

January 31, 2019

Project No.: 3497-355-01

ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

HRP MERCER, LLC

Former Mercer Generating Station

1365 Lamberton Road

Trenton, New Jersey 08611

PREPARED BY



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Weaver Consultants Group North Central, LLC

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1 INTRODUCTION

On behalf of HRP Mercer, LLC, Weaver Consultants Group North Central LLC (Weaver Consultants) has prepared this Annual Groundwater Monitoring and Corrective Action Report (Report) pursuant to the requirements of 40 Code of Federal Regulations (CFR) 257.90(e) for the former Mercer Generating Station located at 1365 Lamberton Road in Trenton, New Jersey (the Property). Effective December 21, 2018 the ownership of this property has been transferred from PSEG Fossil LLC to HRP Mercer, LLC (HRP), located at 5 Revere Drive, Suite 206, Northbrook, Illinois 60062. As a result of this acquisition, HRP is now the responsible party regarding the groundwater monitoring and corrective action program that has been established for the two inactive Coal Combustion Residual (CCR) units on the Property. Thus, this Report has been prepared to document the status of the groundwater monitoring and corrective action program. In addition, this Report summarizes the key actions completed in 2018 and the projected key activities for the upcoming year.

The following two inactive CCR units are located on the Property (refer to **Figure 1 – Site Location Map with CCR Unit Locations**):

- North Fly Ash Pond; and
- South Fly Ash Pond.

The CCR units are constructed as predominantly incised ponds with a bermed wall along Lamberton Road that varies in height above the surrounding grade by five to six feet. These units ceased receiving CCR prior to October 19, 2015 and as described in a March 23, 2017 memorandum prepared by GEI Consultants, Inc. (GEI), CCR removal from the units was completed on October 19, 2016 while the Property was owned by Public Service Electric and Gas (PSEG) Power LLC. A Notice of Intent (NOI) to initiate closure of the inactive CCR units in accordance with 40 CFR Section 257.100 was posted on the PSEG CCR Rule Compliance Data and Information website on November 6, 2015. A CCR Rule Compliance Report Summary dated April 17, 2018 and prepared by GEI was posted on PSEG's website¹. As part of CCR unit closure activities, the Initial Detection Monitoring Program was initiated in 2018. The following

¹ <https://corporate.pseg.com/aboutpseg/companyinformation/thepsegfamilyofcompanies/psegfossilllc>

presents the information required by 40 CFR 257.90(e) for submission of an Annual Groundwater Monitoring and Corrective Action Report.

2 FIGURE DEPICTING CCR UNITS

A figure depicting the two CCR units and the six groundwater monitoring wells installed in 2018 as part of the Initial Detection Monitoring Program is included as **Figure 2 – CCR Units and Groundwater Monitoring Well Location Map**.

3 MONITORING WELL INSTALLATION, DEVELOPMENT, AND SURVEYING

As part of the first phase of the Detection Monitoring System, six two-inch permanent monitoring wells were installed in the vicinity of the inactive CCR units in accordance with 40 CFR 257.91(a) (refer to **Figure 2** for well locations). Five of the wells (MW-1 through MW-5) were installed upgradient and downgradient to the CCR units to assess the quality of groundwater in the uppermost aquifer and to monitor potential contaminant pathways. Monitoring well MW-6 was installed in a crossgradient location away from the CCR units to obtain a representation of the background groundwater that has not been affected by leakage from the CCR units.

The New Jersey Department of Environmental Protection (NJDEP) issued well installation permits for the five monitoring wells on April 27, 2018 and the monitoring wells were installed by Joel D Bernstein of Subsurface Environmental Technologies, LLC on June 7 to 11, 2018 utilizing a Geoprobe® drilling rig (e.g., direct-push technology). The well permits are included in **Appendix A – Monitoring Well Permits**. The monitoring wells were constructed of two-inch diameter Schedule 40 PVC risers and a 0.010-inch slotted PVC well screens that ranged in size from ten (10) to fifteen (15) feet. The 8.25-inch outer diameter (OD) auger holes were completed at depths between thirteen (13) and twenty (20) feet below ground surface (bgs) and the PVC screens and risers were lowered into the completed auger holes. The monitoring wells were backfilled with Global #5 quartz sand from the bottom of the auger holes to approximately two feet above the well screen. The annulus space from the ground surface to the sand pack was backfilled with ¾" bentonite pellets. The monitoring well riser at MW-5 was cut flush with the ground surface and covered with a flush-mounted protective steel cover and concrete pad. The remaining wells risers were cut approximately two feet above the ground surface and covered with protective steel covers and concrete pads. The soil probe and monitoring well logs are included in **Appendix B – Soil Probe/Monitoring Well Logs**.

Upon completion of the monitoring well installation activities, the two-inch monitoring wells were developed utilizing a groundwater pump or bailer. The pump or bailer was used to remove approximately ten well volumes of groundwater from each well and to remove suspended particles so that the turbidity of the water was less than fifty (50) nephelometric turbidity units. During development, the groundwater levels were measured to ensure that the pumping rate was sufficient to create a drawdown in each well. It should be noted that after approximately one hour of purging, monitoring well MW-3 remained extremely turbid. Turbid

groundwater was also observed at this well during the subsequent sampling events discussed in **Section 4.0**.

Following installation and development, the monitoring wells were surveyed by Dennis W. Sklar, Inc. (DWS) on September 4, 2018. The State Plane Coordinates were utilized for the horizontal coordinates. NAVD88 GEOID12B was utilized as the vertical datum to survey the elevation of the monitoring wells. Mean sea level (msl) was utilized as the datum to survey the elevation of the monitoring wells to assess the flow characteristics of the uppermost aquifer. A survey point was indicated by placing a notch on top of the PVC well casing. The elevation data is included in **Table 1 – Monitoring Well Survey Data**. The following section provides the groundwater sampling procedures and results.

4 GROUNDWATER SAMPLING AND RESULTS

As part of the first phase of the Initial Detection Monitoring Program, five of eight independent sampling events of initial monitoring were conducted in 2018. Prior to sampling, depth to groundwater measurements were taken from the survey point to obtain the groundwater elevation. The elevations were collected using an electronic oil-water interface probe. The depth to groundwater information is presented in **Table 2 – Groundwater Elevation Measurements**. The groundwater elevations collected during the five events as well as inferred groundwater contours are shown on **Figures 3a through 3e – Groundwater Elevation Contour Maps**. As shown on **Figure 3e – Groundwater Elevation Contour Map – Event #5**, the groundwater elevations surrounding the North and South Fly Ash Ponds from the most recent event ranged from 3.49 feet above msl in MW-5, 3.77 feet above msl in MW-1, to 6.36 feet above msl in MW-3 indicating general groundwater flow directions to the southeast and southwest from the northern side of the CCR units.

Groundwater samples were collected from each monitoring well on the following dates:

- Event 1: August 3 to 7, 2018;
- Event 2: September 4, 2018;
- Event 3: October 4, 2018;
- Event 4: October 29, 2018; and
- Event 5: December 6, 2018.

The groundwater samples were collected using a stainless steel bladder pump with disposable Teflon bladders and a disposable length of ¼" diameter Teflon-lined polyethylene tubing. The pump was used to implement low flow methodology to minimize sediment disturbance (e.g., between 100 milliliters per minute [ml/min] to 500 ml/min). Prior to sample collection, the wells were purged until the purge water exhibited stable conditions based upon field measurements of pH, specific conductivity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature. The groundwater sampling field forms are included in **Appendix C – Groundwater Sampling Field Forms**.

Groundwater samples were collected in containers provided by the laboratory and preserved as necessary for their respective analyses. The sample containers were tightly capped, labeled, and placed in a cooler and surrounded with ice in order to maintain their temperature near four degrees Celsius. Each sample was logged onto a chain of custody form which is used to track

the samples from the point of collection to receipt by the laboratory. The chain of custody is included with the laboratory analysis reports in **Appendix D – Laboratory Analytical Reports**.

The groundwater samples were submitted to Eurofins Lancaster Laboratories Environmental (Eurofins) for laboratory analysis of the constituents listed in Appendices III and IV of 40 CFR 257. As presented in **Tables 3a through 3e - Groundwater Analytical Results**, laboratory results were compared to the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs). Based on the analytical data, concentrations of cobalt and/or lithium were detected above USEPA MCLs during three of the sampling events in the monitoring wells surrounding the CCR Units and no Appendix III and Appendix IV constituents were detected above USEPA MCLs from the background well location MW-6.

5 MONITORING PROGRAM

In support of closing the two inactive CCR units on the Property, the Initial Detection Monitoring Program was initiated in 2018. During 2018, five of eight sampling events were completed. Upon completion of the three remaining sampling events in 2019, a statistical analysis will be conducted to establish background concentrations of the constituents listed in Appendix III and IV of 40 CFR 257. The established background concentrations will be used to detect statistically significant increases (SSI) in future groundwater samples collected semi-annually as part of the Detection Monitoring Program. Should SSI above background concentrations be detected at one or more downgradient wells, the Assessment Monitoring Program will be initiated. The results of the Initial Detection Monitoring Program as well as the statistical analysis will be submitted by April 17, 2019.

Per the requirements of 40 CFR 257.107, this Report will be posted on HRP Mercer, LLC's CCR Rule Compliance Data and Information web site.

6 CERTIFICATION

In accordance with 40 CFR 257.91(f), I certify that, based on my review of the work completed to date, the groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR 257.91. Given that the CCR was physically removed from the CCR units prior to monitoring well installation and that groundwater flow direction in the vicinity of the units was not known prior to monitoring well installation, the monitoring well network was installed to observe the perimeter of the impoundments and background at the Property. Based on the absence of groundwater elevation data and the Property's proximity to the Delaware River, groundwater flow direction was presumed to be towards the river and generally consistent with surface topography. Should statistical analysis and subsequent monitoring indicate the need for additional monitoring well data to assess data gaps or delineate observed exceedances, additional wells may be installed following submission of the April 2019 report.

Carolyn Cybulski, P.E.

062-059114

By (print):

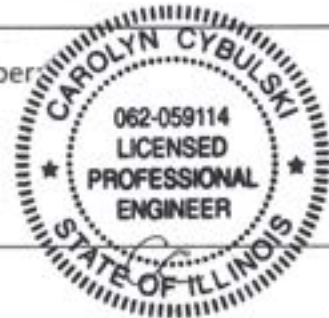
Registration Number:



By (signature):

11-30-2019

Expiration Date:



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Date:

Weaver Consultants Group North Central, LLC

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TABLES

Table 1
Monitoring Well Survey Data
Former Mercer Generating Station
Trenton, New Jersey

Well ID	Ground Surface Elevation (ft-msl)	TOC Elevation (ft-msl)	Protective Vault/Cover Elevation (ft-msl)	State Plane Coordinates		Latitude (North)			Longitude (West)		
				Northing	Easting	°	'	"	°	'	"
MW-1	14.64	16.76	17.24	491127.04	426960.53	40	10	53.538	74	43	59.653
MW-2	12.25	15.30	15.69	491584.22	426592.20	40	10	58.046	74	44	4.414
MW-3	11.17	14.21	14.49	491247.40	427923.35	40	10	54.752	74	43	47.251
MW-4	8.15	11.19	11.48	490555.44	428091.99	40	10	47.918	74	43	45.055
MW-5	15.57	15.41	15.70	490746.01	427670.72	40	10	49.790	74	43	50.489
MW-6	10.61	13.36	13.69	490343.12	428711.06	40	10	45.835	74	43	37.071

Notes:

This survey was completed on September 4, 2018 utilizing the New Jersey State Plane East in units of US Survey Feet, NAVD 88 vertical datum, and GEOID 12B.

TOC - Top of Casing

ft-msl - Feet above Mean Sea Level

Table 2
Groundwater Elevation Measurements
Former Hudson Generating Station
Jersey City, New Jersey

Well ID	Total Depth (ft)	Surface Construction	Well Diameter (in)	Screen Interval (ft)	TOC Elevation (ft-msl)	Event 1		Event 2		Event 3		Event 4		Event 5	
						August 1-7, 2018		September 4, 2018		October 4, 2018		October 31-November 1, 2018		December 3-4, 2018	
						Depth to Water (ft)	Groundwater Elevation (ft-msl)	Depth to Water (ft)	Groundwater Elevation (ft-msl)	Depth to Water (ft)	Groundwater Elevation (ft-msl))	Depth to Water (ft)	Groundwater Elevation (ft-msl)	Depth to Water (ft)	Groundwater Elevation (ft-msl)
MW-1	17	stick-up	2	7-17	16.76	13.95	2.81	14.4	2.36	13.41	3.35	13.62	3.14	12.99	3.77
MW-2	16	stick-up	2	1-16	15.3	12.45	2.85	12.77	2.53	11.6	3.7	12.11	3.19	11.28	4.02
MW-3	20	stick-up	2	8-20	14.21	10.91	3.3	11.83	2.38	9.67	4.54	10.33	3.88	7.85	6.36
MW-4	13	stick-up	2	3-13	11.19	7.64	3.55	8.36	2.83	6.49	4.7	7.36	3.83	5.45	5.74
MW-5	20	flushmount	2	10-20	15.41	13.76	1.65	13.26	2.15	12.2	3.21	12.37	3.04	11.92	3.49
MW-6	19	stick-up	2	4-19	13.36	10.71	2.65	11.15	2.21	9.78	3.58	10.22	3.14	8.95	4.41

Notes:
This survey was completed utilizing the New Jersey State Plane East in units of US Survey Feet, NAVD 83 vertical datum, and GEOID 12B.
TOC - Top of Casing
ft-msl - Feet above Mean Sea Level

Table 3a
Groundwater Analytical Summary Event 1
Former Mercer Generating Station
Trenton, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Fly Ash Ponds					Background
			MW-1 8/3/18	MW-2 8/3/18	MW-3 8/7/18	MW-4 8/7/18	MW-5 8/7/18	MW-6 8/3/18
Appendix III Analytes								
Boron	mg/L	---	1.00	0.963	0.238	<0.0600	0.377	0.0981
Calcium	mg/L	---	213.00	113.00	69.90	5.09	98.40	33.40
Chloride	mg/L	---	152.00	107.00	334.00	1.40	113.00	219.00
Fluoride	mg/L	4.00	<0.25	<0.25	0.35	<0.25	0.42	<0.25
pH	S.U.	---	8.00	7.60	6.80	7.00	7.80	7.70
Sulfate	mg/L	---	337.00	156.00	21.60	3.90	119.00	7.90
Total Dissolved Solids	mg/L	---	1240.00	552.00	724.00	51.00	614.00	430.00
Appendix IV Analytes								
Antimony	mg/L	0.006	<0.00041	0.00066	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	<0.00068	0.0021	0.0022	<0.00068	0.00082	<0.00068
Barium	mg/L	2.00	0.185	0.49	0.25	0.0167	0.212	0.2290
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	<0.00015	0.00028	<0.00015	<0.00015	<0.00015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	<0.0015	0.0073	0.026	0.0025	<0.0015	<0.0015
Fluoride	mg/L	4.00	<0.25	<0.25	0.35	<0.25	0.42	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	<0.0110	0.06	0.0349	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0053	0.0558	0.0203	0.0022	0.0181	0.00072
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.105	<0.105	<0.105	<0.0210
Thallium	mg/L	0.002	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	<3.00	2.55	<3.00	1.36	<3.00
Radium-226	pCi/L	5.00	<1.00	1.89	1.42	<1.00	0.43	<1.00

 Concentration exceeds the USEPA Drinking Water MCL

Notes:

^a Maximum Contaminant Levels obtained from USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

--- MCL not listed in USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

mg/L - milligrams per liter

"<" - Parameter not detected above laboratory reporting limit

pCi/l = picocuries per liter

S.U. - Standard Units

Table 3b
Groundwater Analytical Summary Event 2
Former Mercer Generating Station
Trenton, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Fly Ash Ponds					Background
			MW-1 9/4/18	MW-2 9/4/18	MW-3 9/4/18	MW-4 9/4/18	MW-5 9/4/18	MW-6 9/4/18
Appendix III Analytes								
Boron	mg/L	---	1.00	0.898	0.285	0.04	0.40	0.099
Calcium	mg/L	---	197.00	108.00	61.60	6.17	90.70	29.90
Chloride	mg/L	---	163.00	86.80	205.00	1.80	115.00	226.00
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
pH	S.U.	---	7.90	7.80	7.90	6.80	7.80	7.60
Sulfate	mg/L	---	328.00	171.00	16.20	3.50	10.00	2.40
Total Dissolved Solids	mg/L	---	1160.00	603.00	548.00	45.50	626.00	434.00
Appendix IV Analytes								
Antimony	mg/L	0.006	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	<0.00068	0.0008	0.0013	<0.00068	<0.00068	<0.00068
Barium	mg/L	2.00	0.174	0.20	0.1810	0.0186	0.201	0.193
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.053	<0.0053	<0.0053
Cobalt	mg/L	0.006	<0.0015	0.0087	<0.0015	0.0022	<0.0015	<0.0015
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	<0.0110	0.0831	0.0156	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0035	0.088	0.0036	0.0012	0.0175	0.00076
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210
Thallium	mg/L	0.002	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	<1.00	<1.00	0.916	<1.00	<1.00	<1.00

 Concentration exceeds the USEPA Drinking Water MCL

Notes:

^a Maximum Contaminant Levels obtained from USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

--- MCL not listed in USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

mg/L - milligrams per liter

"<" - Parameter not detected above laboratory reporting limit

pCi/l = picocuries per liter

S.U. - Standard Units

Table 3c
Groundwater Analytical Summary Event 3
Former Mercer Generating Station
Trenton, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Fly Ash Ponds					Background
			MW-1 10/4/18	MW-2 10/4/18	MW-3 10/4/18	MW-4 10/4/18	MW-5 10/4/18	MW-6 10/4/18
Appendix III Analytes								
Boron	mg/L	---	1.10	0.0639	0.276	0.0336	0.427	0.22
Calcium	mg/L	---	208.00	38.30	47.40	2.92	101.00	34.30
Chloride	mg/L	---	146.00	1.50	113.00	1.10	102.00	136.00
Fluoride	mg/L	4.00	<0.25	0.69	<0.25	<0.25	0.72	<0.25
pH	S.U.	---	7.70	7.90	7.70	6.80	8.00	7.50
Sulfate	mg/L	---	297.00	4.60	14.70	<1.5	135.00	6.50
Total Dissolved Solids	mg/L	---	1070.00	140.00	398.00	29.00	602.00	309.00
Appendix IV Analytes								
Antimony	mg/L	0.006	<0.00041	0.0008	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	<0.00068	0.0038	0.0014	<0.00068	<0.00068	<0.00068
Barium	mg/L	2.00	0.18	0.0368	0.186	0.009	0.212	0.166
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Fluoride	mg/L	4.00	<0.25	0.69	<0.25	<0.25	0.72	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	<0.0110	<0.0110	0.0231	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0036	0.0033	0.0098	0.0017	0.0211	0.0035
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210
Thallium	mg/L	0.002	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	1.13	0.337	0.747	0.365	0.661	0.482

 Concentration exceeds the USEPA Drinking Water MCL

Notes:

^a Maximum Contaminant Levels obtained from USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

--- MCL not listed in USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

mg/L - milligrams per liter

"<" - Parameter not detected above laboratory reporting limit

pCi/l = picocuries per liter

S.U. - Standard Units

Table 3d
Groundwater Analytical Summary Event 4
Former Mercer Generating Station
Trenton, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Fly Ash Ponds					Background
			MW-1 10/29/18	MW-2 10/29/18	MW-3 10/29/18	MW-4 10/29/18	MW-5 10/29/18	MW-6 10/29/18
Appendix III Analytes								
Boron	mg/L	---	1.17	0.0358	0.2670	0.0247	0.4100	0.1570
Calcium	mg/L	---	210.00	24.20	48.40	4.52	96.30	40.50
Chloride	mg/L	---	159.00	1.70	257.00	2.10	105.00	246.00
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
pH	S.U.	---	7.10	7.90	7.20	6.70	7.20	6.80
Sulfate	mg/L	---	280.00	6.40	18.20	3.40	104.00	6.40
Total Dissolved Solids	mg/L	---	1120.00	103.00	614.00	38.50	656.00	465.00
Appendix IV Analytes								
Antimony	mg/L	0.006	<0.00041	0.00046	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	<0.00068	0.0031	0.0072	<0.00068	<0.00068	<0.00068
Barium	mg/L	2.00	0.186	0.0179	0.248	0.0119	0.197	0.254
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	0.00022	<0.000091	<0.000091
Cadmium	mg/L	0.005	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	<0.0015	<0.0015	0.0025	0.002	<0.0015	<0.0015
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.0305	<0.0110	0.034	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0037	0.0036	0.0179	0.0015	0.0184	0.0027
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210
Thallium	mg/L	0.002	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	<1.00	<1.00	1.15	<1.00	<1.00	0.58

 Concentration exceeds the USEPA Drinking Water MCL

Notes:

^a Maximum Contaminant Levels obtained from USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

--- MCL not listed in USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

mg/L - milligrams per liter

"<" - Parameter not detected above laboratory reporting limit

pCi/l = picocuries per liter

S.U. - Standard Units

Table 3e
Groundwater Analytical Summary Event 5
Former Mercer Generating Station
Trenton, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Fly Ash Ponds					Background
			MW-1 12/6/18	MW-2 12/6/18	MW-3 12/6/18	MW-4 12/6/18	MW-5 12/6/18	MW-6 12/6/18
Appendix III Analytes								
Boron	mg/L	---	2.18	0.201	0.26	0.0142	0.4440	0.1570
Calcium	mg/L	---	312.00	39.00	54.80	2.94	105.00	38.50
Chloride	mg/L	---	87.00	3.10	68.50	1.40	94.50	26.10
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	0.58	<0.25
Sulfate	mg/L	---	571.00	26.40	25.10	2.10	103.00	6.30
Total Dissolved Solids	mg/L	---	1570.00	153.00	328.00	34.00	660.00	504.00
pH	S.U.	---	7.10	7.70	7.10	6.40	0.30	6.80
Appendix IV Analytes								
Antimony	mg/L	0.006	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	<0.00068	0.0039	0.0059	<0.00068	<0.00068	<0.00068
Barium	mg/L	2.00	0.14	0.0287	0.196	0.0057	0.202	0.211
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	0.0002	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	0.015	<0.0015	0.0038	<0.0015	<0.0015	0.0024
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	0.5800	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.0158	<0.0110	0.0254	<0.0110	<0.0110	0.0150
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0577	0.0089	0.0122	0.0029	0.0185	0.0022
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210
Thallium	mg/L	0.002	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	<3.00	<3.00	<3.00	2.40	<3.00
Radium-226	pCi/L	5.00	<1.00	<1.00	<1.00	<1.00	0.699	0.824

 Concentration exceeds the USEPA Drinking Water MCL

Notes:

^a Maximum Contaminant Levels obtained from USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

--- MCL not listed in USEPA National Primary Drinking Water Regulation Table updated May 2009 or 40 CFR 257.95(h)(2).

mg/L - milligrams per liter

"<" - Parameter not detected above laboratory reporting limit

pCi/l = picocuries per liter

S.U. - Standard Units

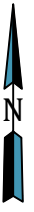
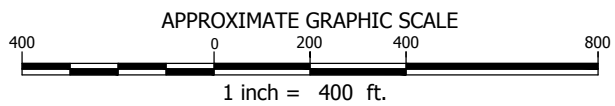
FIGURES



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- - - APPROXIMATE CCR UNIT LIMIT

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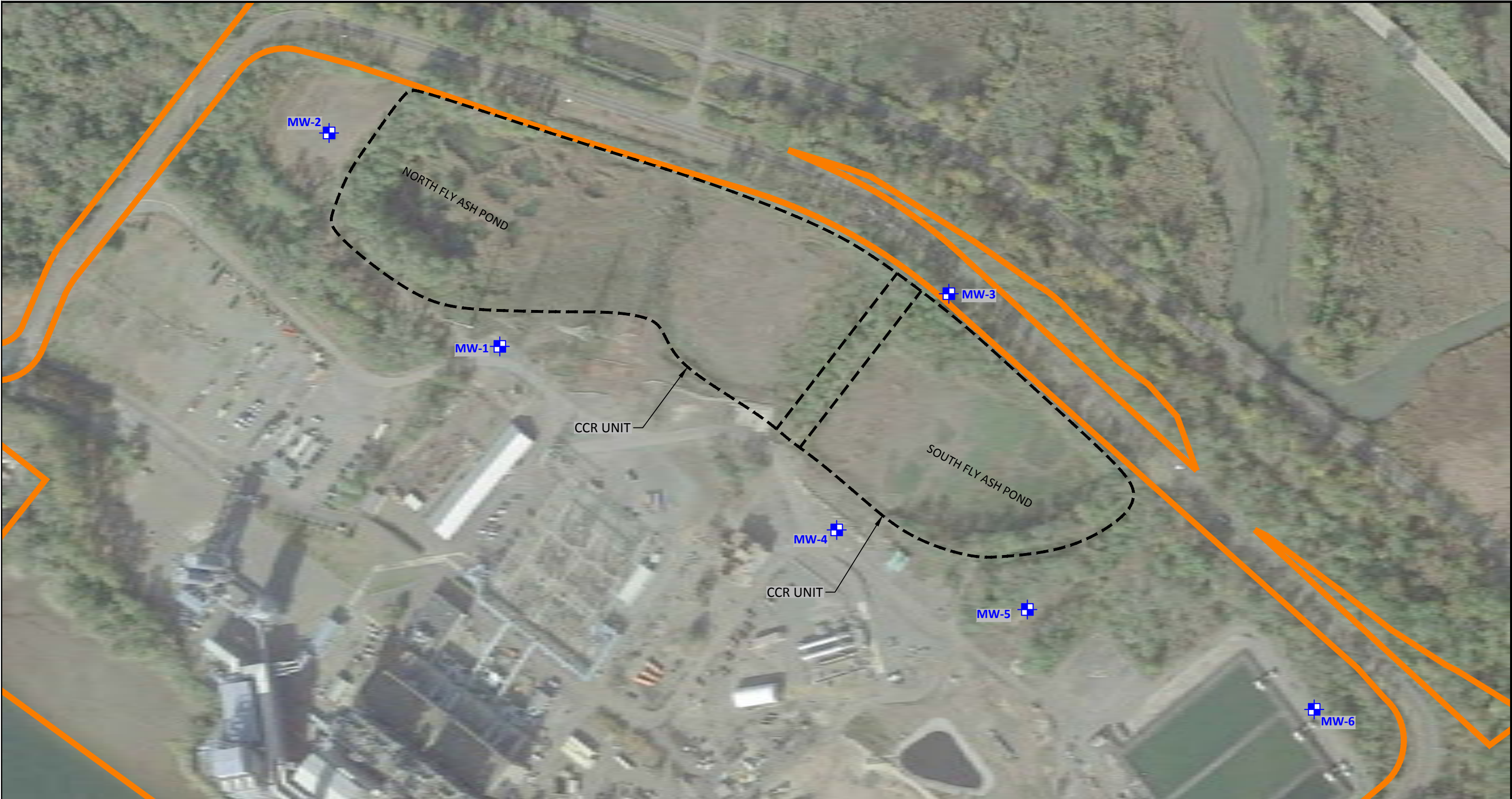
SITE LOCATION MAP WITH COAL COMBUSTION RESIDUAL (CCR) LOCATIONS
FORMER MERCER GENERATING STATION
TRENTON, NJ

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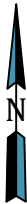
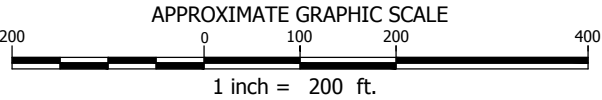
Weaver Consultants Group
CHICAGO, ILLINOIS
(312) 922-1030 www.wcgrp.com

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REVIEWED BY:	AF
DATE:	1/29/2019
FILE:	3497-355-02-01
CAD:	SITELOC.dwg
FIGURE 1	



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)



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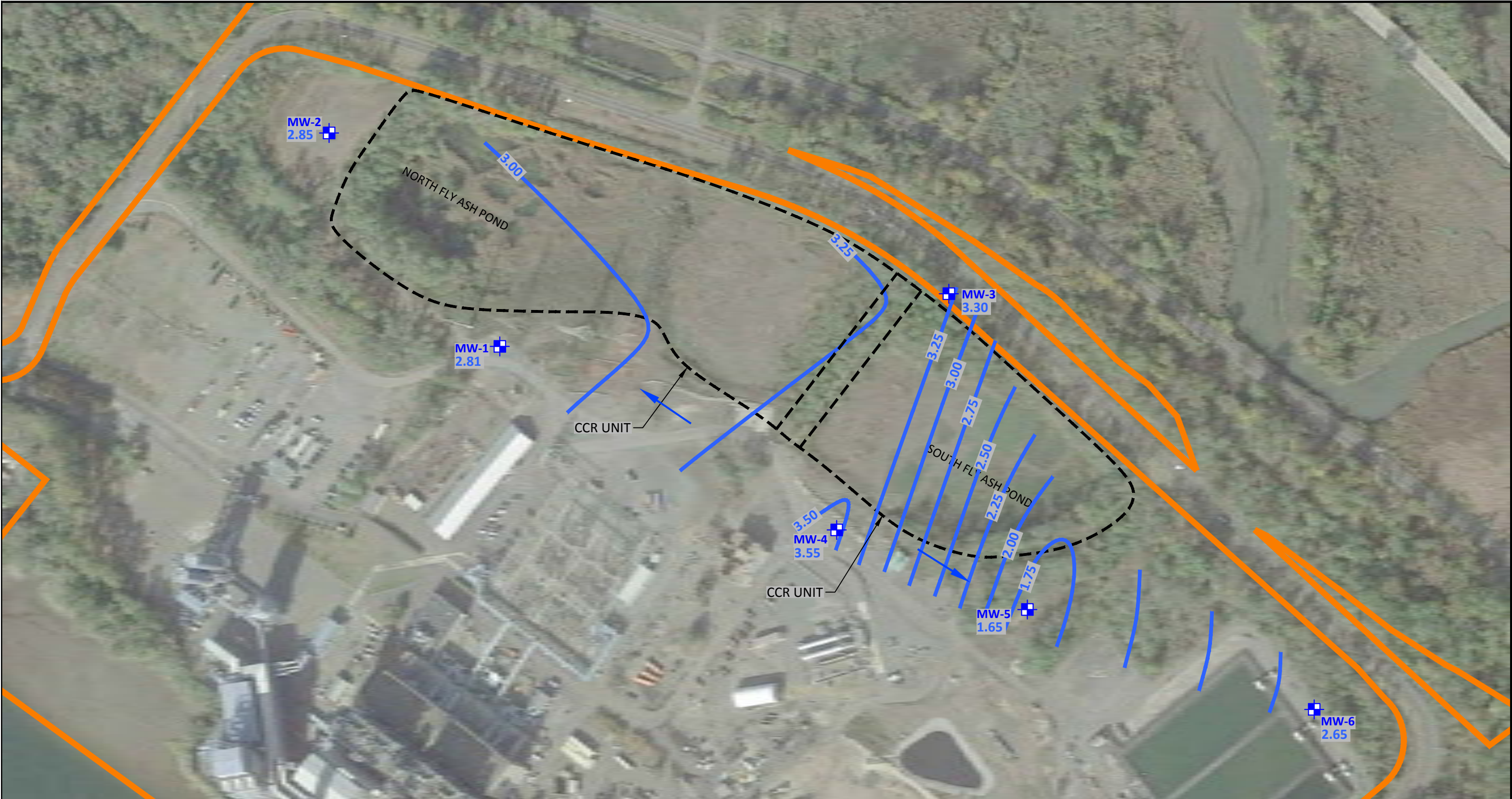
**CCR UNITS & GROUNDWATER
MONITORING WELL LOCATION MAP**
FORMER MERCER GENERATING STATION
TRENTON, NJ

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FIGURE 2

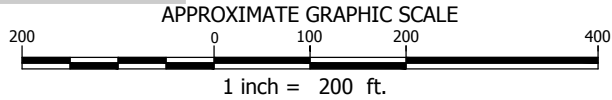


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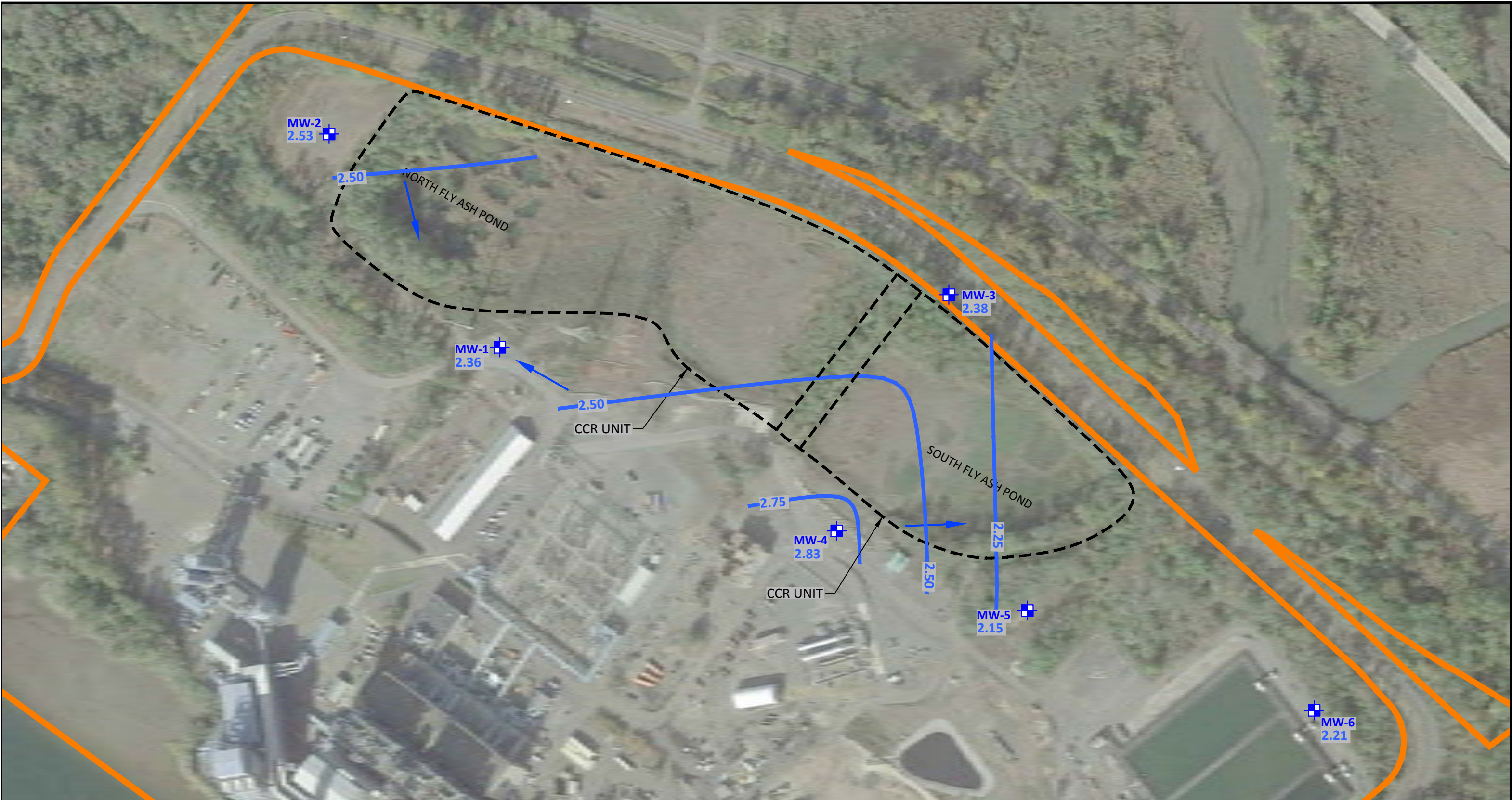
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #1 MEASUREMENTS TAKEN AUGUST 3, 2018 TO AUGUST 7, 2018.

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PREPARED FOR: HRP MERCER, LLC	GROUNDWATER ELEVATION CONTOUR MAP - EVENT #1 FORMER MERCER GENERATING STATION TRENTON, NJ		 Weaver Consultants Group CHICAGO, ILLINOIS (312) 922-1030 www.wcgrp.com	DRAWN BY: RMD
				REVIEWED BY: AF
				DATE: 1/29/2019
				FILE: 3497-355-02-01
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				FIGURE 3a
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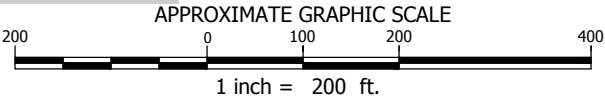


LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #2 MEASUREMENTS TAKEN ON SEPTEMBER 4, 2018.

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GROUNDWATER ELEVATION
CONTOUR MAP - EVENT #2
FORMER MERCER GENERATING STATION
TRENTON, NJ

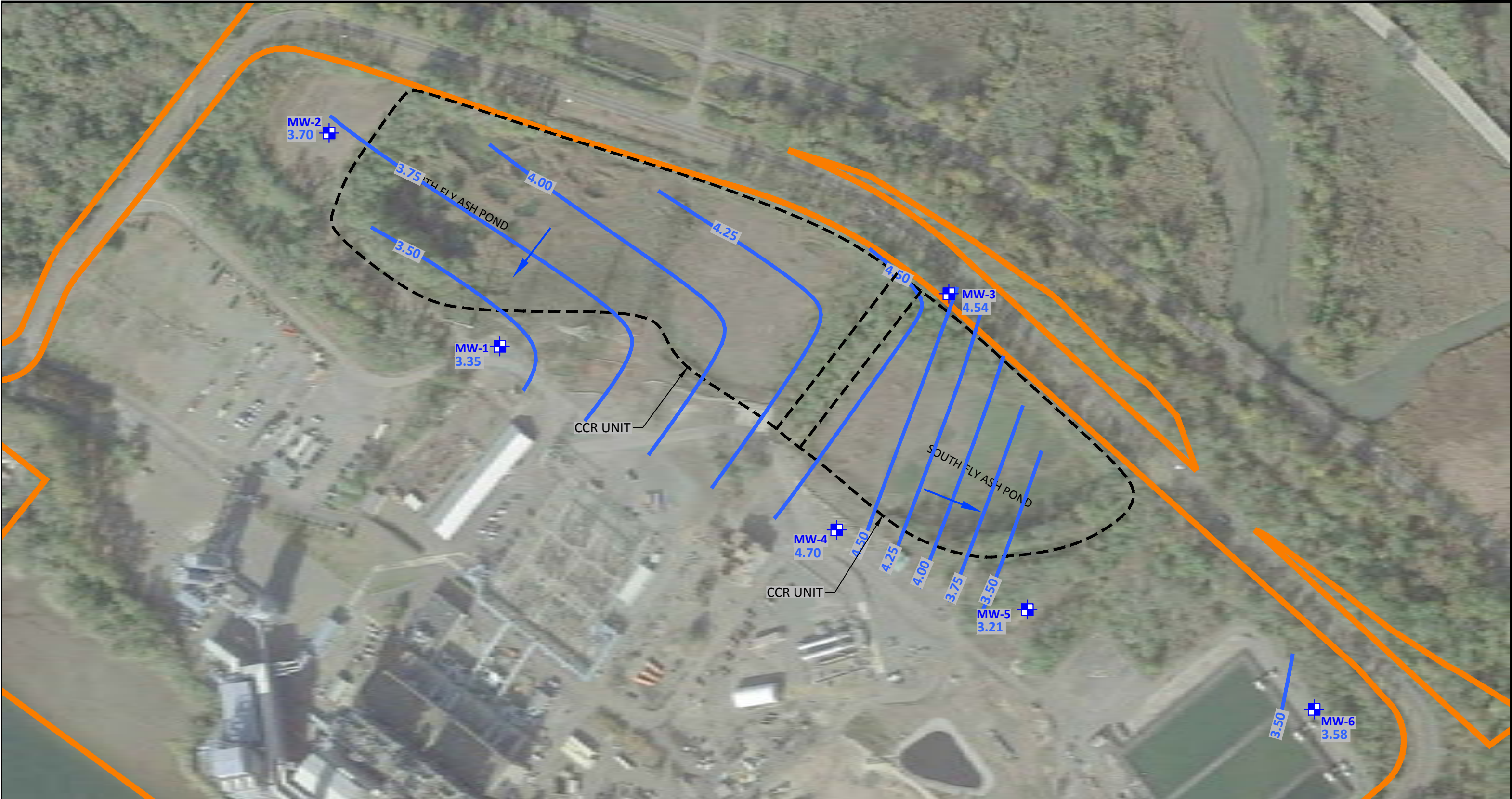
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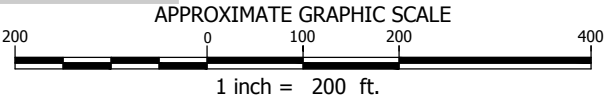
FIGURE 3b



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #3 MEASUREMENTS TAKEN ON OCTOBER 4, 2018.



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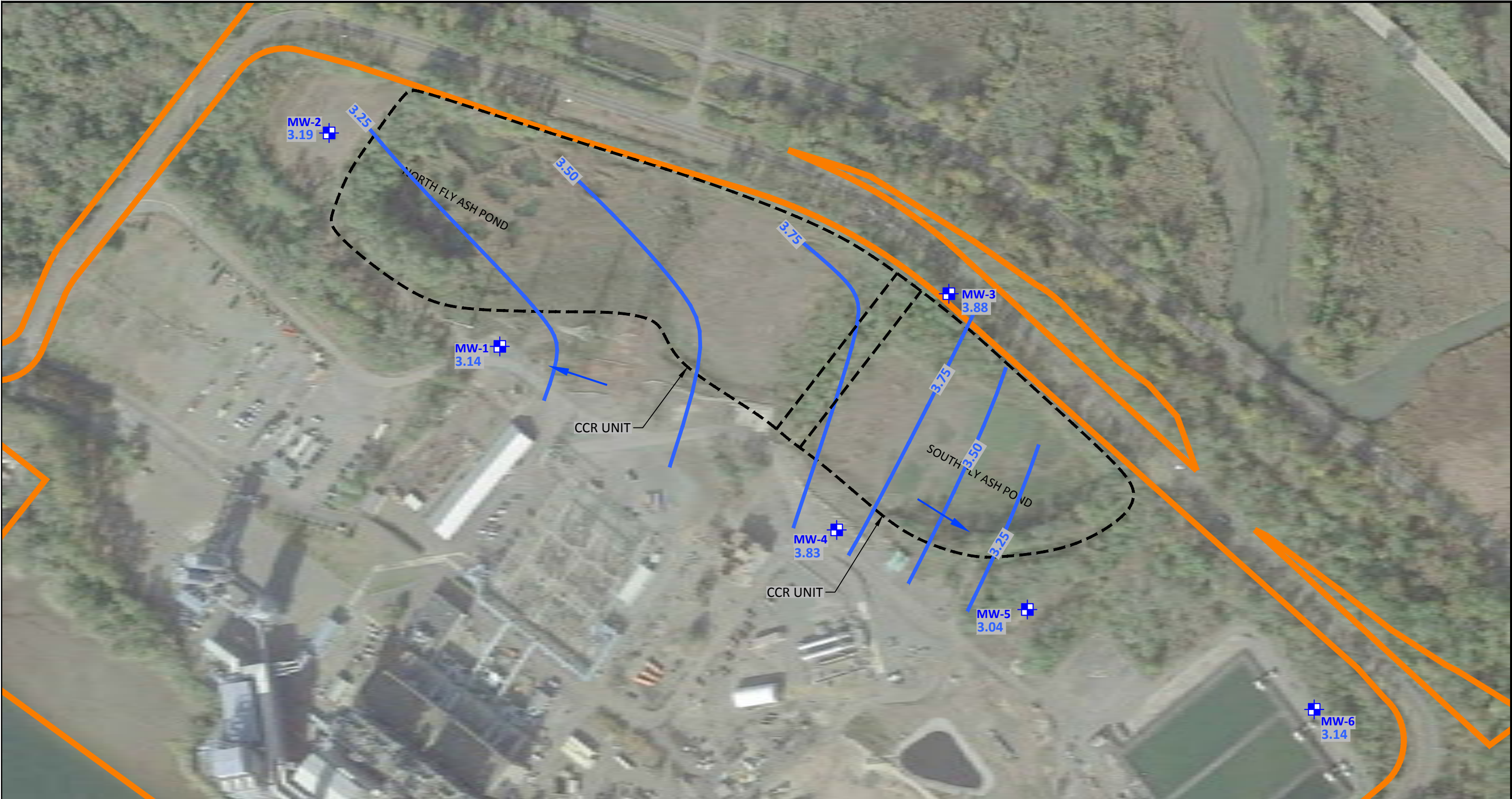
GROUNDWATER ELEVATION
CONTOUR MAP - EVENT #3
FORMER MERCER GENERATING STATION
TRENTON, NJ

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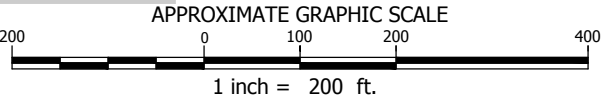
FIGURE 3c



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #4 MEASUREMENTS TAKEN ON OCTOBER 29, 2018.



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GROUNDWATER ELEVATION
CONTOUR MAP - EVENT #4
FORMER MERCER GENERATING STATION
TRENTON, NJ

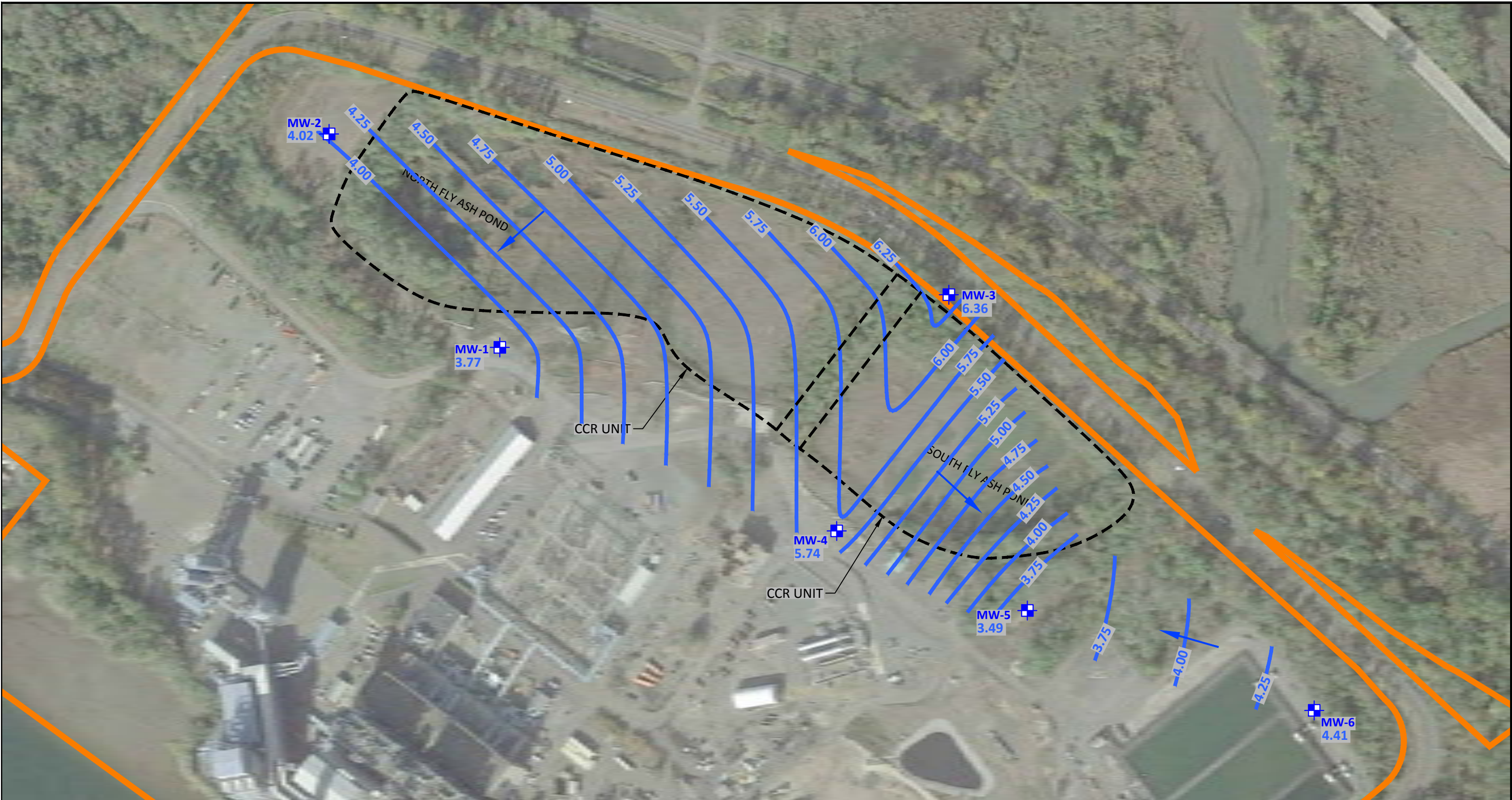
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FIGURE 3d

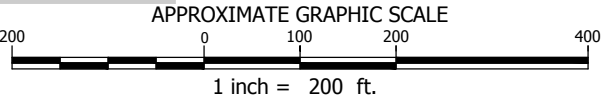


LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE CCR UNIT LIMIT
- APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)
- GROUNDWATER CONTOUR
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #5 MEASUREMENTS TAKEN ON DECEMBER 6, 2018.

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GROUNDWATER ELEVATION
CONTOUR MAP - EVENT #5
FORMER MERCER GENERATING STATION
TRENTON, NJ

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FIGURE 3e

APPENDIX A

Monitoring Well Permits

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0024433

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE. PENNINGTON, NJ 085349958

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEGPowert, LLC

Address: 80 Park Plaza T-6B

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: 1365 Lanigerton Road

County: Mercer

Municipality: Hamilton Twp

Lot: 8

Block: 2506

Easting (X): 426868 **Northing (Y):** 491138

Local ID: MW-1

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s):

Diameter (in.): 2

Regulatory Program

Requiring Well's Barings:

Depth (ft.): 25

Case ID Number

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Auger

Attachments:

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018

Expiration Date: April 27, 2019

Approved by the authority of:

Catherine R. McCabe

Acting Commissioner

Well Permit -- Page 1 of 2

Terry Pilawski

Terry Pilawski, Chief

Bureau of Water Allocation and Well Permitting

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0024433

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085248995

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEGPowerLLC

Address: 80 Park Plaza T 6H

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: 1365 Lambertson Road

County: Mercer

Municipality: Hamilton Twp

Lot: 8

Block: 250b

Easting (X): 426584 Northing (Y): 461598

Local ID: MW-2

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells Borings: _____

Depth (ft): 25

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

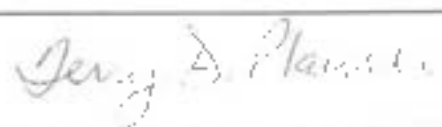
Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018
Expiration Date: April 27, 2019

Approved by the authority of
Catherine R. McCabe
Acting Commissioner

Well Permit -- Page 1 of 2


Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0024453

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: TOWNSHIP OF HAMILTON

Organization: Township of Hamilton

Address: 2100 Greenwood Avenue

City: Hamilton

State: New Jersey

Zip Code: 08609

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: Lamberton Road

County: Mercer

Municipality: Hamilton Twp

Lot: ROW

Block: ROW

Easting (X): 427685 Northing (Y): 491432

Local ID: MW-3

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in): 2

Regulatory Program: _____

Depth (ft): 25

Requiring Wells Borings: _____

Pump Capacity (gpm): 0

Case ID Number: _____

Deviation Requested: N

Drilling Method: Hollow Stem Augers

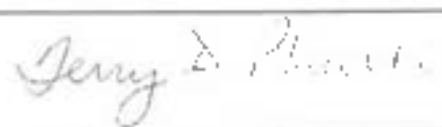
Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018
Expiration Date: April 27, 2019

Approved by the authority of:
Catherine R. McCabe
Acting Commissioner

Well Permit -- Page 1 of 2


Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0024433

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 08545998

PROPERTY OWNER

Name: PSEG POWER, LLC

Organization: PSEGPowerLLC

Address: 80 Park Plaza 1-6B

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: 1365 Lambertson Road

County: Mercer

Municipality: Hamilton Twp

Lot: 8

Block: 2506

Easting (X): 428125 Northing (Y): 490666

Local ID: MW-4

Coordinate System: NJ State Plane (NAD83) - L SFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Uses: _____

Diameter (in.): 2

Regulatory Program

Requiring Wells Bearings: _____

Depth (ft): 25

Case ID Number _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018

Expiration Date: April 27, 2019

Approved by the authority of:

Catherine R. McCabe

Acting Commissioner

Well Permit Page 7 of 2

Jerry D. Pilawski

Jerry Pilawski, Chief

Bureau of Water Allocation and Well Permitting

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0024431

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE, PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEGPowerLLC

Address: 80 Park Plaza T-6H

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: 1265 Lamberton Road

County: Mercer

Municipality: Hammonton Twp

Lot: 8

Block: 250A

Easting (X): 427695

Northing (Y): 490793

Local ID: MW-5

Coordinate System: NJ State Plane (NAD83) - L511FEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Bores: _____

Depth (ft.): 25

Case ID Number _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018

Expiration Date: April 27, 2019

Approved by the authority of:

Catherine R. McCabe

Acting Commissioner

Well Permit -- Page 1 of 2

Jerry A. Pilawski

Jerry Pilawski, Chief

Bureau of Water Allocation and Well Permitting

WELL PERMIT

New Well

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Certifying Driller: JOEL D BERNSTEIN, MONITORING LICENSE # 0034437

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEGPowrLLC

Address: 80 Park Plaza T-6B

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Mercer Generating Station

Address: 1565 Lambertson Road

County: Mercer

Municipality: Hamilton Twp

Lot: 8

Block: 2536

Easting (X): 428720

Northing (Y): 490422

Local ID: MW-6

Coordinate System: NJ State Plane (NAD83) USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Bearings: _____

Depth (ft.): 25

Case ID Number _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

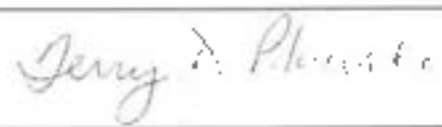
SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018

Expiration Date: April 27, 2019

Approved by the authority of
Catherine R. McCabe
Acting Commissioner

Well Permit -- Page 1 of 2


Terry Palawski, Chief
Bureau of Water Allocation and Well Permitting

APPENDIX B

Soil Probe/Monitoring Well Logs



18000 Horizon Way Suite 200
Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-01

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 25.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/7/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/7/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 11' SAMPLING METHOD
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES: Refusal on wood at 11' bgs. Offset 2' and continue.

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	0			NM		(0.0' - 7.0') FILL containing grey Silt with Sand, Concrete, Brick, Coal Fragments, and trace rounded Gravel.	
	5						
						(7.0' - 10.0') Reddish brown medium SAND with trace Silt.	
	10					(10.0' - 11.0') Gray CLAY with some Silt; Refusal at wood layer at 11'. Relocate boring to complete 11-25' interval.	
						(11.0' - 25.0') Gray medium to fine SAND with trace Silt; Wet.	
	15						
	20						
	25						

Bottom of borehole at 25.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET

08/03/2015 MT LAUREL TEMPLATE 2018 MERCER BORING LOGS.GPJ SJG TEMPLATE 11-7-13.GDT 1/16/19



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Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

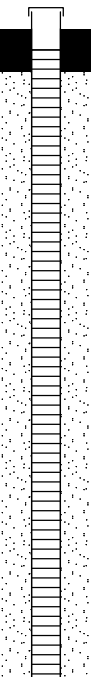
CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-02

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 25.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/7/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/7/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 6' SAMPLING METHOD
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES:

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	0			NM		(0.0' - 6.0') FILL containing Brick, Concrete, and Sand.	
	5					(6.0' - 13.0') Dark gray CLAY with some Silt and trace fine to medium sand; Wet.	
	10					(13.0' - 25.0') Tan to dark gray CLAY with some Silt; Wet.	
	15						
	20						
	25						

Bottom of borehole at 25.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET



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Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

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1 of 1

MW-03

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 25.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/11/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/11/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 9' SAMPLING METHOD _____
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES: _____

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	0			NM		(0.0' - 1.0') Reddish tan CLAY with trace fine SAND.	
						(1.0' - 4.0') Gray to olive green medium to fine SAND with little Gravel and trace Silt.	
						(4.0' - 7.0') Black ASH.	
	5					(7.0' - 9.0') Reddish tan dense CLAY.	
						(9.0' - 14.0') Gray to tan medium SAND with trace Silt; Wet.	
	10					(14.0' - 18.0') Reddish gray CLAY with trace fine Sand.	
						(18.0' - 23.0') Gray medium SAND.	
	15					(23.0' - 25.0') Rounded gray GRAVEL with trace medium to coarse Sand.	
	20						
	25						

Bottom of borehole at 25.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET

08/03/2015 MT LAUREL TEMPLATE 2018 MERCER BORING LOGS.GPJ SJG TEMPLATE 11-7-13.GDT 1/16/19



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Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-04

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 20.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/11/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/11/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 4' SAMPLING METHOD
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES:

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	0			NM		(0.0' - 7.0') Tan medium to fine SAND; Wet at 4'.	
	5						
	10					(7.0' - 10.0') Gray CLAY with little fine Sand; Wet.	
	15					(10.0' - 20.0') Gray medium to fine SAND; Wet.	
	20						

Bottom of borehole at 20.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET



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Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-05

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 25.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/7/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/7/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 14' SAMPLING METHOD
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES:

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	0			NM		(0.0' - 4.0') FILL containing Gravel and Sand, Concrete, Brick, and trace coal chunks.	
	5					(4.0' - 7.0') Gray SILT with little fine to medium Sand.	
						(7.0' - 8.0') Light gray medium SAND.	
	10					(8.0' - 12.0') Dark gray to black SILT with trace fine sand; some Organic material.	
						(12.0' - 13.0') White medium SAND.	
						(13.0' - 14.0') Dark gray CLAY with Silt.	
	15					(14.0' - 25.0') Gray to tan medium to fine SAND; Wet.	
	20						
	25						

Bottom of borehole at 25.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET



18000 Horizon Way Suite 200
Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Trenton, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-06

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 20.0
NORTHING (FT): N/A EASTING (FT): N/A DATE STARTED: 6/11/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/11/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): 5' SAMPLING METHOD
DRILLING DETAILS: Geoprobe/Hollow Stem Auger / Geoprobe 7660
GENERAL NOTES:

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
0				NM		(0.0' - 1.0') FILL containing asphalt material and Gravel.	
						(1.0' - 9.0') Gray SILT with some fine Sand; Wet at 5'.	
5							
10						(9.0' - 15.0') Tan to gray medium to fine SAND with trace silt; Wet.	
15						(15.0' - 20.0') Gray to dark gray SILT with some fine Sand.	
20							

Bottom of borehole at 20.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL ppm = PARTS PER MILLION
REC = RECOVERY LENGTH OF SAMPLE IN. = INCHES
PID = PHOTOIONIZATION DETECTOR READING FT. = FEET

APPENDIX C

Groundwater Sampling Field Forms



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 84°F, Mostly Cloudy		Sampling Date: 8/3/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 13.95 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.99 - 19.99 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1132	End Purge Time: 1230									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	1140	200	20.82	6.44	1.387	-64.1	0.99	981.3	--	--	14.00
2	1145	200	20.3	6.45	1.438	-73.8	0.40	580.7	--	--	14.02
3	1150	200	20.01	6.46	1.436	-77.4	0.52	306.3	--	--	14.03
4	1155	200	19.99	6.41	1.425	-78.4	0.40	189.5	--	--	14.03
5	1200	200	20.18	6.44	1.423	-78.8	0.40	152.6	--	--	14.03
6	1205	200	20.1	6.42	1.415	-78.8	0.61	84.3	--	--	14.03
7	1210	200	20.11	6.38	1.412	-79.0	0.20	46.2	--	--	14.03
8	1215	200	20.19	6.37	1.410	-79.1	0.23	33.7	--	--	14.03
9	1220	200	20.4	6.34	1.417	-79.9	0.26	5.6	--	--	14.03
10	1225	200	20.53	6.41	1.421	-79.9	0.29	0.3	--	--	14.03
11	1230	200	20.28	6.33	1.410	-79.2	0.22	4.8	--	--	14.03
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony J. Shields					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-1, 8-3-2018, 1235					
Sample Start Time: 1235						End Sample Time: 1250					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:						DO outside of range due to low range.					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 75°F, Partly Cloudy		Sampling Date: 8/3/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.45 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 4.00 - 19.00 (ft)	h. Depth of Pump: 11.5 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 0928	End Purge Time: 1100									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	0935	200	22.75	6.57	0.710	122.6	6.11	716.1	--	--	12.40
2	0940	200	23.32	6.61	0.720	121.6	6.25	530.3	--	--	12.41
3	0945	200	24.27	6.61	0.733	126.8	6.00	542.0	--	--	12.41
4	0950	200	25.45	6.56	0.751	135.9	4.91	787.1	--	--	12.41
5	0955	200	NO READING - CLEAN OUT YSI METER OF SILT.						--	--	12.41
6	1000	200	21.25	6.41	0.681	126.3	3.15	242.6	--	--	12.41
7	1005	200	21.54	6.41	0.688	133.8	2.85	161.4	--	--	12.41
8	1010	200	21.59	6.42	0.689	136.0	2.59	114.7	--	--	12.41
9	1015	200	21.42	6.38	0.688	137.6	2.19	76.2	--	--	12.41
10	1020	200	21.45	6.41	0.688	137.9	2.15	78.8	--	--	12.41
11	1025	200	21.35	6.38	0.687	137.5	1.97	63.3	--	--	12.41
12	1030	200	21.31	6.39	0.686	137.3	1.88	58.3	--	--	12.41
13	1035	200	21.38	6.39	0.686	136.5	1.72	47.0	--	--	12.41
14	1040	200	21.45	6.39	0.687	135.4	1.67	41.3	--	--	12.41
15	1045	200	21.61	6.39	0.688	134.0	1.58	38.4	--	--	12.41
16	1050	200	21.82	6.40	0.690	132.7	1.43	34.3	--	--	12.41
17	1055	200	21.88	6.39	0.691	132.3	1.47	29.6	--	--	12.41
18	1100	200	21.87	6.39	0.690	131.6	1.37	27.5	--	--	12.41
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony J. Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-2, 8-3-2018, 1100							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1100				End Sample Time: 1120							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential Not Measured							
ODOR/SHEEN: None, black silt in purge water and grey color in sample water.											
COMMENTS: 3rd turbidity reading outside of range (sampled due to time and minimal effect).											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 87°F, Partly Cloudy		Sampling Date: 8/7/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.98 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f.	DNAPL Thickness: (c-d) -- (ft)								
g.	Screen Interval: 11.00 - 23.00 (ft)	h.	Depth of Pump: 17.0 (ft)								
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
c.	Begin Purge Time: 1209	End Purge Time: 1430									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	1215	200	27.79	7.11	0.006	-27.6	4.43	1242.0	--	--	11.00
2	1220	200	24.36	6.71	1.184	-78.9	0.51	998.1	--	--	11.00
3	1225	200	24.87	6.70	1.199	-86.9	0.70	1231.0	--	--	11.00
4	1230	200	24.82	6.69	1.196	-89.2	0.60	1230.0	--	--	11.00
5	1235	200	24.94	6.69	1.193	-91.3	0.63	1232.0	--	--	11.00
6	1240	200	24.60	6.68	1.168	-98.3	0.67	1229.0	--	--	11.00
7	1245	200	24.67	6.69	1.170	-100.4	0.64	1229.0	--	--	11.00
8	1330*	200	24.80	6.60	1.189	-94.4	3.01	1229.0	--	--	11.00
9	1335	200	24.34	6.60	1.166	-96.2	3.27	1226.0	--	--	11.00
10	1340	200	23.53	6.67	1.129	-104.0	5.10	614.0	--	--	11.00
11	1345	200	23.42	6.64	1.134	-103.4	5.82	545.9	--	--	11.00
12	1350	200	23.49	6.67	1.141	-105.7	6.8	537.6	--	--	11.00
13	1355	200	23.41	6.69	1.143	-109.5	6.91	468.1	--	--	11.00
14	1400	200	23.40	6.70	1.143	-112.3	7.08	403.7	--	--	11.00
15	1405	200	23.32	6.71	1.143	-113.7	7.08	363.0	--	--	11.00
16	1410	200	23.12	6.71	1.138	-115.0	7.08	328.0	--	--	11.00
17	1415	200	23.17	6.73	1.138	-116.5	7.05	320.9	--	--	11.00
18	1420	200	23.15	6.73	1.138	-117.7	6.90	304.9	--	--	11.00
19	1425	200	23.01	6.73	1.136	-118.1	6.82	293.4	--	--	11.00
20	1430	200	22.90	6.73	1.133	-118.5	6.75	284.4	--	--	11.00
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony J. Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-3, 8-7-2018, 1435							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1435				End Sample Time: 1450							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None odor or sheen, red silt and color.							
COMMENTS:				Extreme siltiness during purge and sample. *Trouble shooting well, readings missed							



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 77°F, Cloudy		Sampling Date: 8/7/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 7.85 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 15.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 5.99 - 15.99 (ft)	h. Depth of Pump: 11.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 0841	End Purge Time: 0925									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	0845	200	24.61	5.10	0.045	224.0	1.63	413.6	--	--	7.85
2	0850	200	24.87	5.24	0.044	208.1	1.02	176.8	--	--	7.95
3	0855	200	24.99	5.53	0.046	175.4	0.85	78.1	--	--	8.05
4	0900	200	25.07	5.69	0.046	159.7	0.79	34.9	--	--	8.05
5	0905	200	25.19	5.77	0.046	150.5	1.01	15.2	--	--	8.05
6	0910	200	25.26	5.81	0.046	145.7	0.81	7.0	--	--	8.05
7	0915	200	25.30	5.82	0.046	144.5	0.74	4.0	--	--	8.05
8	0920	200	25.37	5.84	0.047	143.7	0.65	5.0	--	--	8.05
9	0925	200	25.40	5.84	0.047	141.9	0.58	3.0	--	--	8.05
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									--	--	
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony J. Shields					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-4, 8-7-2018, 0930					
Sample Start Time: 0930						End Sample Time: 0940					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:						DO readings outside range (low values causing variation).					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 81°F, Partly Cloudy		Sampling Date: 8/7/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	-- (ft)	b. Depth to Water:	12.75 (ft)								
c. Depth to DNAPL:	-- (ft)	d. Total Well Depth:	19.79 (ft)								
e. LNAPL Thickness: (a-b)	-- (ft)	f. DNAPL Thickness: (c-d)	-- (ft)								
g. Screen Interval:	9.79 - 19.79 (ft)	h. Depth of Pump:	14.8 (ft)								
2. WELL PURGE DATA											
a. Purge Method:	QED Bladder Pump / MP50 Controller										
b. Field Testing Equipment:	YSI 650 w/ turbidity meter										
e. Begin Purge Time:	0957	End Purge Time:	1125								
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	1005	200	22.64	6.77	0.896	-105.5	1.11	251.7	--	--	12.68
2	1010	200	21.33	6.76	0.878	-113.0	0.52	324.3	--	--	12.68
3	1015	200	20.85	6.79	0.870	-114.2	0.42	239.4	--	--	12.68
4	1020	200	20.96	6.78	0.870	-115.2	0.39	174.2	--	--	12.68
5	1025	200	21.18	6.76	0.875	-114.8	0.38	137.9	--	--	12.68
6	1030	200	21.30	6.75	0.877	-114.7	0.38	106.7	--	--	12.68
7	1035	200	21.18	6.73	0.876	-114.3	0.38	94.4	--	--	12.68
8	1040	200	21.21	6.71	0.876	-114.0	0.39	65.0	--	--	12.68
9	1045	200	21.36	6.71	0.878	-113.8	0.39	60.2	--	--	12.68
10	1050	200	21.08	6.69	0.875	-113.7	0.40	43.6	--	--	12.68
11	1055	200	21.17	6.68	0.875	-113.4	0.41	30.3	--	--	12.68
12	1100	200	21.27	6.60	0.877	-114.3	0.42	26.9	--	--	12.68
13	1105	200	21.11	6.67	0.875	-114.1	0.46	18.5	--	--	12.68
14	1110	200	21.33	6.67	0.877	-114.9	0.45	18.6	--	--	12.68
15	1115	200	21.45	6.68	0.880	-116.1	0.46	13.4	--	--	12.68
16	1120	200	21.48	6.67	0.881	-116.7	0.47	11.9	--	--	12.68
17	1125	200	21.47	6.67	0.881	-117.1	0.48	11.2	--	--	12.68
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony J. Shields					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-5, 8-7-2018, 1130					
Sample Start Time: 1130						End Sample Time: 1145					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 86°F, Partly Cloudy		Sampling Date: 8/3/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.71 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 22.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.00 - 22.00 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1304	End Purge Time: 1430									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	1310	200	20.11	6.51	0.680	-50.0	1.61	554.3	--	--	10.71
2	1315	200	20.16	6.46	0.675	-57.8	0.71	805.6	--	--	10.79
3	1320	200	19.92	6.46	0.670	-59.8	0.50	828.5	--	--	10.79
4	1325	200	18.91	6.47	0.655	-60.5	0.36	786.5	--	--	10.79
5	1330	200	18.36	6.48	0.645	-61.8	0.31	562.6	--	--	10.79
6	1335	200	18.39	6.51	0.645	-64.1	0.27	339.3	--	--	10.79
7	1340	200	18.14	6.53	0.641	-65.7	0.27	203.1	--	--	10.79
8	1345	200	17.96	6.55	0.639	-68.0	0.24	108.5	--	--	10.79
9	1350	200	17.89	6.57	0.641	-70.7	0.22	58.2	--	--	10.79
10	1355	200	17.77	6.57	0.640	-72.7	0.21	35.9	--	--	10.79
11	1400	200	17.47	6.58	0.637	-74.2	0.19	24.5	--	--	10.79
12	1405	200	17.85	6.58	0.634	-74.6	0.19	22.4	--	--	10.79
13	1410	200	17.41	6.57	0.633	-74.4	0.18	17.0	--	--	10.79
14	1415	200	17.17	6.57	0.627	-73.8	0.24	11.4	--	--	10.79
15	1420	200	17.00	6.57	0.624	-73.4	0.17	9.3	--	--	10.79
16	1425	200	17.12	6.57	0.624	-72.9	0.17	6.7	--	--	10.79
17	1430	200	17.24	6.57	0.624	-72.98	0.16	6.3	--	--	10.79
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony J. Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-6, 8-3-2018, 1435					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1435						End Sample Time: 1450					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, grey color.					
COMMENTS:						3rd turbidity reading out of range. Sampled for time.					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions:		Sampling Date: 9/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 14.60 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.99 - 19.99 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1505	End Purge Time: 1545									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	150	20.70	6.35	1.144	-148.8	1.26	25.2	--	--	14.60
2	10	150	20.10	6.32	1.009	-147.2	0.76	27.1	--	--	14.60
3	15	150	20.15	6.32	1.000	-145.5	0.19	52.0	--	--	14.60
4	20	150	19.49	6.31	1.576	-144.1	0.51	38.1	--	--	14.60
5	25	150	19.15	6.34	1.559	-144.4	0.40	29.5	--	--	14.60
6	30	150	19.05	6.33	1.549	-143.4	0.38	11.0	--	--	14.60
7	35	150	19.03	6.38	1.543	-144.3	0.36	12.1	--	--	14.60
8	40	150	19.00	6.36	1.543	-144.3	0.35	8.6	--	--	14.60
3. SAMPLE COLLECTION DATA				Sampling Personnel: Shane Wagner							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-1, 9-4-2018, 1545							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1545				End Sample Time: 1555							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None odor or sheen, clear.							
COMMENTS:											

LOW-FLOW GROUNDWATER SAMPLE COLLECTION RECORD

WELL NO.:

MW-2

PERMIT NO.:[illegible]



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions:		Sampling Date: 9/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL: -- (ft)	b.	Depth to Water: 11.78 (ft)								
c.	Depth to DNAPL: -- (ft)	d.	Total Well Depth: 23.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f.	DNAPL Thickness: (c-d) -- (ft)								
g.	Screen Interval: 11.00 - 23.00 (ft)	h.	Depth of Pump: 17.0 (ft)								
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
c.	Begin Purge Time: 1450	End Purge Time: 1535									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	0	100	20.76	6.87	0.997	-95.6	2.70	160.0	--	--	11.78
2	5	100	17.66	6.71	0.891	-100.2	0.95	102.7	--	--	11.84
3	10	100	17.58	6.70	0.873	-106.4	1.33	55.7	--	--	11.90
4	15	100	17.18	6.70	0.859	-109.6	1.42	25.2	--	--	11.97
5	20	100	17.00	6.72	0.853	-112.1	1.31	16.5	--	--	12.02
6	25	100	17.14	6.74	0.854	-114.3	1.38	9.6	--	--	12.10
7	30	100	17.19	6.77	0.888	-116.4	1.38	7.1	--	--	12.17
8	35	100	16.97	6.79	0.849	-117.7	0.84	5.4	--	--	12.22
9	40	100	16.73	6.80	0.843	-119.0	0.83	7.2	--	--	12.22
10	45	100	16.73	6.81	0.842	-119.4	0.83	8.1	--	--	12.22
3. SAMPLE COLLECTION DATA				Sampling Personnel: Casey Kincaid							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-3, 9-4-2018, 1545							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1545				End Sample Time: 1555							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				Little, light sheen.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions:		Sampling Date: 9/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 8.32 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 15.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 5.99 - 15.99 (ft)	h. Depth of Pump: 11.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1030	End Purge Time: 1120									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	0	150	24.99	5.62	0.103	24.7	1.03	114.2	--	--	8.32
2	5	150	25.63	5.85	0.085	25.2	0.81	77.8	--	--	8.51
3	10	150	25.78	5.96	0.077	25.6	0.63	80.2	--	--	8.52
4	15	150	25.92	6.01	0.075	23.1	0.61	56.8	--	--	8.53
5	20	150	56.17	6.08	0.072	19.8	0.55	34.0	--	--	8.53
6	25	150	26.57	6.14	0.072	14.3	0.47	17.7	--	--	8.53
7	30	150	26.93	6.16	0.075	15.1	0.44	15.2	--	--	8.54
8	35	150	27.15	6.17	0.072	7.2	0.44	7.2	--	--	8.55
9	40	150	27.45	6.16	0.071	7.6	0.44	7.0	--	--	8.55
10	45	150	27.58	6.15	0.071	7.7	0.44	4.1	--	--	8.55
11	50	150	27.77	6.15	0.071	7.7	0.44	2.6	--	--	8.55
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-4, 9-4-2018, 1125					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1125						End Sample Time: 1135					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions:		Sampling Date: 9/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.93 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.79 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.79 - 19.79 (ft)	h. Depth of Pump: 14.8 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1235	End Purge Time: 1345									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	19.86	6.64	0.944	-164.8	3.19	74.1	--	--	12.93
2	10	200	19.61	6.62	0.940	-164.9	2.80	72.1	--	--	12.93
3	15	200	19.48	6.60	0.932	-165.6	1.29	66.6	--	--	12.93
4	20	200	19.08	6.63	0.927	-168.6	1.24	48.6	--	--	12.93
5	25	200	18.78	6.68	0.923	-171.7	1.16	47.2	--	--	12.93
6	30	200	18.52	6.73	0.918	-174.0	1.05	38.0	--	--	12.93
7	35	200	18.40	6.71	0.913	-171.7	0.64	30.4	--	--	12.93
8	40	200	18.36	6.70	0.910	-169.4	0.43	125.8	--	--	12.93
9	45	200	18.28	6.72	0.911	-171.8	0.48	32.6	--	--	12.93
10	50	200	18.21	6.75	0.912	-172.3	0.52	28.4	--	--	12.93
11	55	200	17.94	6.75	0.912	-175.4	0.52	23.7	--	--	12.93
12	60	200	17.9	6.77	0.914	-179.9	0.53	18.4	--	--	12.93
13	65	200	17.85	6.76	0.913	-178.6	0.53	17.6	--	--	12.93
14	70	200	17.72	6.77	0.913	-177.2	0.53	16.0	--	--	12.93
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-5, 9-4-2018, 1350					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1350						End Sample Time: 1400					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions:		Sampling Date: 9/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 11.12 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 22.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.00 - 22.00 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1045	End Purge Time: 1125									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	0	100	20.70	7.06	0.821	-95.2	1.51	27.9	--	--	11.12
2	5	100	17.16	6.04	0.718	-80.8	1.12	9.2	--	--	11.12
3	10	100	16.56	6.65	0.709	-81.1	0.93	5.3	--	--	11.12
4	15	100	16.38	6.67	0.707	-78.8	0.91	3.9	--	--	11.12
5	20	100	16.47	6.66	0.709	-79.3	0.90	2.9	--	--	11.12
6	25	100	16.55	6.68	0.711	-81.7	0.90	2.7	--	--	11.12
7	30	100	16.49	6.68	0.711	-83.3	0.92	1.8	--	--	11.12
8	35	100	16.45	6.69	0.710	-78.5	0.91	1.5	--	--	11.12
9	40	100	16.30	6.68	0.708	-76.4	0.95	1.4	--	--	11.12
3. SAMPLE COLLECTION DATA				Sampling Personnel: Shane Wagner							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-6, 9-4-2018, 1130							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1130				End Sample Time: 1140							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 76°F, Sunny		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.92 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.99 - 19.99 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1310	End Purge Time: 1425									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	150	21.97	6.61	1.016	-46.2	3.69	500.9	--	--	12.92
2	10	150	19.46	6.48	1.468	-58.4	1.18	297.6	--	--	12.92
3	15	150	19.15	6.49	1.472	-60.1	1.14	188.2	--	--	12.92
4	20	150	19.05	6.50	1.474	-61.1	1.35	111.4	--	--	12.92
5	25	150	19.02	6.51	1.472	-61.8	1.26	98.2	--	--	12.92
6	30	150	19.00	6.51	1.469	-62.0	1.20	68.8	--	--	12.92
7	35	150	19.06	6.51	1.466	-62.1	1.31	47.1	--	--	12.92
8	40	150	19.02	6.51	1.462	-61.4	1.34	29.7	--	--	12.92
9	45	150	19.07	6.51	1.464	-61.0	1.49	25.4	--	--	12.92
10	50	150	19.04	6.50	1.461	-60.7	1.50	18.5	--	--	12.92
11	55	150	19.18	6.50	1.465	-60.4	1.58	14.8	--	--	12.92
12	60	150	19.37	6.51	1.468	-59.8	1.6	14.5	--	--	12.92
13	65	150	19.26	6.50	1.469	-58.1	1.59	9.9	--	--	12.92
14	70	150	19.22	6.50	1.469	-58.4	1.59	8.6	--	--	12.92
15	75	150	19.18	6.51	1.470	-58.9	1.60	7.3	--	--	12.92
3. SAMPLE COLLECTION DATA				Sampling Personnel: Casey Kincaid							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-1, 10-4-2018, 1425							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1425				End Sample Time: 1430							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None odor or sheen, clear.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 70°F, Partly Cloudy		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 11.60 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 4.00 - 19.00 (ft)	h. Depth of Pump: 11.5 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1102	End Purge Time: 1140									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	23.20	6.93	0.191	187.5	6.67	199.6	--	--	11.60
2	10	200	23.18	7.22	0.205	165.8	5.72	87.3	--	--	11.54
3	15	200	23.20	7.23	0.205	162.7	5.62	38.0	--	--	11.54
4	20	200	23.21	7.29	0.206	161.8	5.51	11.1	--	--	11.54
5	25	200	23.22	7.24	0.206	161.5	5.50	6.3	--	--	11.54
6	30	200	23.28	7.24	0.207	161.8	5.46	3.8	--	--	11.54
7	35	200	23.35	7.24	0.207	161.2	5.46	2.8	--	--	11.54
8	40	200	23.42	7.24	0.208	161.0	5.42	2.2	--	--	11.54
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-2, 10-4-2018, 1145							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1145				End Sample Time: 1150							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None							
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 76°F, Sunny		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 9.67 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f.	DNAPL Thickness: (c-d) -- (ft)								
g.	Screen Interval: 11.00 - 23.00 (ft)	h.	Depth of Pump: 17.0 (ft)								
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
c.	Begin Purge Time: 1226	End Purge Time: 1335									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	25.44	7.55	0.001	154.2	8.03	-1.2	--	--	9.67
2	10	200	23.56	6.74	0.001	59.7	2.30	1770.0	--	--	9.67
3	15	200	22.70	6.42	0.319	5.1	0.73	1762.0	--	--	9.67
4	20	200	20.94	6.39	0.331	47.5	0.68	1739.0	--	--	9.67
5	25	200	20.31	6.41	0.366	40.4	0.69	1730.0	--	--	9.67
6	30	200	21.44	7.20	0.003	54.9	0.71	1449.0	--	--	9.67
7	35	200	19.51	6.48	0.492	27.9	0.87	1365.0	--	--	9.67
8	40	200	19.34	6.50	0.518	10.9	0.77	1717.0	--	--	9.67
9	45	200	19.29	6.51	0.526	7.2	0.76	1686.0	--	--	9.67
10	50	200	19.26	6.51	0.529	3.1	0.76	1704.0	--	--	9.67
11	55	200	19.22	6.51	0.532	-0.7	0.78	1699.0	--	--	9.67
12	60	200	19.13	6.52	0.536	-4.6	0.8	1714.0	--	--	9.67
13	65	200	19.07	6.52	0.539	-6.6	0.8	1713.0	--	--	9.67
14	70	200	19.05	6.53	0.545	-8.9	0.8	1664.0	--	--	9.67
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-3, 10-4-2018, 1340					
Sample Start Time: 1340						End Sample Time: 1345					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None					
COMMENTS:						Extremely turbid/brown color					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 62°F, Cloudy		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	-- (ft)	b. Depth to Water:	6.49 (ft)								
c. Depth to DNAPL:	-- (ft)	d. Total Well Depth:	15.99 (ft)								
e. LNAPL Thickness: (a-b)	-- (ft)	f. DNAPL Thickness: (c-d)	-- (ft)								
g. Screen Interval:	5.99 - 15.99 (ft)	h. Depth of Pump:	11.0 (ft)								
2. WELL PURGE DATA											
a. Purge Method:	QED Bladder Pump / MP50 Controller										
b. Field Testing Equipment:	YSI 650 w/ turbidity meter										
e. Begin Purge Time:	924	End Purge Time:	1015								
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	20.97	5.69	0.030	167.5	2.43	370.9	--	--	6.49
2	10	200	21.30	5.59	0.027	190.8	2.04	179.3	--	--	6.65
3	15	200	21.41	5.60	0.027	194.3	2.16	97.2	--	--	6.65
4	20	200	21.48	5.57	0.026	199.8	1.95	52.3	--	--	6.65
5	25	200	21.51	5.57	0.027	198.2	1.72	33.5	--	--	6.65
6	30	200	21.53	5.57	0.026	198.3	1.64	28.5	--	--	6.65
7	35	200	21.51	5.57	0.026	198.3	1.63	29.0	--	--	6.65
8	40	200	21.52	5.56	0.027	199.7	1.60	26.9	--	--	6.65
9	45	200	21.59	5.56	0.027	200.9	1.58	27.4	--	--	6.65
10	50	200	21.64	5.56	0.027	201.1	1.53	25.6	--	--	6.65
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-4, 10-4-2018, 1020					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1020						End Sample Time: 1025					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 71°F, Cloudy		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	-- (ft)	b. Depth to Water:	11.80 (ft)								
c. Depth to DNAPL:	-- (ft)	d. Total Well Depth:	19.79 (ft)								
e. LNAPL Thickness: (a-b)	-- (ft)	f. DNAPL Thickness: (c-d)	-- (ft)								
g. Screen Interval:	9.79 - 19.79 (ft)	h. Depth of Pump:	14.8 (ft)								
2. WELL PURGE DATA											
a. Purge Method:	QED Bladder Pump / MP50 Controller										
b. Field Testing Equipment:	YSI 650 w/ turbidity meter										
e. Begin Purge Time:	1115	End Purge Time:	1240								
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	120	20.25	6.79	0.910	-68.1	2.04	809.4	--	--	11.85
2	10	120	17.72	6.79	0.852	-81.9	0.93	574.4	--	--	11.85
3	15	120	17.60	6.80	0.851	-85.8	0.84	340.2	--	--	11.85
4	20	120	17.53	6.81	0.850	-87.3	0.82	222.6	--	--	11.85
5	25	120	17.50	6.81	0.850	-88.9	0.77	174.5	--	--	11.85
6	30	120	17.47	6.81	0.850	-89.5	0.76	128.0	--	--	11.85
7	35	120	17.47	6.81	0.851	-89.4	0.73	96.2	--	--	11.85
8	40	120	17.40	6.82	0.850	-89.3	0.73	83.5	--	--	11.85
9	45	120	17.53	6.82	0.851	-89.4	0.74	67.5	--	--	11.85
10	50	120	17.59	6.82	0.854	-89.2	0.73	56.7	--	--	11.85
11	55	120	17.61	6.82	0.855	-89.8	0.72	41.6	--	--	11.85
12	60	120	17.62	6.81	0.855	-89.8	0.73	37.3	--	--	11.85
13	65	120	17.45	6.81	0.853	-89.7	0.72	28.3	--	--	11.85
14	70	120	17.46	6.82	0.851	-90.0	0.71	21.1	--	--	11.85
15	75	120	17.44	6.82	0.851	-91.0	0.71	18.5	--	--	11.85
16	80	120	17.46	6.82	0.851	-91.4	0.72	18.2	--	--	11.85
17	85	120	17.47	6.82	0.851	-91.6	0.72	18.0	--	--	11.85
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-5, 10-4-2018, 1240					
Sample Start Time: 1240						End Sample Time: 1245					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton									
Weather Conditions: 72°F, Cloudy		Sampling Date: 10/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 9.77 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 22.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.00 - 22.00 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method:	QED Bladder Pump / MP50 Controller									
b.	Field Testing Equipment:	YSI 650 w/ turbidity meter									
e.	Begin Purge Time:	925	End Purge Time: 1015								
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	17.44	7.48	0.274	-2.2	5.11	232.4	--	--	9.77
2	10	200	16.95	6.66	0.532	-57.3	1.71	136.2	--	--	9.77
3	15	200	16.83	6.64	0.531	-62.4	1.42	69.2	--	--	9.77
4	20	200	16.79	6.65	0.536	-66.1	1.18	34.3	--	--	9.77
5	25	200	16.79	6.66	0.538	-68.6	1.08	23.7	--	--	9.77
6	30	200	16.77	6.66	0.537	-70.3	0.96	14.4	--	--	9.77
7	35	200	16.76	6.66	0.537	-71.2	0.88	11.5	--	--	9.77
8	40	200	16.77	6.67	0.536	-71.7	0.82	9.6	--	--	9.77
9	45	200	16.78	6.66	0.536	-72.4	0.78	6.7	--	--	9.77
10	50	200	16.81	6.66	0.534	-72.4	0.77	4.5	--	--	9.77
3. SAMPLE COLLECTION DATA				Sampling Personnel: Casey Kincaid							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-6, 10-4-2018, 1020							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1020				End Sample Time: 1025							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 53°F, Mostly Cloudy		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 13.62 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.99 - 19.99 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1020	End Purge Time: 1425									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	150	17.44	6.60	1.468	-6.4	2.35	302.4	--	--	13.70
2	10	150	17.74	6.60	1.469	-43.4	0.53	184.5	--	--	13.70
3	15	150	17.78	6.61	1.473	-57.8	0.38	76.7	--	--	13.72
4	20	150	17.74	6.63	1.476	-68.2	0.30	56.6	--	--	13.73
5	25	150	17.74	6.64	1.480	-75.2	0.27	46.9	--	--	13.74
6	30	150	17.75	6.64	1.482	-79.4	0.25	43.0	--	--	13.75
7	35	150	17.77	6.63	1.488	-83.3	0.23	39.2	--	--	13.75
8	40	150	17.78	6.64	1.487	-86.1	0.23	36.8	--	--	13.75
9	45	150	17.77	6.64	1.496	-88.0	0.22	35.6	--	--	13.75
10	50	150	17.74	6.64	1.484	-90.3	0.21	33.1	--	--	13.75
11	55	150	17.80	6.64	1.484	-91.6	0.21	28.5	--	--	13.75
12	60	150	18.02	6.64	1.491	-91.2	0.21	6.1	--	--	13.75
13	65	150	18.08	6.64	1.487	-91.7	0.19	5.5	--	--	13.75
14	70	150	18.10	6.64	1.489	-91.9	0.19	4.8	--	--	13.75
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-1, 10-29-2018, 1130					
Sample Start Time: 1130						End Sample Time: 1140					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 52°F, Overcast		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.11 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 4.00 - 19.00 (ft)	h. Depth of Pump: 11.5 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1015	End Purge Time: 1105									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	14.97	7.42	0.123	173.2	9.40	322.1	--	--	12.11
2	10	200	15.04	7.49	0.123	181.1	9.12	228.1	--	--	12.11
3	15	200	14.66	7.51	0.122	191.8	9.52	145.1	--	--	12.11
4	20	200	14.56	7.48	0.121	198.7	9.43	62.1	--	--	12.11
5	25	200	14.60	7.49	0.121	200.0	9.39	40.2	--	--	12.11
6	30	200	14.60	7.48	0.121	203.1	9.32	26.5	--	--	12.11
7	35	200	14.71	7.50	0.121	206.9	9.25	16.2	--	--	12.11
8	40	200	14.57	7.48	0.121	211.3	9.26	10.0	--	--	12.11
9	45	200	14.62	7.48	0.121	214.4	9.23	9.7	--	--	12.11
10	50	200	14.59	7.50	0.121	215.7	9.22	9.8	--	--	12.11
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-2, 10-29-2018, 1110							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1110				End Sample Time: 1120							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None							
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 56°F, Partly Sunny		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.33 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f.	DNAPL Thickness: (c-d) -- (ft)								
g.	Screen Interval:	11.00 - 23.00 (ft)	h. Depth of Pump: 17.0 (ft)								
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
c.	Begin Purge Time:	1357	End Purge Time: 1455								
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	15.89	6.73	0.809	47.5	3.30	1320.0	--	--	10.33
2	10	200	15.75	6.79	0.862	6.3	3.70	987.9	--	--	10.33
3	15	200	15.74	6.82	0.872	-10.7	4.49	426.0	--	--	10.33
4	20	200	15.58	6.84	0.875	-22.9	6.84	200.1	--	--	10.33
5	25	200	15.41	6.86	0.870	-30.8	6.86	116.1	--	--	10.33
6	30	200	15.24	6.87	0.866	-35.8	5.39	75.7	--	--	10.33
7	35	200	15.24	6.89	0.868	-39.9	5.25	53.6	--	--	10.33
8	40	200	15.25	6.89	0.869	-42.9	5.24	51.2	--	--	10.33
9	45	200	15.37	6.90	0.873	-46.7	5.10	36.6	--	--	10.33
10	50	200	15.53	6.89	0.880	-48.7	5.00	34.0	--	--	10.33
11	55	200	15.63	6.89	0.883	-52.4	4.77	32.0	--	--	10.33
12	60	200	15.63	6.89	0.884	-53.5	4.70	31.8	--	--	10.33
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-3, 10-29-2018, 1500							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1500				End Sample Time: 1510							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None							
COMMENTS:				Extremely turbid/brown color							



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 54°F, Overcast		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 7.36 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 15.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 5.99 - 15.99 (ft)	h. Depth of Pump: 11.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1155	End Purge Time: 1255									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	200	17.40	5.68	0.033	191.8	4.04	380.1	--	--	7.36
2	10	200	17.51	5.65	0.033	197.2	4.30	300.3	--	--	7.36
3	15	200	17.44	5.69	0.033	197.4	4.63	227.2	--	--	7.36
4	20	200	17.33	5.73	0.033	197.0	5.03	118.1	--	--	7.36
5	25	200	17.42	5.72	0.034	195.8	5.60	82.5	--	--	7.36
6	30	200	17.29	5.74	0.034	194.0	5.74	56.7	--	--	7.36
7	35	200	17.44	5.79	0.034	192.1	5.81	41.9	--	--	7.36
8	40	200	17.47	5.79	0.034	191.7	6.05	29.5	--	--	7.36
9	45	200	17.52	5.81	0.034	191.1	5.93	26.0	--	--	7.36
10	50	200	17.47	5.76	0.034	195.6	5.90	18.2	--	--	7.36
11	55	200	17.57	5.79	0.034	195.7	5.92	17.1	--	--	7.36
12	60	200	17.62	5.82	0.034	193.2	5.91	18.7	--	--	7.36
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-4, 10-29-2018, 1300					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1300						End Sample Time: 1310					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 54°F, Overcast		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.37 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 19.79 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 9.79 - 19.79 (ft)	h. Depth of Pump: 14.8 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1155	End Purge Time: 1240									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	150	16.42	6.93	0.905	-68.9	1.24	257.6	--	--	12.50
2	10	150	16.40	6.92	0.902	-93.3	0.43	228.0	--	--	12.51
3	15	150	16.43	6.92	0.897	-96.9	0.36	210.2	--	--	12.52
4	20	150	16.43	6.92	0.895	-98.1	0.30	165.4	--	--	12.52
5	25	150	16.44	6.92	0.895	-100.4	0.24	124.9	--	--	12.53
6	30	150	16.42	6.92	0.895	-102.4	0.21	91.1	--	--	12.55
7	35	150	16.42	6.92	0.899	-104.3	0.22	65.2	--	--	12.55
8	40	150	16.47	6.93	0.898	-105.6	0.20	54.2	--	--	12.57
9	45	150	16.47	6.93	0.898	-106.6	0.21	44.3	--	--	12.57
10	50	150	16.45	6.93	0.898	-107.6	0.21	39.0	--	--	12.58
11	55	150	16.46	6.93	0.898	-108.3	0.19	46.4	--	--	12.59
12	60	150	16.48	6.93	0.898	-109.1	0.18	34.1	--	--	12.59
13	65	150	16.46	6.93	0.899	-109.8	0.16	32.7	--	--	12.61
14	70	150	16.41	6.93	0.898	-109.3	0.17	31.8	--	--	12.62
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-5, 10-29-2018, 1310					
Sample Start Time: 1310						End Sample Time: 1320					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None odor or sheen, clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Mercer		Project Location: Trenton, NJ									
Weather Conditions: 56°F, Mostly Cloudy		Sampling Date: 10/29/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.22 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 22.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.00 - 22.00 (ft)	h. Depth of Pump: 15.0 (ft)									
2. WELL PURGE DATA											
a.	Purge Method: QED Bladder Pump / MP50 Controller										
b.	Field Testing Equipment: YSI 650 w/ turbidity meter										
e.	Begin Purge Time: 1350	End Purge Time: 1455									
Read No.	Lapse Time (min.)	Purge Rate mL/min	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
0	--	--	--	--	--	--	--	--	--	--	--
PURGING VALUES											
1	5	150	16.14	6.65	0.685	-23.1	0.64	225.9	--	--	10.40
2	10	150	15.93	6.60	0.714	-42.6	0.37	94.6	--	--	10.43
3	15	150	15.87	6.63	0.715	-46.2	0.33	60.7	--	--	10.43
4	20	150	15.83	6.65	0.712	-49.4	0.29	47.5	--	--	10.45
5	25	150	15.79	6.65	0.711	-51.0	0.26	41.3	--	--	10.45
6	30	150	15.82	6.64	0.709	-51.6	0.23	35.3	--	--	10.47
7	35	150	15.79	6.63	0.716	-52.1	0.19	35.1	--	--	10.47
8	40	150	15.76	6.63	0.724	-53.6	0.18	34.3	--	--	10.49
9	45	150	15.77	6.63	0.715	-53.9	0.17	33.2	--	--	10.50
10	50	150	15.78	6.63	0.717	-54.8	0.16	33.0	--	--	10.51
11	55	150	15.77	6.63	0.710	-56.0	0.16	31.2	--	--	10.52
12	60	150	15.75	6.63	0.710	-56.4	0.15	30.8	--	--	10.52
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Sample I.D. (Name, Date, Time):						Poly bladder and QED pump					
Sample Analytical Parameters/Method:						MW-6, 10-29-2018, 1500					
Sample Start Time: 1500						End Sample Time: 1510					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Mercer		Project Location: Trenton NJ									
Weather Conditions: 32F, partly cloudy		Sampling Date: 12/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 12.99 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 17 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 4.01 (ft)		(a-d)									
h. Well Volume: 0.65 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, QED Bladder pump											
e. Begin Purge Time: 9:15		End Purge Time: 10:30									
Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
---	---	---	---	---	---	---	---	---	---	---	---
PURGING VALUES											
1	5	150	13.26	6.73	2.291	76.8	4.26	21.8	---	---	13.20
2	10	150	13.75	6.80	2.325	61.5	4.39	12.6	---	---	13.25
3	15	150	13.97	6.80	2.343	58.0	4.75	11.3	---	---	13.25
4	20	150	13.96	6.86	2.349	55.7	4.1	9.2	---	---	13.25
5	25	150	13.95	6.87	2.350	55.1	4.13	8.7	---	---	13.28
6	30	150	14.09	6.73	2.361	54.8	3.79	9	---	---	13.30
7	35	150	14.10	6.81	2.368	55.5	3.48	8.2	---	---	13.30
8	40	150	14.00	6.8	2.368	56.1	3.34	8.1	---	---	13.30
9	45	150	14.08	6.76	2.367	56.8	3.37	8.1	---	---	13.30
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip: Low flow- QED bladder pump, poly bladder, MP50						Sampling Personnel: RT					
Sample I.D. (Name, Date, Time): MW-1; 2018-12-06; 10:10											
Sample Analytical Parameters/Method: TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH											
Sample Start Time: 10:10						End Sample Time: 10:30					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Mercer		Project Location: Trenton NJ									
Weather Conditions: 33F, clear		Sampling Date: 12/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 11.31 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 16.00 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 4.69 (ft)		(a-d)									
h. Well Volume: 0.77 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, QED Bladder pump											
e. Begin Purge Time: 9:19		End Purge Time:									
Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
---	---	---	---	---	---	---	---	---	---	---	---
PURGING VALUES											
1	9:25	200	8.69	7.50	0.216	202.4	13.34	132.9	---	---	11.31
2	9:30	200	9.61	7.66	0.179	189.4	14.43	45.9	---	---	11.31
3	P:35	200	10.06	7.68	0.180	183.5	15.49	21.5	---	---	11.31
4	9:40	200	10.25	7.69	0.184	179.2	15.87	13.0	---	---	11.31
5	9:45	200	10.35	7.68	0.188	177.9	15.99	10.8	---	---	11.31
6	9:50	200	10.44	7.67	0.196	157.9	17.04	9.3	---	---	11.31
7	9:55	200	10.53	7.63	0.205	174.0	15.80	7.7	---	---	11.31
8	10:00	200	10.66	7.63	0.209	169.3	15.63	5.4	---	---	11.31
9	10:05	200	10.68	7.58	0.211	171.4	15.50	4.4	---	---	11.31
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: AS					
Low flow- QED bladder pump, poly bladder, MP50											
Sample I.D. (Name, Date, Time):						---					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 10:10						End Sample Time:					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS: High DO, but stable											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Mercer		Project Location: Trenton NJ									
Weather Conditions:		Sampling Date: 12/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 7.85 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 20 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 12.15 (ft)		(a-d)									
h. Well Volume: 1.98 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, QED Bladder pump											
e. Begin Purge Time: 12:12		End Purge Time:									
Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
---	---	---	---	---	---	---	---	---	---	---	---
PURGING VALUES											
1	1220	200	10.79	6.69	0.404	52.1	4.62	1227	---	---	7.85
2	1225	200	11.37	6.56	0.449	40.2	1.9	1233	---	---	7.85
3	1230	200	11.86	6.66	0.474	7.9	1.21	1238	---	---	7.85
4	1235	200	11.83	6.67	0.515	3.8	0.97	898	---	---	7.85
5	1240	200	11.7	6.71	0.546	-1.9	0.92	236.8	---	---	7.85
6	1245	200	11.69	6.69	0.564	-5.7	0.82	225.1	---	---	7.85
7	1250	200	11.72	6.71	0.572	-11.4	0.85	160.8	---	---	7.85
8	1255	200	11.73	6.71	0.593	-17.4	0.74	106.8	---	---	7.85
9	1300	200	11.72	6.72	0.612	-20.9	0.68	89.1	---	---	7.85
10	1305	200	11.73	6.73	0.630	-24.3	0.73	58.2	---	---	7.85
11	1310	200	11.71	6.73	0.649	-27.8	0.57	52.1	---	---	7.85
12	1315	200	11.68	6.75	0.663	-31.3	0.51	33.8	---	---	7.85
13	1320	200	11.62	6.76	0.669	-30.8	0.47	32.5	---	---	7.85
14	1325	200	11.63	6.74	0.671	-30.7	0.50	32.9	---	---	7.85
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: AS					
Low flow- QED bladder pump, poly bladder, MP50											
Sample I.D. (Name, Date, Time):						MW-3; 2018-12-06; 13:30					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 13:30						End Sample Time:					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Mercer		Project Location: Trenton NJ									
Weather Conditions:		Sampling Date: 12/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 5.49 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 13.00 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 7.51 (ft)		(a-d)									
h. Well Volume: 1.23 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, QED Bladder pump											
e. Begin Purge Time: 10:58		End Purge Time:									
Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
---	---	---	---	---	---	---	---	---	---	---	---
PURGING VALUES											
1	1045	200	7.92	6.58	0.031	148.9	7.57	260.8	---	---	5.49
2	1050	200	7.69	6.05	0.028	156.5	7.14	163.6	---	---	5.49
3	1055	200	7.48	5.96	0.027	167.1	7.43	167.2	---	---	5.49
4	1100	200	7.41	5.90	0.027	171.9	8.00	82.6	---	---	5.49
5	1105	200	7.28	5.87	0.026	174.6	8.07	64.3	---	---	5.49
6	1110	200	7.28	5.86	0.026	174.7	8.32	50.9	---	---	5.49
7	1115	200	7.26	5.85	0.026	175.2	8.17	45.6	---	---	5.49
8	1120	200	7.28	5.82	0.025	174.7	7.72	40.8	---	---	5.49
9	1125	200	7.22	5.87	0.025	172.4	7.67	40.4	---	---	5.49
10	1130	200	7.30	5.84	0.025	171.3	8.02	39.0	---	---	5.49
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: AS					
Low flow- QED bladder pump, poly bladder, MP50											
Sample I.D. (Name, Date, Time):						MW-4; 2018-12-06; 11:35					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 11:35						End Sample Time:					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Mercer		Project Location: Trenton NJ									
Weather Conditions: 35F, partly cloudy		Sampling Date: 12/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	---	(ft)	b. Depth to Water:	11.92	(ft)						
c. Depth to DNAPL:	----	(ft)	d. Total Well Depth:	20.00	(ft)						
e. LNAPL Thickness:	(a-b) ---	(ft)	f. DNAPL Thickness:	(c-d) ---	(ft)						
g. Length of Water Column:	8.08	(ft)	(a-d)								
h. Well Volume:	1.32	(gal)									
2. WELL PURGE DATA											
a. Purge Method:	Low Flow										
b. Field Testing Equipment:	YSI 6920, QED Bladder pump										
e. Begin Purge Time:	10:40	End Purge Time:	12:55								
Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)
CORRECTION FACTORS											
---	---	---	---	---	---	---	---	---	---	---	---
PURGING VALUES											
1	5	200	13.71	7.02	1.274	17.4	2.41	555.1	---	---	12.21
2	10	200	13.92	8.06	1.279	15.1	2.19	510.1	---	---	12.20
3	15	200	13.92	6.96	1.297	4.7	2.95	256	---	---	12.20
4	20	200	14.41	6.99	1.299	3.0	1.87	189.9	---	---	12.20
5	25	200	41.32	7.01	1.298	2.9	1.89	181	---	---	12.20
6	30	200	14.58	6.99	1.307	-2.2	2.63	114.7	---	---	12.20
7	35	200	14.59	6.99	1.307	-4.7	1.51	90.1	---	---	12.20
8	40	200	14.51	7.00	1.310	-6.9	1.37	75.8	---	---	12.20
9	45	200	14.53	7.00	1.310	-8.6	1.20	63	---	---	12.20
10	50	200	14.64	7.01	1.314	-10.7	1.20	54.2	---	---	12.20
11	55	200	14.53	7.00	1.311	-12.6	1.14	43.9	---	---	12.20
12	60	200	14.44	7.00	1.308	-13.9	1.09	42.2	---	---	12.20
13	65	200	14.38	7.00	1.306	-15.2	1.10	33.1	---	---	12.20
14	70	200	14.38	7.00	1.307	-16.5	1.22	30.3	---	---	12.20
15	75	200	14.83	6.99	1.324	-17.7	0.85	27	---	---	12.20
16	80	200	15.19	6.99	1.338	-20.0	1.11	24.5	---	---	12.20
17	85	200	15.07	7.00	1.332	-21.3	1.08	20.5	---	---	12.20
18	90	200	14.96	6.99	1.328	-22.3	0.91	17.4	---	---	12.20
19	95	200	14.75	6.97	1.319	-23.0	0.86	16.4	---	---	12.20
20	100	200	14.75	6.97	1.317	-24.2	1.32	15.4	---	---	12.20
21	105	200	14.71	6.97	1.316	-24.9	0.90	13.5	---	---	12.20
22	110	200	14.58	6.96	1.311	-25.8	0.87	12.5	---	---	12.20
23	115	200	14.57	6.96	1.310	-26.4	0.95	12.6	---	---	12.20
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: RT					
Low flow- QED bladder pump, poly bladder, MP50											
Sample I.D. (Name, Date, Time):						MW-5; 2015-12-06; 12:40					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 12:40						End Sample Time: 12:55					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710 Client: PSEG
Project Name: PSEG Mercer Project Location: Trenton NJ
Weather Conditions: 38F, mostly cloudy Sampling Date: 12/6/2018

1. WATER LEVEL DATA (measured from top of inner well casing)

a. Depth to LNAPL: --- (ft) b. Depth to Water: 8.95 (ft)
c. Depth to DNAPL: --- (ft) d. Total Well Depth: 19 (ft)
e. LNAPL Thickness: (a-b) --- (ft) f. DNAPL Thickness: (c-d) --- (ft)
g. Length of Water Column: 10.05 (ft) (a-d)
h. Well Volume: 1.64 (gal)

2. WELL PURGE DATA

a. Purge Method: Low Flow
b. Field Testing Equipment: YSI 6920, QED Bladder pump
e. Begin Purge Time: 13:15 End Purge Time: 14:35

Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±3%)	pH (s.u.) (±0.1)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (<0.3 ft)

CORRECTION FACTORS

---	---	---	---	---	---	---	---	---	---	---	---

PURGING VALUES

1	5	200	11.60	6.74	0.610	43.9	1.25	225.5	---	---	9.00
2	10	200	11.87	6.68	0.664	45.6	1.18	144.3	---	---	9.03
3	15	200	12.07	6.65	0.749	46.2	0.92	89.6	---	---	8.97
4	20	200	12.13	6.66	0.808	45.1	0.96	52.1	---	---	8.95
5	25	200	12.10	6.65	0.839	44.2	0.92	40.1	---	---	8.95
6	30	200	12.25	6.66	0.856	42.8	0.84	30.9	---	---	8.99
7	35	200	12.22	6.66	0.882	41.3	0.85	22.9	---	---	8.95
8	40	200	12.18	6.66	0.903	40.5	0.78	18.1	---	---	8.95
9	45	200	12.24	6.65	0.913	40.0	0.77	16.2	---	---	8.95
10	50	200	12.26	6.66	0.929	39.2	0.78	14.6	---	---	8.95
11	55	200	12.28	6.68	0.941	38.0	0.84	14.7	---	---	8.95
12	60	200	12.32	6.66	0.958	37.3	0.79	14.1	---	---	8.95

3. SAMPLE COLLECTION DATA

Sampling Personnel: RT

Sampling Method(s) & Equip: Low flow- QED bladder pump, poly bladder, MP50

Sample I.D. (Name, Date, Time): ---

Sample Analytical Parameters/Method: TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH

Sample Start Time: 14:20 End Sample Time: 14:35

PID/FID READING(s): Not Measured PID/FID Model & Ionization Potential Not Measured

ODOR/SHEEN:

COMMENTS:

APPENDIX D

Laboratory Analytical Reports

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Hudson & Mercer Stations
Groundwater and Water Samples
Collected on 08/03/18

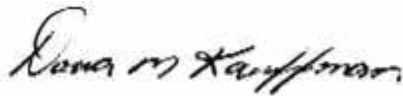
SDG# GEJ46

GROUP	SAMPLE NUMBERS
1973422	9739655-9739658

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-13-10
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 09/11/2018

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ46
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Hudson & Mercer Stations

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9739655	FB-20180803	08/03/2018 11:45	08/06/2018 16:40
9739656	MW-1	08/03/2018 12:35	08/06/2018 16:40
9739657	MW-2	08/03/2018 11:05	08/06/2018 16:40
9739658	MW-6	08/03/2018 14:35	08/06/2018 16:40

Sample pH Log

SDG: GEJ46

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9739655	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:22:00PM	13165
9739655	015A	7	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 7:05:25PM	1532
9739655	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:26:44PM	13165
9739655	055B	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:27:32PM	13165
9739655	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:33:17PM	13165
9739655	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/7/2018 1:37:34PM	12644
9739655	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:22:00PM	13165
9739655	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:22:00PM	13165
9739656	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:20:52PM	13165
9739656	015A	8	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 7:05:37PM	1532
9739656	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:28:23PM	13165
9739656	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:27:44PM	13165
9739656	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:33:00PM	13165
9739656	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/7/2018 12:52:05PM	12644
9739656	148A	7	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 7:05:04PM	1532
9739656	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:20:52PM	13165
9739656	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:20:52PM	13165
9739657	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:19:39PM	13165
9739657	015A	7	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 7:05:47PM	1532
9739657	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:27:13PM	13165
9739657	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:27:56PM	13165
9739657	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:34:14PM	13165
9739657	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/7/2018 1:34:33PM	12644
9739657	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:19:39PM	13165
9739657	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:19:39PM	13165
9739658	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:18:09PM	13165
9739658	015A	7	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 7:05:15PM	1532
9739658	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:27:01PM	13165
9739658	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:28:06PM	13165
9739658	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:34:02PM	13165
9739658	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/7/2018 1:54:17PM	12644
9739658	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:18:09PM	13165
9739658	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/6/2018 10:18:09PM	13165

<u>LLI Sample</u>	<u>Bottle</u>	<u>Actual</u>	<u>Exp.</u>	<u>*pH Check</u>	<u>Adj.</u>	<u>Adjusted</u>	<u>Adjusted</u>	<u>Preservative</u>	<u>Preservative</u>	<u>LLI</u>	<u>Sulfide</u>	<u>Corrective</u>	<u>**Chlorine</u>	<u>Corrective</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
<u>Number</u>	<u>Code</u>	<u>pH</u>	<u>pH</u>	<u>Code</u>	<u>pH</u>	<u>Date</u>	<u>Time</u>	<u>Added</u>	<u>Lot #</u>	<u>Supplied</u>	<u>Present?</u>	<u>Substance</u>	<u>Present?</u>	<u>Substance</u>	<u>CS Lot #</u>		

<u>*pH Check Code Key</u>	<u>**Chlorine Present Code Key</u>
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

00259 Mercury

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U5

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U5

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: September 11, 2018 10:06

Project: PSEG Hudson & Mercer Stations

Account #: 07701
Group Number: 1973422
SDG: GEJ46
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
FB-20180803 Grab Water	08/03/2018 11:45	9739655
MW-1 Grab Groundwater	08/03/2018 12:35	9739656
MW-2 Grab Groundwater	08/03/2018 11:05	9739657
MW-6 Grab Groundwater	08/03/2018 14:35	9739658

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Hudson & Mercer Stations

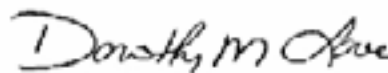
Sampling Date(s): 08/03/18

Laboratory Sample ID(s): 9739655-9739658

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	EPH Method: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	No
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Dorothy M. Love
Director

09/11/2018



Project Name: PSEG Hudson & Mercer Stations
ELLE Group #: 1973422

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Sample #s: 9739655-9739658

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9739655, 9739656, 9739657, 9739658

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

Sample #s: 9739655, 9739656, 9739657, 9739658

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.

Batch #: 182201404401 (Sample number(s): 9739655-9739658 UNSPK: 9739656 BKG: 9739656)

The recovery(ies) for the following analyte(s) in the MS and/or MSD were below the acceptance window:
Calcium

SW-846 6020B Rev.2, July 2014, Metals Dissolved

Sample #s: 9739655, 9739656, 9739657, 9739658

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.

Sample Description: FB-20180803 Grab Water
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739655
ELLE Group #: 1973422
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:45
SDG#: GEJ46-01FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0100	1
08014	Boron	7440-42-8	N.D.	0.0120	0.100	1
01750	Calcium	7440-70-2	0.107 J	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.					
06027	Beryllium	7440-41-7	N.D. K1K2	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0040	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.4	0.010	0.010	1
	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.2	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20180803 Grab Water
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739655
ELLE Group #: 1973422
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:45
SDG#: GEJ46-01FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
	The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.					

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:07	Xavier Arroyo	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:01	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:01	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:01	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:01	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:01	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182201404701C	09/05/2018 00:02	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182200571309	08/13/2018 08:31	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182201404401	08/08/2018 15:59	Barbara A Kane	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20180803 Grab Water
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739655
ELLE Group #: 1973422
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:45
SDG#: GEJ46-01FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182201404701	08/08/2018 17:50	Barbara A Kane	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182200571309	08/10/2018 17:10	Barbara A Kane	1
00224	Chloride	EPA 300.0	1	18219120212A	08/08/2018 04:24	Clinton M Wilson	1
01504	Fluoride	EPA 300.0	1	18219120212A	08/08/2018 04:24	Clinton M Wilson	1
00228	Sulfate	EPA 300.0	1	18219120212A	08/08/2018 04:24	Clinton M Wilson	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921202A	08/08/2018 15:13	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009206A	08/10/2018 11:36	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009206A	08/10/2018 11:36	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739656
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 12:35
SDG#: GEJ46-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.185	0.0010	0.0100	1
08014	Boron	7440-42-8	1.00	0.0120	0.100	1
01750	Calcium	7440-70-2	213	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.					
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0053	0.00031	0.0040	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	152	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	337	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,240	160	480	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.7	0.010	0.010	1
	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	8.0	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739656
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 12:35
SDG#: GEJ46-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
	The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.					

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 02:49	Xavier Arroyo	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 19:39	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 19:39	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182201404701A	09/04/2018 23:48	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 19:39	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 19:39	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182201404701C	09/04/2018 23:48	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182200571309	08/13/2018 08:23	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182201404401	08/08/2018 15:59	Barbara A Kane	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739656
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 12:35
SDG#: GEJ46-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182201404701	08/08/2018 17:50	Barbara A Kane	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182200571309	08/10/2018 17:10	Barbara A Kane	1
00224	Chloride	EPA 300.0	1	18219120212A	08/08/2018 04:06	Clinton M Wilson	50
01504	Fluoride	EPA 300.0	1	18219120212A	08/08/2018 03:49	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18219120212A	08/08/2018 04:06	Clinton M Wilson	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921202A	08/08/2018 15:13	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009207A	08/10/2018 12:44	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009207A	08/10/2018 12:44	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739657
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:05
SDG#: GEJ46-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.490	0.0010	0.0100	1
08014	Boron	7440-42-8	0.983	0.0120	0.100	1
01750	Calcium	7440-70-2	113	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	0.0073 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0575 J	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	0.00066 J	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0021 J	0.00068	0.0040	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06027	Beryllium	7440-41-7	N.D. K1K2	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00028 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0558	0.00031	0.0040	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	107	4.0	8.0	20
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	156	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	552	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.5	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.6	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739657
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:05
SDG#: GEJ46-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
	The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.					

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:14	Xavier Arroyo	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:03	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:03	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:03	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:03	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:03	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182201404701C	09/05/2018 00:09	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182200571309	08/13/2018 08:34	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182201404401	08/08/2018 15:59	Barbara A Kane	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739657
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 11:05
SDG#: GEJ46-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182201404701	08/08/2018 17:50	Barbara A Kane	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182200571309	08/10/2018 17:10	Barbara A Kane	1
00224	Chloride	EPA 300.0	1	18219120212A	08/08/2018 04:59	Clinton M Wilson	20
01504	Fluoride	EPA 300.0	1	18219120212A	08/08/2018 04:41	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18219120212A	08/11/2018 02:46	Samuel J Weaver	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921202A	08/08/2018 15:13	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009206A	08/10/2018 11:30	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009206A	08/10/2018 11:30	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739658
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 14:35
SDG#: GEJ46-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved			SW-846 6010D Rev.4, July 2014	mg/l	mg/l	
07046	Barium	7440-39-3	0.229	0.0010	0.0100	1
08014	Boron	7440-42-8	0.0981 J	0.0120	0.100	1
01750	Calcium	7440-70-2	33.4	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
			SW-846 6020B Rev.2, July 2014	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06027	Beryllium	7440-41-7	N.D. K1K2	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.00072 J	0.00031	0.0040	1
			SW-846 7470A	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry			EPA 300.0	mg/l	mg/l	
00224	Chloride	16887-00-6	219	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	7.9	1.5	5.0	5
			SM 2540 C-2011	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	430	40.0	120	1
			SM 2550 B-2010	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.6	0.010	0.010	1
			SM 4500-H+ B-2011	Std. Units	Std. Units	
12152	pH	n.a.	7.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739658
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 14:35
SDG#: GEJ46-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
	The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.					

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182201404401	08/09/2018 03:17	Xavier Arroyo	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:06	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:06	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:06	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:06	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182201404701A	08/20/2018 20:06	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182201404701C	09/05/2018 00:11	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182200571309	08/13/2018 08:40	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182201404401	08/08/2018 15:59	Barbara A Kane	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9739658
ELLE Group #: 1973422
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/06/2018 16:40
Collection Date/Time: 08/03/2018 14:35
SDG#: GEJ46-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182201404701	08/08/2018 17:50	Barbara A Kane	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182200571309	08/10/2018 17:10	Barbara A Kane	1
00224	Chloride	EPA 300.0	1	18219120212A	08/08/2018 05:33	Clinton M Wilson	50
01504	Fluoride	EPA 300.0	1	18219120212A	08/08/2018 05:16	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18219120212A	08/08/2018 05:16	Clinton M Wilson	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921202A	08/08/2018 15:13	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009207A	08/10/2018 12:51	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009207A	08/10/2018 12:51	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:06

Group Number: 1973422

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 182200571309	Sample number(s): 9739655-9739658		
Mercury	N.D.	0.000050	0.00020
Batch number: 182201404401	Sample number(s): 9739655-9739658		
Barium	N.D.	0.0010	0.0100
Boron	N.D.	0.0120	0.100
Calcium	N.D.	0.0330	1.00
Chromium	N.D.	0.0053	0.0300
Cobalt	N.D.	0.0015	0.0100
Lithium	N.D.	0.0110	0.100
Selenium	N.D.	0.0210	0.100
Thallium	N.D.	0.0140	0.0600
Batch number: 182201404701A	Sample number(s): 9739655-9739658		
Antimony	N.D.	0.00041	0.0040
Arsenic	N.D.	0.00068	0.0040
Beryllium	N.D.	0.000091	0.0010
Cadmium	N.D.	0.00015	0.0020
Lead	N.D.	0.0011	0.0060
Batch number: 182201404701C	Sample number(s): 9739655-9739658		
Molybdenum	N.D.	0.00031	0.0040
Batch number: 18219120212A	Sample number(s): 9739655-9739658		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18220921202A	Sample number(s): 9739655-9739658		
Total Dissolved Solids	N.D.	20.0	60.0

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 182200571309	Sample number(s): 9739655-9739658								
Mercury	0.00100	0.000856			86		80-120		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:06

Group Number: 1973422

LCS/LCSD (continued)

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 182201404401	Sample number(s): 9739655-9739658								
Barium	2.00	2.01			100		80-120		
Boron	2.00	1.82			91		80-120		
Calcium	4.00	4.02			101		80-120		
Chromium	0.200	0.198			99		80-120		
Cobalt	0.500	0.520			104		80-120		
Lithium	1.00	1.04			104		80-120		
Selenium	0.150	0.149			99		80-120		
Thallium	0.150	0.145			97		80-120		
Batch number: 182201404701A	Sample number(s): 9739655-9739658								
Antimony	0.00600	0.00617			103		80-120		
Arsenic	0.0100	0.0104			104		80-120		
Beryllium	0.00400	0.00409			102		80-120		
Cadmium	0.00500	0.00550			110		80-120		
Lead	0.0150	0.0153			102		80-120		
Batch number: 182201404701C	Sample number(s): 9739655-9739658								
Molybdenum	0.0500	0.0476			95		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18219120212A	Sample number(s): 9739655-9739658								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.713			95		90-110		
Sulfate	7.50	7.59			101		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18220921202A	Sample number(s): 9739655-9739658								
Total Dissolved Solids	200	213			107		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18221009206A	Sample number(s): 9739655,9739657								
pH	7.00	7.07			101		95-105		
Batch number: 18221009207A	Sample number(s): 9739656,9739658								
pH	7.00	7.05			101		95-105		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc	MS Spike Added	MS Conc	MSD Spike Added	MSD Conc	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:06

Group Number: 1973422

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 182200571309 Mercury	Sample number(s): 9739655-9739658 UNSPK: 9739656 N.D.	0.00100	0.000912	0.00100	0.000915	91	91	75-125	0	20
Batch number: 182201404401	Sample number(s): 9739655-9739658 UNSPK: 9739656									
Barium	0.185	2.00	2.16	2.00	2.14	99	98	75-125	1	20
Boron	1.00	2.00	2.99	2.00	2.97	99	98	75-125	1	20
Calcium	213.02	4.00	212.21	4.00	209.91	-20 (2)	-78 (2)	75-125	1	20
Chromium	N.D.	0.200	0.195	0.200	0.192	97	96	75-125	2	20
Cobalt	N.D.	0.500	0.499	0.500	0.493	100	99	75-125	1	20
Lithium	N.D.	1.00	1.02	1.00	0.988	102	99	75-125	3	20
Selenium	N.D.	0.150	0.152	0.150	0.145	102	97	75-125	5	20
Thallium	N.D.	0.150	0.141	0.150	0.142	94	95	75-125	1	20
Batch number: 182201404701A	Sample number(s): 9739655-9739658 UNSPK: 9739656									
Antimony	N.D.	0.00600	0.00637	0.00600	0.00629	106	105	75-125	1	20
Arsenic	N.D.	0.0100	0.0100	0.0100	0.0115	100	115	75-125	13	20
Beryllium	N.D.	0.00400	0.00418	0.00400	0.00419	104	105	75-125	0	20
Cadmium	N.D.	0.00500	0.00492	0.00500	0.00506	98	101	75-125	3	20
Lead	N.D.	0.0150	0.0159	0.0150	0.0156	106	104	75-125	2	20
Batch number: 182201404701C	Sample number(s): 9739655-9739658 UNSPK: 9739656									
Molybdenum	0.00531	0.0500	0.0548	0.0500	0.0592	99	108	75-125	8	20

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 182200571309 Mercury	Sample number(s): 9739655-9739658 BKG: 9739656 N.D.	N.D.	0 (1)	20
Batch number: 182201404401	Sample number(s): 9739655-9739658 BKG: 9739656			
Barium	0.185	0.185	0	20
Boron	1.00	0.981	2	20
Calcium	213.02	207.4	3	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	N.D.	N.D.	0 (1)	20
Lithium	N.D.	N.D.	0 (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:06

Group Number: 1973422

Laboratory Duplicate (continued)

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 182201404701A	Sample number(s): 9739655-9739658 BKG: 9739656			
Antimony	N.D.	N.D.	0 (1)	20
Arsenic	N.D.	N.D.	0 (1)	20
Beryllium	N.D.	N.D.	0 (1)	20
Cadmium	N.D.	N.D.	0 (1)	20
Lead	N.D.	N.D.	0 (1)	20
Batch number: 182201404701C	Sample number(s): 9739655-9739658 BKG: 9739656			
Molybdenum	0.00531	0.00446	17 (1)	20

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Account # 1701

For Eurofins Lancaster Laboratories Environmental use only

Group # 1913122 Sample # 1709655-52

COC #

Client Information				Matrix		Analysis Requested										For Lab Use Only					
Client #		Anal #		Tissue		Preservation Codes										FSC					
Project Name		PWSID #		Ground												SCRP					
Project Manager		PO #		Surface												Preservation Codes					
Sampler		Date		NPDES												H-HCl T-HNO ₃ /Pale					
Comments (sample location, etc.)		For Contamination		Other												N-HNO ₃ B NaOH					
Yes ☒ No ☐																S-H ₂ SO ₄ O-Other					
Sample Identification		Collected		Grab	Composite	Soil	Water	Other	Total # of Containers											Remarks	
Date	Time									Metals (Site List)	Metals GC	Chloride Fluoride Sulfide	pH	TDS	Res 226 + 228						
FB-20180803	8-3-18	1145																			
MW-1	8-3-18	1235																			
MW-2	8-3-18	1105																			
MW-6	8-3-18	1435																			
Turnaround Time (TAT) Requested (please circle)		Standard		Flush		Date requested by		Time		Date received by		Time		Date		Time					
Date results are needed.		E-mail address: jskohl@GECConsultants.com		Date requested by		Time		Date received by		Time		Date		Time		Time					
Data Package Options (circle if required)		Type I (EPA Level 3 Equivalent/Non CLP)		Type VI (Raw Data Only)		Date requested by		Time		Date received by		Time		Date		Time					
Type II (Reduced non CLP)		NO-OKOP		TX TRAP-13		Date requested by		Time		Date received by		Time		Date		Time					
NYSDEC Category A or B		MA MCP		CT RCP		Date requested by		Time		Date received by		Time		Date		Time					
EDD Required? (Yes/No)		If yes, format:		Site Specific QC (MS/MSD/Dup)?		Yes/No		Temperature upon receipt		09		C									

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pk., Lancaster, PA 17601 • 717-656-2300

The white copy should accompany samples to Eurofins Lancaster Laboratories. The pink copy should be returned by the client.

Sample Administration
Receipt Documentation Log

Doc Log ID: 223411



Group Number(s): 1973422

Client: GEI Consultants**Delivery and Receipt Information**

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>08/06/2018 16:40</u>
Number of Packages:	<u>1</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>NJ</u>		

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace $\geq$ 6mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

*Unpacked by Cory Jeremiah (10469) at 17:15 on 08/06/2018***Samples Chilled Details***Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT42-01	0.9	DT	Wet	Y	Bagged	N

General Comments: Received Metals Batch QC for MW-1

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9739655	FB-20180803	X		Field Blank
9739656	MW-1	X		
9739657	MW-2	X		
9739658	MW-6	X		

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Method defined actions are taken for any failed matrix QC.

Batch#: 182201404401 (Sample number(s): 9739655-9739658, UNSPK: 9739656, BKG: 9739656)
The recovery(ies) for the following analyte(s) in the MS and MSD were below the acceptance window: Calcium

SAMPLE ANALYSIS:

Refer to analysis run log for samples requiring dilutions.

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

ICP Metals

Fraction: Metals in Liquid

instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9739655-9739658: Analysis: 07036)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium.

(Sample number(s): 9739655-9739658: Analysis: 06025)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.

(Sample number(s): 9739655-9739658: Analysis: 07051)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike
P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9739655
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/06/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	12.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	107	B		P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9739656BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 08/06/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	185			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1000			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	213000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	5.3			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9739657
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/06/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.66	B		MS
7440-38-2	Arsenic	2.1	B		MS
7440-39-3	Barium	490			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	983			P
7440-43-9	Cadmium	0.28	B		MS
7440-70-2	Calcium	113000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	7.3	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	57.5	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	55.8			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9739658
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/06/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	229			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	98.1	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	33400			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.72	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ46

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182201404401	9739655
Boron		9739656BKG
Calcium		9739656MS
Chromium		9739656MSD
Cobalt		9739656DUP
Lithium		9739657
Selenium		9739658
Thallium		P22004AB
		P22004AQ

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ46

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182201404701	9739655
Arsenic		9739656BKG
Beryllium		9739656MS
Cadmium		9739656MSD
Lead		9739656DUP
Molybdenum		9739657
		9739658
		P22004AB
		P22004AQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ46

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182200571309	9739655
		9739656BKG
		9739656MS
		9739656MSD
		9739656DUP
		9739657
		9739658
		P22071IB
		P22071IQ

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: P
Run Name: 1822102T70
Calibration Date(s): 08/09/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	599.71	100.0	500.0	500.59	100.1	500.0	498.65	99.7
Boron		600.0	557.53	92.9	500.0	464.93	93.0	500.0	466.66	93.3
Calcium		30000.0	29431.02	98.1	25000.0	24414.07	97.7	25000.0	24191.57	96.8
Chromium		600.0	583.92	97.3	500.0	482.87	96.6	500.0	482.62	96.5
Cobalt		600.0	596.41	99.4	500.0	497.38	99.5	500.0	498.43	99.7
Lithium		600.0	589.41	98.2	500.0	500.58	100.1	500.0	506.42	101.3
Selenium		600.0	594.62	99.1	500.0	494.43	98.9	500.0	497.04	99.4
Thallium		600.0	591.52	98.6	500.0	481.89	96.4	500.0	492.52	98.5

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: P
Run Name: 1822102T70
Calibration Date(s): 08/09/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	494.40	98.9	500.0	493.45	98.7
Boron					500.0	469.51	93.9	500.0	462.53	92.5
Calcium					25000.0	23762.63	95.1	25000.0	23642.27	94.6
Chromium					500.0	475.44	95.1	500.0	472.29	94.5
Cobalt					500.0	492.66	98.5	500.0	487.82	97.6
Lithium					500.0	506.62	101.3	500.0	498.22	99.6
Selenium					500.0	510.78	102.2	500.0	490.06	98.0
Thallium					500.0	481.89	96.4	500.0	475.90	95.2

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: P

Run Name: 1822901T71

Calibration Date(s): 08/17/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron		600.0	586.38	97.7	500.0	491.72	98.3	500.0	482.61	96.5
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium										
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: P

Run Name: 1822901T71

Calibration Date(s): 08/17/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron					500.0	483.28	96.7			
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium										
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: MS
Run Name: 1823207E03
Calibration Date(s): 08/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	53.41	106.8	25.0	25.48	101.9	25.0	26.26	105.0
Arsenic	75	500.0	505.20	101.0	250.0	251.90	100.8	250.0	262.40	105.0
Beryllium	9	50.0	53.78	107.6	25.0	26.54	106.2	25.0	26.85	107.4
Cadmium	111	50.0	51.92	103.8	25.0	25.41	101.6	25.0	26.73	106.9
Lead	208	50.0	50.63	101.3	25.0	26.37	105.5	25.0	25.70	102.8
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: MS
Run Name: 1823207E03
Calibration Date(s): 08/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	25.42	101.7			
Arsenic	75				250.0	259.20	103.7			
Beryllium	9				25.0	26.82	107.3			
Cadmium	111				25.0	25.68	102.7			
Lead	208				25.0	26.09	104.4			
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: MS

Run Name: 1824710E03

Calibration Date(s): 9/4/2018 - 09/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic										
Beryllium	9	50.0	53.05	106.1	25.0	26.97	107.9	25.0	25.74	103.0
Cadmium										
Lead										
Molybdenum	98	50.0	51.43	102.9	25.0	25.96	103.8	25.0	24.91	99.6

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: MS

Run Name: 1824710E03

Calibration Date(s): 9/4/2018 - 09/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic										
Beryllium	9				25.0	26.02	104.1	25.0	25.83	103.3
Cadmium										
Lead										
Molybdenum	98				25.0	24.39	97.6	25.0	25.28	101.1

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: MS
Run Name: 1824710E03
Calibration Date(s): 9/4/2018 - 09/05/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic										
Beryllium										
Cadmium										
Lead										
Molybdenum	98				25.0	24.81	99.2			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: CV
Run Name: 1822501M09
Calibration Date(s): 08/13/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.46	98.4	1.0	1.02	102.0	1.0	1.01	101.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: CV
Run Name: 1822501M09
Calibration Date(s): 08/13/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.01	101.0	1.0	1.01	101.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ46

Method: CV
Run Name: 1822501M09
Calibration Date(s): 08/13/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.00	100.0	1.0	1.00	100.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence

Method: P
Run Name: 1822102T70
Calibration Date(s): 08/09/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		10.0	10.00	100.0		
Boron		100.0	93.93	93.9		
Calcium		1000.0	1008.03	100.8		
Chromium		30.0	29.67	98.9		
Cobalt		10.0	10.68	106.8		
Lithium		100.0	97.56	97.6		
Selenium		100.0	101.56	101.6		
Thallium		60.0	58.50	97.5		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ46

Method: P

Run Name: 1822901T71

Calibration Date(s): 08/17/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron		100.0	95.91	95.9		
Calcium						
Chromium						
Cobalt						
Lithium						
Selenium						
Thallium						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ46

Method: MS

Run Name: 1823207E03

Calibration Date(s): 08/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	4.0	4.55	113.8		
Arsenic	75	4.0	4.11	102.8		
Beryllium	9	1.0	1.17	117.0		
Cadmium	111	2.0	2.10	105.0		
Lead	208	6.0	6.33	105.5		
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ46

Method: MS

Run Name: 1824710E03

Calibration Date(s): 9/4/2018 - 09/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic						
Beryllium	9	1.0	1.11	111.0		
Cadmium						
Lead						
Molybdenum	98	4.0	4.12	103.0		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ46

Method: CV

Run Name: 1822501M09

Calibration Date(s): 08/13/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.21	105.0		

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ46

Method: P

Run Name: 1822102T70

Calibration Date(s): 08/09/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Barium		0.33	U	0.33	U	0.33	U	0.33	U		1.000	U182201404401
Boron		8.4	U	8.4	U	8.4	U	8.4	U		12.000	U182201404401
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		33.000	U182201404401
Chromium		0.96	U	0.96	U	0.96	U	0.96	U		5.300	U182201404401
Cobalt		0.53	U	0.53	U	0.53	U	-0.56	B		1.500	U182201404401
Lithium		9.6	U	9.6	U	9.6	U	9.6	U		-15.650	B182201404401
Selenium		8.4	U	8.4	U	8.4	U	8.4	U		21.000	U182201404401
Thallium		6.7	U	-6.7	B	6.7	U	6.7	U		14.000	U182201404401

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: P
Run Name: 1822102T70
Calibration Date(s): 08/09/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass	C	Batch Number
Barium			0.33	U							
Boron			8.4	U							
Calcium			33.4	U							
Chromium			0.96	U							
Cobalt			0.53	U							
Lithium			9.6	U							
Selenium			8.4	U							
Thallium			6.7	U							

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: P
Run Name: 1822901T71
Calibration Date(s): 08/17/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium											
Boron		8.4U		8.4U		8.4U		8.4U			
Calcium											
Chromium											
Cobalt											
Lithium											
Selenium											
Thallium											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ46

Method: MS

Run Name: 1823207E03

Calibration Date(s): 08/20/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony	121	0.34	U	0.34	U	0.34	U	0.34	U	121	0.410	U182201404701A
Arsenic	75	0.40	U	0.40	U	0.40	U	0.40	U	75	0.680	U182201404701A
Beryllium	9	1.3		0.57	B	0.57	B	0.53	B	9	0.091	U182201404701A
Cadmium	111	0.14	U	0.14	U	0.14	U	0.14	U	111	0.150	U182201404701A
Lead	208	0.20	U	0.20	U	0.20	U	0.20	U	208	1.100	U182201404701A
Molybdenum												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: MS

Run Name: 1824710E03

Calibration Date(s): 09/04/2018 - 09/05/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)				
			C	1	C	2	C	3	C	Mass		C	Batch Number
Antimony													
Arsenic													
Beryllium	9	0.018U		0.13B		0.018U		-0.025B					
Cadmium													
Lead													
Molybdenum	98	0.25U		0.25U		0.25U		0.25U		98	0.310U		182201404701A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: MS

Run Name: 1824710E03

Calibration Date(s): 09/04/2018 - 09/05/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony											
Arsenic											
Beryllium	9			0.018	U						
Cadmium											
Lead											
Molybdenum	98			0.25	U	0.25	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: CV

Run Name: 1822501M09

Calibration Date(s): 08/13/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Mass	Batch Number
Mercury		-0.073	B	-0.080	B	-0.080	B	-0.079	B	-0.072	B182200571309

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ46

Method: CV
Run Name: 1822501M09
Calibration Date(s): 08/13/2018

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)			
			C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury				-0.083	B	-0.078	B	-0.080	B				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ46

Instrument ID: 11016
Run Name: 1822102T70
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		487747	97.5						
Barium	0		1							
Boron	0		-93							
Calcium	500000		500424	100.1						
Chromium	0		0							
Cobalt	0		1							
Iron	200000		199242	99.6						
Lithium	0		-2							
Magnesium	500000		528890	105.8						
Selenium	0		-8							
Thallium	0		0							

Control Limits: All Metals 80%-120%



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QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ46

Instrument ID: 16315
Run Name: 1822901T71
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		502868	100.6						
Barium										
Boron	0		-2							
Calcium	500000		512877	102.6						
Chromium										
Cobalt										
Iron	200000		196754	98.4						
Lithium										
Magnesium	500000		517073	103.4						
Selenium										
Thallium										

Control Limits: All Metals 80%-120%

Instrument ID: 11332
Run Name: 1823207E03
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		119800	119.8		
Antimony	121	0		1			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		322600	107.5		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		292400	117.0		
Lead	208	0		1			
Magnesium	24	100000		116600	116.6		
Molybdenum	98	2000		2468	123.4		
Phosphorus	31	10000		NA			
Potassium	39	100000		124100	124.1		
Sodium	23	250000		260100	104.0		
Sulfur	34	10000		NA			
Titanium	47	2000		2364	118.2		

Control Limits: All Metals 80%-120%

Instrument ID: 11332
 Run Name: 1824710E03
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		100400	100.4		
Antimony							
Arsenic							
Beryllium	9	0		0			
Cadmium							
Calcium	44	300000		296000	98.7		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		267600	107.0		
Lead							
Magnesium	24	100000		99170	99.2		
Molybdenum	98	2000		2200	110.0		
Phosphorus	31	10000		NA			
Potassium	39	100000		95440	95.4		
Sodium	23	250000		236500	94.6		
Sulfur	34	10000		NA			
Titanium	47	2000		2126	106.3		

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9739656BKG Matrix Spike Lab Sample ID: 9739656MS Matrix Spike Duplicate Lab Sample ID: 9739656MSD
Batch Number(s): 182201404701, 182201404401, 182200571309

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		M
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	
Antimony	121	0.4060	U	6.3720		6.2930		6.0000	6.0000	UG/L	106		105		1		75 - 125	20	MS
Arsenic	75	0.6800	U	10.0100		11.4500		10.0000	10.0000	UG/L	100		115		13		75 - 125	20	MS
Barium		184.6200		2157.9400		2141.0700		2000.0000	2000.0000	UG/L	99		98		1		75 - 125	20	P
Beryllium	9	0.0910	U	4.1780		4.1910		4.0000	4.0000	UG/L	104		105		0		75 - 125	20	MS
Boron		1002.1100		2990.7500		2965.5000		2000.0000	2000.0000	UG/L	99		98		1		75 - 125	20	P
Cadmium	111	0.1510	U	4.9150		5.0610		5.0000	5.0000	UG/L	98		101		3		75 - 125	20	MS
Calcium		213019.1100		212205.0900		209914.0500		4000.0000	4000.0000	UG/L	-20		-78		1				P
Chromium		5.3000	U	194.7500		191.6400		200.0000	200.0000	UG/L	97		96		2		75 - 125	20	P
Cobalt		1.5000	U	498.7800		493.3200		500.0000	500.0000	UG/L	100		99		1		75 - 125	20	P
Lead	208	1.0700	U	15.8800		15.6300		15.0000	15.0000	UG/L	106		104		2		75 - 125	20	MS
Lithium		11.0000	U	1016.6800		987.5400		1000.0000	1000.0000	UG/L	102		99		3		75 - 125	20	P
Mercury		0.0500	U	0.9124		0.9147		1.0000	1.0000	UG/L	91		91		0		75 - 125	20	CV
Molybdenum	98	5.3050		54.7700		59.1600		50.0000	50.0000	UG/L	99		108		8		75 - 125	20	MS
Selenium		21.0000	U	152.2700		145.3100		150.0000	150.0000	UG/L	102		97		5		75 - 125	20	P
Thallium		14.0000	U	141.2800		142.1500		150.0000	150.0000	UG/L	94		95		1		75 - 125	20	P

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS:		CONCENTRATION QUALIFIERS:	
P = ICP Atomic Emission Spectrometer	CV = Cold Vapor	U = Below MDL, B = Below LOQ	
MS = ICP Mass Spectrometry	AF = Cold Vapor Atomic Fluorescence	FLAGS:	
		N = Matrix Spike OOS, * = Duplicate OOS	



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ46

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9739656BKG

Duplicate Lab Sample ID: 9739656DUP

Batch Number(s): 182201404701, 182201404401, 182200571309

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Antimony	121		0.4060	U	0.4060	U			MS
Arsenic	75		0.6800	U	0.6800	U			MS
Barium			184.6200		185.4200		0		P
Beryllium	9		0.0910	U	0.0910	U			MS
Boron			1002.1100		981.0400		2		P
Cadmium	111		0.1510	U	0.1510	U			MS
Calcium			213019.1100		207401.6100		3		P
Chromium			5.3000	U	5.3000	U			P
Cobalt			1.5000	U	1.5000	U			P
Lead	208		1.0700	U	1.0700	U			MS
Lithium			11.0000	U	11.0000	U			P
Mercury			-0.0792	B	-0.0701	B	-12		CV
Molybdenum	98	4.0	5.3050		4.4620		17		MS
Selenium			21.0000	U	21.0000	U			P
Thallium			14.0000	U	14.0000	U			P

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > 20% OR |(S) - (D)| > LOQ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: * = Duplicate Out of Spec



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ46
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182201404701	UG/L	6.000	6.165		80 - 120	103	MS	Yes
Arsenic	75	182201404701	UG/L	10.000	10.430		80 - 120	104	MS	Yes
Barium		182201404401	UG/L	2000.000	2008.800		80 - 120	100	P	Yes
Beryllium	9	182201404701	UG/L	4.000	4.090		80 - 120	102	MS	Yes
Boron		182201404401	UG/L	2000.000	1817.400		80 - 120	91	P	Yes
Cadmium	111	182201404701	UG/L	5.000	5.502		80 - 120	110	MS	Yes
Calcium		182201404401	UG/L	4000.000	4024.280		80 - 120	101	P	Yes
Chromium		182201404401	UG/L	200.000	198.330		80 - 120	99	P	Yes
Cobalt		182201404401	UG/L	500.000	520.430		80 - 120	104	P	Yes
Lead	208	182201404701	UG/L	15.000	15.250		80 - 120	102	MS	Yes
Lithium		182201404401	UG/L	1000.000	1042.570		80 - 120	104	P	Yes
Mercury		182200571309	UG/L	1.000	0.856		80 - 120	86	CV	Yes
Molybdenum	98	182201404701	UG/L	50.000	47.610		80 - 120	95	MS	Yes
Selenium		182201404401	UG/L	150.000	148.520		80 - 120	99	P	Yes
Thallium		182201404401	UG/L	150.000	145.210		80 - 120	97	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ46

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9739656BKG Serial Dilution Lab Sample ID: 9739656L

Batch Number(s): 182201404701, 182201404401

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	0.4060	U	2.0300	U			MS
Arsenic	75	0.6800	U	3.4000	U			MS
Barium		184.6200		182.4500		1		P
Beryllium	9	0.0910	U	0.4550	U			MS
Boron		1002.1100		1041.2000		4		P
Cadmium	111	0.1510	U	0.7550	U			MS
Calcium		213019.1100		208819.2000		2		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		1.5000	U	7.5000	U			P
Lead	208	1.0700	U	5.3500	U			MS
Lithium		11.0000	U	55.0000	U			P
Molybdenum	98	5.3050		5.2500	B	1		MS
Selenium		21.0000	U	105.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 11016
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.33
Boron	249.67		8.4
Calcium	317.93		33.4
Chromium	267.72		0.96
Cobalt	228.62		0.53
Lithium	670.78		9.6
Selenium	196.09		8.4
Thallium	190.86		6.7

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: P
Instrument ID: 16315
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron	249.67		8.4
Calcium			
Chromium			
Cobalt			
Lithium			
Selenium			
Thallium			

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 11332
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.34
Arsenic	75		0.40
Beryllium	9		0.018
Cadmium	111		0.14
Lead	208		0.20
Molybdenum	98		0.25

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 23283
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury			0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ46
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		10.0	1.0
Boron	249.67		100	12.0
Calcium	317.93		1000	33.0
Chromium	267.72		30.0	5.3
Cobalt	228.62		10.0	1.5
Lithium	670.78		100	11.0
Selenium	196.09		100	21.0
Thallium	190.86		60.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ46
Matrix: WATER

Method: MS
Date: 07/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		4.0	0.41
Arsenic	75		4.0	0.68
Beryllium	9		1.0	0.091
Cadmium	111		2.0	0.15
Lead	208		6.0	1.1
Molybdenum	98		4.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ46
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury			0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 15
ICP-MS TUNE
SDG No.: GEJ46
Matrix: WATER

Instrument ID: 11332
Date: 08/20/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	5.95	0.70	1.2
Magnesium	24.000	23.90	0.60	1.4
Rhodium	103.000	102.95	0.55	0.8
Indium	115.000	114.95	0.55	1.5
Cerium	140.000	139.90	0.55	1.8
Lead	208.000	208.00	0.65	1.7
Uranium	238.000	238.05	0.65	1.2

Comments:

Instrument ID: 11332
Date: 09/04/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	6.00	0.65	1.5
Magnesium	24.000	23.95	0.65	0.5
Rhodium	103.000	102.95	0.60	0.9
Indium	115.000	114.90	0.60	2.2
Cerium	140.000	140.00	0.60	1.7
Lead	208.000	208.00	0.65	1.8
Uranium	238.000	238.05	0.65	2.9

Comments:



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ46

Instrument ID: 11332

Start Date: 08/20/2018

Run Name: 1823207E03

End Date: 08/20/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	IN-1-115	AS, CD, SB
SC-2-45	BE		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element IN-1-115	Q	Element BI-1-209	Q	Element	Q	Element	Q	Element	Q
S0	19:04	100		100		100							
S	19:07	107		101		104							
ICV	19:09	103		104		107							
ICB	19:12	99		97		99							
LLC	19:14	99		98		101							
ICSA	19:17	90		90		88							
LRS2	19:19	97		91		91							
LRS3	19:21	103		93		93							
CCS	19:24	99		95		98							
CCS	19:26	100		98		100							
CCV	19:29	100		99		99							
CCB	19:31	96		90		93							
P22004AB	19:34	100		93		94							
P22004AQ	19:36	97		93		95							
9739656BKG	19:39			95		94							
9739656A	19:41			95		94							
9739656DUP	19:44	104		100		98							
9739656MS	19:46			101		97							
9739656MSD	19:49			91		93							
9739656L	19:51			102		102							
ZZZZZZ	19:54												
CCV	19:56	102		98		100							
CCB	19:58	94		92		94							
9739655	20:01	104		98		99							
9739657	20:03	105		99		100							
9739658	20:06	97		96		96							
ZZZZZZ	20:08												
CCV	20:11	100		100		99							
CCB	20:13	110		101		101							

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Instrument ID: 11332

Start Date: 09/04/2018

Run Name: 1824710E03

End Date: 09/05/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	MO	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	22:39	100		100									
S	22:41	105		100									
ICV	22:43	105		101									
ICB	22:46	100		100									
LLC	22:48	102		103									
ICSA	22:50	90		95									
LRS2	22:53	100		100									
LRS3	22:55	99		98									
CCS	22:57	104		100									
CCS	22:59	106		102									
CCV	23:02	101		102									
CCB	23:04	103		104									
ZZZZZZ	23:06												
ZZZZZZ	23:09												
ZZZZZZ	23:11												
ZZZZZZ	23:13												
ZZZZZZ	23:16												
ZZZZZZ	23:18												
ZZZZZZ	23:20												
ZZZZZZ	23:23												
ZZZZZZ	23:25												
CCV	23:27	107		105									
CCB	23:29	108		104									
ZZZZZZ	23:32												
ZZZZZZ	23:34												
ZZZZZZ	23:36												
CCV	23:39	110		105									
CCB	23:41	117		106									
P22004AB	23:43	112		104									
P22004AQ	23:46	109		106									
9739656BKG	23:48	104		99									
9739656A	23:50	111		101									

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Instrument ID:

Start Date:

Run Name: 15151

End Date:

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	MO	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
9739656DUP	23:53			101									
9739656MS	23:55	105		99									
9739656MSD	23:57	111		96									
9739656L	00:00	106		102									
9739655	00:02			104									
CCV	00:04	112		102									
CCB	00:06	102		99									
9739657	00:09			98									
9739658	00:11			97									
CCV	00:13	107		104									
CCB	00:16	105		100									

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Preparation and Run Logs

Metals in Liquid



Method: P

Batch Number: 182201404401

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9739655	08/08/2018	50.00	50
9739657	08/08/2018	50.00	50
9739658	08/08/2018	50.00	50
9739656BKG	08/08/2018	50.00	50
9739656DUP	08/08/2018	50.00	50
9739656MSD	08/08/2018	50.00	50
9739656MS	08/08/2018	50.00	50
P22004AB	08/08/2018	50.00	50
P22004AQ	08/08/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Method: MS
Batch Number: 182201404701

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9739655	08/08/2018	50.00	50
9739657	08/08/2018	50.00	50
9739658	08/08/2018	50.00	50
9739656BKG	08/08/2018	50.00	50
9739656DUP	08/08/2018	50.00	50
9739656MSD	08/08/2018	50.00	50
9739656MS	08/08/2018	50.00	50
P22004AB	08/08/2018	50.00	50
P22004AQ	08/08/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Method: CV
Batch Number: 182200571309

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9739655	08/10/2018	40.00	40
9739657	08/10/2018	40.00	40
9739658	08/10/2018	40.00	40
9739656BKG	08/10/2018	40.00	40
9739656DUP	08/10/2018	40.00	40
9739656MSD	08/10/2018	40.00	40
9739656MS	08/10/2018	40.00	40
P22071IB	08/10/2018	40.00	40
P22071IQ	08/10/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ46

Method: P

Instrument ID: 11016

Run Name: 1822102T70

Run Start Date: 08/09/2018

Run End Date: 08/09/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L														
S0	1.00	02:02			X		X		X	X	X		X			X	X													
S	1.00	02:05							X																					
S	1.00	02:07			X		X				X		X			X	X													
S	1.00	02:10								X																				
ICV	1.00	02:13			X		X		X	X	X		X			X	X													
ICB	1.00	02:15			X		X		X	X	X		X			X	X													
LLC	1.00	02:18			X		X		X	X	X		X			X	X													
ICSA	1.00	02:20			X		X		X	X	X		X			X	X													
CCV	1.00	02:23			X		X		X	X	X		X			X	X													
CCB	1.00	02:25			X		X		X	X	X		X			X	X													
LRS2	1.00	02:28			X		X		X	X	X		X			X	X													
LRS4	1.00	02:30			X		X		X	X	X		X			X	X													
LRS3	1.00	02:33			X		X		X	X	X		X			X	X													
LRS5	1.00	02:36			X		X		X	X	X		X			X	X													
CCV	1.00	02:39			X		X		X	X	X		X			X	X													
CCB	1.00	02:41			X		X		X	X	X		X			X	X													
P22004AB	1.00	02:43			X		X		X	X	X		X			X	X													
P22004AQ	1.00	02:46			X		X		X	X	X		X			X	X													
9739656BKG	1.00	02:49			X		X		X	X	X		X			X	X													
9739656A	1.00	02:51																												
9739656DUP	1.00	02:54			X		X		X	X	X		X			X	X													
9739656MS	1.00	02:56			X				X	X	X		X			X	X													
9739656MSD	1.00	02:59			X				X	X	X		X			X	X													
9739656L	5.00	03:02			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	03:04																												
9739655	1.00	03:07			X		X		X	X	X		X			X	X													
CCV	1.00	03:09			X		X		X	X	X		X			X	X													
CCB	1.00	03:12			X		X		X	X	X		X			X	X													
9739657	1.00	03:14			X		X		X	X	X		X			X	X													
9739658	1.00	03:17			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	03:19																												
CCV	1.00	03:22			X		X		X	X	X		X			X	X													
CCB	1.00	03:24			X		X		X	X	X		X			X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ46

Method: P
Instrument ID: 16315
Run Name: 1822901T71

Run Start Date: 08/17/2018
Run End Date: 08/17/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	04:08					X																							
S	1.00	04:11																												
S	1.00	04:13					X																							
S	1.00	04:16																												
ICV	1.00	04:19					X																							
ICB	1.00	04:21					X																							
LLC	1.00	04:24					X																							
ICSA	1.00	04:26					X																							
CCV	1.00	04:29					X																							
CCB	1.00	04:32					X																							
LRS2	1.00	04:34					X																							
LRS4	1.00	04:37					X																							
LRS3	1.00	04:40					X																							
LRS5	1.00	04:43					X																							
CCV	1.00	04:45					X																							
CCB	1.00	04:48					X																							
9739656MS	5.00	04:50					X																							
9739656MSD	5.00	04:53					X																							
CCV	1.00	04:56					X																							
CCB	1.00	04:58					X																							

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ46

Method: MS

Instrument ID: 11332

Run Name: 1823207E03

Run Start Date: 08/20/2018

Run End Date: 08/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
S0	1.00	19:04	X	X		X		X				X																		
S	1.00	19:07	X	X		X		X				X																		
ICV	1.00	19:09	X	X		X		X				X																		
ICB	1.00	19:12	X	X		X		X				X																		
LLC	1.00	19:14	X	X		X		X				X																		
ICSA	1.00	19:17	X	X		X		X				X																		
LRS2	1.00	19:19	X	X		X		X				X																		
LRS3	1.00	19:21	X	X		X		X				X																		
CCS	1.00	19:24	X	X		X		X				X																		
CCS	1.00	19:26	X	X		X		X				X																		
CCV	1.00	19:29	X	X		X		X				X																		
CCB	1.00	19:31	X	X		X		X				X																		
P22004AB	1.00	19:34	X	X		X		X				X																		
P22004AQ	1.00	19:36	X	X				X				X																		
9739656BKG	1.00	19:39	X	X				X				X																		
9739656A	1.00	19:41																												
9739656DUP	1.00	19:44	X	X		X		X				X																		
9739656MS	1.00	19:46	X	X				X				X																		
9739656MSD	1.00	19:49	X	X				X				X																		
9739656L	5.00	19:51	X	X				X				X																		
ZZZZZZ	1.00	19:54																												
CCV	1.00	19:56	X	X		X		X				X																		
CCB	1.00	19:58	X	X		X		X				X																		
9739655	1.00	20:01	X	X		X		X				X																		
9739657	1.00	20:03	X	X		X		X				X																		
9739658	1.00	20:06	X	X		X		X				X																		
ZZZZZZ	1.00	20:08																												
CCV	1.00	20:11	X	X		X		X				X																		
CCB	1.00	20:13	X	X		X		X				X																		

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ46

Method: MS

Instrument ID: 11332

Run Name: 1824710E03

Run Start Date: 09/04/2018

Run End Date: 09/05/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B 	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	22:39				X									X															
S	1.00	22:41				X									X															
ICV	1.00	22:43				X									X															
ICB	1.00	22:46				X									X															
LLC	1.00	22:48				X									X															
ICSA	1.00	22:50				X									X															
LRS2	1.00	22:53				X									X															
LRS3	1.00	22:55				X									X															
CCS	1.00	22:57				X									X															
CCS	1.00	22:59				X									X															
CCV	1.00	23:02				X									X															
CCB	1.00	23:04				X									X															
ZZZZZZ	1.00	23:06																												
ZZZZZZ	1.00	23:09																												
ZZZZZZ	1.00	23:11																												
ZZZZZZ	1.00	23:13																												
ZZZZZZ	1.00	23:16																												
ZZZZZZ	1.00	23:18																												
ZZZZZZ	1.00	23:20																												
ZZZZZZ	5.00	23:23																												
ZZZZZZ	1.00	23:25																												
CCV	1.00	23:27				X									X															
CCB	1.00	23:29				X									X															
ZZZZZZ	1.00	23:32																												
ZZZZZZ	1.00	23:34																												
ZZZZZZ	1.00	23:36																												
CCV	1.00	23:39				X									X															
CCB	1.00	23:41				X									X															
P22004AB	1.00	23:43													X															
P22004AQ	1.00	23:46				X									X															
9739656BKG	1.00	23:48				X									X															
9739656A	1.00	23:50																												
9739656DUP	1.00	23:53													X															
9739656MS	1.00	23:55				X									X															
9739656MSD	1.00	23:57				X									X															
9739656L	5.00	00:00				X									X															
9739655	1.00	00:02													X															
CCV	1.00	00:04				X									X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ46

Method: MS

Instrument ID: 11332

Run Name: 1824710E03

Run Start Date: 09/04/2018

Run End Date: 09/05/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
CCB	1.00	00:06				X									X															
9739657	1.00	00:09													X															
9739658	1.00	00:11													X															
CCV	1.00	00:13													X															
CCB	1.00	00:16													X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ46

Method: CV
Instrument ID: 23283
Run Name: 1822501M09

Run Start Date: 08/13/2018
Run End Date: 08/13/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	06:32												X																
S0.2	1.00	06:34												X																
S0.5	1.00	06:36												X																
S1.0	1.00	06:38												X																
S2.5	1.00	06:40												X																
S5.0	1.00	06:42												X																
ICV	1.00	06:44												X																
ICB	1.00	06:50												X																
CRA	1.00	06:52												X																
CCV	1.00	06:54												X																
CCB	1.00	06:56												X																
ZZZZZZ	1.00	07:02																												
ZZZZZZ	1.00	07:04																												
ZZZZZZ	1.00	07:06																												
ZZZZZZ	1.00	07:08																												
ZZZZZZ	1.00	07:10																												
ZZZZZZ	1.00	07:12																												
ZZZZZZ	1.00	07:14																												
ZZZZZZ	1.00	07:16																												
ZZZZZZ	1.00	07:18																												
ZZZZZZ	1.00	07:20																												
CCV	1.00	07:22												X																
CCB	1.00	07:24												X																
ZZZZZZ	1.00	07:26																												
ZZZZZZ	1.00	07:28																												
ZZZZZZ	1.00	07:30																												
ZZZZZZ	1.00	07:32																												
ZZZZZZ	1.00	07:34																												
ZZZZZZ	1.00	07:36																												
ZZZZZZ	1.00	07:38																												
ZZZZZZ	1.00	07:40																												
ZZZZZZ	1.00	07:42																												
ZZZZZZ	1.00	07:45																												
CCV	1.00	07:47												X																
CCB	1.00	07:49												X																
ZZZZZZ	1.00	07:51																												
ZZZZZZ	1.00	07:53																												
ZZZZZZ	1.00	07:55																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ46

Method: CV

Instrument ID: 23283

Run Name: 1822501M09

Run Start Date: 08/13/2018

Run End Date: 08/13/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	07:57																												
ZZZZZZ	1.00	07:59																												
ZZZZZZ	1.00	08:01																												
ZZZZZZ	1.00	08:03																												
ZZZZZZ	1.00	08:05																												
ZZZZZZ	1.00	08:07																												
ZZZZZZ	1.00	08:09																												
CCV	1.00	08:11												X																
CCB	1.00	08:13												X																
ZZZZZZ	1.00	08:15																												
ZZZZZZ	1.00	08:17																												
P22071IB	1.00	08:19												X																
P22071IQ	1.00	08:21												X																
9739656BKG	1.00	08:23												X																
9739656DUP	1.00	08:25												X																
9739656MS	1.00	08:27												X																
9739656MSD	1.00	08:29												X																
9739655	1.00	08:31												X																
9739657	1.00	08:34												X																
CCV	1.00	08:36												X																
CCB	1.00	08:38												X																
9739658	1.00	08:40												X																
ZZZZZZ	1.00	08:42																												
ZZZZZZ	1.00	08:44																												
ZZZZZZ	1.00	08:46																												
ZZZZZZ	1.00	08:48																												
ZZZZZZ	1.00	08:50																												
ZZZZZZ	1.00	08:52																												
ZZZZZZ	1.00	08:54																												
ZZZZZZ	1.00	08:56																												
ZZZZZZ	1.00	08:58																												
CCV	1.00	09:00												X																
CCB	1.00	09:02												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Instrumental Water Quality Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9739655	FB-20180803	X		Field Blank
9739656	MW-1	X		
9739657	MW-2	X		
9739658	MW-6	X		

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9739655	DF1	DF1	DF1
9739656	DF50	DF5	DF50

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Instrumental Water Quality Fraction: Instrumental Wet Chemistry

Samples	Chloride	Fluoride	Sulfate
9739657	DF20	DF5	DF50
9739658	DF50	DF5	DF5

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18219120212A	9739655	08/08/2018 04:24:00	X	X	X
	9739656	08/08/2018 03:49:00		X	
	9739656	08/08/2018 04:06:00	X		X
	9739657	08/08/2018 04:41:00		X	
	9739657	08/08/2018 04:59:00	X		
	9739657	08/11/2018 02:46:00			X
	9739658	08/08/2018 05:16:00		X	X
	9739658	08/08/2018 05:33:00	X		
	P21920LB	08/08/2018 12:31:00	X	X	X
	P21920LQ	08/08/2018 12:13:00	X	X	X

Fraction: Instrumental Wet Chemistry

18219120212A / P21920LB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	08/08/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	08/08/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	08/08/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P21920LQ	Batch: 18219120212A (Sample number(s): 9739655-9739658)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.99	NA	100	NA	90-110	NA	NA
Fluoride	IC	0.750	0.713	NA	95	NA	90-110	NA	NA
Sulfate	IC	7.50	7.59	NA	101	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ46

Instrument ID: 18919
Calibration Date: 07/20/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.625258	1.165384	3.007012	5.849180	9.033771	0.9990	0.9995
Fluoride	0.169301	0.630876	1.635389	3.294450	5.247430	0.9989	0.9995
Sulfate	0.363846	0.720188	1.866154	3.669929	5.760123	0.9994	0.9997

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18219120212A
Run Start Dates: 08/07/2018, 08/10/2018
Run Names: 1821901D12, 1822201D12

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	3.1344	104	7.5	7.8963	105	0.75	0.7574	101
ICB	0	ND	NA	0	ND	NA	0	ND	NA
Low Chk	1.5	1.5422	103	3.75	3.7913	101	0.75	0.7391	99
High Chk	4.5	4.6140	103	11.25	11.5899	103	2.25	2.3048	102
CCV2	3	3.0322	101	7.5	7.6991	103	0.75	0.7362	98
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0243	101	7.5	7.6735	102	0.75	0.7332	98
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9932	100	7.5	7.6041	101	0.75	0.7104	95
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9797	99	7.5	7.5974	101	0.75	0.7177	96
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2				7.5	7.5400	101			
CCB				0	ND	NA			
CCV2				7.5	7.5747	101			
CCB				0	ND	NA			

* = Out of Specifications

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9739655	FB-20180803	X		1	Field Blank
9739656	MW-1	X		1	
9739657	MW-2	X		1	
9739658	MW-6	X		1	

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Water Quality

Fraction: Wet Chemistry

R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry



Lancaster Laboratories
Environmental

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ46

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18220921202A	B220872B	08/08/2018 15:15
		L220872Q	08/08/2018 15:15
		9739655	08/08/2018 15:13
		9739656	08/08/2018 15:13
		9739657	08/08/2018 15:13
		9739658	08/08/2018 15:13

Quality Control Reference List
Water Quality**CLIENT: GEI Consultants, Inc.**
SDG: GEJ46**Fraction: Wet Chemistry**

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18221009206A	9739655	08/10/2018 11:36:00	X	X
	9739657	08/10/2018 11:30:00	X	X
	P009206Q	08/10/2018 10:32:00	X	
18221009207A	9739656	08/10/2018 12:44:00	X	X
	9739658	08/10/2018 12:51:00	X	X
	P009207Q	08/10/2018 12:13:00	X	

Fraction: Wet Chemistry

18220921202A / B220872B						
Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	08/08/18	N.D.	mg/l	20.0	60.0

Water Quality
Fraction: Wet Chemistry

LCS: L220872Q	Batch: 18220921202A (Sample number(s): 9739655-9739658)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	213	NA	107	NA	62-127	NA	NA

LCS: P009206Q	Batch: 18221009206A (Sample number(s): 9739655, 9739657)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.07	NA	101	NA	95-105	NA	NA

LCS: P009207Q	Batch: 18221009207A (Sample number(s): 9739656, 9739658)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.05	NA	101	NA	95-105	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Hudson & Mercer Stations
Groundwater and Water Samples
Collected on 08/07/18

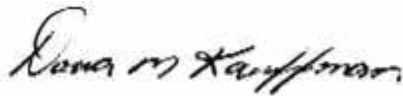
SDG# GEJ47

GROUP	SAMPLE NUMBERS
1974423	9744060-9744063

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-13-10
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 09/11/2018

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ47
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Hudson & Mercer Stations

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9744060	MW-3	08/07/2018 14:35	08/08/2018 17:20
9744061	MW-4	08/07/2018 09:30	08/08/2018 17:20
9744062	MW-5	08/07/2018 11:30	08/08/2018 17:20
9744063	FB-20180807	08/07/2018 12:30	08/08/2018 17:20

Sample pH Log

SDG: GEJ47

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9744060	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:05:19PM	12665
9744060	015A	5	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 9:32:56PM	1201
9744060	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:11:23PM	24788
9744060	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:13:27PM	24788
9744060	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:25:36PM	12665
9744060	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/10/2018 10:50:29PM	1201
9744060	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:05:19PM	12665
9744060	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:05:19PM	12665
9744061	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:06:35PM	12665
9744061	015A	5	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 9:32:35PM	1201
9744061	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:13:41PM	24788
9744061	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:12:17PM	24788
9744061	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:14:29PM	12665
9744061	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/10/2018 9:37:23PM	25804
9744061	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:06:35PM	12665
9744061	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:06:35PM	12665
9744062	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:28:28PM	12665
9744062	015A	5	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 9:32:17PM	1201
9744062	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:14:04PM	24788
9744062	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:13:01PM	24788
9744062	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:16:20PM	12665
9744062	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/10/2018 10:18:38PM	1201
9744062	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:28:28PM	12665
9744062	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:16:20PM	12665
9744063	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:09:31PM	12665
9744063	015A	5	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 9:32:48PM	1201
9744063	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:12:28PM	24788
9744063	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 11:12:40PM	24788
9744063	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:19:51PM	12665
9744063	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/10/2018 10:37:36PM	1201
9744063	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:09:31PM	12665
9744063	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/8/2018 10:09:31PM	12665

<u>LLI Sample</u> <u>Number</u>	<u>Bottle</u> <u>Code</u>	<u>Actual</u> <u>pH</u>	<u>Exp.</u> <u>pH</u>	<u>*pH Check</u> <u>Code</u>	<u>Adj.</u> <u>pH</u>	<u>Adjusted</u> <u>Date</u>	<u>Adjusted</u> <u>Time</u>	<u>Preservative</u> <u>Added</u>	<u>Preservative</u> <u>Lot #</u>	<u>LLI</u> <u>Supplied</u> <u>Bottle?</u>	<u>Sulfide</u> <u>Present?</u>	<u>Corrective</u> <u>Substance</u>	<u>CS Lot #</u>	<u>**Chlorine</u> <u>Present?</u>	<u>Corrective</u> <u>Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>

<u>*pH Check Code Key</u>	<u>**Chlorine Present Code Key</u>
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

00259 Mercury

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U5

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U5

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: September 11, 2018 10:09

Project: PSEG Hudson & Mercer Stations

Account #: 07701
Group Number: 1974423
SDG: GEJ47
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
MW-3 Grab Groundwater	08/07/2018 14:35	9744060
MW-4 Grab Groundwater	08/07/2018 09:30	9744061
MW-5 Grab Groundwater	08/07/2018 11:30	9744062
FB-20180807 Grab Water	08/07/2018 12:30	9744063

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Hudson & Mercer Stations

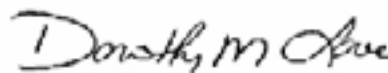
Sampling Date(s): 08/07/18

Laboratory Sample ID(s): 9744060-9744063

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	EPH Method: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	No
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Dorothy M. Love
Director

09/11/2018



Project Name: PSEG Hudson & Mercer Stations
ELLE Group #: 1974423

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Sample #s: 9744060-9744063

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9744060, 9744061, 9744062, 9744063

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

Sample #s: 9744060, 9744061, 9744062, 9744063

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium
An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.

SW-846 6020B Rev.2, July 2014, Metals Dissolved

Sample #s: 9744060, 9744061, 9744062, 9744063

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.

SM 2540 C-2011, Wet Chemistry

Batch #: 18225921202A (Sample number(s): 9744060, 9744062-9744063 BKG: 9744062)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Total Dissolved Solids

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744060
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submission Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 14:35
SDG#: GEJ47-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.250	0.0010	0.0100	1
08014	Boron	7440-42-8	0.238 J	0.0600	0.500	5
01750	Calcium	7440-70-2	69.9	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	0.0026 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0349 J	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.105	0.500	5
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium. An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D. K3K4	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0022 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D. K4	0.000091	0.0010	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0203	0.00031	0.0040	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	334	20.0	40.0	100
01504	Fluoride	16984-48-8	0.35 J	0.25	0.50	5
00228	Sulfate	14808-79-8	21.8	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	724	80.0	240	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	11.5	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744060
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 14:35
SDG#: GEJ47-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.8	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:32	Xavier Arroyo	5
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:32	Xavier Arroyo	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:31	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/30/2018 23:09	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182261404701A	09/05/2018 18:34	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:14	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:14	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:14	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182261404701C	08/30/2018 23:09	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182250571302	08/14/2018 08:46	Damary Valentin	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744060
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 14:35
SDG#: GEJ47-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182261404403	08/14/2018 22:31	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182261404701	08/14/2018 21:00	Annamaria Kuhns	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182250571302	08/13/2018 23:00	Annamaria Kuhns	1
00224	Chloride	EPA 300.0	1	18227837109B	08/18/2018 19:14	Clinton M Wilson	100
01504	Fluoride	EPA 300.0	1	18227837109B	08/15/2018 20:48	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	1	18227837109B	08/15/2018 20:48	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18225921202A	08/13/2018 15:08	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18225121521A	08/13/2018 17:20	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18225121521A	08/13/2018 17:20	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744061
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 09:30
SDG#: GEJ47-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0167	0.0010	0.0100	1
08014	Boron	7440-42-8	N.D.	0.0600	0.500	5
01750	Calcium	7440-70-2	5.09	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	0.0025 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.105	0.500	5
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium. An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D. K3	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D. K4	0.000091	0.0010	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0022 J	0.00031	0.0040	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.4 J	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	3.9 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	51.0 J	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.6	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744061
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 09:30
SDG#: GEJ47-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.0	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:34	Xavier Arroyo	5
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:34	Xavier Arroyo	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:34	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/30/2018 23:16	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182261404701A	09/05/2018 18:41	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:21	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:21	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:21	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182261404701C	08/30/2018 23:16	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182250571302	08/14/2018 08:52	Damary Valentin	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744061
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20

Collection Date/Time: 08/07/2018 09:30

SDG#: GEJ47-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182261404403	08/14/2018 22:31	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182261404701	08/14/2018 21:00	Annamaria Kuhns	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182250571302	08/13/2018 23:00	Annamaria Kuhns	1
00224	Chloride	EPA 300.0	1	18227837109B	08/15/2018 21:41	Samuel J Weaver	5
01504	Fluoride	EPA 300.0	1	18227837109B	08/15/2018 21:41	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	1	18227837109B	08/15/2018 21:41	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18221921202A	08/09/2018 16:26	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009206A	08/10/2018 11:22	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009206A	08/10/2018 11:22	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744062
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 11:30
SDG#: GEJ47-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.212	0.0010	0.0100	1
08014	Boron	7440-42-8	0.377 J	0.0600	0.500	5
01750	Calcium	7440-70-2	98.4	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.105	0.500	5
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D. K3	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.00082 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D. K4	0.000091	0.0010	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0181	0.00031	0.0040	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	113	10.0	20.0	50
01504	Fluoride	16984-48-8	0.42 J	0.25	0.50	5
00228	Sulfate	14808-79-8	119	3.0	10.0	10
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	614	80.0	240	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.7	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744062
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 11:30
SDG#: GEJ47-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.8	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:37	Xavier Arroyo	5
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:37	Xavier Arroyo	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:41	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/30/2018 23:18	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182261404701A	09/05/2018 18:44	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:24	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:24	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:24	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182261404701C	08/30/2018 23:18	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182250571302	08/14/2018 08:55	Damary Valentin	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744062
ELLE Group #: 1974423
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20

Collection Date/Time: 08/07/2018 11:30

SDG#: GEJ47-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182261404403	08/14/2018 22:31	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182261404701	08/14/2018 21:00	Annamaria Kuhns	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182250571302	08/13/2018 23:00	Annamaria Kuhns	1
00224	Chloride	EPA 300.0	1	18227837109B	08/18/2018 20:06	Clinton M Wilson	50
01504	Fluoride	EPA 300.0	1	18227837109B	08/15/2018 22:34	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	1	18227837109B	08/18/2018 19:49	Clinton M Wilson	10
00212	Total Dissolved Solids	SM 2540 C-2011	1	18225921202A	08/13/2018 15:10	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009207A	08/10/2018 12:40	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009207A	08/10/2018 12:40	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20180807 Grab Water
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744063
ELLE Group #: 1974423
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 12:30
SDG#: GEJ47-04FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0100	1
08014	Boron	7440-42-8	N.D.	0.0600	0.500	5
01750	Calcium	7440-70-2	0.0567 J	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.105	0.500	5
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D. K3	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.00070 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D. K4	0.000091	0.0010	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.						
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0040	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.4	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	

*=This limit was used in the evaluation of the final result

Sample Description: FB-20180807 Grab Water
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744063
ELLE Group #: 1974423
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20
Collection Date/Time: 08/07/2018 12:30
SDG#: GEJ47-04FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.0	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:40	Xavier Arroyo	5
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/23/2018 00:40	Xavier Arroyo	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182261404403	08/15/2018 05:44	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/30/2018 23:21	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182261404701A	09/05/2018 18:46	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:26	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:26	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182261404701A	08/29/2018 16:26	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182261404701C	08/30/2018 23:21	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182250571302	08/14/2018 08:57	Damary Valentin	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20180807 Grab Water
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9744063
ELLE Group #: 1974423
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/08/2018 17:20

Collection Date/Time: 08/07/2018 12:30

SDG#: GEJ47-04FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182261404403	08/14/2018 22:31	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182261404701	08/14/2018 21:00	Annamaria Kuhns	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182250571302	08/13/2018 23:00	Annamaria Kuhns	1
00224	Chloride	EPA 300.0	1	18227837109B	08/15/2018 23:45	Samuel J Weaver	1
01504	Fluoride	EPA 300.0	1	18227837109B	08/15/2018 23:45	Samuel J Weaver	1
00228	Sulfate	EPA 300.0	1	18227837109B	08/15/2018 23:45	Samuel J Weaver	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18225921202A	08/13/2018 15:08	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18221009206A	08/10/2018 11:33	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18221009206A	08/10/2018 11:33	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:09

Group Number: 1974423

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 182250571302	Sample number(s): 9744060-9744063		
Mercury	N.D.	0.000050	0.00020
Batch number: 182261404403	Sample number(s): 9744060-9744063		
Barium	N.D.	0.0010	0.0100
Boron	N.D.	0.0120	0.100
Calcium	N.D.	0.0330	1.00
Chromium	N.D.	0.0053	0.0300
Cobalt	N.D.	0.0015	0.0100
Lithium	N.D.	0.0110	0.100
Selenium	N.D.	0.0210	0.100
Thallium	N.D.	0.0140	0.0600
Batch number: 182261404701A	Sample number(s): 9744060-9744063		
Antimony	N.D.	0.00041	0.0040
Arsenic	N.D.	0.00068	0.0040
Beryllium	N.D.	0.000091	0.0010
Cadmium	N.D.	0.00015	0.0020
Lead	N.D.	0.0011	0.0060
Batch number: 182261404701C	Sample number(s): 9744060-9744063		
Molybdenum	N.D.	0.00031	0.0040
Batch number: 18227837109B	Sample number(s): 9744060-9744063		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18221921202A	Sample number(s): 9744061		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18225921202A	Sample number(s): 9744060,9744062-9744063		
Total Dissolved Solids	N.D.	20.0	60.0

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:09

Group Number: 1974423

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 182250571302 Mercury	Sample number(s): 9744060-9744063 0.00100	0.000929			93		80-120		
Batch number: 182261404403	Sample number(s): 9744060-9744063								
Barium	2.00	2.03			102		80-120		
Boron	2.00	1.91			96		80-120		
Calcium	4.00	4.11			103		80-120		
Chromium	0.200	0.202			101		80-120		
Cobalt	0.500	0.519			104		80-120		
Lithium	1.00	1.04			104		80-120		
Selenium	0.150	0.153			102		80-120		
Thallium	0.150	0.151			100		80-120		
Batch number: 182261404701A	Sample number(s): 9744060-9744063								
Antimony	0.00600	0.00603			101		80-120		
Arsenic	0.0100	0.0106			106		80-120		
Beryllium	0.00400	0.00427			107		80-120		
Cadmium	0.00500	0.00485			97		80-120		
Lead	0.0150	0.0154			103		80-120		
Batch number: 182261404701C	Sample number(s): 9744060-9744063								
Molybdenum	0.0500	0.0529			106		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18227837109B	Sample number(s): 9744060-9744063								
Chloride	3.00	2.77			92		90-110		
Fluoride	0.750	0.701			94		90-110		
Sulfate	7.50	7.01			93		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18221921202A	Sample number(s): 9744061								
Total Dissolved Solids	200	202			101		62-127		
Batch number: 18225921202A	Sample number(s): 9744060,9744062-9744063								
Total Dissolved Solids	200	188			94		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18221009206A	Sample number(s): 9744061,9744063								
pH	7.00	7.07			101		95-105		
Batch number: 18221009207A	Sample number(s): 9744062								
pH	7.00	7.05			101		95-105		
Batch number: 18225121521A	Sample number(s): 9744060								
pH	7.00	6.99			100		95-105		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/11/2018 10:09

Group Number: 1974423

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 18225921202A	Sample number(s): 9744060,9744062-9744063 BKG: 9744062			
Total Dissolved Solids	614	662	8* (1)	5

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

For Clients Lancaster Laboratories Environmental use only

Acc # 7701

Group # 1974423

Sample # 19744460-63

COC # 578118

Client Information				Matrix		Analysis Requested										For Lab Use Only	
Client Name: <u>GE Consultants, Inc.</u> Project Name: <u>DEG Mercer / 1504710</u> Project Manager: <u>Jason Kohl</u> Analyst: <u>Anthony J. Shields</u> Date: <u>8/2/18</u> Time: <u>14:30</u>				Soil ☐ Sediment ☐ Tissue ☐ Potable ☐ Ground ☒ Surface ☐ Water ☐ NPDES ☐ Other: ☐		Preservation and Filtration Codes										FSC	SCR#
Sample Identification: <u>MW-3</u> Collected: <u>8-2-18</u> <u>14:30</u> Grab ☒ Composite ☐				Total # of Containers: <u>2</u> TDS: <u>1</u> Site-List Metals: <u>1</u> Radiation (Subtract out): <u>1</u> Volatiles, Fluoride, Sulfate: <u>1</u> pH: <u>1</u>		Preservation Codes: H=HCl I=Iodide N=HNO ₃ B=NaOH S=H ₂ SO ₄ P=H ₂ PO ₄ F=Filtered D=Dry										Remarks:	
Turnaround Time (TAT) Requested (please circle): Standard ☒ Rush ☐ Requested TAT in business days: <u>2</u> E-mail address: <u>J.Kohl@GEConsultants.com</u>				Bottle Storage: <u>8/2/18</u> <u>17:00</u> Analysis: <u>8/8/18</u> <u>13:35</u> Analysis: <u>8/8/18</u> <u>17:20</u> Analysis: <u>8/8/18</u> <u>17:20</u>		Data Package Options (circle if required): Type I (EPA Level 3) ☐ Type V (Raw Data Only) ☐ Equivalent Non-CLP ☐ TX 1 RRP-13 ☐ Type III (Reduced non-CLP) ☒ N/DKQP ☐ TX 1 RRP-13 ☐ NYSDEC Category A or B ☐ MA MCP ☐ CY RCP ☐										EDD Required? Yes ☐ No ☒ Site-Specific QC (MS/MS/Dup)? Yes ☐ No ☒ Relinquished by Commercial Carrier: UPS ☐ FedEx ☐ Other ☐ Temperature upon receipt: <u>0.7</u> °C	

Kerri Sachtleben

From: Kerri Sachtleben
Sent: Thursday, August 09, 2018 12:37 PM
To: 'Shields, Anthony'
Subject: RE: MW-5 sample collected yesterday

Anthony,

Sorry, I looked at the wrong entry - 11:25 is on the COC for MW-5 but we'll enter it as 11:30

Thanks,
Kerri

From: Shields, Anthony (mailto:ashields@peiconsultants.com)
Sent: Thursday, August 09, 2018 12:02 PM
To: Kerri Sachtleben
Subject: RE: MW-5 sample collected yesterday

EXTERNAL EMAIL

11:30 should be correct for MW-5 at PSEG Mercer.

Anthony J. Shields, E.I.T.,
Project Engineer
Direct: 856.791.5475

From: Kerri Sachtleben@eurofinsUS.com <KerriSachtleben@eurofinsUS.com>
Sent: Thursday, August 9, 2018 11:54 AM
To: Shields, Anthony <ashields@peiconsultants.com>
Subject: MW-5 sample collected yesterday

Hi Anthony,

The COC for MW-5 has a collection time of 12:30. The sample label says 11:30. Please let me know which is correct.

Thanks!

Kerri Sachtleben
Senior Client Service Specialist

Eurofins Lancaster Laboratories Environmental LLC
2425 New Holland Pike
Lancaster, PA 17601
USA

Phone: (717) 556-7376

Kerri.Sachtleben@EurofinsUS.com
www.EurofinsUS.com/LancLabsLn



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Client: GEI Consultants

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>08/08/2018 17:20</u>
Number of Packages:	<u>2</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>NJ</u>		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace $\geq$ 6mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Wanita Curry (14057) at 18:21 on 08/08/2018

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT146	0.7	DT	Wet	Y	Bagged	N
2	DT146	0.7	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9744060	MW-3	X		
9744061	MW-4	X		
9744062	MW-5	X		
9744063	FB-20180807	X		Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

Refer to analysis run log for samples requiring dilutions.

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

ICP Metals

Fraction: Metals in Liquid

instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9744060-9744063: Analysis: 07036)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium
An interfering analyte exceeded the linear range of the instrument, and all affected analytes were analyzed at a higher dilution. The reporting limits were raised accordingly.

(Sample number(s): 9744060-9744063: Analysis: 06027)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: arsenic, lead.

(Sample number(s): 9744060-9744063: Analysis: 07051)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike
P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ47

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9744060
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/08/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	2.2	B		MS
7440-39-3	Barium	250			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	238	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	69900			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.6	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	34.9	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	20.3			MS
7782-49-2	Selenium	105	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ47

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9744061
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/08/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	16.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	60.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	5090			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.5	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.2	B		MS
7782-49-2	Selenium	105	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ47

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9744062
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/08/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.82	B		MS
7440-39-3	Barium	212			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	377	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	98400			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	18.1			MS
7782-49-2	Selenium	105	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ47

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9744063
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/08/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.70	B		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	60.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	56.7	B		P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	105	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ47

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182261404403	9744060
Boron		9744061
Calcium		9744062
Chromium		9744063
Cobalt		*44390BKG
Lithium		P22604CB
Selenium		P22604CQ
Thallium		

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ47

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182261404701	9744060
Arsenic		9744061
Beryllium		9744062
Cadmium		9744063
Lead		*46739BKG
Molybdenum		P22604AB
		P22604AQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ47

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182250571302	9744060
		9744061
		9744062
		9744063
		*44386BKG
		P22571BB
		P22571BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P
Run Name: 1822702T71
Calibration Date(s): 08/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	602.63	100.4	500.0	503.79	100.8	500.0	493.83	98.8
Boron										
Calcium		30000.0	29774.28	99.2	25000.0	25202.68	100.8	25000.0	24864.67	99.5
Chromium		600.0	577.25	96.2	500.0	487.42	97.5	500.0	490.14	98.0
Cobalt		600.0	589.69	98.3	500.0	501.45	100.3	500.0	503.75	100.8
Lithium		600.0	611.06	101.8	500.0	518.32	103.7	500.0	523.71	104.7
Selenium										
Thallium		600.0	603.90	100.7	500.0	505.56	101.1	500.0	503.37	100.7

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P
Run Name: 1822702T71
Calibration Date(s): 08/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	486.05	97.2	500.0	490.45	98.1
Boron										
Calcium					25000.0	24311.55	97.2	25000.0	24111.41	96.4
Chromium					500.0	496.72	99.3	500.0	501.80	100.4
Cobalt					500.0	504.31	100.9	500.0	502.73	100.5
Lithium					500.0	542.60	108.5	500.0	542.17	108.4
Selenium										
Thallium					500.0	505.06	101.0	500.0	510.98	102.2

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P

Run Name: 1823408T75

Calibration Date(s): 08/22/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron		600.0	592.23	98.7	500.0	495.04	99.0	500.0	495.82	99.2
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium		600.0	598.35	99.7	500.0	480.50	96.1	500.0	492.69	98.5
Thallium		600.0	612.49	102.1	500.0	507.21	101.4	500.0	507.32	101.5

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P

Run Name: 1823408T75

Calibration Date(s): 08/22/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron					500.0	488.74	97.7			
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium					500.0	489.48	97.9			
Thallium					500.0	495.85	99.2			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P
Run Name: 1823410T72
Calibration Date(s): 8/22/2018 - 08/23/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron		600.0	595.64	99.3	500.0	482.49	96.5	500.0	488.39	97.7
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium		600.0	608.65	101.4	500.0	501.28	100.3	500.0	491.43	98.3
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: P
Run Name: 1823410T72
Calibration Date(s): 8/22/2018 - 08/23/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron					500.0	475.79	95.2			
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium					500.0	480.50	96.1			
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS
Run Name: 1824106E03
Calibration Date(s): 08/29/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic										
Beryllium	9	50.0	50.40	100.8	25.0	24.74	99.0	25.0	36.53	146.1*
Cadmium	111	50.0	51.71	103.4	25.0	26.64	106.6	25.0	26.43	105.7
Lead	208	50.0	50.96	101.9	25.0	27.23	108.9	25.0	26.43	105.7
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS
Run Name: 1824106E03
Calibration Date(s): 08/29/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic										
Beryllium	9				25.0	38.16	152.6*			
Cadmium	111				25.0	25.99	104.0			
Lead	208				25.0	26.03	104.1			
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS
Run Name: 1824210E03
Calibration Date(s): 08/30/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	55.61	111.2*	25.0	27.85	111.4*	25.0	25.80	103.2
Arsenic	75	500.0	524.50	104.9	250.0	266.40	106.6	250.0	273.50	109.4
Beryllium										
Cadmium										
Lead										
Molybdenum	98	50.0	51.84	103.7	25.0	26.98	107.9	25.0	25.58	102.3

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS
Run Name: 1824210E03
Calibration Date(s): 08/30/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	27.05	108.2			
Arsenic										
Beryllium										
Cadmium										
Lead										
Molybdenum	98				25.0	26.05	104.2			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS

Run Name: 1824808E03

Calibration Date(s): 09/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	54.25	108.5	25.0	25.03	100.1	25.0	24.80	99.2
Arsenic	75	500.0	533.70	106.7	250.0	256.60	102.6	250.0	270.40	108.2
Beryllium	9	50.0	50.42	100.8	25.0	25.65	102.6	25.0	26.97	107.9
Cadmium										
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: MS
Run Name: 1824808E03
Calibration Date(s): 09/05/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75				250.0	258.70	103.5			
Beryllium										
Cadmium										
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: CV
Run Name: 1822601M07
Calibration Date(s): 08/14/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.49	99.6	1.0	0.99	99.0	1.0	1.00	100.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: CV
Run Name: 1822601M07
Calibration Date(s): 08/14/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.97	97.0	1.0	1.02	102.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ47

Method: CV
Run Name: 1822601M07
Calibration Date(s): 08/14/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.01	101.0			

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: P
Run Name: 1822702T71
Calibration Date(s): 08/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		10.0	11.07	110.7		
Boron						
Calcium		1000.0	1044.98	104.5		
Chromium		30.0	29.67	98.9		
Cobalt		10.0	11.04	110.4		
Lithium		100.0	102.61	102.6		
Selenium						
Thallium		60.0	58.45	97.4		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: P

Run Name: 1823408T75

Calibration Date(s): 08/22/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron		100.0	102.78	102.8		
Calcium						
Chromium						
Cobalt						
Lithium						
Selenium		100.0	115.66	115.7		
Thallium		60.0	63.56	105.9		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: P

Run Name: 1823410T72

Calibration Date(s): 8/22/2018 - 08/23/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron		100.0	97.90	97.9		
Calcium						
Chromium						
Cobalt						
Lithium						
Selenium		100.0	103.40	103.4		
Thallium						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: MS

Run Name: 1824106E03

Calibration Date(s): 08/29/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic						
Beryllium	9	1.0	1.07	107.0		
Cadmium	111	2.0	2.27	113.5		
Lead	208	6.0	6.29	104.8		
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: MS

Run Name: 1824210E03

Calibration Date(s): 08/30/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	4.0	5.02	125.5		
Arsenic	75	4.0	4.84	121.0		
Beryllium						
Cadmium						
Lead						
Molybdenum	98	4.0	4.44	111.0		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: MS

Run Name: 1824808E03

Calibration Date(s): 09/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	4.0	3.73	93.3		
Arsenic	75	4.0	3.71	92.8		
Beryllium	9	1.0	0.99	99.0		
Cadmium						
Lead						
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ47

Method: CV

Run Name: 1822601M07

Calibration Date(s): 08/14/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.20	100.0		

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: P

Run Name: 1822702T71

Calibration Date(s): 08/15/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium		0.64	U	0.64	U	0.64	U	0.64	U	1.000	U182261404403
Boron											
Calcium		33.4	U	33.4	U	33.4	U	33.4	U	33.000	U182261404403
Chromium		1.2	U	1.2	U	-1.2	B	1.2	U	5.300	U182261404403
Cobalt		0.90	B	0.76	U	0.76	U	0.76	U	1.500	U182261404403
Lithium		4.0	U	4.0	U	4.0	U	4.0	U	11.000	U182261404403
Selenium											
Thallium		-8.3	B	7.3	U	7.3	U	7.3	U	14.000	U182261404403

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: P
Run Name: 1822702T71
Calibration Date(s): 08/15/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass		Batch Number
Barium			0.64	U							
Boron											
Calcium			33.4	U							
Chromium			1.2	U							
Cobalt			0.76	U							
Lithium			4.0	U							
Selenium											
Thallium			7.3	U							

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: P

Run Name: 1823408T75

Calibration Date(s): 08/22/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)				
			C	1	C	2	C	3	C	Mass		C	Batch Number
Barium													
Boron		8.4	U	8.4	U	8.4	U	8.4	U		12.000	U	182261404403
Calcium													
Chromium													
Cobalt													
Lithium													
Selenium		8.4	B	9.7	B	12.6	B	8.7	B		21.000	U	182261404403
Thallium		7.3	U	7.3	U	7.3	U	7.3	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: P

Run Name: 1823410T72

Calibration Date(s): 08/22/2018 - 08/23/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)				Preparation Blank (UG/L)			
		C	1	C	2	C	3	C	Mass	Batch Number
Barium										
Boron		8.4U	8.4U		8.4U		8.4U			
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium		5.8U	5.8U		5.8U		5.8U			
Thallium										

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: MS

Run Name: 1824106E03

Calibration Date(s): 08/29/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony											
Arsenic											
Beryllium	9	0.052B		0.030B		0.036B		0.048B			
Cadmium	111	0.14U		0.14U		0.14U		0.20B	111	0.150U	182261404701A
Lead	208	0.20U		0.20U		0.20U		0.20U	208	1.100U	182261404701A
Molybdenum											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: MS

Run Name: 1824210E03

Calibration Date(s): 08/30/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony	121	0.35	B	0.78	B	0.34	U	0.38	B			
Arsenic	75	0.96	B	0.40	U	1.1	B			75	0.680	U182261404701A
Beryllium												
Cadmium												
Lead												
Molybdenum	98	0.25	U	0.25	U	0.25	U	0.25	U	98	0.310	U182261404701A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: MS

Run Name: 1824808E03

Calibration Date(s): 09/05/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony	121	0.34	U	0.42	B	0.34	U			121	0.410	U182261404701A
Arsenic	75	0.72	B	0.40	U	1.2	B	0.40	U			
Beryllium	9	0.018	U	0.018	U	-0.036	B			9	0.091	U182261404701A
Cadmium												
Lead												
Molybdenum												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: CV

Run Name: 1822601M07

Calibration Date(s): 08/14/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Batch Number
Mercury		0.050	U	0.050	U	0.050	U	0.050	U	182250571302

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ47

Method: CV
Run Name: 1822601M07
Calibration Date(s): 08/14/2018

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)			
			C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury				0.050	U	0.050	U						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ47

Instrument ID: 16315
Run Name: 1822702T71
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		502004	100.4						
Barium	0		1							
Boron										
Calcium	500000		510449	102.1						
Chromium	0		-6							
Cobalt	0		-1							
Iron	200000		198971	99.5						
Lithium	0		51							
Magnesium	500000		507799	101.6						
Selenium										
Thallium	0		-4							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ47

Instrument ID: 23290
Run Name: 1823408T75
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		487299	97.5						
Barium										
Boron	0		-20							
Calcium	500000		482228	96.4						
Chromium										
Cobalt										
Iron	200000		193638	96.8						
Lithium										
Magnesium	500000		486324	97.3						
Selenium	0		5							
Thallium	0		2							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ47

Instrument ID: 16417
Run Name: 1823410T72
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		482752	96.6						
Barium										
Boron	0		-20							
Calcium	500000		481446	96.3						
Chromium										
Cobalt										
Iron	200000		188128	94.1						
Lithium										
Magnesium	500000		505214	101.0						
Selenium	0		14							
Thallium										

Control Limits: All Metals 80%-120%

Instrument ID: 11332
Run Name: 1824106E03
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		104000	104.0		
Antimony							
Arsenic							
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		293000	97.7		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		270500	108.2		
Lead	208	0		1			
Magnesium	24	100000		98820	98.8		
Molybdenum	98	2000		2565	128.3		
Phosphorus	31	10000		NA			
Potassium	39	100000		105900	105.9		
Sodium	23	250000		232000	92.8		
Sulfur	34	10000		NA			
Titanium	47	2000		2002	100.1		

Control Limits: All Metals 80%-120%

Instrument ID: 11332
Run Name: 1824210E03
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		112100	112.1		
Antimony	121	0		2			
Arsenic	75	0		1			
Beryllium							
Cadmium							
Calcium	44	300000		298600	99.5		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		273500	109.4		
Lead							
Magnesium	24	100000		109000	109.0		
Molybdenum	98	2000		2398	119.9		
Phosphorus	31	10000		NA			
Potassium	39	100000		114400	114.4		
Sodium	23	250000		248900	99.6		
Sulfur	34	10000		NA			
Titanium	47	2000		2068	103.4		

Control Limits: All Metals 80%-120%

Instrument ID: 11332
Run Name: 1824808E03
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		106200	106.2		
Antimony	121	0		1			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium							
Calcium	44	300000		298500	99.5		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		269600	107.8		
Lead							
Magnesium	24	100000		101900	101.9		
Molybdenum	98	2000		2132	106.6		
Phosphorus	31	10000		NA			
Potassium	39	100000		121500	121.5		
Sodium	23	250000		232500	93.0		
Sulfur	34	10000		NA			
Titanium	47	2000		2082	104.1		

Control Limits: All Metals 80%-120%

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ47
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182261404701	UG/L	6.000	6.030		80 - 120	101	MS	Yes
Arsenic	75	182261404701	UG/L	10.000	10.550		80 - 120	106	MS	Yes
Barium		182261404403	UG/L	2000.000	2030.200		80 - 120	102	P	Yes
Beryllium	9	182261404701	UG/L	4.000	4.269		80 - 120	107	MS	Yes
Boron		182261404403	UG/L	2000.000	1913.720		80 - 120	96	P	Yes
Cadmium	111	182261404701	UG/L	5.000	4.849		80 - 120	97	MS	Yes
Calcium		182261404403	UG/L	4000.000	4111.710		80 - 120	103	P	Yes
Chromium		182261404403	UG/L	200.000	202.260		80 - 120	101	P	Yes
Cobalt		182261404403	UG/L	500.000	519.210		80 - 120	104	P	Yes
Lead	208	182261404701	UG/L	15.000	15.400		80 - 120	103	MS	Yes
Lithium		182261404403	UG/L	1000.000	1043.690		80 - 120	104	P	Yes
Mercury		182250571302	UG/L	1.000	0.929		80 - 120	93	CV	Yes
Molybdenum	98	182261404701	UG/L	50.000	52.880		80 - 120	106	MS	Yes
Selenium		182261404403	UG/L	150.000	152.750		80 - 120	102	P	Yes
Thallium		182261404403	UG/L	150.000	150.500		80 - 120	100	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ47

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *44390BKG

Serial Dilution Lab Sample ID: *44390L

Batch Number(s): 182261404403

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		52.9800		52.5000		1		P
Boron		158.0000	B	600.0000	U	100		P
Calcium		104168.6600		106528.1500		2		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		37.9300		43.9000	B	16		P
Lithium		12.4400	B	55.0000	U	100		P
Selenium		210.0000	U	1050.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL

B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ47

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *46739BKG

Serial Dilution Lab Sample ID: *46739L

Batch Number(s): 182261404701

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	1.1850	B	2.0300	U	100		MS
Arsenic	75	30.0000		27.9550		7		MS
Beryllium	9	0.0910	U	0.4550	U			MS
Cadmium	111	0.1601	B	0.7550	U	100		MS
Lead	208	1.5110	B	5.3500	U	100		MS
Molybdenum	98	4.2440		5.0700	B	19		MS

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 16315
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.64
Boron			
Calcium	317.93		33.4
Chromium	267.72		1.2
Cobalt	228.62		0.76
Lithium	670.78		4.0
Selenium			
Thallium	190.86		7.3

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: P
Instrument ID: 16417
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron	249.67		8.4
Calcium			
Chromium			
Cobalt			
Lithium			
Selenium	196.09		5.8
Thallium			

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: P
Instrument ID: 23290
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron	249.67		8.4
Calcium			
Chromium			
Cobalt			
Lithium			
Selenium	196.09		4.4
Thallium	190.86		5.4

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 11332
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.34
Arsenic	75		0.40
Beryllium	9		0.018
Cadmium	111		0.14
Lead	208		0.20
Molybdenum	98		0.25

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 17384
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury	254.00		0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ47
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		10.0	1.0
Boron	249.67		100	12.0
Calcium	317.93		1000	33.0
Chromium	267.72		30.0	5.3
Cobalt	228.62		10.0	1.5
Lithium	670.78		100	11.0
Selenium	196.09		100	21.0
Thallium	190.86		60.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ47
Matrix: WATER

Method: MS
Date: 07/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		4.0	0.41
Arsenic	75		4.0	0.68
Beryllium	9		1.0	0.091
Cadmium	111		2.0	0.15
Lead	208		6.0	1.1
Molybdenum	98		4.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ47
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury	254.00		0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 15
ICP-MS TUNE
SDG No.: GEJ47
Matrix: WATER

Instrument ID: 11332
Date: 08/28/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	6.10	0.60	1.0
Magnesium	24.000	24.05	0.65	1.0
Rhodium	103.000	103.00	0.60	1.5
Indium	115.000	114.95	0.60	1.5
Cerium	140.000	140.00	0.60	1.6
Lead	208.000	208.00	0.70	2.9
Uranium	238.000	238.05	0.70	1.7

Comments:



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 15
ICP-MS TUNE
SDG No.: GEJ47
Matrix: WATER

Instrument ID: 11332
Date: 08/30/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	6.05	0.65	1.9
Magnesium	24.000	24.00	0.65	1.6
Rhodium	103.000	102.95	0.60	1.7
Indium	115.000	115.00	0.60	2.2
Cerium	140.000	140.00	0.60	2.1
Lead	208.000	208.05	0.65	2.7
Uranium	238.000	238.10	0.70	2.6

Comments:



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 15
ICP-MS TUNE
SDG No.: GEJ47
Matrix: WATER

Instrument ID: 11332
Date: 09/05/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	6.05	0.65	1.9
Magnesium	24.000	23.95	0.65	3.3
Rhodium	103.000	102.95	0.60	3.2
Indium	115.000	115.00	0.55	4.0
Cerium	140.000	140.00	0.60	3.5
Lead	208.000	208.00	0.65	3.2
Uranium	238.000	238.05	0.70	1.9

Comments:



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ47

Instrument ID: 11332

Start Date: 08/29/2018

Run Name: 1824106E03

End Date: 08/29/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-2-209	PB	GE-1-72	BE
IN-2-115	CD		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element GE-1-72	Q	Element IN-2-115	Q	Element BI-2-209	Q	Element	Q	Element	Q	Element	Q
S0	15:28	100		100		100							
S	15:31	105		103		104							
ICV	15:33	100		100		101							
ICB	15:35	95		94		93							
LLC	15:38	101		101		103							
ICSA	15:40	99		95		96							
LRS2	15:42	99		92		92							
LRS3	15:44	99		95		100							
CCS	15:47	97		91		92							
CCS	15:49	94		94		97							
CCV	15:51	99		96		97							
CCB	15:54	97		98		99							
P22604AB	15:56	99		90		94							
P22604AQ	15:58	101		92		95							
*46739BKG	16:01	88		87		82							
ZZZZZZ	16:03												
ZZZZZZ	16:05												
ZZZZZZ	16:08												
ZZZZZZ	16:10												
*46739L	16:12	114		107		101							
9744060	16:14	115		108		104							
CCV	16:17	120		109		104							
CCB	16:19	113		111		106							
9744061	16:21	117		108		105							
9744062	16:24	120		105		103							
9744063	16:26	115		110		106							
ZZZZZZ	16:28												
ZZZZZZ	16:31												
ZZZZZZ	16:33												
ZZZZZZ	16:35												
ZZZZZZ	16:37												
ZZZZZZ	16:40												

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ47

Instrument ID: 11332

Start Date: 08/29/2018

Run Name: 1824106E03

End Date: 08/29/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-2-209	PB	GE-1-72	BE
IN-2-115	CD		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element GE-1-72	Q	Element IN-2-115	Q	Element BI-2-209	Q	Element	Q	Element	Q	Element	Q
CCV	16:42	120		113		111							
CCB	16:44	114		104		100							

LEGEND:

BKG = Background MS = Matrix Spike
DUP = Duplicate MSD = Matrix Spike Duplicate
L = Serial Dilution A = Post Digest Spike
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
BI = Bismuth SC = Scandium
GE = Germanium TB = Terbium
HO = Holmium Y = Yttrium
IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ47

Instrument ID: 11332

Start Date: 08/30/2018

Run Name: 1824210E03

End Date: 08/30/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	AS,MO,SB		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	22:23	100											
S	22:25	109											
ICV	22:27	106											
ICB	22:30	102											
LLC	22:32	96											
ICSA	22:34	99											
LRS2	22:37	95											
LRS3	22:39	97											
CCS	22:41	93											
CCS	22:44	90											
CCV	22:46	99											
CCB	22:48	92											
P22604AB	22:51	100											
P22604AQ	22:53	102											
*46739BKG	22:55	87											
ZZZZZZ	22:57												
ZZZZZZ	23:00												
ZZZZZZ	23:02												
ZZZZZZ	23:04												
*46739L	23:07	109											
9744060	23:09	118											
CCV	23:11	119											
CCB	23:14	112											
9744061	23:16	113											
9744062	23:18	111											
9744063	23:21	115											
ZZZZZZ	23:23												
ZZZZZZ	23:25												
ZZZZZZ	23:27												
ZZZZZZ	23:30												
ZZZZZZ	23:32												
CCV	23:34	114											

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ47

Instrument ID: 11332

Start Date: 08/30/2018

Run Name: 1824210E03

End Date: 08/30/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	AS,MO,SB		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q	Element	Q
CCB	23:37	110											

LEGEND: BKG = Background DUP = Duplicate L = Serial Dilution B = Blank Q = Laboratory Control Sample Y = Laboratory Control Sample Duplicate FLAG: R = Internal Standard Relative Intensity OOS	INTERNAL STANDARD ELEMENTS: BE = Beryllium BI = Bismuth GE = Germanium HO = Holmium IN = Indium LI = Lithium SC = Scandium TB = Terbium Y = Yttrium

Instrument ID: 11332

Start Date: 09/05/2018

Run Name: 1824808E03

End Date: 09/05/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	AS, SB	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	17:48	100		100									
S	17:51	99		112									
ICV	17:53	97		106									
ICB	17:55	88		100									
LLC	17:58	92		103									
ICSA	18:00	88		98									
LRS2	18:02	92		110									
LRS3	18:04	95		101									
CCS	18:07	85		93									
CCS	18:09	86		92									
CCV	18:11	99		106									
CCB	18:14	90		98									
P22604AB	18:16	91		102									
P22604AQ	18:18	96		100									
*46739BKG	18:21			87									
ZZZZZZ	18:23												
ZZZZZZ	18:25												
ZZZZZZ	18:28												
ZZZZZZ	18:30												
*46739L	18:32			108									
9744060	18:34			101									
CCV	18:37	106		110									
CCB	18:39	107		101									
9744061	18:41			115									
9744062	18:44			107									
9744063	18:46			113									
ZZZZZZ	18:48												
ZZZZZZ	18:51												
ZZZZZZ	18:53												
ZZZZZZ	18:55												
ZZZZZZ	18:58												
CCV	19:00	107		113									

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ47

Instrument ID: 11332

Start Date: 09/05/2018

Run Name: 1824808E03

End Date: 09/05/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-2-115	AS, SB	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
CCB	19:02	98		112									

LEGEND: BKG = Background MS = Matrix Spike DUP = Duplicate MSD = Matrix Spike Duplicate L = Serial Dilution A = Post Digest Spike B = Blank Q = Laboratory Control Sample Y = Laboratory Control Sample Duplicate FLAG: R = Internal Standard Relative Intensity OOS	INTERNAL STANDARD ELEMENTS: BE = Beryllium LI = Lithium BI = Bismuth SC = Scandium GE = Germanium TB = Terbium HO = Holmium Y = Yttrium IN = Indium

Preparation and Run Logs

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ47

Method: P

Batch Number: 182261404403

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9744060	08/14/2018	50.00	50
9744061	08/14/2018	50.00	50
9744062	08/14/2018	50.00	50
9744063	08/14/2018	50.00	50
*44390BKG	08/14/2018	50.00	50
P22604CB	08/14/2018	50.00	50
P22604CQ	08/14/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ47

Method: MS
Batch Number: 182261404701

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9744060	08/14/2018	50.00	50
9744061	08/14/2018	50.00	50
9744062	08/14/2018	50.00	50
9744063	08/14/2018	50.00	50
*46739BKG	08/14/2018	50.00	50
P22604AB	08/14/2018	50.00	50
P22604AQ	08/14/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ47

Method: CV
Batch Number: 182250571302

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9744060	08/13/2018	40.00	40
9744061	08/13/2018	40.00	40
9744062	08/13/2018	40.00	40
9744063	08/13/2018	40.00	40
*44386BKG	08/13/2018	40.00	40
P22571BB	08/13/2018	40.00	40
P22571BQ	08/13/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ47

Method: P

Instrument ID: 16315

Run Name: 1822702T71

Run Start Date: 08/15/2018

Run End Date: 08/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	04:27			X				X	X	X		X				X													
S	1.00	04:30							X																					
S	1.00	04:32			X						X	X					X													
S	1.00	04:35								X																				
ICV	1.00	04:37			X				X	X	X		X				X													
ICB	1.00	04:40			X				X	X	X		X				X													
LLC	1.00	04:42			X				X	X	X		X				X													
ICSA	1.00	04:45			X				X	X	X		X				X													
CCV	1.00	04:48			X				X	X	X		X				X													
CCB	1.00	04:50			X				X	X	X		X				X													
LRS2	1.00	04:53			X				X	X	X		X				X													
LRS4	1.00	04:56			X				X	X	X		X				X													
LRS3	1.00	04:59			X				X	X	X		X				X													
LRS5	1.00	05:01			X				X	X	X		X				X													
CCV	1.00	05:04			X				X	X	X		X				X													
CCB	1.00	05:07			X				X	X	X		X				X													
P22604CB	1.00	05:09			X				X	X	X		X				X													
P22604CQ	1.00	05:12			X				X	X	X		X				X													
*44390BKG	1.00	05:14			X				X	X	X		X																	
ZZZZZZ	1.00	05:17																												
ZZZZZZ	1.00	05:20																												
ZZZZZZ	1.00	05:23																												
ZZZZZZ	1.00	05:25																												
*44390L	5.00	05:28			X				X	X	X		X																	
9744060	1.00	05:31			X				X	X	X		X				X													
9744061	1.00	05:34			X				X	X	X		X				X													
CCV	1.00	05:36			X				X	X	X		X				X													
CCB	1.00	05:39			X				X	X	X		X				X													
9744062	1.00	05:41			X				X	X	X		X				X													
9744063	1.00	05:44			X				X	X	X		X				X													
ZZZZZZ	1.00	05:47																												
ZZZZZZ	1.00	05:49																												
ZZZZZZ	1.00	05:52																												
ZZZZZZ	1.00	05:54																												
ZZZZZZ	1.00	05:57																												
ZZZZZZ	1.00	06:00																												
ZZZZZZ	1.00	06:02																												
ZZZZZZ	1.00	06:05																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ47

Method: P
Instrument ID: 16315
Run Name: 1822702T71

Run Start Date: 08/15/2018
Run End Date: 08/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
CCV	1.00	06:08			X				X	X	X		X				X													
CCB	1.00	06:10			X				X	X	X		X				X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ47

Method: P

Instrument ID: 23290

Run Name: 1823408T75

Run Start Date: 08/22/2018

Run End Date: 08/22/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	14:20					X									X	X													
S	1.00	14:23																												
S	1.00	14:25					X									X	X													
S	1.00	14:28																												
ICV	1.00	14:30					X									X	X													
ICB	1.00	14:33					X									X	X													
LLC	1.00	14:35					X									X	X													
ICSA	1.00	14:38					X									X	X													
CCV	1.00	14:41					X									X	X													
CCB	1.00	14:43					X									X	X													
LRS2	1.00	14:46					X									X	X													
LRS4	1.00	14:49					X									X	X													
LRS3	1.00	14:52					X									X	X													
LRS5	1.00	14:55					X									X	X													
CCV	1.00	14:57					X									X	X													
CCB	1.00	15:00					X									X	X													
P22604CB	1.00	15:02					X									X														
P22604CQ	1.00	15:05					X									X														
*44390BKG	1.00	15:08															X													
ZZZZZZ	1.00	15:11																												
ZZZZZZ	1.00	15:13																												
ZZZZZZ	1.00	15:16																												
ZZZZZZ	1.00	15:19																												
*44390L	5.00	15:22															X													
ZZZZZZ	5.00	15:25																												
ZZZZZZ	5.00	15:27																												
CCV	1.00	15:30					X									X	X													
CCB	1.00	15:32					X									X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ47

Method: P

Instrument ID: 16417

Run Name: 1823410T72

Run Start Date: 08/22/2018

Run End Date: 08/23/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	23:31					X									X														
S	1.00	23:34																												
S	1.00	23:37					X									X														
S	1.00	23:39																												
ICV	1.00	23:42					X									X														
ICB	1.00	23:45					X									X														
LLC	1.00	23:47					X									X														
ICSA	1.00	23:50					X									X														
CCV	1.00	23:53					X									X														
CCB	1.00	23:56					X									X														
LRS2	1.00	23:58					X									X														
LRS4	1.00	00:02					X									X														
LRS3	1.00	00:05					X									X														
LRS5	1.00	00:08					X									X														
CCV	1.00	00:10					X									X														
CCB	1.00	00:13					X									X														
*44390BKG	10.00	00:16					X									X														
ZZZZZZ	10.00	00:19																												
ZZZZZZ	10.00	00:21																												
ZZZZZZ	10.00	00:24																												
ZZZZZZ	10.00	00:26																												
*44390L	50.00	00:29					X									X														
9744060	5.00	00:32					X									X														
9744061	5.00	00:34					X									X														
9744062	5.00	00:37					X									X														
9744063	5.00	00:40					X									X														
CCV	1.00	00:42					X									X														
CCB	1.00	00:45					X									X														

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ47

Method: MS

Instrument ID: 11332

Run Name: 1824106E03

Run Start Date: 08/29/2018

Run End Date: 08/29/2018

Lab Sample ID	D/F	Time	Analytes																									
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L											
S0	1.00	15:28				X		X				X																
S	1.00	15:31				X		X				X																
ICV	1.00	15:33				X		X				X																
ICB	1.00	15:35				X		X				X																
LLC	1.00	15:38				X		X				X																
ICSA	1.00	15:40				X		X				X																
LRS2	1.00	15:42				X		X				X																
LRS3	1.00	15:44				X		X				X																
CCS	1.00	15:47				X		X				X																
CCS	1.00	15:49				X		X				X																
CCV	1.00	15:51				X		X				X																
CCB	1.00	15:54				X		X				X																
P22604AB	1.00	15:56						X				X																
P22604AQ	1.00	15:58						X				X																
*46739BKG	1.00	16:01				X		X				X																
ZZZZZZ	1.00	16:03																										
ZZZZZZ	1.00	16:05																										
ZZZZZZ	1.00	16:08																										
ZZZZZZ	1.00	16:10																										
*46739L	5.00	16:12				X		X				X																
9744060	1.00	16:14				X		X				X																
CCV	1.00	16:17				X		X				X																
CCB	1.00	16:19				X		X				X																
9744061	1.00	16:21				X		X				X																
9744062	1.00	16:24				X		X				X																
9744063	1.00	16:26				X		X				X																
ZZZZZZ	1.00	16:28																										
ZZZZZZ	1.00	16:31																										
ZZZZZZ	1.00	16:33																										
ZZZZZZ	1.00	16:35																										
ZZZZZZ	1.00	16:37																										
ZZZZZZ	1.00	16:40																										
CCV	1.00	16:42				X		X				X																
CCB	1.00	16:44				X		X				X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ47

Method: MS

Instrument ID: 11332

Run Name: 1824210E03

Run Start Date: 08/30/2018

Run End Date: 08/30/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
S0	1.00	22:23	X	X											X															
S	1.00	22:25	X	X											X															
ICV	1.00	22:27	X	X											X															
ICB	1.00	22:30	X	X											X															
LLC	1.00	22:32	X	X											X															
ICSA	1.00	22:34	X	X											X															
LRS2	1.00	22:37	X	X											X															
LRS3	1.00	22:39	X	X											X															
CCS	1.00	22:41	X	X											X															
CCS	1.00	22:44	X	X											X															
CCV	1.00	22:46	X	X											X															
CCB	1.00	22:48	X	X											X															
P22604AB	1.00	22:51		X											X															
P22604AQ	1.00	22:53													X															
*46739BKG	1.00	22:55													X															
ZZZZZZ	1.00	22:57																												
ZZZZZZ	1.00	23:00																												
ZZZZZZ	1.00	23:02																												
ZZZZZZ	1.00	23:04																												
*46739L	5.00	23:07													X															
9744060	1.00	23:09	X												X															
CCV	1.00	23:11	X	X											X															
CCB	1.00	23:14	X	X											X															
9744061	1.00	23:16	X												X															
9744062	1.00	23:18	X												X															
9744063	1.00	23:21	X												X															
ZZZZZZ	1.00	23:23																												
ZZZZZZ	1.00	23:25																												
ZZZZZZ	1.00	23:27																												
ZZZZZZ	1.00	23:30																												
ZZZZZZ	1.00	23:32																												
CCV	1.00	23:34	X												X															
CCB	1.00	23:37	X												X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ47

Method: MS
Instrument ID: 11332
Run Name: 1824808E03

Run Start Date: 09/05/2018
Run End Date: 09/05/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
S0	1.00	17:48	X	X		X																								
S	1.00	17:51	X	X		X																								
ICV	1.00	17:53	X	X		X																								
ICB	1.00	17:55	X	X		X																								
LLC	1.00	17:58	X	X		X																								
ICSA	1.00	18:00	X	X		X																								
LRS2	1.00	18:02	X	X		X																								
LRS3	1.00	18:04	X	X		X																								
CCS	1.00	18:07	X	X		X																								
CCS	1.00	18:09	X	X		X																								
CCV	1.00	18:11	X	X		X																								
CCB	1.00	18:14	X	X		X																								
P22604AB	1.00	18:16	X			X																								
P22604AQ	1.00	18:18	X	X		X																								
*46739BKG	1.00	18:21	X	X																										
ZZZZZZ	1.00	18:23																												
ZZZZZZ	1.00	18:25																												
ZZZZZZ	1.00	18:28																												
ZZZZZZ	1.00	18:30																												
*46739L	5.00	18:32	X	X																										
9744060	1.00	18:34		X																										
CCV	1.00	18:37	X	X		X																								
CCB	1.00	18:39	X	X		X																								
9744061	1.00	18:41		X																										
9744062	1.00	18:44		X																										
9744063	1.00	18:46		X																										
ZZZZZZ	1.00	18:48																												
ZZZZZZ	1.00	18:51																												
ZZZZZZ	1.00	18:53																												
ZZZZZZ	1.00	18:55																												
ZZZZZZ	1.00	18:58																												
CCV	1.00	19:00		X																										
CCB	1.00	19:02		X																										

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
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A = Post Digest Spike
L = Serial Dilution
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Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ47

Method: CV
Instrument ID: 17384
Run Name: 1822601M07

Run Start Date: 08/14/2018
Run End Date: 08/14/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	07:17												X																
S0.2	1.00	07:19												X																
S0.5	1.00	07:21												X																
S1.0	1.00	07:23												X																
S2.5	1.00	07:25												X																
S5.0	1.00	07:27												X																
ICV	1.00	07:29												X																
ICB	1.00	07:31												X																
CRA	1.00	07:33												X																
CCV	1.00	07:35												X																
CCB	1.00	07:37												X																
ZZZZZZ	1.00	07:39																												
ZZZZZZ	1.00	07:41																												
ZZZZZZ	1.00	07:43																												
ZZZZZZ	1.00	07:45																												
ZZZZZZ	1.00	07:47																												
ZZZZZZ	1.00	07:49																												
ZZZZZZ	1.00	07:52																												
ZZZZZZ	1.00	07:54																												
ZZZZZZ	1.00	07:56																												
ZZZZZZ	1.00	07:58																												
CCV	1.00	08:00												X																
CCB	1.00	08:02												X																
ZZZZZZ	1.00	08:04																												
ZZZZZZ	1.00	08:06																												
ZZZZZZ	1.00	08:08																												
ZZZZZZ	1.00	08:10																												
ZZZZZZ	1.00	08:12																												
ZZZZZZ	1.00	08:14																												
ZZZZZZ	1.00	08:16																												
ZZZZZZ	1.00	08:18																												
ZZZZZZ	1.00	08:20																												
ZZZZZZ	1.00	08:22																												
CCV	1.00	08:24												X																
CCB	1.00	08:26												X																
ZZZZZZ	1.00	08:28																												
ZZZZZZ	1.00	08:30																												
ZZZZZZ	1.00	08:32																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
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MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ47

Method: CV

Instrument ID: 17384

Run Name: 1822601M07

Run Start Date: 08/14/2018

Run End Date: 08/14/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
P22571BB	1.00	08:34												X																
P22571BQ	1.00	08:36												X																
*44386BKG	1.00	08:38												X																
ZZZZZZ	1.00	08:40																												
ZZZZZZ	1.00	08:42																												
ZZZZZZ	1.00	08:44																												
9744060	1.00	08:46												X																
CCV	1.00	08:48												X																
CCB	1.00	08:50												X																
9744061	1.00	08:52												X																
9744062	1.00	08:55												X																
9744063	1.00	08:57												X																
ZZZZZZ	1.00	08:59																												
ZZZZZZ	1.00	09:01																												
ZZZZZZ	1.00	09:03																												
ZZZZZZ	1.00	09:05																												
ZZZZZZ	1.00	09:07																												
ZZZZZZ	1.00	09:09																												
ZZZZZZ	1.00	09:11																												
CCV	1.00	09:13												X																
CCB	1.00	09:15												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
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LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Instrumental Water Quality Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9744060	MW-3	X		
9744061	MW-4	X		
9744062	MW-5	X		
9744063	FB-20180807	X		Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9744060	DF100	DF5	DF5
9744061	DF5	DF5	DF5

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Instrumental Water Quality Fraction: Instrumental Wet Chemistry

Samples	Chloride	Fluoride	Sulfate
9744062	DF50	DF5	DF10
9744063	DF1	DF1	DF1

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18227837109A	P22737IB	08/15/2018 11:40:00	X	X	X
	P22737IQ	08/15/2018 11:22:00	X	X	X
18227837109B	9744060	08/15/2018 20:48:00		X	X
	9744060	08/18/2018 19:14:00	X		
	9744061	08/15/2018 21:41:00	X	X	X
	9744062	08/15/2018 22:34:00		X	
	9744062	08/18/2018 19:49:00			X
	9744062	08/18/2018 20:06:00	X		
	9744063	08/15/2018 23:45:00	X	X	X

Fraction: Instrumental Wet Chemistry

18227837109A / P227371B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	08/15/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	08/15/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	08/15/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P22737IQ	Batch: 18227837109B (Sample number(s): 9744060-9744063)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.77	NA	92	NA	90-110	NA	NA
Fluoride	IC	0.750	0.701	NA	94	NA	90-110	NA	NA
Sulfate	IC	7.50	7.01	NA	93	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ47

Instrument ID: 18919
Calibration Date: 07/20/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.625258	1.165384	3.007012	5.849180	9.033771	0.9990	0.9995
Sulfate	0.363846	0.720188	1.866154	3.669929	5.760123	0.9994	0.9997

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18227837109B
Run Start Dates: 08/17/2018
Run Names: 1822902D12

Sample	Chloride			Sulfate		
	True	Result	%Rec	True	Result	%Rec
ICV	3	3.1344	104	7.5	7.8963	105
ICB	0	ND	NA	0	ND	NA
CCV2	3	2.9693	99	7.5	7.5874	101
CCB	0	ND	NA	0	ND	NA
CCV2	3	2.9839	99	7.5	7.5816	101
CCB	0	ND	NA	0	ND	NA

* = Out of Specifications

SDG: GEJ47

Instrument ID: 17694
Calibration Date: 08/08/2018

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18227837109B
Run Start Dates: 08/15/2018
Run Names: 1822701D09

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.572015	1.115551	2.842117	5.688816	8.540717	0.9995	0.9998
Fluoride	0.140763	0.562585	1.505117	3.218560	5.073797	0.9993	0.9997
Sulfate	0.349346	0.717126	1.872626	3.881805	6.020595	0.9998	0.9999

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9657	99	7.5	7.1851	96	0.75	0.7460	99
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7890	93	7.5	7.0997	95	0.75	0.7050	94
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7738	92	7.5	7.0887	95	0.75	0.6906	92
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7570	92	7.5	6.9972	93	0.75	0.7283	97
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7560	92	7.5	7.0150	94	0.75	0.7231	96
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7695	92	7.5	7.0281	94	0.75	0.7076	94
CCB	0	ND	NA	0	ND	NA	0	ND	NA

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9744060	MW-3	X		1	
9744061	MW-4	X		1	
9744062	MW-5	X		1	
9744063	FB-20180807	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

Sample Duplicate

Method defined actions are taken for any failed matrix QC.

Batch#: 18225921202A (Sample number(s): 9744060, 9744062-9744063, BKG: 9744062)
The duplicate RPD for the following analyte(s) is outside the acceptance window: Total Dissolved Solids

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18221921202A	B221872B	08/09/2018 16:27
		L221872Q	08/09/2018 16:27
		9744061	08/09/2018 16:26
Total Dissolved Solids	18225921202A	B225872B	08/13/2018 15:10
		L225872Q	08/13/2018 15:10
		9744060	08/13/2018 15:08
		9744062 BKG	08/13/2018 15:10
		9744062 DUP	08/13/2018 15:11
		9744063	08/13/2018 15:08

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ47

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18221009206A	9744061	08/10/2018 11:22:00	X	X
	9744063	08/10/2018 11:33:00	X	X
	P009206Q	08/10/2018 10:32:00	X	
18221009207A	9744062	08/10/2018 12:40:00	X	X
	P009207Q	08/10/2018 12:13:00	X	
18225121521A	9744060	08/13/2018 17:20:00	X	X
	P225121Q	08/13/2018 17:20:00	X	

Fraction: Wet Chemistry

18221921202A / B221872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	08/09/18	N.D.	mg/l	20.0	60.0

18225921202A / B225872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	08/13/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

BKG: 9744062 DUP: 9744062	Batch: 18225921202A (Sample number(s): 9744060, 9744062-9744063)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	614.	662.	8* (1)	5

Comments:

(1) The sample and/or duplicate result is less than five times the LOQ.

* = Out of Specification

Results are being reported on an as received basis.

SDG: GEJ47
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: P009206Q	Batch: 18221009206A (Sample number(s): 9744061, 9744063)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.07	NA	101	NA	95-105	NA	NA

LCS: P009207Q	Batch: 18221009207A (Sample number(s): 9744062)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.05	NA	101	NA	95-105	NA	NA

LCS: L221872Q	Batch: 18221921202A (Sample number(s): 9744061)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	202	NA	101	NA	62-127	NA	NA

LCS: P225121Q	Batch: 18225121521A (Sample number(s): 9744060)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	6.99	NA	100	NA	95-105	NA	NA

LCS: L225872Q	Batch: 18225921202A (Sample number(s): 9744060, 9744062-9744063)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	188	NA	94	NA	62-127	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

September 05, 2018

Ms. Madeline Ratcliff
Eurofins Lancaster Laboratories Environmental, LLC
2425 New Holland Pike
Lancaster, Pennsylvania 17601

Re: NJ Radiochemistry Analyses
Work Order: 456677

Dear Ms. Ratcliff:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on August 08, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Julie Robinson
Project Manager

Purchase Order: GELP15-0603
Chain of Custody: 1973423
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 456677**

September 05, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on August 08, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
456677001	FB-20180803
456677002	MW-1
456677003	MW-2
456677004	MW-6

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.



Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

[illegible]

SAMPLE RECEIPT & REVIEW FORM

Client: LANC		SDG/AR/COC/Work Order: 456677	
Received By: SLB		Date Received: 8/8/18 JR	
Carrier and Tracking Number		Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other	
		5035 4244 9038	
		5035 4244 9016 - 15° 5035 4244 9027 - 12°	
Suspected Hazard Information	Yes ☐ No ☒	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
Shipped as a DOT Hazardous?	Yes ☐ No ☒	Hazard Class Shipped: _____ UN#: _____	
COC/Samples marked or classified as radioactive?	Yes ☐ No ☒	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 CPM / mR/Hr Classified as: Rad 1 Rad 2 Rad 3	
Is package, COC, and/or Samples marked HAZ?	Yes ☐ No ☒	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other: _____	

Sample Receipt Criteria	Yes	NA	N/A	Comments/Qualifiers (Required for Non-Conforming Items)
1 Shipping containers received intact and sealed?	☒	☐	☐	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?	☒	☐	☐	
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	☐	☐	☒	Preservation Method: Wet Ice Ice Packs Dry ice None Other: _____ *all temperatures are recorded in Celsius TEMP: above
4 Daily check performed and passed on IR temperature gun?	☒	☐	☐	Temperature Device Serial #: 1R3-17 Secondary Temperature Device Serial # (If Applicable): _____
5 Sample containers intact and sealed?	☒	☐	☐	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6 Samples requiring chemical preservation at proper pH?	☐	☐	☒	Sample ID's and Containers Affected: SEE BELOW If Preservation added, Lot#: 1807308P
7 Do any samples require Volatile Analysis?	☐	☐	☒	If Yes, Are Encores or Soil Kits present? Yes ___ No ___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes ___ No ___ N/A (If unknown, select No) VOA vials free of headspace? Yes ___ No ___ N/A Sample ID's and containers affected: _____
8 Samples received within holding time?	☒	☐	☐	ID's and tests affected: _____
9 Sample ID's on COC match ID's on bottles?	☒	☐	☐	Sample ID's and containers affected: _____
10 Date & time on COC match date & time on bottles?	☒	☐	☐	Sample ID's affected: _____
11 Number of containers received match number indicated on COC?	☒	☐	☐	Sample ID's affected: _____
12 Are sample containers identifiable as GEL provided?	☐	☐	☒	
13 COC form is properly signed in relinquished/received sections?	☒	☐	☐	

Comments (Use Continuation Form if needed):

B12
B11
B13
B10

PM (or PMA) review: Initials **JWC** Date **8/9/18** Page **1** of **1**

Laboratory Certifications

List of current GEL Certifications as of 05 September 2018

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-26
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LANC)
SDG #: 456677**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1791273

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
456677001	FB-20180803
456677002	MW-1
456677003	MW-2
456677004	MW-6
1204089245	Method Blank (MB)
1204089246	456680008(MW-8) Sample Duplicate (DUP)
1204089247	456680008(MW-8) Matrix Spike (MS)
1204089248	456680008(MW-8) Matrix Spike Duplicate (MSD)
1204089249	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Samples were re-eluted and recounted to verify sample results. The recounts are reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204089247 (MW-8MS) and 1204089248 (MW-8MSD), aliquots were reduced to conserve sample volume.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1790749

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
456677001	FB-20180803
456677002	MW-1
456677003	MW-2
456677004	MW-6
1204088003	Method Blank (MB)
1204088004	456752001(NonSDG) Sample Duplicate (DUP)
1204088005	456752001(NonSDG) Matrix Spike (MS)
1204088006	456752001(NonSDG) Matrix Spike Duplicate (MSD)
1204088007	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Duplication Criteria between MS and MSD

The Matrix Spike and Matrix Spike Duplicate (See Below) do not meet the duplication requirement; however, they both meet the spiked recovery requirement.

Sample	Analyte	Value
1204088005MS and 1204088006MSD (Non SDG 456752001)	Radium-226	RPD 26.1* (0%-20%)

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204088005 (Non SDG 456752001MS) and 1204088006 (Non SDG 456752001MSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 456677 GEL Work Order: 456677

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:



Name: Kate Gellatly

Date: 05 SEP 2018

Title: Analyst I

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 5, 2018

Company : Eurofins Lancaster Laboratories Environmental, LLC
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601

Contact: Ms. Madeline Ratcliff
Project: NJ Radiochemistry Analyses

Client Sample ID: FB-20180803
Sample ID: 456677001
Matrix: Water
Collect Date: 03-AUG-18 11:45
Receive Date: 08-AUG-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	0.427	+/-1.00	1.79	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.0599	+/-0.186	0.369	1.00	pCi/L			PCW	08/14/18	0930	1790749	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			78.2	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 5, 2018

Company : Eurofins Lancaster Laboratories Environmental, LLC
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601

Contact: Ms. Madeline Ratcliff
Project: NJ Radiochemistry Analyses

Client Sample ID:	MW-1	Project:	LANC00115
Sample ID:	456677002	Client ID:	LANC006
Matrix:	Water		
Collect Date:	03-AUG-18 12:35		
Receive Date:	08-AUG-18		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	0.237	+/-0.879	1.62	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.323	+/-0.276	0.423	1.00	pCi/L			PCW	08/14/18	0930	1790749	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			77.5	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 5, 2018

Company : Eurofins Lancaster Laboratories Environmental, LLC
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601

Contact: Ms. Madeline Ratcliff
Project: NJ Radiochemistry Analyses

Client Sample ID:	MW-2	Project:	LANC00115
Sample ID:	456677003	Client ID:	LANC006
Matrix:	Water		
Collect Date:	03-AUG-18 11:05		
Receive Date:	08-AUG-18		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	1.09	+/-1.23	2.07	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		1.89	+/-0.600	0.517	1.00	pCi/L			PCW	08/14/18	0930	1790749	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			78.5	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 5, 2018

Company : Eurofins Lancaster Laboratories Environmental, LLC
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601

Contact: Ms. Madeline Ratcliff
Project: NJ Radiochemistry Analyses

Client Sample ID:	MW-6	Project:	LANC00115
Sample ID:	456677004	Client ID:	LANC006
Matrix:	Water		
Collect Date:	03-AUG-18 14:35		
Receive Date:	08-AUG-18		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	0.993	+/-0.890	1.43	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.182	+/-0.238	0.406	1.00	pCi/L			PCW	08/14/18	0930	1790749	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			73.5	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

Quality Control Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: September 5, 2018

Page 1 of 2

Eurofins Lancaster Laboratories Environmental, LLC

2425 New Holland Pike
Lancaster, Pennsylvania

Contact: Ms. Madeline Ratcliff

Workorder: 456677

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1791273										
QC1204089246	456680008	DUP									
Radium-228	U	0.484	U	0.751	pCi/L	N/A		N/A	JXC9	08/22/18	14:52
	Uncertainty	+/-0.782		+/-0.870							
QC1204089249	LCS										
Radium-228	17.6			18.2	pCi/L		104	(75%-125%)		08/22/18	14:52
	Uncertainty			+/-2.30							
QC1204089245	MB										
Radium-228			U	0.189	pCi/L					08/22/18	14:52
	Uncertainty			+/-0.914							
QC1204089247	456680008	MS									
Radium-228	52.9	U	0.484	52.6	pCi/L		99.5	(75%-125%)		08/22/18	14:52
	Uncertainty		+/-0.782	+/-6.51							
QC1204089248	456680008	MSD									
Radium-228	52.9	U	0.484	47.1	pCi/L	0	88.9	(0%-20%)		08/22/18	14:52
	Uncertainty		+/-0.782	+/-5.56							
Rad Ra-226											
Batch	1790749										
QC1204088004	456752001	DUP									
Radium-226	U	0.250	U	0.287	pCi/L	N/A		N/A	PCW	08/14/18	10:35
	Uncertainty	+/-0.212		+/-0.272							
QC1204088007	LCS										
Radium-226	26.0			21.8	pCi/L		84	(75%-125%)		08/14/18	11:05
	Uncertainty			+/-1.58							
QC1204088003	MB										
Radium-226			U	0.0664	pCi/L					08/14/18	10:35
	Uncertainty			+/-0.260							
QC1204088005	456752001	MS									
Radium-226	130	U	0.250	114	pCi/L		87.6	(75%-125%)		08/14/18	10:35
	Uncertainty		+/-0.212	+/-8.03							
QC1204088006	456752001	MSD									
Radium-226	130	U	0.250	148	pCi/L	26.1*	114	(0%-20%)		08/14/18	10:35
	Uncertainty		+/-0.212	+/-10.9							

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QC Summary

Workorder: 456677

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

**	Analyte is a Tracer compound
<	Result is less than value reported
>	Result is greater than value reported
BD	Results are either below the MDC or tracer recovery is low
FA	Failed analysis.
H	Analytical holding time was exceeded
J	Value is estimated
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.
M	M if above MDC and less than LLD
M	REMP Result > MDC/CL and < RDL
N/A	RPD or %Recovery limits do not apply.
N1	See case narrative
ND	Analyte concentration is not detected above the detection limit
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
R	Sample results are rejected
U	Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
UI	Gamma Spectroscopy--Uncertain identification
UJ	Gamma Spectroscopy--Uncertain identification
UL	Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
h	Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1791273 Check-list

This check-list was completed on 22-AUG-18 by Nat Long

This batch was reviewed by Nat Long on 22-AUG-18 and Kenshalla Oston on 24-AUG-18.

Batch ID:
1791273

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-009

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID: 1791273
Analyst: Jasmine Conley (JXC9)
Method: EPA 904.0/SW846 9320 Modified
Lab SOP: GL-RAD-A-063 REV# 2
Instrument: GFC-51204863

Due Dates for Lab: 02-SEP-2018			Package: 04-SEP-2018	SDG: 06-SEP-2018		
Type	Sample Id	Description		Serial Number	Spike Amount	Spike Units
LCS	1204089249	Radium-228 SPIKE		1809-A	.1	mL
MS	1204089247	Radium-228 SPIKE		1809-A	.1	mL
MSD	1204089248	Radium-228 SPIKE		1809-A	.1	mL

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	456675001	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
2	456677001	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
3	456677002	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
4	456677003	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
5	456677004	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
6	456680001	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
7	456680002	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
8	456680003	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
9	456680004	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
10	456680005	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
11	456680006	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
12	456680007	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
13	456680008	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
14	456680009	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
15	456680010	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
16	456683001	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
17	456683002	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
18	456683003	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
19	1204089245 MB	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
20	1204089246 DUP (456680008)	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50
21	1204089247 MS (456680008)	13-AUG-2018	3	100	08/16/18 07:52	08/22/18 12:50
22	1204089248 MSD (456680008)	13-AUG-2018	3	100	08/16/18 07:52	08/22/18 12:50
23	1204089249 LCS	13-AUG-2018	3	300	08/16/18 07:52	08/22/18 12:50

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 13-AUG-2018 00:00
REGNT 2662331.3	cerium 500 mg/L in 2%HCl	.2 mL	
REGNT 2665682	Barium Carrier 228 REG	1 mL	
REGNT 2672182	RGF-1.5 Ammonium Sulfate	10 mL	
REGNT 2672200.7	Hydrofluoric Acid Poly Bottle	3 mL	
REGNT 2769304.6	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 2805576.10	16M Nitric Acid Poly Coated Bottle	5 mL	
REGNT 2817429	2M HCl	20 mL	
REGNT 2819500	RGF-50% Potassium Carbonate	2 mL	
REGNT 2819965	7M HNO3	25 mL	
REGNT 2822290	RGF-1M Citric Acid	5 mL	

Prep Logbook

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
Reagent/Solvent Lot ID		Description		Amount	Comments:	
WORK 0487-D		Barium-133 TRACER		.1 mL		

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.4.2

Tracer S/N : 0487-D
Tracer Exp Date : 11/8/2018
Tracer Volume Added: 0.10

Batch : 1791273
Analyst : JAS02031
Prep Date : 8/13/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 3 pCi/L
Ra-228 Abundance : 1.00
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.15 hours

Geometry: CeF on 25mm Filter

Sample Characteristics					Tracer Calculations		Tracer Ref.	Tracer Samp.		Tracer Samp.	Tracer	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Tracer Ref. Activity (CPM)	Tracer Ref. Count Uncertainty (%)	Tracer Samp. Activity (CPM)	Tracer Samp. Count Uncertainty (%)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)		
1	456675001.1	0.3000	1.8459E-05	8/6/2018 8:50	216.3	4.34%	160.6	5.19%	0.1	0.000200		
2	456677001.1	0.3000	1.8459E-05	8/3/2018 11:45	216.3	4.34%	169.2	5.02%	0.1	0.000200		
3	456677002.1	0.3000	1.8459E-05	8/3/2018 12:35	216.3	4.34%	167.7	5.05%	0.1	0.000200		
4	456677003.1	0.3000	1.8459E-05	8/3/2018 11:05	216.3	4.34%	169.9	5.01%	0.1	0.000200		
5	456677004.1	0.3000	1.8459E-05	8/3/2018 14:35	216.3	4.34%	159.0	5.22%	0.1	0.000200		
6	456680001.1	0.3000	1.8459E-05	7/30/2018 11:30	216.3	4.34%	163.9	5.12%	0.1	0.000200		
7	456680002.1	0.3000	1.8459E-05	7/30/2018 13:40	216.3	4.34%	163.6	5.13%	0.1	0.000200		
8	456680003.1	0.3000	1.8459E-05	7/31/2018 10:10	216.3	4.34%	150.0	5.41%	0.1	0.000200		
9	456680004.1	0.3000	1.8459E-05	7/31/2018 12:15	216.3	4.34%	145.2	5.52%	0.1	0.000200		
10	456680005.1	0.3000	1.8459E-05	7/31/2018 15:45	216.3	4.34%	181.3	4.82%	0.1	0.000200		
11	456680006.1	0.3000	1.8459E-05	7/31/2018 14:10	216.3	4.34%	182.6	4.80%	0.1	0.000200		
12	456680007.1	0.3000	1.8459E-05	8/1/2018 12:45	216.3	4.34%	187.1	4.73%	0.1	0.000200		
13	456680008.1	0.3000	1.8459E-05	8/1/2018 14:40	216.3	4.34%	173.6	4.95%	0.1	0.000200		
14	456680009.1	0.3000	1.8459E-05	8/1/2018 11:05	216.3	4.34%	177.3	4.88%	0.1	0.000200		
15	456680010.1	0.3000	1.8459E-05	7/31/2018 12:00	216.3	4.34%	177.8	4.88%	0.1	0.000200		
16	456683001.1	0.3000	1.8459E-05	8/2/2018 11:55	216.3	4.34%	162.0	5.16%	0.1	0.000200		
17	456683002.1	0.3000	1.8459E-05	8/2/2018 13:20	216.3	4.34%	173.9	4.94%	0.1	0.000200		
18	456683003.1	0.3000	1.8459E-05	8/2/2018 13:40	216.3	4.34%	186.7	4.73%	0.1	0.000200		
19	1204089245.1	0.3000	1.8459E-05	8/13/2018 0:00	216.3	4.34%	185.6	4.75%	0.1	0.000200		
20	1204089246.1	0.3000	1.8459E-05	8/1/2018 14:40	216.3	4.34%	179.9	4.84%	0.1	0.000200		
21	1204089247.1	0.1000	1.1370E-05	8/1/2018 14:40	216.3	4.34%	175.6	4.91%	0.1	0.000200		
22	1204089248.1	0.1000	1.1370E-05	8/1/2018 14:40	216.3	4.34%	210.3	4.41%	0.1	0.000200		
23	1204089249.1	0.3000	1.8459E-05	8/13/2018 0:00	216.3	4.34%	165.6	5.09%	0.1	0.000200		

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
Instrument SOP: GL-RAD-I-016

Count raw Data													Calculated	
	Counting			Gross Counts		Beta	Count	Ac-228	Ac-228			Ac-228	Sample	Sample
Pos.	Detector ID	Time (min.)	Alpha	Beta	cpm	Start Date/Time	Ingrowth Date/Time	Decay Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Ingrowth	Count Correction	Recovery %	Recovery Error %
1	1A	60	14	47	0.783	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.995	0.802	1.000	1.057	74.2%	3.39%
2	1B	60	5	56	0.933	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.994	0.802	1.000	1.057	78.2%	3.33%
3	1C	60	6	41	0.683	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.994	0.802	1.000	1.057	77.5%	3.34%
4	1D	60	13	85	1.417	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.994	0.802	1.000	1.057	78.5%	3.33%
5	2A	60	6	39	0.650	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.994	0.802	1.000	1.057	73.5%	3.41%
6	2B	60	5	68	1.133	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.992	0.802	1.000	1.057	75.8%	3.37%
7	2D	60	6	118	1.967	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.992	0.802	1.000	1.057	75.6%	3.37%
8	3B	60	8	61	1.017	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.802	1.000	1.057	69.3%	3.48%
9	3C	60	17	65	1.083	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.802	1.000	1.057	67.1%	3.52%
10	3D	60	12	57	0.950	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.802	1.000	1.057	83.8%	3.26%
11	4A	60	7	80	1.333	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	84.4%	3.25%
12	4B	60	5	36	0.600	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	86.5%	3.22%
13	4C	60	11	37	0.617	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	80.3%	3.30%
14	4D	60	11	43	0.717	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	82.0%	3.28%
15	5A	60	14	31	0.517	8/22/2018 14:47	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	82.2%	3.28%
16	5D	60	11	103	1.717	8/22/2018 14:48	8/16/2018 7:52	8/22/2018 12:50	0.993	0.801	1.000	1.057	74.9%	3.38%
17	6A	60	14	87	1.450	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.993	0.794	1.000	1.057	80.4%	3.30%
18	6B	60	1	77	1.283	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.993	0.794	1.000	1.057	86.3%	3.22%
19	6C	60	8	56	0.933	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.997	0.794	1.000	1.057	85.8%	3.23%
20	7A	60	4	48	0.800	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.993	0.794	1.000	1.057	83.2%	3.26%
21	7B	60	13	317	5.283	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.993	0.794	1.000	1.057	81.2%	3.29%
22	7C	60	3	324	5.400	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.993	0.794	1.000	1.057	97.2%	3.11%
23	7D	60	11	288	4.800	8/22/2018 14:52	8/16/2018 7:52	8/22/2018 12:50	0.997	0.794	1.000	1.057	76.6%	3.36%

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	PIC	6/1/2017	5/31/2019	0.6430	0.00738	0.514	8/17/2018 17:13	500
2	PIC	6/1/2017	5/31/2019	0.6519	0.00711	0.824	8/17/2018 17:13	500
3	PIC	6/1/2017	5/31/2019	0.6443	0.00847	0.624	8/17/2018 17:14	500
4	PIC	6/1/2017	5/31/2019	0.6504	0.00692	1.138	8/17/2018 17:14	500
5	PIC	6/1/2017	5/31/2019	0.6444	0.01914	0.414	8/17/2018 17:14	500
6	PIC	6/1/2017	5/31/2019	0.6448	0.02111	0.546	8/17/2018 17:14	500
7	PIC	6/1/2017	5/31/2019	0.6283	0.00745	0.808	8/17/2018 17:14	500
8	PIC	6/1/2017	5/31/2019	0.6291	0.01614	0.662	8/17/2018 17:33	500
9	PIC	6/1/2017	5/31/2019	0.6374	0.00988	0.928	8/17/2018 17:14	500
10	PIC	6/1/2017	5/31/2019	0.6255	0.02297	0.570	8/17/2018 17:14	500
11	PIC	6/1/2017	5/31/2019	0.6420	0.01123	0.644	8/17/2018 17:14	500
12	PIC	6/1/2017	5/31/2019	0.6410	0.01519	0.534	8/17/2018 17:14	500
13	PIC	6/1/2017	5/31/2019	0.6608	0.00889	0.488	8/17/2018 17:14	500
14	PIC	6/1/2017	5/31/2019	0.6462	0.00773	0.638	8/17/2018 17:35	500
15	PIC	6/1/2017	5/31/2019	0.6766	0.00851	0.508	8/17/2018 17:15	500
16	PIC	6/1/2017	5/31/2019	0.6669	0.00925	1.446	8/17/2018 17:35	500
17	PIC	6/1/2017	5/31/2019	0.6547	0.02228	0.754	8/17/2018 17:16	500
18	PIC	6/1/2017	5/31/2019	0.6465	0.00851	0.976	8/17/2018 17:16	500
19	PIC	6/1/2017	5/31/2019	0.6594	0.01970	0.880	8/17/2018 17:16	500
20	PIC	6/1/2017	5/31/2019	0.6570	0.00594	0.596	8/17/2018 17:16	500
21	PIC	6/1/2017	5/31/2019	0.6688	0.00627	0.550	8/17/2018 17:16	500
22	PIC	6/1/2017	5/31/2019	0.6600	0.00790	0.400	8/17/2018 17:16	500
23	PIC	6/1/2017	5/31/2019	0.6352	0.01113	0.384	8/17/2018 17:17	500

Notes:

- 1 - Results are decay corrected to Sample Date/Time
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1809-A
Spike Exp Date : 9/15/2018
Spike Activity (dpm/ml): 117.05
Spike Volume Added: 0.10

* - RPD changed to 0% due to sample & dup activity below MDA

LCS S/N : 1809-A
LCS Exp Date : 9/15/2018
LCS Activity (dpm/ml): 117.05
LCS Volume Added: 0.10

Results																	
	Decision	Critical	Required		Sample Act.	Sample Act.	Net Count	Net Count	2 SIGMA	2 SIGMA							
Pos.	Level	Level	MDA	MDA	Conc.	Error	Rate	Rate Error	Counting	Total Prop.		Sample	Sample		Nominal		
	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	%	CPM	CPM	Uncertainty	Uncertainty		QC	Type	RPD	RER	pCi/L	Recovery
1	0.9514	0.6717	3	1.5518	1.1227	44.20%	0.2693	0.1187	0.9696	1.0118			SAMPLE				
2	1.1289	0.7970	3	1.7894	0.4271	120.01%	0.1093	0.1312	1.0043	1.0103			SAMPLE				
3	1.0030	0.7081	3	1.6157	0.2367	189.49%	0.0593	0.1124	0.8788	0.8809			SAMPLE				
4	1.3245	0.9351	3	2.0652	1.0869	57.84%	0.2787	0.1609	1.2300	1.2613			SAMPLE				
5	0.8617	0.6083	3	1.4270	0.9928	45.92%	0.2360	0.1080	0.8904	0.9271			SAMPLE				
6	0.9607	0.6783	3	1.5607	2.3987	24.39%	0.5873	0.1414	1.1315	1.2925			SAMPLE				
7	1.2017	0.8484	3	1.9069	4.8660	16.37%	1.1587	0.1855	1.5265	1.9752			SAMPLE				
8	1.1845	0.8362	3	1.9011	1.6219	38.30%	0.3547	0.1352	1.2115	1.2826			SAMPLE				
9	1.4299	1.0095	3	2.2521	0.7243	90.92%	0.1553	0.1411	1.2896	1.3031			SAMPLE				
10	0.9147	0.6458	3	1.4819	1.4462	34.52%	0.3800	0.1303	0.9718	1.0423			SAMPLE				
11	0.9405	0.6640	3	1.5121	2.5378	22.51%	0.6893	0.1533	1.1064	1.2850			SAMPLE				
12	0.8369	0.5909	3	1.3616	0.2374	159.44%	0.0660	0.1052	0.7418	0.7444			SAMPLE				
13	0.8366	0.5906	3	1.3694	0.4840	82.52%	0.1287	0.1061	0.7822	0.7921			SAMPLE				
14	0.9578	0.6762	3	1.5408	0.2963	146.20%	0.0787	0.1150	0.8489	0.8523			SAMPLE				
15	0.8143	0.5749	3	1.3293	0.0311	1132.13%	0.0087	0.0981	0.6902	0.6904			SAMPLE				
16	1.5291	1.0796	3	2.3588	1.0812	65.67%	0.2707	0.1775	1.3896	1.4173			SAMPLE				
17	1.0570	0.7463	3	1.6837	2.6614	23.36%	0.6960	0.1602	1.2009	1.3867			SAMPLE				
18	1.1344	0.8009	3	1.7821	1.1086	49.82%	0.3073	0.1528	1.0801	1.1170			SAMPLE				
19	1.0582	0.7471	3	1.6713	0.1890	246.76%	0.0533	0.1316	0.9139	0.9152			MB				
20	0.9052	0.6391	3	1.4624	0.7514	59.17%	0.2040	0.1205	0.8701	0.8913	456680008.1	DUP	43.3%				
21	2.6258	1.8539	3	4.2638	52.6458	7.14%	4.7333	0.2986	6.5092	15.0165	456680008.1	MS				52.9244	99.5%
22	1.8947	1.3377	3	3.1459	47.0531	6.83%	5.0000	0.3013	5.5580	13.2808	456680008.1	MSD	*	0.0%		52.9244	88.9%
23	0.8136	0.5744	3	1.3550	18.2128	7.34%	4.4160	0.2842	2.2973	5.2306		LCS				17.5753	103.6%

1791273r2.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
456675001	1A	60	14	47	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456677001	1B	60	5	56	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456677002	1C	60	6	41	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456677003	1D	60	13	85	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456677004	2A	60	6	39	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680001	2B	60	5	68	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680002	2D	60	6	118	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680003	3B	60	8	61	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680004	3C	60	17	65	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680005	3D	60	12	57	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680006	4A	60	7	80	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680007	4B	60	5	36	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680008	4C	60	11	37	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680009	4D	60	11	43	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456680010	5A	60	14	31	8/22/2018 14:47	8/22/2018 15:47	PIC	1791273
456683001	5D	60	11	103	8/22/2018 14:48	8/22/2018 15:48	PIC	1791273
456683002	6A	60	14	87	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
456683003	6B	60	1	77	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
1204089245	6C	60	8	56	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
1204089246	7A	60	4	48	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
1204089247	7B	60	13	317	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
1204089248	7C	60	3	324	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273
1204089249	7D	60	11	288	8/22/2018 14:52	8/22/2018 15:52	PIC	1791273

ASSAY 17-Aug-18 11:44:05

Protocol id 8 228_REC
Time limit 180
Count limit 50000
Isotope Ba-133
Protocol date 23-Sep-13 14:18:56
Run id. 88

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	98	1	180	759	216.3	4.34		11:44:13
2	98	2	180	592	160.6	5.19	74.25	11:47:24
3	98	3	180	618	169.2	5.02	78.22	11:50:36
4	98	4	180	613	167.7	5.05	77.53	11:53:47
5	98	5	180	620	169.9	5.01	78.55	11:56:58
6	51	6	180	587	159	5.22	73.51	12:00:26
7	51	7	180	602	163.9	5.12	75.77	12:03:37
8	51	8	180	601	163.6	5.13	75.64	12:06:49
9	51	9	180	560	150	5.41	69.35	12:10:00
10	51	10	180	546	145.2	5.52	67.13	12:13:11
11	78	11	180	654	181.3	4.82	83.82	12:16:36
12	78	12	180	658	182.6	4.8	84.42	12:19:47
13	78	13	180	671	187.1	4.73	86.50	12:22:59
14	78	14	180	631	173.6	4.95	80.26	12:26:10
15	78	15	180	642	177.3	4.88	81.97	12:29:21
16	81	16	180	644	177.8	4.88	82.20	12:32:45
17	81	17	180	596	162	5.16	74.90	12:35:57
18	81	18	180	632	173.9	4.94	80.40	12:39:08
19	81	19	180	670	186.7	4.73	86.32	12:42:20
20	81	20	180	667	185.6	4.75	85.81	12:45:31
21	88	21	180	650	179.9	4.84	83.17	12:48:56
22	88	22	180	637	175.6	4.91	81.18	12:52:07
23	88	23	180	741	210.3	4.41	97.23	12:55:18
24	88	24	180	607	165.6	5.09	76.56	12:58:30

END OF ASSAY

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 22-Aug-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

Short Name	Status	Paramname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100B4	Above	Beta bkg	22-Aug 04:54	60	6.767	0.607	2.163	+20.75
LB4100C4	Below	Alpha bkg	22-Aug 04:56	60	0.00E+0	4.08E-6	0.304	-3.00
LB4100C4	Above	Beta bkg	22-Aug 04:56	60	3.867	0.686	2.113	+10.37
LB4100E2	Above	Beta bkg	22-Aug 04:54	60	5.283	0.937	2.376	+15.12
LB4100E2	Below	Beta eff	22-Aug 06:19	5	16241	16310	19260	-3.14
LB4100E2	Above	Beta XTalk	22-Aug 06:19	5	4.93E-4	1.04E-4	4.54E-4	+3.67
LB4100F3	Below	Alpha XTalk	22-Aug 06:54	5	0.273	0.277	0.357	-3.25
LB4100F4	Above	Beta bkg	22-Aug 04:54	60	2.883	-5.38E+0	30.300	-1.61
LB4100F4	Below	Beta eff	22-Aug 06:19	5	33167	33210	34710	-3.17
LB4100G2	Above	Alpha XTalk	22-Aug 06:19	5	0.466	0.256	0.413	+5.05
LB4100G2	Above	Beta bkg	22-Aug 04:54	60	3282	0.414	2.180	+11,147.44
LB4100G2	Above	Beta eff	22-Aug 06:25	5	20153	15140	19980	+3.21
LB4100H2	Above	Beta bkg	22-Aug 06:56	60	2.600	-1.72E+0	4.979	+1.25
LB4100I1	Below	Alpha eff	22-Aug 06:03	5	9615	9671	11370	-3.20
LB4100I1	Below	Beta eff	22-Aug 06:11	5	13908	14210	16190	-3.92
LB4100I2	Below	Alpha eff	22-Aug 06:03	5	12280	12630	14630	-4.05
LB4100I2	Above	Beta bkg	22-Aug 04:54	60	9.517	0.458	2.118	+20.75
LB4100I2	Below	Beta eff	22-Aug 06:11	5	15426	16230	18330	-5.30
LB4100I3	Above	Beta bkg	22-Aug 04:54	60	2.267	-5.60E+1	3.474	+1.20
PIC2C	Above	Beta bkg	22-Aug 05:53	60	0.833	0.109	0.711	+4.21
PIC12A	Above	Alpha bkg	22-Aug 06:52	60	0.333	-1.44E-2	0.356	+2.63

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

LB4100B3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D2	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D4	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC3A	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC6D	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

PIC13C

Alpha pkg, Alpha ell, Alpha XTalk, Beta pkg, Beta ell, Beta XTalk

Reviewed by 1. [Signature] / [Signature]

Date 3-10-18

GEL Laboratories LLC

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1791273

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
456675001	SAMPLE	JXC9	PIC1A	AUG-22-18 14:47:26	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456677001	SAMPLE	JXC9	PIC1B	AUG-22-18 14:47:28	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456677002	SAMPLE	JXC9	PIC1C	AUG-22-18 14:47:30	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456677003	SAMPLE	JXC9	PIC1D	AUG-22-18 14:47:32	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456677004	SAMPLE	JXC9	PIC2A	AUG-22-18 14:47:34	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680001	SAMPLE	JXC9	PIC2B	AUG-22-18 14:47:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680002	SAMPLE	JXC9	PIC2D	AUG-22-18 14:47:41	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680003	SAMPLE	JXC9	PIC3B	AUG-22-18 14:47:43	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680004	SAMPLE	JXC9	PIC3C	AUG-22-18 14:47:44	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680005	SAMPLE	JXC9	PIC3D	AUG-22-18 14:47:46	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680006	SAMPLE	JXC9	PIC4A	AUG-22-18 14:47:48	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680007	SAMPLE	JXC9	PIC4B	AUG-22-18 14:47:50	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680008	SAMPLE	JXC9	PIC4C	AUG-22-18 14:47:53	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680009	SAMPLE	JXC9	PIC4D	AUG-22-18 14:47:55	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456680010	SAMPLE	JXC9	PIC5A	AUG-22-18 14:47:59	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456683001	SAMPLE	JXC9	PIC5D	AUG-22-18 14:48:02	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204089245	MB	JXC9	PIC6C	AUG-22-18 14:52:31	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204089246	DUP	JXC9	PIC7A	AUG-22-18 14:52:34	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204089247	MS	JXC9	PIC7B	AUG-22-18 14:52:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204089248	MSD	JXC9	PIC7C	AUG-22-18 14:52:39	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204089249	LCS	JXC9	PIC7D	AUG-22-18 14:52:41	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456683002	SAMPLE	JXC9	PIC6A	AUG-22-18 14:52:44	DONE	CeF on 25mm Filter	01-JUN-17 00:00
456683003	SAMPLE	JXC9	PIC6B	AUG-22-18 14:52:46	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1790749 Check-list

This check-list was completed on 14-AUG-18 by Lyndsey Pace

This batch was reviewed by Lyndsey Pace on 14-AUG-18 and Elizabeth Krouse on 15-AUG-18.

Batch ID:
1790749

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?		No	
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Radium-226 Queue Sheet

09-AUG-18

GEL Laboratories, Radiochemistry Division

Batch #: 1790749

Analyst: PCW

First Client Due Date: 08/29/2018

Internal Due Date: 08/27/2018

Spike Isotope: Radium-226

Spike Code: 1790749

Expiration Date: 01/01/20

Vol: 1.0

End Initial/Degas Date/Time: 8/16/18

LCS Isotope: Radium-226

LCS Code: 1790749

Expiration Date: 01/01/20

Vol: 1.0

End LN De-em Date: 8/16/18

Bkg Count Time: 10 Min

Sample Count Time: 10 Min

Start Count Date: 8/16/18

Prep Date: 8/16/18

Paper ID: 2790749

Balance ID: 1790749

Initials: PCW

Witness: 1790749

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDL	Client	Position Label	Aliquot (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
45677001-1	FR-20190603	SAMPLE		WATER	1 pCi/L	LANC006	1	5.0	8/16/18	8/16/18	100	1	100	100
45677002-1	MW-1	SAMPLE		WATER	1 pCi/L	LANC006	2	5.0	8/16/18	8/16/18	100	1	100	100
45677003-1	MW-2	SAMPLE		WATER	1 pCi/L	LANC006	3	5.0	8/16/18	8/16/18	100	1	100	100
45677004-1	MW-3	SAMPLE		WATER	1 pCi/L	LANC006	4	5.0	8/16/18	8/16/18	100	1	100	100
45677005-1	MW-4	SAMPLE		WATER	1 pCi/L	LANC006	5	5.0	8/16/18	8/16/18	100	1	100	100
45677006-1	MW-5	SAMPLE		WATER	1 pCi/L	LANC006	6	5.0	8/16/18	8/16/18	100	1	100	100
45677007-1	MW-6	SAMPLE		WATER	1 pCi/L	LANC006	7	5.0	8/16/18	8/16/18	100	1	100	100
45677008-1	MW-7	SAMPLE		WATER	1 pCi/L	LANC006	8	5.0	8/16/18	8/16/18	100	1	100	100
45677009-1	MW-8	SAMPLE		WATER	1 pCi/L	LANC006	9	5.0	8/16/18	8/16/18	100	1	100	100
45677010-1	2018021738 MW-9	SAMPLE		WATER	1 pCi/L	DUP0007	10	5.0	8/16/18	8/16/18	100	1	100	100
45677011-1	2018021737 MW-4	SAMPLE		WATER	1 pCi/L	DUP0007	11	5.0	8/16/18	8/16/18	100	1	100	100
45677012-1	2018021738 MW-5	SAMPLE		WATER	1 pCi/L	DUP0007	12	5.0	8/16/18	8/16/18	100	1	100	100
45677013-1	2018021739 MW-11D	SAMPLE		WATER	1 pCi/L	DUP0007	13	5.0	8/16/18	8/16/18	100	1	100	100
45677014-1	2018021740 MW-15D	SAMPLE		WATER	1 pCi/L	DUP0007	14	5.0	8/16/18	8/16/18	100	1	100	100
45677015-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	15	5.0	8/16/18	8/16/18	100	1	100	100
45677016-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	16	5.0	8/16/18	8/16/18	100	1	100	100
45677017-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	17	5.0	8/16/18	8/16/18	100	1	100	100
45677018-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	18	5.0	8/16/18	8/16/18	100	1	100	100
45677019-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	19	5.0	8/16/18	8/16/18	100	1	100	100
45677020-1	2018021738	SAMPLE		SURFACE WA	1 pCi/L	DUP0006	20	5.0	8/16/18	8/16/18	100	1	100	100
1204088003-1	MB for back 1790749	MB		SURFACE WA	1 pCi/L	QC ACCOUNT	21	5.0	8/16/18	8/16/18	100	1	100	100
1204088004-1	2018021738 45677001 DUP	DUP		SURFACE WA	1 pCi/L	QC ACCOUNT	22	5.0	8/16/18	8/16/18	100	1	100	100
1204088005-1	2018021738 45677001 MS	MS		SURFACE WA	1 pCi/L	QC ACCOUNT	23	5.0	8/16/18	8/16/18	100	1	100	100
1204088006-1	2018021738 45677001 MSD	MSD		SURFACE WA	1 pCi/L	QC ACCOUNT	24	5.0	8/16/18	8/16/18	100	1	100	100
1204088007-1	LCS for back 1790749	LCS		SURFACE WA	1 pCi/L	QC ACCOUNT	25	5.0	8/16/18	8/16/18	100	1	100	100

Comments: _____

Data Reviewed By: _____

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1790749
Analyst : PCW
Prep Date : 8/10/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Halflife of Ra-226 : 1600 years
Ra-226 Abundance : 1.00
Halflife of Rn-222: 3.8235 days

Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Background Counts	Background CPM	Count Time (min.)	Cell Efficiency (cpm/dpm)
1	456677001.1	0.5000	2.0256E-05	8/3/2018 11:45	105	30	6	0.200	4	0.133	30	2.0440
2	456677002.1	0.5000	2.0256E-05	8/3/2018 12:35	204	30	17	0.567	6	0.200	30	2.0820
3	456677003.1	0.5000	2.0256E-05	8/3/2018 11:05	308	30	49	1.633	4	0.133	30	1.4570
4	456677004.1	0.5000	2.0256E-05	8/3/2018 14:35	402	30	11	0.367	5	0.167	30	2.0200
5	456680001.1	0.5000	2.0256E-05	7/30/2018 11:30	508	30	51	1.700	2	0.067	30	2.1080
6	456680002.1	0.5000	2.0256E-05	7/30/2018 13:40	606	30	89	2.967	3	0.100	30	1.9430
7	456680003.1	0.5000	2.0256E-05	7/31/2018 10:10	706	30	16	0.533	4	0.133	30	1.9130
8	456680004.1	0.5000	2.0256E-05	7/31/2018 12:15	807	30	34	1.133	8	0.267	30	1.9580
9	456680005.1	0.5000	2.0256E-05	7/31/2018 15:45	107	30	29	0.967	2	0.067	30	1.5510
10	456732001.1	0.5000	2.0256E-05	8/6/2018 12:10	208	30	73	2.433	6	0.200	30	1.8820
11	456732002.1	0.5000	2.0256E-05	8/6/2018 12:34	302	30	52	1.733	5	0.167	30	1.6870
12	456732003.1	0.5000	2.0256E-05	8/6/2018 14:36	408	30	61	2.033	8	0.267	30	1.8510
13	456732004.1	0.5000	2.0256E-05	8/6/2018 15:52	506	30	5	0.167	1	0.033	30	2.0990
14	456732005.1	0.5000	2.0256E-05	8/6/2018 15:59	607	30	40	1.333	2	0.067	30	2.1300
15	456752001.1	0.5000	2.0256E-05	8/7/2018 8:30	701	30	10	0.333	2	0.067	30	1.9520
16	456752002.1	0.5000	2.0256E-05	8/7/2018 9:00	802	30	21	0.700	1	0.033	30	1.6450
17	456755001.1	0.5000	2.0256E-05	8/6/2018 9:05	110	30	11	0.367	5	0.167	30	2.0570
18	456755002.1	0.5000	2.0256E-05	8/6/2018 10:20	201	30	11	0.367	4	0.133	30	2.0070
19	456755003.1	0.5000	2.0256E-05	8/6/2018 11:10	305	30	8	0.267	2	0.067	30	1.4880
20	456755004.1	0.5000	2.0256E-05	8/6/2018 14:45	407	30	13	0.433	2	0.067	30	1.7420
21	1204088003.1	0.5000	2.0256E-05	8/10/2018 0:00	504	30	9	0.300	7	0.233	30	1.8310
22	1204088004.1	0.5000	2.0256E-05	8/7/2018 8:30	601	30	14	0.467	5	0.167	30	1.9080
23	1204088005.1	0.1000	1.1370E-05	8/7/2018 8:30	703	30	775	25.833	1	0.033	30	2.0680
24	1204088006.1	0.1000	1.1370E-05	8/7/2018 8:30	803	30	721	24.033	3	0.100	30	1.4750
25	1204088007.1	0.5000	2.0256E-05	8/10/2018 0:00	104	30	738	24.600	1	0.033	30	2.0520

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-008
Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
9.300%	5/1/2018	4/30/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
1.700%	8/1/2018	7/31/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
9.500%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
1.600%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
5.200%	6/1/2018	5/31/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
2.400%	7/1/2018	6/30/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
3.000%	11/1/2017	10/31/2018	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
9.200%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:29	8/14/2018 9:30	0.503	0.977	1.002	1.000
9.300%	5/1/2018	4/30/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
5.200%	8/1/2018	7/31/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
9.700%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
7.000%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
2.500%	6/1/2018	5/31/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
2.900%	7/1/2018	6/30/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
1.900%	11/1/2017	10/31/2018	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
5.600%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 6:58	8/14/2018 10:00	0.505	0.977	1.002	1.000
5.000%	5/1/2018	4/30/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
8.300%	8/1/2018	7/31/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
2.900%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
6.600%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
9.700%	6/1/2018	5/31/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
8.500%	7/1/2018	6/30/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
2.400%	11/1/2017	10/31/2018	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
2.200%	3/1/2018	2/28/2019	8/10/2018 10:00	8/14/2018 7:30	8/14/2018 10:35	0.507	0.977	1.002	1.000
7.800%	5/1/2018	4/30/2019	8/10/2018 10:00	8/14/2018 7:49	8/14/2018 11:05	0.508	0.976	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1715-D
Spike Exp Date : 12/19/2018
Spike Activity (dpm/ml): 288.45
Spike Volume Added: 0.10

LCS S/N : 1715-D
LCS Exp Date : 12/19/2018
LCS Activity (dpm/ml): 288.45
LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.1974	0.1394	1	0.3686	0.0599	158.39%	0.0667	0.1054	0.1857	0.1862		SAMPLE				
2	0.2374	0.1676	1	0.4234	0.3235	43.63%	0.3667	0.1599	0.2764	0.2806		SAMPLE				
3	0.2769	0.1955	1	0.5171	1.8911	18.76%	1.5000	0.2427	0.5996	0.7470		SAMPLE				
4	0.2233	0.1577	1	0.4063	0.1819	66.69%	0.2000	0.1333	0.2376	0.2392		SAMPLE				
5	0.1354	0.0956	1	0.2783	1.4233	15.74%	1.6333	0.2427	0.4145	0.4848		SAMPLE				
6	0.1799	0.1270	1	0.3485	2.7101	11.41%	2.8667	0.3197	0.5924	0.7213		SAMPLE				
7	0.2109	0.1489	1	0.3939	0.3841	37.39%	0.4000	0.1491	0.2806	0.2869		SAMPLE				
8	0.2914	0.2058	1	0.5053	0.8131	26.57%	0.8667	0.2160	0.3972	0.4394		SAMPLE				
9	0.1833	0.1294	1	0.3769	1.0622	22.62%	0.9000	0.1856	0.4293	0.4953		SAMPLE				
10	0.2617	0.1848	1	0.4668	2.1722	14.25%	2.2333	0.2963	0.5648	0.6829		SAMPLE				
11	0.2665	0.1881	1	0.4848	1.6999	18.77%	1.5667	0.2517	0.5352	0.6717		SAMPLE				
12	0.3072	0.2169	1	0.5327	1.7471	17.17%	1.7667	0.2769	0.5367	0.6396		SAMPLE				
13	0.0958	0.0676	1	0.2225	0.1163	61.29%	0.1333	0.0816	0.1396	0.1407		SAMPLE				
14	0.1335	0.0942	1	0.2744	1.0886	17.30%	1.2667	0.2160	0.3639	0.4012		SAMPLE				
15	0.1457	0.1028	1	0.2995	0.2501	43.34%	0.2667	0.1155	0.2122	0.2155		SAMPLE				
16	0.1222	0.0863	1	0.2839	0.7418	24.11%	0.6667	0.1563	0.3410	0.3666		SAMPLE				
17	0.2178	0.1538	1	0.3962	0.1773	66.85%	0.2000	0.1333	0.2317	0.2338		SAMPLE				
18	0.1996	0.1409	1	0.3728	0.2121	55.95%	0.2333	0.1291	0.2300	0.2345		SAMPLE				
19	0.1904	0.1344	1	0.3914	0.2452	52.78%	0.2000	0.1054	0.2533	0.2561		SAMPLE				
20	0.1626	0.1148	1	0.3344	0.3839	35.82%	0.3667	0.1291	0.2649	0.2752		SAMPLE				
21	0.2895	0.2044	1	0.5084	0.0664	200.24%	0.0667	0.1333	0.2603	0.2608		MB				
22	0.2348	0.1658	1	0.4271	0.2868	49.17%	0.3000	0.1453	0.2722	0.2795	456752001.1	DUP	13.7%			
23	0.4844	0.3420	1	1.1250	113.7788	4.33%	25.8000	0.9286	8.0261	19.0476	456752001.1	MS			129.9319	87.6%
24	1.1763	0.8305	1	2.2792	147.9801	4.35%	23.9333	0.8969	10.8694	24.8022	456752001.1	MSD	26.1%		129.9319	113.9%
25	0.0975	0.0689	1	0.2265	21.8163	8.63%	24.5667	0.9062	1.5772	4.8507		LCS			25.9863	84.0%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 14-AUG-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	07:35	1	1.27E+05	127047	-1.95		
LUCAS2	EFF	07:35	1	1.31E+05	130758	0.9		
LUCAS3	EFF	07:35	1	1.36E+05	135798	-2.48		
LUCAS4	EFF	07:35	1	1.35E+05	134706	2.92		
LUCAS5	EFF	07:35	1	1.34E+05	133556	-0.09		
LUCAS6	EFF	07:35	1	1.35E+05	135204	0.53		
LUCAS7	EFF	07:35	1	1.43E+05	142901	2.1		
LUCAS8	EFF	07:35	1	1.38E+05	138078	-0.34		

Reviewed by:

Lyndsey Pace

Date: 14-AUG-18

GEL Laboratories LLC

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1790749

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
456677001	SAMPLE	PCW	LUCAS1	AUG-14-18 09:30:00	DONE	Lucas Cell	01-MAY-18 00:00
456677002	SAMPLE	PCW	LUCAS2	AUG-14-18 09:30:00	DONE	Lucas Cell	01-AUG-18 00:00
456677003	SAMPLE	PCW	LUCAS3	AUG-14-18 09:30:00	DONE	Lucas Cell	01-MAR-18 00:00
456677004	SAMPLE	PCW	LUCAS4	AUG-14-18 09:30:00	DONE	Lucas Cell	01-MAR-18 00:00
456680001	SAMPLE	PCW	LUCAS5	AUG-14-18 09:30:00	DONE	Lucas Cell	01-JUN-18 00:00
456680002	SAMPLE	PCW	LUCAS6	AUG-14-18 09:30:00	DONE	Lucas Cell	01-JUL-18 00:00
456680003	SAMPLE	PCW	LUCAS7	AUG-14-18 09:30:00	DONE	Lucas Cell	01-NOV-17 00:00
456680004	SAMPLE	PCW	LUCAS8	AUG-14-18 09:30:00	DONE	Lucas Cell	01-MAR-18 00:00
456680005	SAMPLE	PCW	LUCAS1	AUG-14-18 10:00:00	DONE	Lucas Cell	01-MAY-18 00:00
456732001	SAMPLE	PCW	LUCAS2	AUG-14-18 10:00:00	DONE	Lucas Cell	01-AUG-18 00:00
456732002	SAMPLE	PCW	LUCAS3	AUG-14-18 10:00:00	DONE	Lucas Cell	01-MAR-18 00:00
456732003	SAMPLE	PCW	LUCAS4	AUG-14-18 10:00:00	DONE	Lucas Cell	01-MAR-18 00:00
456732004	SAMPLE	PCW	LUCAS5	AUG-14-18 10:00:00	DONE	Lucas Cell	01-JUN-18 00:00
456732005	SAMPLE	PCW	LUCAS6	AUG-14-18 10:00:00	DONE	Lucas Cell	01-JUL-18 00:00
456752001	SAMPLE	PCW	LUCAS7	AUG-14-18 10:00:00	DONE	Lucas Cell	01-NOV-17 00:00
456752002	SAMPLE	PCW	LUCAS8	AUG-14-18 10:00:00	DONE	Lucas Cell	01-MAR-18 00:00
456755001	SAMPLE	PCW	LUCAS1	AUG-14-18 10:35:00	DONE	Lucas Cell	01-MAY-18 00:00
456755002	SAMPLE	PCW	LUCAS2	AUG-14-18 10:35:00	DONE	Lucas Cell	01-AUG-18 00:00
456755003	SAMPLE	PCW	LUCAS3	AUG-14-18 10:35:00	DONE	Lucas Cell	01-MAR-18 00:00
456755004	SAMPLE	PCW	LUCAS4	AUG-14-18 10:35:00	DONE	Lucas Cell	01-MAR-18 00:00
1204088003	MB	PCW	LUCAS5	AUG-14-18 10:35:00	DONE	Lucas Cell	01-JUN-18 00:00
1204088004	DUP	PCW	LUCAS6	AUG-14-18 10:35:00	DONE	Lucas Cell	01-JUL-18 00:00
1204088005	MS	PCW	LUCAS7	AUG-14-18 10:35:00	DONE	Lucas Cell	01-NOV-17 00:00
1204088006	MSD	PCW	LUCAS8	AUG-14-18 10:35:00	DONE	Lucas Cell	01-MAR-18 00:00
1204088007	LCS	PCW	LUCAS1	AUG-14-18 11:05:00	DONE	Lucas Cell	01-MAY-18 00:00

September 10, 2018

Ms. Madeline Ratcliff
Eurofins Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Re: Radiochemistry Analyses - GELP15-1046
Work Order: 456946

Dear Ms. Ratcliff:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on August 10, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

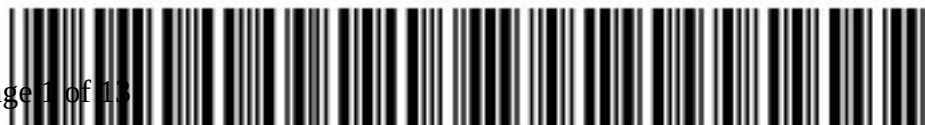
Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Taylor Cannon for
Julie Robinson
Project Manager

Purchase Order: GELP15-0603
Chain of Custody: 1974425
Enclosures



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 – (843) 556-8171 – www.gel.com

Certificate of Analysis Report for

LANC001 Eurofins Lancaster Laboratories

Client SDG: 456946 GEL Work Order: 456946

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- ** Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 10, 2018

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601--5994
Contact: Ms. Madeline Ratcliff
Project: Radiochemistry Analyses - GELP15-1046

Client Sample ID: MW-3
Sample ID: 456946001
Matrix: Water
Collect Date: 07-AUG-18 14:35
Receive Date: 10-AUG-18
Collector: Client
Project: LANC00115
Client ID: LANC001

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting GFPC, Ra228, Liquid "As Received"													
Radium-228		2.55	+/-1.05	1.40	3.00	pCi/L			JXC9	08/28/18	1114	1792303	1
Rad Radium-226 Lucas Cell, Ra226, liquid "As Received"													
Radium-226		1.42	+/-0.419	0.378	1.00	pCi/L			PCW	08/21/18	0725	1792029	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			90.4	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 10, 2018

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601--5994
Contact: Ms. Madeline Ratcliff
Project: Radiochemistry Analyses - GELP15-1046

Client Sample ID: MW-4
Sample ID: 456946002
Matrix: Water
Collect Date: 07-AUG-18 09:30
Receive Date: 10-AUG-18
Collector: Client

Project: LANC00115
Client ID: LANC001

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	0.705	+/-0.818	1.37	3.00	pCi/L			JXC9	08/28/18	1114	1792303	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.0235	+/-0.138	0.289	1.00	pCi/L			PCW	08/21/18	0725	1792029	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			85.8	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 10, 2018

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601--5994
Contact: Ms. Madeline Ratcliff
Project: Radiochemistry Analyses - GELP15-1046

Client Sample ID: MW-5
Sample ID: 456946003
Matrix: Water
Collect Date: 07-AUG-18 11:25
Receive Date: 10-AUG-18
Collector: Client
Project: LANC00115
Client ID: LANC001

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228		1.36	+/-0.829	1.20	3.00	pCi/L			JXC9	08/28/18	1114	1792303	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		0.426	+/-0.273	0.383	1.00	pCi/L			PCW	08/21/18	0725	1792029	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			81.1	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: September 10, 2018

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601--5994
Contact: Ms. Madeline Ratcliff
Project: Radiochemistry Analyses - GELP15-1046

Client Sample ID: FB-20180807
Sample ID: 456946004
Matrix: Water
Collect Date: 07-AUG-18 12:30
Receive Date: 10-AUG-18
Collector: Client

Project: LANC00115
Client ID: LANC001

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Ra228, Liquid "As Received"													
Radium-228	U	0.465	+/-0.752	1.31	3.00	pCi/L			JXC9	08/28/18	1115	1792303	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.166	+/-0.154	0.227	1.00	pCi/L			PCW	08/21/18	0725	1792029	2

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			84.6	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: September 10, 2018

Page 1 of 2

Eurofins Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania
Ms. Madeline Ratcliff

Contact:

Workorder: 456946

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1792303										
QC1204091407	456941002	DUP									
Radium-228	U	0.243	U	1.20	pCi/L	N/A		N/A	JXC9	08/28/18	11:22
	Uncertainty	+/-0.825		+/-1.10							
QC1204091408	LCS										
Radium-228	17.6			15.3	pCi/L		87.2	(75%-125%)		08/28/18	11:22
	Uncertainty			+/-2.06							
QC1204091406	MB										
Radium-228			U	0.648	pCi/L					08/28/18	11:22
	Uncertainty			+/-1.05							
Rad Ra-226											
Batch	1792029										
QC1204090851	456941002	DUP									
Radium-226		1.20		1.05	pCi/L	12.9		(0% - 100%)	PCW	08/21/18	08:00
	Uncertainty	+/-0.365		+/-0.357							
QC1204090854	LCS										
Radium-226	26.0			22.9	pCi/L		88.3	(75%-125%)		08/21/18	08:35
	Uncertainty			+/-1.56							
QC1204090850	MB										
Radium-226			U	0.0736	pCi/L					08/21/18	08:00
	Uncertainty			+/-0.186							
QC1204090852	456941002	MS									
Radium-226	130	1.20		103	pCi/L		78.4	(75%-125%)		08/21/18	08:35
	Uncertainty	+/-0.365		+/-6.90							
QC1204090853	456941002	MSD									
Radium-226	130	1.20		112	pCi/L	8.4	85.4	(0%-20%)		08/21/18	08:35
	Uncertainty	+/-0.365		+/-7.25							

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

** Analyte is a Tracer compound

< Result is less than value reported

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 456946

Page 2 of 2

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
>	Result is greater than value reported										
BD	Results are either below the MDC or tracer recovery is low										
FA	Failed analysis.										
H	Analytical holding time was exceeded										
J	Value is estimated										
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.										
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.										
M	M if above MDC and less than LLD										
M	REMP Result > MDC/CL and < RDL										
N/A	RPD or %Recovery limits do not apply.										
N1	See case narrative										
ND	Analyte concentration is not detected above the detection limit										
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.										
R	Sample results are rejected										
U	Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.										
UI	Gamma Spectroscopy--Uncertain identification										
UJ	Gamma Spectroscopy--Uncertain identification										
UL	Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.										
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LEANC)
SDG #: 456946**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1792303

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
456946001	MW-3
456946002	MW-4
456946003	MW-5
456946004	FB-20180807
1204091406	Method Blank (MB)
1204091407	456941002(NonSDG) Sample Duplicate (DUP)
1204091408	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Samples were re-eluted and recounted due to a suspected blank false positive. The recounts are reported.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1792029

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
456946001	MW-3
456946002	MW-4
456946003	MW-5
456946004	FB-20180807
1204090850	Method Blank (MB)
1204090851	456941002(NonSDG) Sample Duplicate (DUP)
1204090852	456941002(NonSDG) Matrix Spike (MS)

1204090853	456941002(NonSDG) Matrix Spike Duplicate (MSD)
1204090854	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Miscellaneous Information

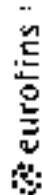
Additional Comments

The matrix spike and matrix spike duplicate, 1204090852 (Non SDG 456941002MS) and 1204090853 (Non SDG 456941002MSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

4496946

Order # 1974425 Sample # 9744066-69

Subcontractor		GEL		For Lab Use Only	
Project Name#	Site ID #	Analyses Requested			
Requester	PO # NA	Preservation and Filtration Codes			
Sampler	PWSID #	Matrix			
Phone # 717-555-2300 Ext 1189	Quote #	☐ Tissue ☐ Sediment ☐ Water ☐ Other:			
State where samples were collected	NJ	Total # of Containers			
Collection		Date			
Sample Identification	Time	Time			
MW-3	8/7/2018 14:35	X			
MW-4	8/7/2018 09:30	X			
MW-5	8/7/2018 11:25	X			
FB-20182807	8/7/2018 12:20	X			
Remarks		9744066			
Remarks		9744067			
Remarks		9744069			
Remarks		9744069			
Remarks		OKQP			
Turnaround Time Requested (TAT) (please check)		Standard		Relish	
(Each TAT is subject to analytical approve and surcharges)					
Date results are needed		Requested by		Received by	
8/10/18		8/10/18		8/10/18	
Rush (results requested by please check)		Relinquished by		Relinquished by	
8/10/18		8/10/18		8/10/18	
E-mail Address ENVSubcontracting@EurofinsUS.com		Relinquished by		Relinquished by	
Phone 717-555-2300 Ext 1189		Relinquished by		Relinquished by	
Data Package Options (please check if required)		Relinquished by		Relinquished by	
Type I (Validation-CLP)		Relinquished by		Relinquished by	
Type II (Reduced non-CLP)		Relinquished by		Relinquished by	
Type VI (Raw Data Only)		Relinquished by		Relinquished by	
NJ DKQP		Relinquished by		Relinquished by	
EDD Required?		Yes		No	
If yes formal		If yes formal		If yes formal	
Hazard Site		Hazard Site		Hazard Site	
Signature upon receipt		Signature upon receipt		Signature upon receipt	

GEL

SAMPLE RECEIPT & REVIEW FORM

Client: <u>LANC</u>		SIGMA/COG Work Order: <u>456946</u>	
Received By: <u>ZKW</u>		Date Received: <u>8/10/18</u>	
Carrier and Tracking Number		(If Applicable) Media Types: ☒ Index Ground ☐ GPS ☐ Field Services ☐ Courier ☐ Other <u>5035 4244 9071</u> <u>5035 4244 9060</u>	
Suspected Hazard Information Shipped As a DOE Hazardous? COG/Samples marked or Classified as radioactive? Is package, COG, and/or Samples marked HAZ?	Yes ☐ ☐ ☐ ☒	No ☒ ☐ ☐ ☒	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation. Hazard Class Shipped: <u>CN1</u> Maximum Net Count Observed* (Observed Count - Area Background Count): <u>0</u> <u>CPM</u> mR/hr Classified as: Rad 1 Rad 2 Rad 3 If yes, select Hazards below, and contact the GEL Safety Group IS/HS Flammable Flammable RCRA Asbestos Respiratory Other
Sample Receipt Criteria		Yes	No
1. Shipping containers received intact and sealed?		☒	☐
2. Chain of custody documents included with shipment?		☒	☐
3. Samples requiring cold preservation within (1 g & 1 day C)?		☒	☐
4. Daily check performed and passed on IR temperature gas?		☒	☐
5. Sample containers intact and sealed?		☒	☐
6. Samples requiring chemical preservation at proper pH?		☒	☐
7. Do any samples require Volatile Analysis?		☒	☐
8. Samples received within holding time?		☒	☐
9. Sample IDs on COG match IDs on bottles?		☒	☐
10. Date & time on COG match date & time on bottles?		☒	☐
11. Number of containers received match number indicated on COG?		☒	☐
12. Are sample containers identifiable as GEL provided?		☒	☐
13. COG form is properly signed in relevant/received sections?		☒	☐
Comments (Use Continuation form if needed): 			

PM for PMAC review, Initials: ZKWDate: 8/13/18 Page: 1 of 1

GL-CHL-SR-011 Rev 5

List of current GEL Certifications as of 10 September 2018

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-26
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Mercer
Groundwater and Water Samples
Collected on 09/04/18

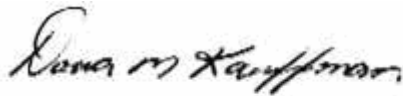
SDG# GEJ52

GROUP	SAMPLE NUMBERS
1984789	9792212-9792218

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-13-10
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 09/24/2018

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ52
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Mercer

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9792212	MW-4	09/04/2018 11:25	09/07/2018 17:00
9792213	MW-6	09/04/2018 11:30	09/07/2018 17:00
9792214	MW-2	09/04/2018 13:30	09/07/2018 17:00
9792215	MW-5	09/04/2018 13:50	09/07/2018 17:00
9792216	MW-1	09/04/2018 15:45	09/07/2018 17:00
9792217	MW-3	09/04/2018 15:50	09/07/2018 17:00
9792218	FB-09042018	09/04/2018 13:15	09/07/2018 17:00

Sample pH Log

SDG: GEJ52

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9792212	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:32:59PM	12190
9792212	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:17:55PM	25804
9792212	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:57:29PM	12665
9792212	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:57:49PM	12665
9792212	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:56:09PM	12190
9792212	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:52:39PM	12644
9792212	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:32:59PM	12190
9792212	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:32:59PM	12190
9792213	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:44:15PM	12190
9792213	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:21:40PM	25804
9792213	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:56:52PM	12665
9792213	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:57:09PM	12665
9792213	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:57:14PM	12190
9792213	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 5:56:17PM	1532
9792213	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:44:15PM	12190
9792213	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:44:15PM	12190
9792214	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:01:25PM	12190
9792214	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:17:04PM	25804
9792214	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:56:11PM	12665
9792214	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:56:35PM	12665
9792214	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:04:15PM	12190
9792214	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:40:18PM	12644
9792214	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:01:25PM	12190
9792214	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:01:25PM	12190
9792215	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:31:02PM	12190
9792215	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:19:17PM	25804
9792215	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:55:31PM	12665
9792215	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:55:50PM	12665
9792215	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:55:33PM	12190
9792215	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 1:45:58PM	12644
9792215	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:31:02PM	12190
9792215	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:31:02PM	12190
9792216	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:35:36PM	12190
9792216	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:20:52PM	25804
9792216	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:53:23PM	12665
9792216	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:55:15PM	12665
9792216	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:56:43PM	12190
9792216	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 1:30:33PM	12644

LLI Sample Number	Bottle Code	Actual pH	Exp. pH	*pH Check Code	Adj. pH	Adjusted Date	Adjusted Time	Preservative Added	Preservative Lot #	LLI Supplied Bottle?	Sulfide Present?	Corrective Substance	CS Lot #	**Chlorine Present?	Corrective Substance	CS Lot #	Record Date	Employee
9792216	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:35:36PM	12190
9792216	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:35:36PM	12190
9792217	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:46:38PM	12190
9792217	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:11:33PM	25804
9792217	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:52:50PM	12665
9792217	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:53:06PM	12665
9792217	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:58:26PM	12190
9792217	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 5:58:44PM	1532
9792217	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:46:38PM	12190
9792217	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:46:38PM	12190
9792218	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:54:11PM	12190
9792218	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:15:52PM	25804
9792218	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:52:07PM	12665
9792218	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:52:33PM	12665
9792218	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:09:55PM	12190
9792218	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:30:47PM	12644
9792218	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:54:11PM	12190
9792218	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:54:11PM	12190

<u>*pH Check Code Key</u>	<u>**Chlorine Present Code Key</u>
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

00259 Mercury

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U5

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U5

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: September 21, 2018 16:44

Project: PSEG Mercer

Account #: 07701
Group Number: 1984789
SDG: GEJ52
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
MW-4 Grab Groundwater	09/04/2018 11:25	9792212
MW-6 Grab Groundwater	09/04/2018 11:30	9792213
MW-2 Grab Groundwater	09/04/2018 13:30	9792214
MW-5 Grab Groundwater	09/04/2018 13:50	9792215
MW-1 Grab Groundwater	09/04/2018 15:45	9792216
MW-3 Grab Groundwater	09/04/2018 15:50	9792217
FB-09042018 Grab Water	09/04/2018 13:15	9792218

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Mercer

Sampling Date(s): 09/04/18

Laboratory Sample ID(s): 9792212-9792218

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	EPH Method: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	Yes
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Christiane S. Sweigart
Senior Specialist

09/21/2018



Project Name: PSEG Mercer
ELLE Group #: 1984789

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Sample #s: 9792212-9792217

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9792212, 9792213, 9792214, 9792215, 9792216, 9792217, 9792218

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

Sample Description: MW-4 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792212
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:25
SDG#: GEJ52-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0186	0.0010	0.0100	1
08014	Boron	7440-42-8	0.0388 J	0.0120	0.100	1
01750	Calcium	7440-70-2	6.17	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0022 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

SW-846 6020B Rev.2, July 2014

06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0012 J	0.00031	0.0040	1

SW-846 7470A

00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.8 J	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	3.5 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	45.5 J	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792212
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:25
SDG#: GEJ52-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.8	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 6.8	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:11	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:34	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:34	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:34	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:34	Patrick J Engle	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792212
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:25
SDG#: GEJ52-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:34	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:34	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:09	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 09:13	Ashlynn M Cornelius	5
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 09:13	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 09:13	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204B	09/12/2018 01:25	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204B	09/12/2018 01:25	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792213
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:30
SDG#: GEJ52-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.193	0.0010	0.0100	1
08014	Boron	7440-42-8	0.0990 J	0.0120	0.100	1
01750	Calcium	7440-70-2	29.9	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

SW-846 6020B Rev.2, July 2014

06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.00076 J	0.00031	0.0040	1

SW-846 7470A

00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	226	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	2.4 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	434	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792213
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:30
SDG#: GEJ52-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.6	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:14	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:37	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:37	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:37	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:37	Patrick J Engle	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792213
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 11:30
SDG#: GEJ52-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:37	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:37	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:11	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 10:07	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 09:49	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 09:49	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921203A	09/10/2018 16:10	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204A	09/12/2018 02:11	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 02:11	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792214
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:30
SDG#: GEJ52-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.200	0.0010	0.0100	1
08014	Boron	7440-42-8	0.898	0.0120	0.100	1
01750	Calcium	7440-70-2	108	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0087 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0831 J	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

SW-846 6020B Rev.2, July 2014

06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.00079 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0880	0.00031	0.0040	1

SW-846 7470A

00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	86.8	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	171	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	603	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9792214
ELLE Group #: 1984789
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 09/07/2018 17:00**Collection Date/Time:** 09/04/2018 13:30**SDG#:** GEJ52-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.8	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
 This sample was lab filtered for dissolved metals.
 All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
 See Project Notes.
 The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:21	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:40	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:40	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:40	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:40	Patrick J Engle	1

*This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792214
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:30
SDG#: GEJ52-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:40	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:40	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:13	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 10:44	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 10:26	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 10:44	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921202A	09/10/2018 15:53	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204A	09/12/2018 01:55	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:55	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792215
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:50
SDG#: GEJ52-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved			SW-846 6010D Rev.4, July 2014	mg/l	mg/l	
07046	Barium	7440-39-3	0.201	0.0010	0.0100	1
08014	Boron	7440-42-8	0.400	0.0120	0.100	1
01750	Calcium	7440-70-2	90.7	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

			SW-846 6020B Rev.2, July 2014	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0175	0.00031	0.0040	1

			SW-846 7470A	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	115	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	110	15.0	50.0	50
			SM 2540 C-2011	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	626	40.0	120	1
			SM 2550 B-2010	Degrees C	Degrees C	Degrees C

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792215
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:50
SDG#: GEJ52-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.8	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:24	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:42	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:42	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:42	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:42	Patrick J Engle	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792215
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:50
SDG#: GEJ52-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:42	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:42	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:15	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 11:57	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 11:02	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 11:57	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204A	09/12/2018 01:59	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:59	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792216
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:45
SDG#: GEJ52-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.174	0.0010	0.0100	1
08014	Boron	7440-42-8	1.00	0.0120	0.100	1
01750	Calcium	7440-70-2	197	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

SW-846 6020B Rev.2, July 2014

06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0035 J	0.00031	0.0040	1

SW-846 7470A

00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	163	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	328	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,160	160	480	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792216
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:45
SDG#: GEJ52-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.9	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:27	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:45	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:45	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:45	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:45	Patrick J Engle	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792216
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:45
SDG#: GEJ52-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:45	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:45	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:17	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 12:33	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 12:15	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 12:33	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204A	09/12/2018 02:03	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 02:03	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792217
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:50
SDG#: GEJ52-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.181	0.0010	0.0100	1
08014	Boron	7440-42-8	0.285	0.0120	0.100	1
01750	Calcium	7440-70-2	61.6	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0156 J	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0013 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0036 J	0.00031	0.0040	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	205	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	16.2	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	548	40.0	120	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792217
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:50
SDG#: GEJ52-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.8	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.9	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:30	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:48	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:48	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:48	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:48	Patrick J Engle	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792217
ELLE Group #: 1984789
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 15:50
SDG#: GEJ52-06

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:48	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:48	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:19	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 13:10	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 12:52	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 12:52	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006204A	09/12/2018 01:48	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:48	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-09042018 Grab Water
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792218
ELLE Group #: 1984789
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:15
SDG#: GEJ52-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0100	1
08014	Boron	7440-42-8	N.D.	0.0120	0.100	1
01750	Calcium	7440-70-2	0.0492 J	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.100	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.100	1

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0140	0.0600	1

SW-846 6020B Rev.2, July 2014

06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0040	1

SW-846 7470A

00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: FB-09042018 Grab Water
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792218
ELLE Group #: 1984789
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:15
SDG#: GEJ52-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.8	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 5.7	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.
All Depts: FOLLOW NJ DKQP PROTOCOL / REQUIREMENTS !!!!!!!!!!!!!!!
See Project Notes.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:32	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:51	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:51	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:51	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:51	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:51	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:51	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:21	Damary Valentin	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-09042018 Grab Water
PSEG - Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9792218
ELLE Group #: 1984789
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/04/2018 13:15
SDG#: GEJ52-07FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182541404402	09/12/2018 06:23	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182541404701	09/12/2018 06:17	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182540571302	09/11/2018 16:10	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18253520206B	09/11/2018 13:28	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18253520206B	09/11/2018 13:28	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18253520206B	09/11/2018 13:28	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921202A	09/10/2018 15:53	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18254006203A	09/12/2018 00:48	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:48	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/21/2018 16:44

Group Number: 1984789

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 182540571302	Sample number(s): 9792212-9792218		
Mercury	N.D.	0.000050	0.00020
Batch number: 182541404402	Sample number(s): 9792212-9792218		
Barium	N.D.	0.0010	0.0100
Boron	N.D.	0.0120	0.100
Calcium	N.D.	0.0330	1.00
Chromium	N.D.	0.0053	0.0300
Cobalt	N.D.	0.0015	0.0100
Lithium	N.D.	0.0110	0.100
Selenium	N.D.	0.0210	0.100
Thallium	N.D.	0.0140	0.0600
Batch number: 182541404701A	Sample number(s): 9792212-9792218		
Antimony	N.D.	0.00041	0.0040
Arsenic	N.D.	0.00068	0.0040
Beryllium	N.D.	0.000091	0.0010
Cadmium	N.D.	0.00015	0.0020
Lead	N.D.	0.0011	0.0060
Batch number: 182541404701C	Sample number(s): 9792212-9792218		
Molybdenum	N.D.	0.00031	0.0040
Batch number: 18253520206B	Sample number(s): 9792212-9792218		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18253921201A	Sample number(s): 9792212,9792215-9792217		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18253921202A	Sample number(s): 9792214,9792218		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18253921203A	Sample number(s): 9792213		
Total Dissolved Solids	N.D.	20.0	60.0

LCS/LCSD

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/21/2018 16:44

Group Number: 1984789

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 182540571302 Mercury	Sample number(s): 9792212-9792218 0.00100	0.000976			98		80-120		
Batch number: 182541404402	Sample number(s): 9792212-9792218								
Barium	2.00	2.02			101		80-120		
Boron	2.00	1.90			95		80-120		
Calcium	4.00	3.97			99		80-120		
Chromium	0.200	0.200			100		80-120		
Cobalt	0.500	0.513			103		80-120		
Lithium	1.00	1.01			101		80-120		
Selenium	0.150	0.136			91		80-120		
Thallium	0.150	0.160			106		80-120		
Batch number: 182541404701A	Sample number(s): 9792212-9792218								
Antimony	0.00600	0.00674			112		80-120		
Arsenic	0.0100	0.00924			92		80-120		
Beryllium	0.00400	0.00391			98		80-120		
Cadmium	0.00500	0.00474			95		80-120		
Lead	0.0150	0.0151			101		80-120		
Batch number: 182541404701C	Sample number(s): 9792212-9792218								
Molybdenum	0.0500	0.0456			91		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18253520206B	Sample number(s): 9792212-9792218								
Chloride	3.00	2.98			99		90-110		
Fluoride	0.750	0.717			96		90-110		
Sulfate	7.50	7.46			99		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18253921201A	Sample number(s): 9792212,9792215-9792217								
Total Dissolved Solids	200	208			104		62-127		
Batch number: 18253921202A	Sample number(s): 9792214,9792218								
Total Dissolved Solids	200	204			102		62-127		
Batch number: 18253921203A	Sample number(s): 9792213								
Total Dissolved Solids	200	199			100		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18254006203A	Sample number(s): 9792218								
pH	7.00	7.01			100		95-105		
Batch number: 18254006204A	Sample number(s): 9792213-9792217								
pH	7.00	7.01			100		95-105		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/21/2018 16:44

Group Number: 1984789

LCS/LCSD (continued)

Analysis Name	LCS Spike Added Std. Units	LCS Conc Std. Units	LCSD Spike Added Std. Units	LCSD Conc Std. Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 18254006204B pH	Sample number(s): 9792212 7.00	7.01			100		95-105		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 18253921201A Total Dissolved Solids	Sample number(s): 9792212, 9792215-9792217 1164	1600	2728	UNSPK: 9792216		98		62-127		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc Degrees C	DUP Conc Degrees C	DUP RPD	DUP RPD Max
Batch number: 18254006204B Temperature of pH	Sample number(s): 9792212 23.84	BKG: 9792212 23.83	0	5
	mg/l	mg/l		
Batch number: 18253921201A Total Dissolved Solids	Sample number(s): 9792212, 9792215-9792217 1164	BKG: 9792216 1120	4 (1)	5
	Std. Units	Std. Units		
Batch number: 18254006204B pH	Sample number(s): 9792212 6.78	BKG: 9792212 6.80	0	4

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

eurofins

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Sample # 1 74221 6.7 (1)

COC # 579972

GE 152 Page 38 of 122

Client: GEI Consultants

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Timestamp:	09/07/2018 17:00
Number of Packages:	4	Number of Projects:	2
State/Province of Origin:	NZ		

Arrival Condition Summary

Shipping Container Sealed	Yes	Sample IDs on COC match Containers	Yes
Custody Seal Present	Yes	Sample Date/Times match COC	Yes
Custody Seal Intact	Yes	VOA Vial Headspace 2.5mm	N/A
Samples Chilled	Yes	Total Trip Blank Qty	0
Paperwork Enclosed	Yes	Air Quality Samples Present	No
Samples Intact	Yes		
Missing Samples	No		
Extra Samples	No		
Discrepancy in Container Qty on COC	No		

Unpacked by Melvin Sanchez (8943) at 19:30 on 09/07/2018

Samples Chilled Details

Thermometer Types DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C

Spec #	Thermometer ID	Collected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Evaluated Temp?
1	DT146	0.7	DT	Wet	Y	Bagged	Y
2	DT146	0.7	DT	Wet	Y	Bagged	N
3	DT146	4.3	DT	Wet	Y	Bagged	N
4	DT146	5.1	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9792212	MW-4	X		1	
9792213	MW-6	X		1	
9792214	MW-2	X		1	
9792215	MW-5	X		1	
9792216	MW-1	X		1	
9792217	MW-3	X		1	
9792218	FB-09042018	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

ICP Metals

Fraction: Metals in Liquid

instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9792212-9792218: Analysis: 07036)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Arsenic, Lead, Selenium, Thallium.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike
P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792212
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	18.6			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	38.8	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	6170			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.2	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	1.2	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792213
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	193			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	99.0	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	29900			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.76	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792214
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.79	B		MS
7440-39-3	Barium	200			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	898			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	108000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	8.7	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	83.1	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	88.0			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792215
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	201			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	400			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	90700			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	17.5			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792216
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	174			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1000			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	197000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.5	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792217
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.3	B		MS
7440-39-3	Barium	181			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	285			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	61600			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	15.6	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.6	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ52

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792218
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	12.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	49.2	B		P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ52

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182541404402	*92194BKG
Boron		9792212
Calcium		9792213
Chromium		9792214
Cobalt		9792215
Lithium		9792216
Selenium		9792217
Thallium		9792218
		P25404BB
		P25404BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ52

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182541404701	*92194BKG
Arsenic		9792212
Beryllium		9792213
Cadmium		9792214
Lead		9792215
Molybdenum		9792216
		9792217
		9792218
		P25404AB
		P25404AQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ52

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182540571302	*92194BKG
		9792212
		9792213
		9792214
		9792215
		9792216
		9792217
		9792218
		P25471BB
		P25471BQ

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

SDG No.: GEJ52

Method: P

Run Name: 1826003T73

Calibration Date(s): 09/17/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	596.34	99.4	500.0	493.74	98.7	500.0	499.33	99.9
Boron		600.0	598.41	99.7	500.0	491.86	98.4	500.0	496.75	99.4
Calcium		30000.0	29324.00	97.7	25000.0	24528.12	98.1	25000.0	24483.96	97.9
Chromium		600.0	588.92	98.2	500.0	483.80	96.8	500.0	483.45	96.7
Cobalt		600.0	588.46	98.1	500.0	485.68	97.1	500.0	483.09	96.6
Lithium		600.0	597.03	99.5	500.0	497.15	99.4	500.0	496.47	99.3
Selenium		600.0	576.47	96.1	500.0	460.48	92.1	500.0	479.62	95.9
Thallium		600.0	598.64	99.8	500.0	492.37	98.5	500.0	492.82	98.6

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: P
Run Name: 1826003T73
Calibration Date(s): 09/17/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	492.70	98.5	500.0	497.80	99.6
Boron					500.0	495.94	99.2	500.0	490.08	98.0
Calcium					25000.0	24224.07	96.9	25000.0	24172.54	96.7
Chromium					500.0	478.47	95.7	500.0	480.62	96.1
Cobalt					500.0	483.26	96.7	500.0	484.61	96.9
Lithium					500.0	499.79	100.0	500.0	499.99	100.0
Selenium					500.0	483.97	96.8	500.0	478.31	95.7
Thallium					500.0	496.79	99.4	500.0	495.75	99.2

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: P
Run Name: 1826003T73
Calibration Date(s): 09/17/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	501.69	100.3			
Boron					500.0	487.55	97.5			
Calcium					25000.0	24098.94	96.4			
Chromium					500.0	483.20	96.6			
Cobalt					500.0	483.02	96.6			
Lithium					500.0	501.78	100.4			
Selenium					500.0	459.05	91.8			
Thallium					500.0	490.90	98.2			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: MS

Run Name: 1826301E05

Calibration Date(s): 09/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	51.13	102.3	25.0	23.30	93.2	25.0	22.59	90.4
Arsenic	75	500.0	494.29	98.9	250.0	244.67	97.9	250.0	237.87	95.1
Beryllium	9	50.0	51.48	103.0	25.0	24.53	98.1	25.0	26.43	105.7
Cadmium	111	50.0	49.46	98.9	25.0	24.04	96.2	25.0	23.02	92.1
Lead	208	50.0	50.80	101.6	25.0	24.89	99.6	25.0	25.61	102.4
Molybdenum	98	50.0	48.56	97.1	25.0	23.43	93.7	25.0	23.28	93.1

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: MS
Run Name: 1826301E05
Calibration Date(s): 09/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	26.27	105.1	25.0	25.28	101.1
Arsenic	75				250.0	254.45	101.8	250.0	248.76	99.5
Beryllium	9				25.0	24.35	97.4	25.0	26.68	106.7
Cadmium	111				25.0	24.74	99.0	25.0	24.48	97.9
Lead	208				25.0	25.38	101.5	25.0	25.79	103.2
Molybdenum	98				25.0	23.70	94.8	25.0	24.81	99.2

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: CV
Run Name: 1825501M09
Calibration Date(s): 09/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.56	102.4	1.0	1.00	100.0	1.0	0.98	98.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: CV
Run Name: 1825501M09
Calibration Date(s): 09/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.98	98.0	1.0	0.98	98.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ52

Method: CV
Run Name: 1825501M09
Calibration Date(s): 09/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.97	97.0	1.0	0.98	98.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ52

Method: P
Run Name: 1826003T73
Calibration Date(s): 09/17/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		10.0	10.43	104.3		
Boron		100.0	95.68	95.7		
Calcium		1000.0	982.34	98.2		
Chromium		30.0	29.12	97.1		
Cobalt		10.0	10.10	101.0		
Lithium		100.0	96.61	96.6		
Selenium		100.0	88.20	88.2		
Thallium		60.0	63.74	106.2		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Run Name: 1826301E05
Calibration Date(s): 09/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	4.0	4.36	109.0		
Arsenic	75	4.0	3.74	93.5		
Beryllium	9	1.0	1.04	104.0		
Cadmium	111	2.0	1.84	92.0		
Lead	208	6.0	6.22	103.7		
Molybdenum	98	4.0	3.85	96.3		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ52

Method: CV

Run Name: 1825501M09

Calibration Date(s): 09/12/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.20	100.0		

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



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Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ52

Method: P

Run Name: 1826003T73

Calibration Date(s): 09/17/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Mass	Batch Number
Barium		0.33	U	0.33	U	0.33	U	0.33	U	1.000	U182541404402
Boron		8.4	U	8.4	U	8.4	U	8.4	U	12.000	U182541404402
Calcium		33.4	U	33.4	U	33.4	U	33.4	U	33.000	U182541404402
Chromium		-0.76	B	0.55	U	-0.56	B	0.55	U	5.300	U182541404402
Cobalt		0.40	U	0.40	U	0.40	U	0.40	U	1.500	U182541404402
Lithium		5.3	U	5.3	U	5.3	U	5.3	U	11.000	U182541404402
Selenium		9.2	U	-9.4	B	-15.6	B	-10.4	B	21.000	U182541404402
Thallium		3.1	U	3.1	U	3.1	U	3.1	B	14.000	U182541404402

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ52

Method: P
Run Name: 1826003T73
Calibration Date(s): 09/17/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium				0.33	U	0.33	U				
Boron				8.4	U	8.4	U				
Calcium				33.4	U	33.4	U				
Chromium				0.55	U	0.55	U				
Cobalt				0.40	U	0.40	U				
Lithium				5.3	U	5.3	U				
Selenium				-10.4	B	-10.1	B				
Thallium				3.1	U	3.1	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ52

Method: MS

Run Name: 1826301E05

Calibration Date(s): 09/20/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony	121	0.52	U	0.52	U	0.52	U	0.52	U	121	0.410	U182541404701A
Arsenic	75	0.40	U	0.40	U	0.40	U	0.40	U	75	0.680	U182541404701A
Beryllium	9	0.067	U	0.067	U	0.067	U	0.067	U	9	0.091	U182541404701A
Cadmium	111	0.17	U	0.17	U	0.17	U	0.17	U	111	0.150	U182541404701A
Lead	208	0.21	U	0.21	U	0.21	U	0.21	U	208	1.100	U182541404701A
Molybdenum	98	0.36	U	0.36	U	0.36	U	0.36	U	98	0.310	U182541404701A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ52

Method: MS
Run Name: 1826301E05
Calibration Date(s): 09/20/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass		Batch Number
Antimony	121		0.52	U							
Arsenic	75		0.40	U							
Beryllium	9		0.067	U							
Cadmium	111		0.17	U							
Lead	208		0.21	U							
Molybdenum	98		0.36	U							

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ52

Method: CV

Run Name: 1825501M09

Calibration Date(s): 09/12/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Batch Number
Mercury		0.050	U	0.050	U	0.050	U	0.050	U	182540571302

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ52

Method: CV
Run Name: 1825501M09
Calibration Date(s): 09/12/2018

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Mass	Batch Number
Mercury				0.050	U	0.050	U	0.050	U		

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ52

Instrument ID: 18255
Run Name: 1826003T73
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		488335	97.7						
Barium	0		0							
Boron	0		-17							
Calcium	500000		487678	97.5						
Chromium	0		-1							
Cobalt	0		0							
Iron	200000		196951	98.5						
Lithium	0		-11							
Magnesium	500000		492845	98.6						
Selenium	0		-27							
Thallium	0		8							

Control Limits: All Metals 80%-120%

Instrument ID: 19204
 Run Name: 1826301E05
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		98651	98.7		
Antimony	121	0		1			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		283624	94.5		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		267801	107.1		
Lead	208	0		1			
Magnesium	24	100000		106542	106.5		
Molybdenum	98	2000		2065	103.3		
Phosphorus	31	10000		NA			
Potassium	39	100000		96860	96.9		
Sodium	23	250000		257408	103.0		
Sulfur	34	10000		NA			
Titanium	47	2000		2047	102.4		

Control Limits: All Metals 80%-120%

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ52
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182541404701	UG/L	6.000	6.735		80 - 120	112	MS	Yes
Arsenic	75	182541404701	UG/L	10.000	9.240		80 - 120	92	MS	Yes
Barium		182541404402	UG/L	2000.000	2015.390		80 - 120	101	P	Yes
Beryllium	9	182541404701	UG/L	4.000	3.905		80 - 120	98	MS	Yes
Boron		182541404402	UG/L	2000.000	1897.780		80 - 120	95	P	Yes
Cadmium	111	182541404701	UG/L	5.000	4.741		80 - 120	95	MS	Yes
Calcium		182541404402	UG/L	4000.000	3971.070		80 - 120	99	P	Yes
Chromium		182541404402	UG/L	200.000	200.040		80 - 120	100	P	Yes
Cobalt		182541404402	UG/L	500.000	513.210		80 - 120	103	P	Yes
Lead	208	182541404701	UG/L	15.000	15.133		80 - 120	101	MS	Yes
Lithium		182541404402	UG/L	1000.000	1007.790		80 - 120	101	P	Yes
Mercury		182540571302	UG/L	1.000	0.976		80 - 120	98	CV	Yes
Molybdenum	98	182541404701	UG/L	50.000	45.571		80 - 120	91	MS	Yes
Selenium		182541404402	UG/L	150.000	136.280		80 - 120	91	P	Yes
Thallium		182541404402	UG/L	150.000	159.690		80 - 120	106	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ52

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *92194BKG

Serial Dilution Lab Sample ID: *92194L

Batch Number(s): 182541404701, 182541404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	0.4060	U	2.0300	U			MS
Arsenic	75	3.0080	B	3.4000	U	100		MS
Barium		108.1000		110.0500		2		P
Beryllium	9	0.0910	U	0.4550	U			MS
Boron		968.6800		980.7500		1		P
Cadmium	111	0.1510	U	0.7550	U			MS
Calcium		136103.2800		136053.6500		0		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		1.5000	U	7.5000	U			P
Lead	208	1.0700	U	5.3500	U			MS
Lithium		18.5800	B	55.0000	U	100		P
Molybdenum	98	0.3090	U	1.5450	U			MS
Selenium		21.0000	U	105.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 18255
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.33
Boron	249.67		8.4
Calcium	317.93		33.4
Chromium	267.72		0.55
Cobalt	228.62		0.40
Lithium	670.78		5.3
Selenium	196.09		9.2
Thallium	190.86		3.1

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 19204
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.52
Arsenic	75		0.40
Beryllium	9		0.067
Cadmium	111		0.17
Lead	208		0.21
Molybdenum	98		0.36

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 23283
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury			0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ52
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		10.0	1.0
Boron	249.67		100	12.0
Calcium	317.93		1000	33.0
Chromium				
Cobalt	228.62		10.0	1.5
Lithium	670.78		100	11.0
Selenium				
Thallium				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ52
Matrix: WATER

Method: P
Date: 09/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium				
Boron				
Calcium				
Chromium	267.72		30.0	5.3
Cobalt				
Lithium				
Selenium	196.09		100	21.0
Thallium	190.86		60.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ52
Matrix: WATER

Method: MS
Date: 07/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		4.0	0.41
Arsenic				
Beryllium	9		1.0	0.091
Cadmium	111		2.0	0.15
Lead				
Molybdenum	98		4.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ52
Matrix: WATER

Method: MS
Date: 09/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony				
Arsenic	75		4.0	0.68
Beryllium				
Cadmium				
Lead	208		6.0	1.1
Molybdenum				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ52
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury			0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Tune Report

Batch Folder D:\Agilent\ICPMH\1\DATA\~EPATUNEaa.b
 Report Comment ICP-MS #19204 (E05) Daily Tune Check
 Instrument Name G3281A JP12071581

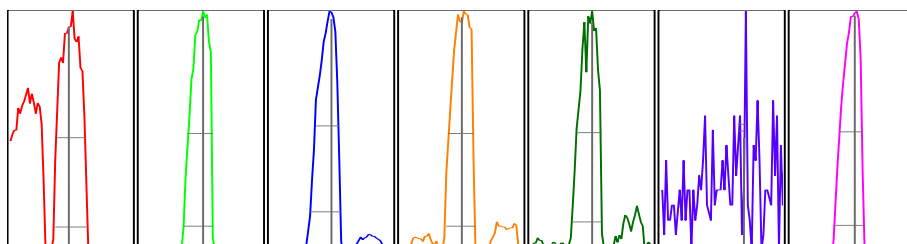
[No Gas]

Mass	Range	Count (Actual)	Response (Actual) [cps/ug/l]	Response (Required) [cps/ug/l]	Response (Flag)	Resp Ratio (Actual)	Resp Ratio (Required)	Resp Ratio (Flag)
7		1244	12443.47	2000.00		0.02	-	
89		8849	88489.03	6000.00		0.12	-	
205		3497	34965.06	3000.00		0.05	-	
70		1095	10950.34	0.00		0.01	0 - 0.015	
156		191	1912.14	0.00		0.00	0 - 0.03	
220		12	119.01	0.00		0.00	-	
140		75135	751345.15	0.00		1.00	1 - 1	

Mass	RSD% (Actual)	RSD% (Required)	RSD% (Flag)	Background (Actual)	Background (Required)	Background (Flag)
7	3.14	5.00				
89	1.51	5.00				
205	1.05	5.00				
70	1.67					
156	2.79					
220	33.67					
140	1.08					

Mass	Replicate 1 Count	Replicate 2 Count	Replicate 3 Count	Replicate 4 Count	Replicate 5 Count
7	1198	1215	1249	1264	1296
89	8669	8965	8901	8747	8962
205	3438	3518	3522	3522	3482
70	1070	1093	1107	1087	1118
156	188	188	190	201	191
220	7	18	10	14	11
140	73989	74934	74930	75798	76020

Integration Time [sec] 0.1



Mass	Peak Height	Axis (Actual)	Axis (Required)	Axis (Flag)	W-50%	W-X% (Actual)	W-X% (Required)	W-X% (Flag)
7	190.94	6.95	6.9 - 7.1		0.70	0.784	0.800	
89	1587.03	89.05	88.9 - 89.1		0.59	0.696	0.800	
205	637.12	205.00	204.9 - 205.1		0.55	0.725	0.800	
70	185.42	70.00	-		0.61	0.729		
156	34.56	156.00	-		0.57	0.720		
220	1.70	220.50	-		0.19	0.187		
140	14127.72	140.05	-		0.55	0.712		

X = 10 Integration Time [sec] 0.1 Acquisition Time [sec] 260.3 Y Axis Linear

Tune Parameters

Plasma Paramters

RF Power 1600 W Carrier Gas 0.25 L/min S/C Temp 20 °C
 RF Matching 1.60 V Option Gas 0.0 % Makeup/Dilution Gas 0.70 L/min
 Smpl Depth 10.0 mm Nebulizer Pump 0.10 rps Gas Switch Dilution Gas

Lenses Parameters

Tune Report

Extract 1	0.0 V	Omega Lens	8.1 V	Deflect	16.4 V
Extract 2	-190.0 V	Cell Entrance	-32 V	Plate Bias	-40 V
Mass	Peak	Axis	Axis	Axis	Axis
	Height	(Actual)	(Required)	(Flag)	
Omega Bias	-90 V	Cell Exit	-58 V		
 ## Cell Parameters ##					
OctP Bias	-8.0 V	He Flow	0.0 mL/min	Energy Discrimination	5.0 V
OctP RF	200 V	H2 Flow	0.0 mL/min		
Use Gas	false	3rd Gas Flow	0 %		



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ52

Instrument ID: 19204

Start Date: 09/20/2018

Run Name: 1826301E05

End Date: 09/20/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	IN-1-115	AS,CD,MO
SC-2-45	BE	TB-1-159	SB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element IN-1-115	Q	Element TB-1-159	Q	Element BI-1-209	Q	Element	Q	Element	Q
S0	12:58	100		100		100		100					
S	13:01	101		98		98		99					
ICV	13:04	99		98		95		97					
ICB	13:07	96		101		97		97					
LLC	13:10	101		105		97		99					
ICSA	13:12	89		86		91		83					
LRS2	13:15	99		97		99		99					
LRS3	13:18	103		104		99		99					
CCS	13:21	105		108		103		105					
CCS	13:24	104		104		103		105					
CCV	13:26	103		105		103		104					
CCB	13:29	104		104		101		103					
P25404AB	13:32	102		101		101		101					
P25404AQ	13:35	101		107		99		100					
*92194BKG	13:38	94		99		99		97					
ZZZZZZ	13:41												
ZZZZZZ	13:43												
ZZZZZZ	13:46												
ZZZZZZ	13:49												
*92194L	13:52	103		107		102		105					
ZZZZZZ	13:55												
CCV	13:57	104		111		103		108					
CCB	14:00	106		109		101		104					
ZZZZZZ	14:03												
ZZZZZZ	14:06												
ZZZZZZ	14:09												
ZZZZZZ	14:11												
ZZZZZZ	14:14												
ZZZZZZ	14:17												
ZZZZZZ	14:20												
ZZZZZZ	14:23												
ZZZZZZ	14:26												

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Instrument ID: 19204

Start Date: 09/20/2018

Run Name: 1826301E05

End Date: 09/20/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	IN-1-115	AS,CD,MO
SC-2-45	BE	TB-1-159	SB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element IN-1-115	Q	Element TB-1-159	Q	Element BI-1-209	Q	Element	Q	Element	Q
CCV	14:28	96		100		93		91					
CCB	14:31	99		99		93		93					
9792212	14:34	105		111		98		97					
9792213	14:37	103		103		97		96					
9792214	14:40	109		106		99		97					
9792215	14:42	109		109		99		98					
9792216	14:45	110		104		102		97					
9792217	14:48	109		104		99		98					
9792218	14:51	113		108		100		101					
ZZZZZZ	14:54												
CCV	14:57	116		110		102		101					
CCB	14:59	116		112		103		105					

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Preparation and Run Logs

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ52

Method: P

Batch Number: 182541404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9792212	09/12/2018	50.00	50
9792213	09/12/2018	50.00	50
9792214	09/12/2018	50.00	50
9792215	09/12/2018	50.00	50
9792216	09/12/2018	50.00	50
9792217	09/12/2018	50.00	50
9792218	09/12/2018	50.00	50
*92194BKG	09/12/2018	50.00	50
P25404BB	09/12/2018	50.00	50
P25404BQ	09/12/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Method: MS
Batch Number: 182541404701

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9792212	09/12/2018	50.00	50
9792213	09/12/2018	50.00	50
9792214	09/12/2018	50.00	50
9792215	09/12/2018	50.00	50
9792216	09/12/2018	50.00	50
9792217	09/12/2018	50.00	50
9792218	09/12/2018	50.00	50
*92194BKG	09/12/2018	50.00	50
P25404AB	09/12/2018	50.00	50
P25404AQ	09/12/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ52

Method: CV
Batch Number: 182540571302

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9792212	09/11/2018	40.00	40
9792213	09/11/2018	40.00	40
9792214	09/11/2018	40.00	40
9792215	09/11/2018	40.00	40
9792216	09/11/2018	40.00	40
9792217	09/11/2018	40.00	40
9792218	09/11/2018	40.00	40
*92194BKG	09/11/2018	40.00	40
P25471BB	09/11/2018	40.00	40
P25471BQ	09/11/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ52

Method: P

Instrument ID: 18255

Run Name: 1826003T73

Run Start Date: 09/17/2018

Run End Date: 09/17/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	11:32			X		X		X	X	X		X			X	X													
S	1.00	11:34							X																					
S	1.00	11:37			X		X				X		X			X	X													
S	1.00	11:40								X																				
ICV	1.00	11:42			X		X		X	X	X		X			X	X													
ICB	1.00	11:45			X		X		X	X	X		X			X	X													
LLC	1.00	11:48			X		X		X	X	X		X			X	X													
ICSA	1.00	11:50			X		X		X	X	X		X			X	X													
CCV	1.00	11:53			X		X		X	X	X		X			X	X													
CCB	1.00	11:55			X		X		X	X	X		X			X	X													
LRS2	1.00	11:58			X		X		X	X	X		X			X	X													
LRS4	1.00	12:01			X		X		X	X	X		X			X	X													
LRS3	1.00	12:04			X		X		X	X	X		X			X	X													
LRS5	1.00	12:07			X		X		X	X	X		X			X	X													
CCV	1.00	12:09			X		X		X	X	X		X			X	X													
CCB	1.00	12:12			X		X		X	X	X		X			X	X													
P25404BB	1.00	12:15			X		X		X	X	X		X			X	X													
P25404BQ	1.00	12:17			X		X		X	X	X		X			X	X													
*92194BKG	1.00	12:20			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	12:23																												
ZZZZZZ	1.00	12:26																												
ZZZZZZ	1.00	12:29																												
ZZZZZZ	1.00	12:32																												
*92194L	5.00	12:34			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	12:37																												
ZZZZZZ	1.00	12:40																												
CCV	1.00	12:43			X		X		X	X	X		X			X	X													
CCB	1.00	12:45			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	12:48																												
ZZZZZZ	1.00	12:51																												
ZZZZZZ	1.00	12:53																												
ZZZZZZ	1.00	12:57																												
ZZZZZZ	1.00	13:00																												
ZZZZZZ	1.00	13:03																												
ZZZZZZ	1.00	13:05																												
ZZZZZZ	1.00	13:08																												
9792212	1.00	13:11			X		X		X	X	X		X			X	X													
9792213	1.00	13:14			X		X		X	X	X		X			X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ52

Method: P
Instrument ID: 18255
Run Name: 1826003T73

Run Start Date: 09/17/2018
Run End Date: 09/17/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
CCV	1.00	13:16			X		X		X	X	X		X			X	X													
CCB	1.00	13:19			X		X		X	X	X		X			X	X													
9792214	1.00	13:21			X		X		X	X	X		X			X	X													
9792215	1.00	13:24			X		X		X	X	X		X			X	X													
9792216	1.00	13:27			X		X		X	X	X		X			X	X													
9792217	1.00	13:30			X		X		X	X	X		X			X	X													
9792218	1.00	13:32			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	13:35																												
CCV	1.00	13:38			X		X		X	X	X		X			X	X													
CCB	1.00	13:40			X		X		X	X	X		X			X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ52

Method: MS

Instrument ID: 19204

Run Name: 1826301E05

Run Start Date: 09/20/2018

Run End Date: 09/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	12:58	X	X		X		X				X			X															
S	1.00	13:01	X	X		X		X				X			X															
ICV	1.00	13:04	X	X		X		X				X			X															
ICB	1.00	13:07	X	X		X		X				X			X															
LLC	1.00	13:10	X	X		X		X				X			X															
ICSA	1.00	13:12	X	X		X		X				X			X															
LRS2	1.00	13:15	X	X		X		X				X			X															
LRS3	1.00	13:18	X	X		X		X				X			X															
CCS	1.00	13:21	X	X		X		X				X			X															
CCS	1.00	13:24	X	X		X		X				X			X															
CCV	1.00	13:26	X	X		X		X				X			X															
CCB	1.00	13:29	X	X		X		X				X			X															
P25404AB	1.00	13:32	X	X		X		X				X			X															
P25404AQ	1.00	13:35	X	X		X		X				X			X															
*92194BKG	1.00	13:38	X	X		X		X				X			X															
ZZZZZZ	1.00	13:41																												
ZZZZZZ	1.00	13:43																												
ZZZZZZ	1.00	13:46																												
ZZZZZZ	1.00	13:49																												
*92194L	5.00	13:52	X	X		X		X				X			X															
ZZZZZZ	1.00	13:55																												
CCV	1.00	13:57	X	X		X		X				X			X															
CCB	1.00	14:00	X	X		X		X				X			X															
ZZZZZZ	1.00	14:03																												
ZZZZZZ	1.00	14:06																												
ZZZZZZ	1.00	14:09																												
ZZZZZZ	1.00	14:11																												
ZZZZZZ	1.00	14:14																												
ZZZZZZ	1.00	14:17																												
ZZZZZZ	1.00	14:20																												
ZZZZZZ	1.00	14:23																												
ZZZZZZ	1.00	14:26																												
CCV	1.00	14:28	X	X		X		X				X			X															
CCB	1.00	14:31	X	X		X		X				X			X															
9792212	1.00	14:34	X	X		X		X				X			X															
9792213	1.00	14:37	X	X		X		X				X			X															
9792214	1.00	14:40	X	X		X		X				X			X															
9792215	1.00	14:42	X	X		X		X				X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
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AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ52

Method: MS

Instrument ID: 19204

Run Name: 1826301E05

Run Start Date: 09/20/2018

Run End Date: 09/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
9792216	1.00	14:45	X	X		X		X				X			X															
9792217	1.00	14:48	X	X		X		X				X			X															
9792218	1.00	14:51	X	X		X		X				X			X															
ZZZZZZ	1.00	14:54																												
CCV	1.00	14:57	X	X		X		X				X			X															
CCB	1.00	14:59	X	X		X		X				X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ52

Method: CV

Instrument ID: 23283

Run Name: 1825501M09

Run Start Date: 09/12/2018

Run End Date: 09/12/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	06:04												X																
S0.2	1.00	06:07												X																
S0.5	1.00	06:09												X																
S1.0	1.00	06:11												X																
S2.5	1.00	06:13												X																
S5.0	1.00	06:15												X																
ICV	1.00	06:17												X																
ICB	1.00	06:19												X																
CRA	1.00	06:21												X																
CCV	1.00	06:23												X																
CCB	1.00	06:25												X																
ZZZZZZ	1.00	06:27																												
ZZZZZZ	1.00	06:29																												
ZZZZZZ	1.00	06:31																												
ZZZZZZ	1.00	06:33																												
ZZZZZZ	1.00	06:35																												
ZZZZZZ	1.00	06:37																												
ZZZZZZ	1.00	06:39																												
ZZZZZZ	1.00	06:41																												
ZZZZZZ	1.00	06:43																												
ZZZZZZ	1.00	06:45																												
CCV	1.00	06:47												X																
CCB	1.00	06:49												X																
ZZZZZZ	1.00	06:51																												
ZZZZZZ	1.00	06:53																												
ZZZZZZ	1.00	06:55																												
ZZZZZZ	1.00	06:57																												
ZZZZZZ	1.00	06:59																												
ZZZZZZ	1.00	07:01																												
ZZZZZZ	1.00	07:04																												
ZZZZZZ	1.00	07:06																												
ZZZZZZ	1.00	07:08																												
ZZZZZZ	1.00	07:10																												
CCV	1.00	07:12												X																
CCB	1.00	07:14												X																
ZZZZZZ	1.00	07:16																												
ZZZZZZ	1.00	07:18																												
ZZZZZZ	1.00	07:20																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ52

Method: CV

Instrument ID: 23283

Run Name: 1825501M09

Run Start Date: 09/12/2018

Run End Date: 09/12/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	07:22																												
ZZZZZZ	1.00	07:24																												
ZZZZZZ	1.00	07:26																												
P25471BB	1.00	07:28												X																
P25471BQ	1.00	07:30												X																
*92194BKG	1.00	07:32												X																
ZZZZZZ	1.00	07:34																												
CCV	1.00	07:36												X																
CCB	1.00	07:38												X																
ZZZZZZ	1.00	07:40																												
ZZZZZZ	1.00	07:42																												
ZZZZZZ	1.00	07:44																												
ZZZZZZ	1.00	07:46																												
ZZZZZZ	1.00	07:48																												
ZZZZZZ	1.00	07:50																												
ZZZZZZ	1.00	07:52																												
ZZZZZZ	1.00	07:54																												
ZZZZZZ	1.00	07:56																												
ZZZZZZ	1.00	07:59																												
CCV	1.00	08:01												X																
CCB	1.00	08:03												X																
ZZZZZZ	1.00	08:05																												
ZZZZZZ	1.00	08:07																												
9792212	1.00	08:09												X																
9792213	1.00	08:11												X																
9792214	1.00	08:13												X																
9792215	1.00	08:15												X																
9792216	1.00	08:17												X																
9792217	1.00	08:19												X																
9792218	1.00	08:21												X																
ZZZZZZ	1.00	08:23																												
CCV	1.00	08:25												X																
CCB	1.00	08:27												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9792212	MW-4	X		
9792213	MW-6	X		
9792214	MW-2	X		
9792215	MW-5	X		
9792216	MW-1	X		
9792217	MW-3	X		
9792218	FB-09042018	X		Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9792212	DF5	DF5	DF5
9792213	DF50	DF5	DF5
9792214	DF50	DF5	DF50
9792215	DF50	DF5	DF50
9792216	DF50	DF5	DF50
9792217	DF50	DF5	DF5
9792218	DF1	DF1	DF1

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18253520206A	P25320FB	09/10/2018 14:03:00	X	X	X
	P25320FQ	09/10/2018 13:44:00	X	X	X
18253520206B	9792212	09/11/2018 09:13:00	X	X	X
	9792213	09/11/2018 09:49:00		X	X
	9792213	09/11/2018 10:07:00	X		
	9792214	09/11/2018 10:26:00		X	
	9792214	09/11/2018 10:44:00	X		X
	9792215	09/11/2018 11:02:00		X	
	9792215	09/11/2018 11:57:00	X		X
	9792216	09/11/2018 12:15:00		X	
	9792216	09/11/2018 12:33:00	X		X
	9792217	09/11/2018 12:52:00		X	X
	9792217	09/11/2018 13:10:00	X		
	9792218	09/11/2018 13:28:00	X	X	X

Fraction: Instrumental Wet Chemistry

18253520206A / P25320FB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	09/10/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	09/10/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	09/10/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P25320FQ	Batch: 18253520206B (Sample number(s): 9792212-9792218)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.98	NA	99	NA	90-110	NA	NA
Fluoride	IC	0.750	0.717	NA	96	NA	90-110	NA	NA
Sulfate	IC	7.50	7.46	NA	99	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ52

Instrument ID: 10913
Calibration Date: 08/20/2018

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18253520206B
Run Start Dates: 09/10/2018
Run Names: 1825301D06

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.475342	0.922655	2.377998	4.832213	7.523233	0.9985	0.9992
Fluoride	0.162212	0.502921	1.274630	2.670815	4.228668	0.9988	0.9994
Sulfate	0.338092	0.678324	1.782684	3.712438	5.884871	0.9992	0.9996

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9533	98	7.5	7.2183	96	0.75	0.7442	99
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9551	99	7.5	7.3400	98	0.75	0.7111	95
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9953	100	7.5	7.4665	100	0.75	0.7360	98
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0406	101	7.5	7.2198	96	0.75	0.7332	98
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9536	98	7.5	7.4054	99	0.75	0.7223	96
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9438	98	7.5	7.3636	98	0.75	0.7157	95
CCB	0	ND	NA	0	ND	NA	0	ND	NA

* = Out of Specifications

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9792212	MW-4	X		1	
9792213	MW-6	X		1	
9792214	MW-2	X		1	
9792215	MW-5	X		1	
9792216	MW-1	X		1	
9792217	MW-3	X		1	
9792218	FB-09042018	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

All QC is within specification.

SAMPLE ANALYSIS:

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.

SDG: GEJ52

Water Quality

Fraction: Wet Chemistry

BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18253921201A	B253871B	09/10/2018 15:31
		L253871Q	09/10/2018 15:31
		9792212	09/10/2018 15:31
		9792215	09/10/2018 15:31
		9792216 UNSPK/BKG,MS,DUP	09/10/2018 15:31
		9792217	09/10/2018 15:31
Total Dissolved Solids	18253921202A	B253872B	09/10/2018 15:53
		L253872Q	09/10/2018 15:53
		9792214	09/10/2018 15:53
		9792218	09/10/2018 15:53
Total Dissolved Solids	18253921203A	B253873B	09/10/2018 16:10
		L253873Q	09/10/2018 16:10
		9792213	09/10/2018 16:10

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ52

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18254006203A	9792218	09/12/2018 00:48:00	X	X
	P006203Q	09/11/2018 23:31:00	X	
18254006204A	9792213	09/12/2018 02:11:00	X	X
	9792214	09/12/2018 01:55:00	X	X
	9792215	09/12/2018 01:59:00	X	X
	9792216	09/12/2018 02:03:00	X	X
	9792217	09/12/2018 01:48:00	X	X
	P006204Q	09/12/2018 01:14:00	X	
18254006204B	9792212 BKG	09/12/2018 01:25:00	X	X
	9792212 DUP	09/12/2018 01:29:00	X	X

Fraction: Wet Chemistry

18253921201A / B253871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	09/10/18	N.D.	mg/l	20.0	60.0

18253921202A / B253872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	09/10/18	N.D.	mg/l	20.0	60.0

18253921203A / B253873B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	09/10/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9792216	Batch: 18253921201A (Sample number(s): 9792212, 9792215-9792217)									
MS: 9792216		Spike Added	Unspiked	MS	MSD			%Rec		%RPD
Parameter	ME	mg/l	Conc	Conc	Conc	MS	MSD	Limits	%RPD	Limits
			mg/l	mg/l	mg/l	%Rec	%Rec			
Total Dissolved Solids	G	1600	1164.	2728.	NA	98	NA	62-127	NA	NA

Comments:

(2) The unspiked sample result is greater than four times the spike added.

* = Out of Specification

Results are being reported on an as received basis.

Water Quality

Fraction: Wet Chemistry

BKG: 9792216 DUP: 9792216	Batch: 18253921201A (Sample number(s): 9792212, 9792215-9792217)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	1164.	1120.	4 (1)	5

BKG: 9792212 DUP: 9792212	Batch: 18254006204B (Sample number(s): 9792212)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	6.78	6.8	0	4

BKG: 9792212 DUP: 9792212	Batch: 18254006204B (Sample number(s): 9792212)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	23.84	23.83	0	5

Comments:

(1) The sample and/or duplicate result is less than five times the LOQ.

* = Out of Specification

Results are being reported on an as received basis.

SDG: GEJ52
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: L253871Q	Batch: 18253921201A (Sample number(s): 9792212, 9792215-9792217)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	208	NA	104	NA	62-127	NA	NA

LCS: L253872Q	Batch: 18253921202A (Sample number(s): 9792214, 9792218)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	204	NA	102	NA	62-127	NA	NA

LCS: L253873Q	Batch: 18253921203A (Sample number(s): 9792213)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	199	NA	100	NA	62-127	NA	NA

LCS: P006203Q	Batch: 18254006203A (Sample number(s): 9792218)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.01	NA	100	NA	95-105	NA	NA

LCS: P006204Q	Batch: 18254006204A (Sample number(s): 9792213-9792217)								
	Batch: 18254006204B (Sample number(s): 9792212)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.01	NA	100	NA	95-105	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

October 03, 2018

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994

Re: NJ Radiochemistry Analyses
Work Order: 459193

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 11, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Taylor Cannon for
Julie Robinson
Project Manager

Purchase Order: 1984791
Chain of Custody: 1984791
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 459193**

October 03, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on September 11, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
459193001	MW-4
459193002	MW-6
459193003	MW-2
459193004	MW-5
459193005	MW-1
459193006	MW-3
459193007	FB-09042018

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

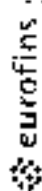


Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

459193

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Page 1 of 1

Acct # _____ Group # _____ SP-100-F

Subcontractor: GEL		Matrix:		Analyses Requested		For Lab Use Only	
Project Name:	1064751	Site ID #	Preservation and Filtration Codes		ST #		
Requestor:	Hannah Colman	P.O. #	N N		SUR #		
Sampler:		PIWSID #					
Phone #	717-556-7383	Circle #					
State where samples were collected: NJ		For Completion	Yes	No			
Sample Identification		Collection		Total # of Containers		Remarks	
MW-4	Date: 9/4/2018 Time: 11:25	Grab	Composite	X	X	Field blank	
MW-6	Date: 9/4/2018 Time: 11:30	X					
MW-2	Date: 9/4/2018 Time: 13:30	X					
MW-5	Date: 9/4/2018 Time: 13:50	X					
MW-1	Date: 9/4/2018 Time: 15:45	X					
MW-3	Date: 9/4/2018 Time: 15:50	X					
FB-090-2018	Date: 9/4/2018 Time: 13:15	X					
Turnaround Time Requested (TAT) (please check)		Standard	Rush	Received by		Date	Time
(Rush TAT is subject to laboratory approval and surcharges)				11/11/18		9/11/18	4:50
Date results are needed		Preservation Needed		Relinquished by		Date	Time
Rush results requested by (please check)		None		Relinquished by		Date	Time
E-mail Address: ENVsubcontracting@eurofinsus.com		E-Mail: []		Relinquished by		Date	Time
Phone: 717-556-7383		Level IV QCD		Relinquished by		Date	Time
Data Package Options (please check if required)		Level IV QCD		Relinquished by		Date	Time
Type I (Validation/Non-CLP)		MA MCP		Relinquished by		Date	Time
Type III (Reduced non-CLP)		CL RCP		Relinquished by		Date	Time
Type VI (Raw Data Only)		1X TRRP 13		Relinquished by		Date	Time
NJ DKOP		NYSDEC Category		Relinquished by Commercial Carrier		Temperature upon receipt	
EDD Required?		Yes	No	Yes	No	°C	

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-556-7383

7045 0117

Laboratory Certifications

There are no "Data Exception Reports" associated with this analytical report.

List of current GEL Certifications as of 03 October 2018

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-27
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LANC)
SDG #: 459193**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1802264

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
459193001	MW-4
459193002	MW-6
459193003	MW-2
459193004	MW-5
459193005	MW-1
459193006	MW-3
459193007	FB-09042018
1204113223	Method Blank (MB)
1204113224	459187008(MW-3) Sample Duplicate (DUP)
1204113225	459187008(MW-3) Matrix Spike (MS)
1204113226	459187008(MW-3) Matrix Spike Duplicate (MSD)
1204113227	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204113225 (MW-3MS) and 1204113226 (MW-3MSD), aliquots were reduced to conserve sample volume.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1802180

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
459193001	MW-4

459193002	MW-6
459193003	MW-2
459193004	MW-5
459193005	MW-1
459193006	MW-3
459193007	FB-09042018
1204113013	Method Blank (MB)
1204113014	459187001(MW-8) Sample Duplicate (DUP)
1204113015	459187001(MW-8) Matrix Spike (MS)
1204113016	459187001(MW-8) Matrix Spike Duplicate (MSD)
1204113017	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Duplication Criteria between QC Sample and Duplicate Sample

The Sample and the Duplicate, (See Below), did not meet the relative percent difference requirement; however, they do meet the relative error ratio requirement with the value listed below.

Sample	Analyte	Value
1204113014 (MW-8DUP)	Radium-226	RPD 139* (0.0%-100.0%) RER 2.06 (0-3)

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204113015 (MW-8MS) and 1204113016 (MW-8MSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

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Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 459193 GEL Work Order: 459193

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:



Name: Theresa Austin

Date: 28 SEP 2018

Title: Group Leader

Sample Data Summary

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: September 28, 2018

Client Sample ID: MW-4
Sample ID: 459193001
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	0.224	+/-0.694	1.28	+/-0.697	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.120	+/-0.324	0.615	+/-0.325	1.00	pCi/L			PCW	09/27/18	0955	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	92	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-6
Sample ID: 459193002
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	0.476	+/-0.752	1.31	+/-0.763	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.403	+/-0.370	0.558	+/-0.376	1.00	pCi/L			PCW	09/27/18	0955	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	88.9	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-2
Sample ID: 459193003
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	1.12	+/-0.873	1.37	+/-0.924	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.187	+/-0.302	0.537	+/-0.303	1.00	pCi/L			PCW	09/27/18	0955	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	87.7	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-5
Sample ID: 459193004
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.786	+/-0.787	1.29	+/-0.815	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.077	+/-0.320	0.622	+/-0.320	1.00	pCi/L			PCW	09/27/18	0955	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	84.6	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-1
Sample ID: 459193005
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.532	+/-0.686	1.17	+/-0.701	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.193	+/-0.311	0.555	+/-0.313	1.00	pCi/L			PCW	09/27/18	0955	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	87.7	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3
Sample ID: 459193006
Matrix: Ground Water
Collect Date: 04-SEP-18
Receive Date: 11-SEP-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	0.754	+/-1.23	2.11	+/-1.24	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226		0.916	+/-0.400	0.319	+/-0.457	1.00	pCi/L			PCW	09/27/18	1030	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	97.9	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: FB-09042018

Project: LANC00115

Sample ID: 459193007

Client ID: LANC006

Matrix: Ground Water

Collect Date: 04-SEP-18

Receive Date: 11-SEP-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	-0.30	+/-0.814	1.63	+/-0.815	3.00	pCi/L			JXC9	09/27/18	0921	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	-0.0855	+/-0.265	0.615	+/-0.265	1.00	pCi/L			PCW	09/27/18	1030	1802180	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1802264	84.6	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

Quality Control Summary

GEL LABORATORIES LLC

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QC Summary

Report Date: September 28, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 459193

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1802264										
QC1204113224	459187008	DUP									
Radium-228		U	0.205	U	0.695	pCi/L	0		N/A	JXC9	09/27/1809:21
		Uncert:	+/-0.846		+/-1.04						
		TPU:	+/-0.848		+/-1.06						
QC1204113227	LCS										
Radium-228		17.3			20.7	pCi/L	120	(75%-125%)	JXC9	09/27/1809:20	
		Uncert:			+/-2.44						
		TPU:			+/-6.12						
QC1204113223	MB										
Radium-228				U	-1.43	pCi/L			JXC9	09/27/1809:21	
		Uncert:			+/-0.817						
		TPU:			+/-0.817						
QC1204113225	459187008	MS									
Radium-228		52.2	U	0.205	50.6	pCi/L	97	(75%-125%)	JXC9	09/27/1809:21	
		Uncert:		+/-0.846	+/-6.59						
		TPU:		+/-0.848	+/-15.2						
QC1204113226	459187008	MSD									
Radium-228		52.2	U	0.205	48.7	pCi/L	3.96	93.2	(0%-20%)	JXC9	09/27/1809:21
		Uncert:		+/-0.846	+/-6.19						
		TPU:		+/-0.848	+/-14.7						
Rad Ra-226											
Batch	1802180										
QC1204113014	459187001	DUP									
Radium-226		U	0.112		0.628	pCi/L	139*	(0% - 100%)	PCW	09/27/1810:30	
		Uncert:	+/-0.303		+/-0.361						
		TPU:	+/-0.304		+/-0.385						
QC1204113017	LCS										
Radium-226		26.0			22.5	pCi/L	86.8	(75%-125%)	PCW	09/27/1810:30	
		Uncert:			+/-1.83						
		TPU:			+/-4.58						
QC1204113013	MB										
Radium-226				U	-0.0754	pCi/L			PCW	09/27/1810:30	
		Uncert:			+/-0.276						
		TPU:			+/-0.277						
QC1204113015	459187001	MS									
Radium-226		130	U	0.112	138	pCi/L	106	(75%-125%)	PCW	09/27/1810:30	
		Uncert:		+/-0.303	+/-10.4						
		TPU:		+/-0.304	+/-32.1						
QC1204113016	459187001	MSD									
Radium-226		130	U	0.112	132	pCi/L	4.1	102	(0%-20%)	PCW	09/27/1810:30
		Uncert:		+/-0.303	+/-10.2						

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QC Summary

Workorder: 459193

Page 2 of 2

Parmname	NOM	Sample Qual	QC	Units	RPD %	REC %	Range	Anlst	Date	Time
Rad Ra-226										
Batch	1802180									
		TPU:	+/-0.304				+/-23.0			

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
 - < Result is less than value reported
 - > Result is greater than value reported
 - BD Results are either below the MDC or tracer recovery is low
 - FA Failed analysis.
 - H Analytical holding time was exceeded
 - J Value is estimated
 - K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
 - L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
 - M M if above MDC and less than LLD
 - M REMF Result > MDC/CL and < RDL
 - N/A RPD or %Recovery limits do not apply.
 - N1 See case narrative
 - ND Analyte concentration is not detected above the detection limit
 - NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
 - R Sample results are rejected
 - U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
 - UI Gamma Spectroscopy--Uncertain identification
 - UJ Gamma Spectroscopy--Uncertain identification
 - UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
 - X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Y Other specific qualifiers were required to properly define the results. Consult case narrative.
 - ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
 - h Preparation or preservation holding time was exceeded
- N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
- ** Indicates analyte is a surrogate/tracer compound.
- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1802264 Check-list

This check-list was completed on 27-SEP-18 by Nat Long

This batch was reviewed by Kenshalla Oston on 27-SEP-18 and Nat Long on 27-SEP-18.

Batch ID:
1802264

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-009

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID:	1802264	Due Dates for Lab:	05-OCT-2018	Package:	07-OCT-2018	SDG:	09-OCT-2018		
Analyst:	Jasmine Conley (JXC9)	Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units		
Method:	EPA 904.0/SW846 9320 Modified	LCS	1204113227	Radium-228 SPIKE	1810-A	.1	mL		
Lab SOP:	GL-RAD-A-063 REV# 2	MS	1204113225	Radium-228 SPIKE	1810-A	.1	mL		
Instrument:	GFC-51204863	MSD	1204113226	Radium-228 SPIKE	1810-A	.1	mL		

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	459187001	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
2	459187002	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
3	459187003	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
4	459187004	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
5	459187005	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
6	459187006	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
7	459187007	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
8	459187008	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
9	459187009	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
10	459187010	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
11	459187011	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
12	459193001	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
13	459193002	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
14	459193003	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
15	459193004	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
16	459193005	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
17	459193006	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
18	459193007	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
19	1204113223 MB	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
20	1204113224 DUP (459187008)	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03
21	1204113225 MS (459187008)	21-SEP-2018	3	100	09/24/18 13:40	09/27/18 07:03
22	1204113226 MSD (459187008)	21-SEP-2018	3	100	09/24/18 13:40	09/27/18 07:03
23	1204113227 LCS	21-SEP-2018	3	300	09/24/18 13:40	09/27/18 07:03

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	
REGNT 2662331.3	cerium 500 mg/L in 2%HCl	.2 mL	Pipet Id: RAD-GFC-1795419
REGNT 2672182	RGF-1.5 Ammonium Sulfate	10 mL	Data Entry Date2: 21-SEP-2018 00:00
REGNT 2770329.5	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 2801523.7	Hydrofluoric Acid Poly Bottle	3 mL	
REGNT 2822290	RGF-1M Citric Acid	5 mL	
REGNT 2828165	RGF-16mg/mL Barium Chloride	1 mL	
REGNT 2831338	RGF-50% Potassium Carbonate	2 mL	
REGNT 2832275.4	HNO3	5 mL	
REGNT 2832949	2M HCl	20 mL	
REGNT 2833686	RGF-7M Nitric Acid	25 mL	

Prep Logbook

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
Reagent/Solvent Lot ID		Description		Amount	Comments:	
WORK 0487-D		Barium-133 TRACER		.1 mL		

RA1802264.xls

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.4.2

Tracer S/N : 0487-D
Tracer Exp Date : 11/8/2018
Tracer Volume Added: 0.10

Batch : 1802264
Analyst : JAS02031
Prep Date : 9/21/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 3 pCi/L
Ra-228 Abundance : 1.00
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.15 hours

Geometry: CeF on 25mm Filter

Sample Characteristics					Tracer Calculations		Tracer Ref.	Tracer Samp.	Tracer Samp.	Tracer	Tracer
	Sample	Sample	Sample		Tracer Ref.	Count		Count			
Pos.	ID	Aliquot	StDev.	Sample	Activity	Uncertainty	Tracer Samp.	Uncertainty	Tracer	Tracer	Aliquot
		L	L	Date/Time	(CPM)	(%)	(CPM)	(%)	Aliquot	Aliquot	StDev. (mL)
1	459187001.1	0.3000	1.8459E-05	9/5/2018 11:30	186.5	7.32%	165.4	7.78%	0.1	0.000200	
2	459187002.1	0.3000	1.8459E-05	9/5/2018 11:40	186.5	7.32%	171.7	7.63%	0.1	0.000200	
3	459187003.1	0.3000	1.8459E-05	9/5/2018 13:00	186.5	7.32%	148.1	8.22%	0.1	0.000200	
4	459187004.1	0.3000	1.8459E-05	9/5/2018 13:30	186.5	7.32%	150.3	8.16%	0.1	0.000200	
5	459187005.1	0.3000	1.8459E-05	9/5/2018 14:40	186.5	7.32%	156.6	7.99%	0.1	0.000200	
6	459187006.1	0.3000	1.8459E-05	9/6/2018 9:55	186.5	7.32%	159.3	7.92%	0.1	0.000200	
7	459187007.1	0.3000	1.8459E-05	9/6/2018 10:00	186.5	7.32%	172.1	7.62%	0.1	0.000200	
8	459187008.1	0.3000	1.8459E-05	9/6/2018 11:55	186.5	7.32%	151.1	8.13%	0.1	0.000200	
9	459187009.1	0.3000	1.8459E-05	9/6/2018 12:00	186.5	7.32%	139.8	8.46%	0.1	0.000200	
10	459187010.1	0.3000	1.8459E-05	9/5/2018 14:00	186.5	7.32%	175.0	7.56%	0.1	0.000200	
11	459187011.1	0.3000	1.8459E-05	9/6/2018 12:30	186.5	7.32%	166.4	7.75%	0.1	0.000200	
12	459193001.1	0.3000	1.8459E-05	9/4/2018 11:25	186.5	7.32%	171.6	7.63%	0.1	0.000200	
13	459193002.1	0.3000	1.8459E-05	9/4/2018 11:30	186.5	7.32%	165.8	7.77%	0.1	0.000200	
14	459193003.1	0.3000	1.8459E-05	9/4/2018 13:30	186.5	7.32%	163.6	7.82%	0.1	0.000200	
15	459193004.1	0.3000	1.8459E-05	9/4/2018 13:50	186.5	7.32%	157.8	7.96%	0.1	0.000200	
16	459193005.1	0.3000	1.8459E-05	9/4/2018 15:45	186.5	7.32%	163.6	7.82%	0.1	0.000200	
17	459193006.1	0.3000	1.8459E-05	9/4/2018 15:50	186.5	7.32%	182.6	7.40%	0.1	0.000200	
18	459193007.1	0.3000	1.8459E-05	9/4/2018 13:15	186.5	7.32%	157.8	7.96%	0.1	0.000200	
19	1204113223.1	0.3000	1.8459E-05	9/21/2018 0:00	186.5	7.32%	164.4	7.80%	0.1	0.000200	
20	1204113224.1	0.3000	1.8459E-05	9/6/2018 11:55	186.5	7.32%	163.2	7.83%	0.1	0.000200	
21	1204113225.1	0.1000	1.1370E-05	9/6/2018 11:55	186.5	7.32%	153.9	8.06%	0.1	0.000200	
22	1204113226.1	0.1000	1.1370E-05	9/6/2018 11:55	186.5	7.32%	164.3	7.80%	0.1	0.000200	
23	1204113227.1	0.3000	1.8459E-05	9/21/2018 0:00	186.5	7.32%	152.9	8.09%	0.1	0.000200	

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
Instrument SOP: GL-RAD-I-006, GL-RAD-I-016

Count raw Data													Calculated	Sample
Counting			Gross Counts		Beta	Count	Ac-228	Ac-228				Ac-228	Sample	Sample
Pos.	Detector	Time	Alpha	Beta	cpm	Start	Ingrowth	Decay	Ra-228	Ac-228	Ac-228	Count	Recovery	Recovery
	ID	(min.)				Date/Time	Date/Time	Date/Time	Decay	Decay	Ingrowth	Correction	%	Error %
1	A1	60	1	104	1.733	9/27/2018 9:25	9/24/2018 13:40	9/27/2018 7:03	0.993	0.765	0.999	1.057	88.7%	5.35%
2	A2	60	5	89	1.483	9/27/2018 9:25	9/24/2018 13:40	9/27/2018 7:03	0.993	0.765	0.999	1.057	92.1%	5.29%
3	A3	60	7	103	1.717	9/27/2018 9:25	9/24/2018 13:40	9/27/2018 7:03	0.993	0.765	0.999	1.057	79.4%	5.51%
4	1A	60	15	47	0.783	9/27/2018 9:11	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	80.6%	5.49%
5	1B	60	12	116	1.933	9/27/2018 9:11	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	84.0%	5.43%
6	1C	60	8	67	1.117	9/27/2018 9:11	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	85.4%	5.40%
7	2A	60	12	67	1.117	9/27/2018 9:11	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	92.3%	5.29%
8	2C	60	7	39	0.650	9/27/2018 9:11	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	81.0%	5.48%
9	3C	60	16	72	1.200	9/27/2018 9:12	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	75.0%	5.60%
10	3D	60	2	40	0.667	9/27/2018 9:12	9/24/2018 13:40	9/27/2018 7:03	0.993	0.785	0.999	1.057	93.8%	5.27%
11	4A	60	5	36	0.600	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.993	0.783	0.999	1.057	89.2%	5.34%
12	4B	60	4	34	0.567	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.992	0.783	0.999	1.057	92.0%	5.29%
13	4C	60	12	40	0.667	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.992	0.783	0.999	1.057	88.9%	5.34%
14	4D	60	13	51	0.850	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.992	0.783	0.999	1.057	87.7%	5.36%
15	5A	60	13	42	0.700	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.992	0.783	0.999	1.057	84.6%	5.41%
16	5B	60	7	32	0.533	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.993	0.783	0.999	1.057	87.7%	5.36%
17	5D	60	4	130	2.167	9/27/2018 9:13	9/24/2018 13:40	9/27/2018 7:03	0.993	0.783	0.999	1.057	97.9%	5.21%
18	6A	60	8	39	0.650	9/27/2018 9:21	9/24/2018 13:40	9/27/2018 7:03	0.992	0.771	0.999	1.057	84.6%	5.41%
19	6B	60	6	40	0.667	9/27/2018 9:21	9/24/2018 13:40	9/27/2018 7:03	0.998	0.771	0.999	1.057	88.1%	5.36%
20	6C	60	8	71	1.183	9/27/2018 9:21	9/24/2018 13:40	9/27/2018 7:03	0.993	0.771	0.999	1.057	87.5%	5.37%
21	9B	60	4	317	5.283	9/27/2018 9:21	9/24/2018 13:40	9/27/2018 7:03	0.993	0.770	0.999	1.057	82.5%	5.45%
22	9D	60	7	299	4.983	9/27/2018 9:21	9/24/2018 13:40	9/27/2018 7:03	0.993	0.770	0.999	1.057	88.1%	5.36%
23	11B	60	10	379	6.317	9/27/2018 9:20	9/24/2018 13:40	9/27/2018 7:03	0.998	0.772	0.999	1.057	82.0%	5.46%

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	LB4100	6/1/2017	5/31/2019	0.6357	0.02044	1.060	9/21/2018 17:20	500
2	LB4100	6/1/2017	5/31/2019	0.5994	0.02268	1.022	9/21/2018 17:20	500
3	LB4100	6/1/2017	5/31/2019	0.5708	0.01784	1.156	9/21/2018 17:20	500
4	PIC	6/1/2017	5/31/2019	0.6430	0.00738	0.466	9/21/2018 16:49	500
5	PIC	6/1/2017	5/31/2019	0.6519	0.00711	0.736	9/21/2018 16:49	500
6	PIC	6/1/2017	5/31/2019	0.6443	0.00847	0.504	9/21/2018 16:49	500
7	PIC	6/1/2017	5/31/2019	0.6444	0.01914	0.396	9/21/2018 16:49	500
8	PIC	6/1/2017	5/31/2019	0.6389	0.01274	0.598	9/21/2018 16:49	500
9	PIC	6/1/2017	5/31/2019	0.6374	0.00988	0.786	9/21/2018 16:50	500
10	PIC	6/1/2017	5/31/2019	0.6255	0.02297	0.466	9/21/2018 16:50	500
11	PIC	6/1/2017	5/31/2019	0.6420	0.01123	0.706	9/21/2018 16:50	500
12	PIC	6/1/2017	5/31/2019	0.6410	0.01519	0.502	9/21/2018 16:50	500
13	PIC	6/1/2017	5/31/2019	0.6608	0.00889	0.530	9/21/2018 16:50	500
14	PIC	6/1/2017	5/31/2019	0.6462	0.00773	0.538	9/21/2018 16:50	500
15	PIC	6/1/2017	5/31/2019	0.6766	0.00851	0.480	9/21/2018 16:50	500
16	PIC	6/1/2017	5/31/2019	0.6547	0.00426	0.384	9/21/2018 16:50	500
17	PIC	6/1/2017	5/31/2019	0.6669	0.00925	1.926	9/22/2018 14:12	500
18	PIC	6/1/2017	5/31/2019	0.6547	0.02228	0.730	9/21/2018 16:54	500
19	PIC	6/1/2017	5/31/2019	0.6465	0.00851	1.060	9/21/2018 16:55	500
20	PIC	6/1/2017	5/31/2019	0.6594	0.01970	0.990	9/21/2018 16:55	500
21	PIC	6/1/2017	5/31/2019	0.6716	0.00754	0.778	9/21/2018 16:56	500
22	PIC	6/1/2017	5/31/2019	0.6494	0.02610	0.516	9/21/2018 16:56	500
23	PIC	6/1/2017	5/31/2019	0.6620	0.00697	0.864	9/21/2018 16:52	500

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1810-A
Spike Exp Date : 5/23/2019
Spike Activity (dpm/ml): 115.34
Spike Volume Added: 0.10

* - RPD changed to 0% due to sample & dup activity below MDA

LCS S/N : 1810-A
LCS Exp Date : 5/23/2019
LCS Activity (dpm/ml): 115.34
LCS Volume Added: 0.10

Results															
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L Recovery
1	1.2167	0.8590	3	1.9036	2.4996	26.77%	0.6733	0.1761	1.2812	1.4513		SAMPLE			
2	1.2201	0.8614	3	1.9124	1.7491	35.93%	0.4613	0.1636	1.2158	1.3061		SAMPLE			
3	1.5803	1.1157	3	2.4622	2.5886	31.89%	0.5607	0.1758	1.5913	1.7414		SAMPLE			
4	0.8547	0.6034	3	1.4036	1.2481	37.68%	0.3173	0.1183	0.9117	0.9725		SAMPLE			
5	1.0168	0.7178	3	1.6218	4.4577	16.28%	1.1973	0.1836	1.3395	1.8028		SAMPLE			
6	0.8369	0.5909	3	1.3669	2.2688	23.51%	0.6127	0.1401	1.0167	1.1877		SAMPLE			
7	0.6865	0.4847	3	1.1406	2.4696	20.13%	0.7207	0.1393	0.9356	1.1516		SAMPLE			
8	0.9691	0.6842	3	1.5652	0.2047	210.99%	0.0520	0.1097	0.8463	0.8481		SAMPLE			
9	1.2036	0.8498	3	1.9128	1.7656	35.93%	0.4140	0.1469	1.2277	1.3185		SAMPLE			
10	0.7552	0.5332	3	1.2402	0.6974	54.99%	0.2007	0.1097	0.7475	0.7714		SAMPLE			
11	0.9536	0.6733	3	1.5248	-0.3779	100.93%	-0.1060	0.1068	0.7465	0.7466		SAMPLE			
12	0.7817	0.5519	3	1.2770	0.2241	158.16%	0.0647	0.1022	0.6943	0.6970		SAMPLE			
13	0.8065	0.5694	3	1.3128	0.4756	80.91%	0.1367	0.1103	0.7525	0.7634		SAMPLE			
14	0.8419	0.5944	3	1.3691	1.1250	39.94%	0.3120	0.1235	0.8725	0.9240		SAMPLE			
15	0.7878	0.5562	3	1.2910	0.7858	51.37%	0.2200	0.1124	0.7867	0.8150		SAMPLE			
16	0.7024	0.4959	3	1.1698	0.5317	66.03%	0.1493	0.0983	0.6858	0.7007		SAMPLE			
17	1.3833	0.9766	3	2.1099	0.7536	83.23%	0.2407	0.1999	1.2269	1.2435		SAMPLE			
18	1.0193	0.7197	3	1.6267	-0.2998	138.72%	-0.0800	0.1109	0.8144	0.8146		SAMPLE			
19	1.1881	0.8388	3	1.8589	-1.4259	29.74%	-0.3933	0.1150	0.8173	0.8174		MB			
20	1.1392	0.8043	3	1.7884	0.6953	76.41%	0.1933	0.1473	1.0385	1.0556	459187008.1	DUP	* 0.0%		
21	3.1552	2.2276	3	5.0170	50.6262	8.63%	4.5053	0.2994	6.5930	15.2182	459187008.1	MS			52.2049 97.0%
22	2.4909	1.7586	3	4.0618	48.6622	8.81%	4.4673	0.2900	6.1911	14.7269	459187008.1	MSD	4.0%		52.2049 93.2%
23	1.1238	0.7934	3	1.7767	20.7090	8.14%	5.4527	0.3271	2.4351	6.1167		LCS			17.3185 119.6%

1802264.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
459187001	A1	60	1	104	9/27/2018 9:25	9/27/2018 10:25	LB4100	1802264
459187002	A2	60	5	89	9/27/2018 9:25	9/27/2018 10:25	LB4100	1802264
459187003	A3	60	7	103	9/27/2018 9:25	9/27/2018 10:25	LB4100	1802264
459187004	1A	60	15	47	9/27/2018 9:11	9/27/2018 10:11	PIC	1802264
459187005	1B	60	12	116	9/27/2018 9:11	9/27/2018 10:11	PIC	1802264
459187006	1C	60	8	67	9/27/2018 9:11	9/27/2018 10:11	PIC	1802264
459187007	2A	60	12	67	9/27/2018 9:11	9/27/2018 10:11	PIC	1802264
459187008	2C	60	7	39	9/27/2018 9:11	9/27/2018 10:11	PIC	1802264
459187009	3C	60	16	72	9/27/2018 9:12	9/27/2018 10:12	PIC	1802264
459187010	3D	60	2	40	9/27/2018 9:12	9/27/2018 10:12	PIC	1802264
459187011	4A	60	5	36	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193001	4B	60	4	34	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193002	4C	60	12	40	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193003	4D	60	13	51	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193004	5A	60	13	42	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193005	5B	60	7	32	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193006	5D	60	4	130	9/27/2018 9:13	9/27/2018 10:13	PIC	1802264
459193007	6A	60	8	39	9/27/2018 9:21	9/27/2018 10:21	PIC	1802264
1204113223	6B	60	6	40	9/27/2018 9:21	9/27/2018 10:21	PIC	1802264
1204113224	6C	60	8	71	9/27/2018 9:21	9/27/2018 10:21	PIC	1802264
1204113225	9B	60	4	317	9/27/2018 9:21	9/27/2018 10:21	PIC	1802264
1204113226	9D	60	7	299	9/27/2018 9:21	9/27/2018 10:21	PIC	1802264
1204113227	11B	60	10	379	9/27/2018 9:20	9/27/2018 10:20	PIC	1802264

ASSAY 24-Sep-18 14:31:14

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 9/24/2018
Run id. 1718

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	97	1	180.03	644.85	186.49	7.32		02:31:14
2	97	2	180.04	581.48	165.36	7.78	88.67	02:34:27
3	97	3	180.05	600.6	171.72	7.63	92.08	02:37:41
4	97	4	180.04	529.6	148.07	8.22	79.40	02:40:55
5	97	5	180.03	536.14	150.26	8.16	80.57	02:44:09
1	76	1	180.04	555.17	156.59	7.99	83.97	02:48:08
2	76	2	180.06	563.31	159.28	7.92	85.41	02:51:22
3	76	3	180.03	601.73	172.13	7.62	92.30	02:54:36
4	76	4	180.04	538.77	151.12	8.13	81.03	02:57:50
5	76	5	180.04	504.9	139.84	8.46	74.99	03:01:04
1	86	1	180.03	610.34	174.99	7.56	93.83	03:04:40
2	86	2	180.04	584.62	166.4	7.75	89.23	03:07:53
3	86	3	180.06	600.17	171.57	7.63	92.00	03:11:07
4	86	4	180.04	582.71	165.77	7.77	88.89	03:14:21
5	86	5	180.04	576.22	163.61	7.82	87.73	03:17:35
1	53	1	180.04	558.68	157.76	7.96	84.59	03:21:18
2	53	2	180.04	576.17	163.59	7.82	87.72	03:24:32
3	53	3	180.04	633.31	182.63	7.4	97.93	03:27:46
4	53	4	180.04	558.82	157.81	7.96	84.62	03:31:00
5	53	5	180.03	578.48	164.37	7.8	88.14	03:34:14
1	70	1	180.06	575.19	163.24	7.83	87.53	03:38:10
2	70	2	180.04	547.22	153.94	8.06	82.55	03:41:24
3	70	3	180.05	578.19	164.25	7.8	88.07	03:44:38
4	70	4	180.04	544.11	152.9	8.09	81.99	03:47:52

END OF ASSAY

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 27-Sep-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

Short Name	Status	Parname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100B1	Below	Alpha eff	27-Sep 08:04	5	9796	10030	12040	-3.70
LB4100B1	Below	Beta eff	27-Sep 08:20	5	48674	50540	59850	-4.20
LB4100B2	Below	Alpha eff	27-Sep 08:04	5	7816	8083	10940	-3.56
LB4100B2	Below	Beta eff	27-Sep 08:20	5	19832	21280	24110	-6.07
LB4100B3	Missing	Alpha eff	27-Sep 08:04	5	0.00E+0	8427	16450	-9.30
LB4100B3	Missing	Alpha XTalk	27-Sep 08:04	5	24702	0.270	0.653	+385.364.00
LB4100B4	Above	Beta bkg	27-Sep 06:07	60	84.350	0.607	2.163	+319.81
LB4100B4	Below	Beta eff	27-Sep 08:20	5	34510	36820	41450	-5.90
LB4100C1	Above	Beta bkg	27-Sep 06:27	60	1.983	1.035	1.925	+3.39
LB4100C2	Below	Beta eff	27-Sep 06:17	5	13735	15090	19370	-4.90
LB4100C2	need 2nd	Beta XTalk	27-Sep 06:17	5	4.37E-4	1.13E-4	4.85E-4	+2.22
LB4100C3	Above	Beta bkg	27-Sep 06:27	60	2.300	0.776	2.251	+3.20
LB4100C4	Above	Beta bkg	27-Sep 06:27	60	5.033	0.686	2.113	+15.27
LB4100C4	Below	Beta eff	27-Sep 06:17	5	18528	17060	23010	-3.54
LB4100E2	Above	Beta bkg	27-Sep 06:12	60	3.333	0.261	3.241	+3.19
LB4100F3	Above	Beta bkg	27-Sep 06:12	60	2.117	0.473	2.078	+3.14
LB4100E4	Above	Beta bkg	27-Sep 06:12	60	2.133	0.641	2.396	+2.28
LB4100G2	need 2nd	Alpha XTalk	27-Sep 05:48	5	0.410	0.256	0.413	+2.90
LB4100G2	Above	Beta bkg	27-Sep 06:17	60	2528	0.414	2.180	+8.587.40
LB4100H2	Above	Beta bkg	27-Sep 06:12	60	2.983	-1.72E+0	4.379	+1.63
LB4100I2	Above	Beta bkg	27-Sep 06:52	60	3.600	-1.65E+1	28.950	-0.35
LB4100I3	Above	Beta bkg	27-Sep 06:52	60	2.583	-5.60E-1	3.474	+1.68
LB4100J1	Above	Alpha bkg	27-Sep 08:30	60	0.367	0.053	0.379	+2.78
PIC7D	Below	Alpha eff	27-Sep 06:10	5	10260	10390	11090	-4.11
PIC7D	Above	Alpha XTalk	27-Sep 06:10	5	0.281	0.252	0.273	+5.21
PIC8A	Above	Beta XTalk	27-Sep 06:11	5	3.58E-4	5.74E-5	2.92E-1	+4.67
PIC12D	Above	Beta bkg	27-Sep 05:19	60	2.367	0.504	1.615	+7.06

PIC13D	Above	Beta bkg	27-Sep 06:28	60	1.850	-2.54E-1	1.788	43.18

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

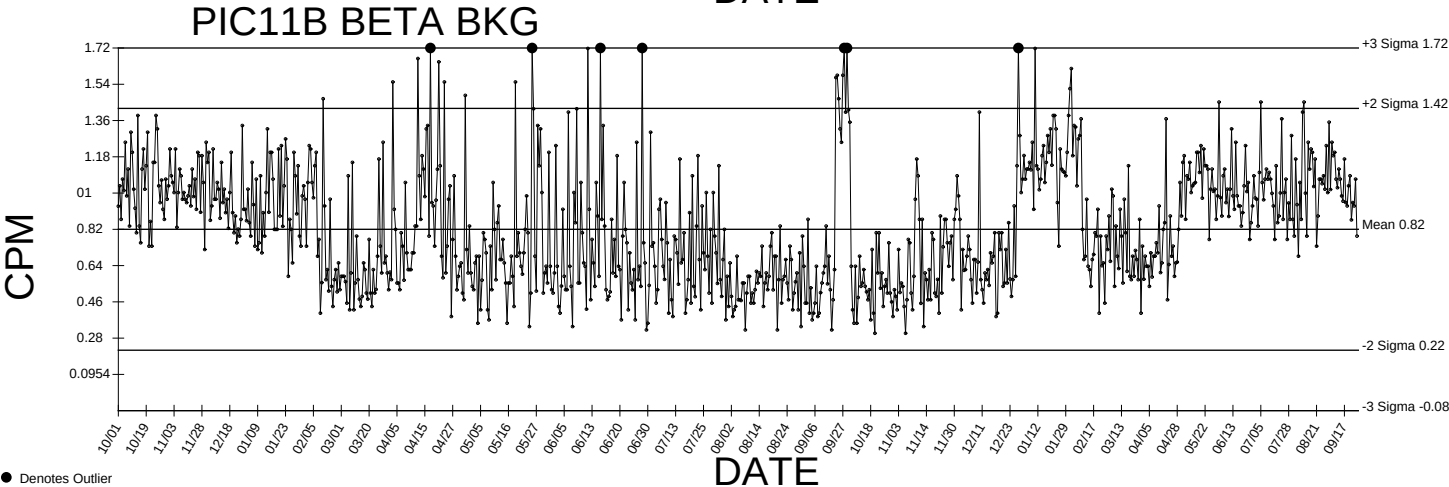
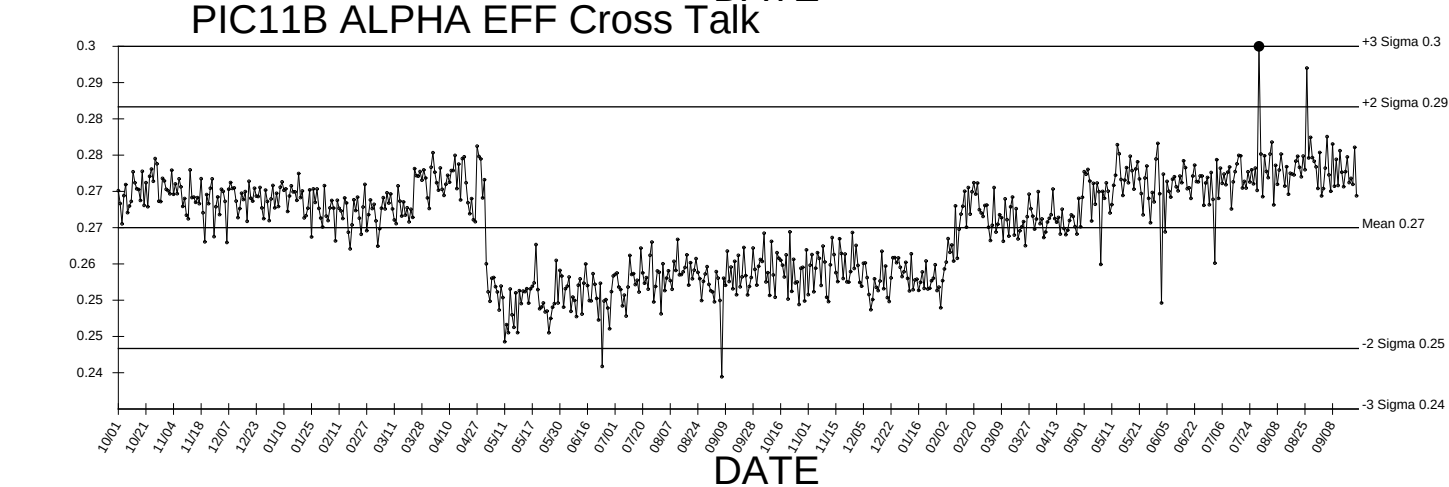
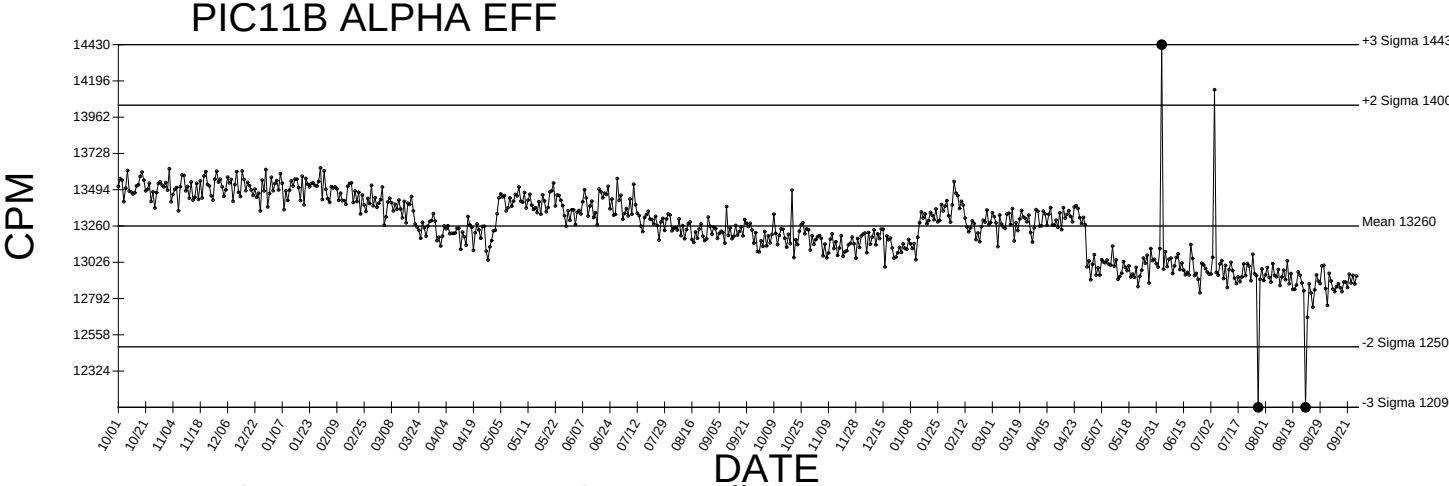
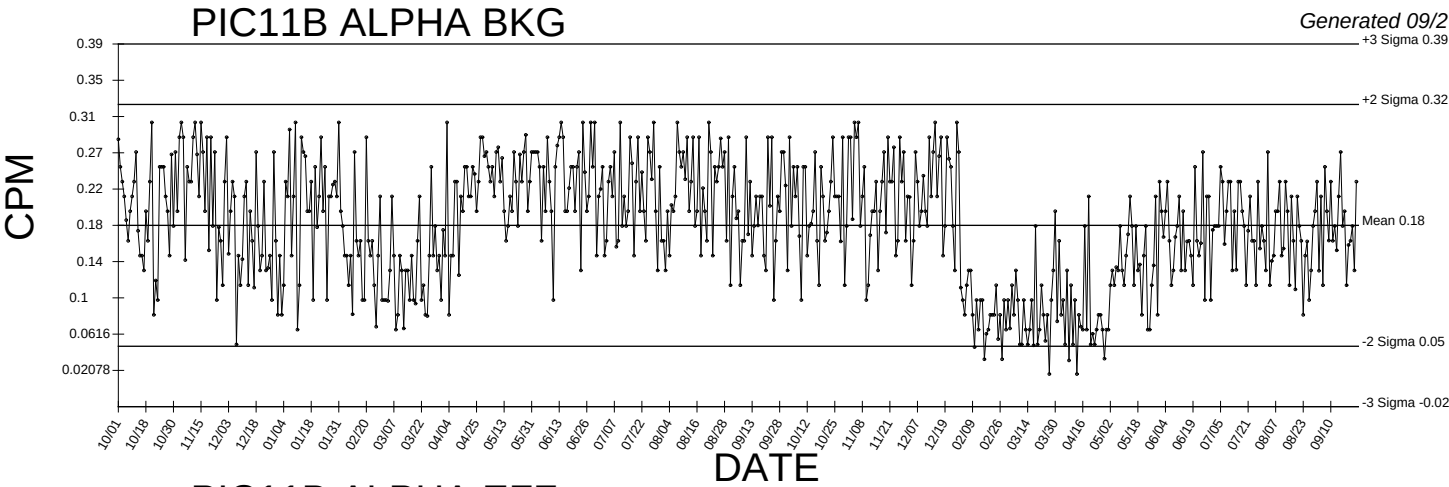
LB4100B3	Alpha bkg, Beta bkg, Beta eff, Beta XTalk
LB4100D1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D2	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D4	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC3A	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC6D	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC13C	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

Reviewed by *[Signature]*

Date 9-27-12

GEL Laboratories LLC

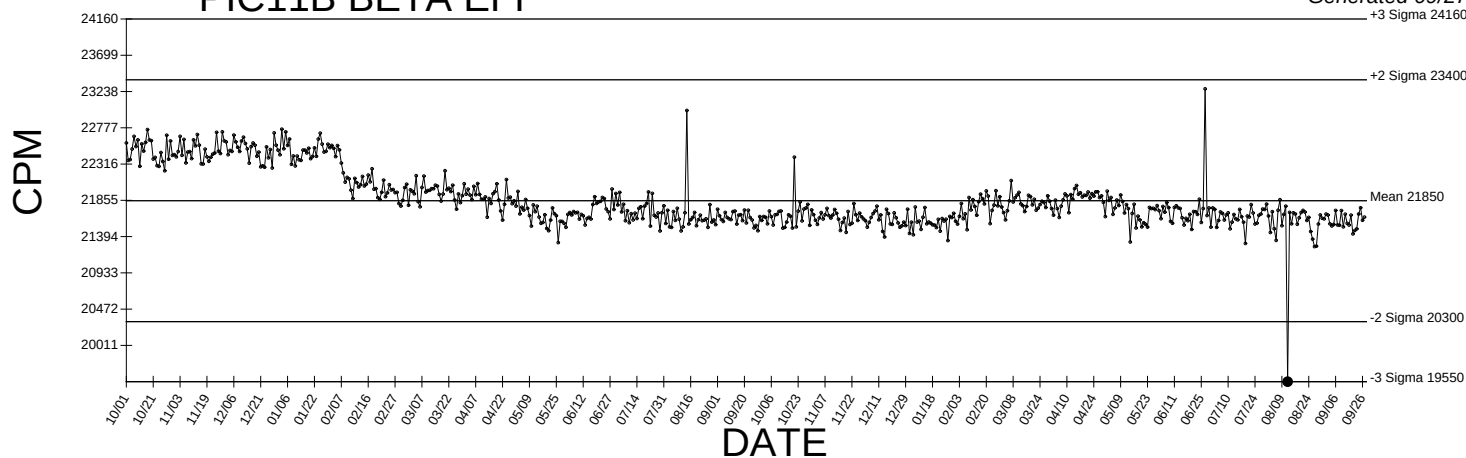
Background and Efficiency Data



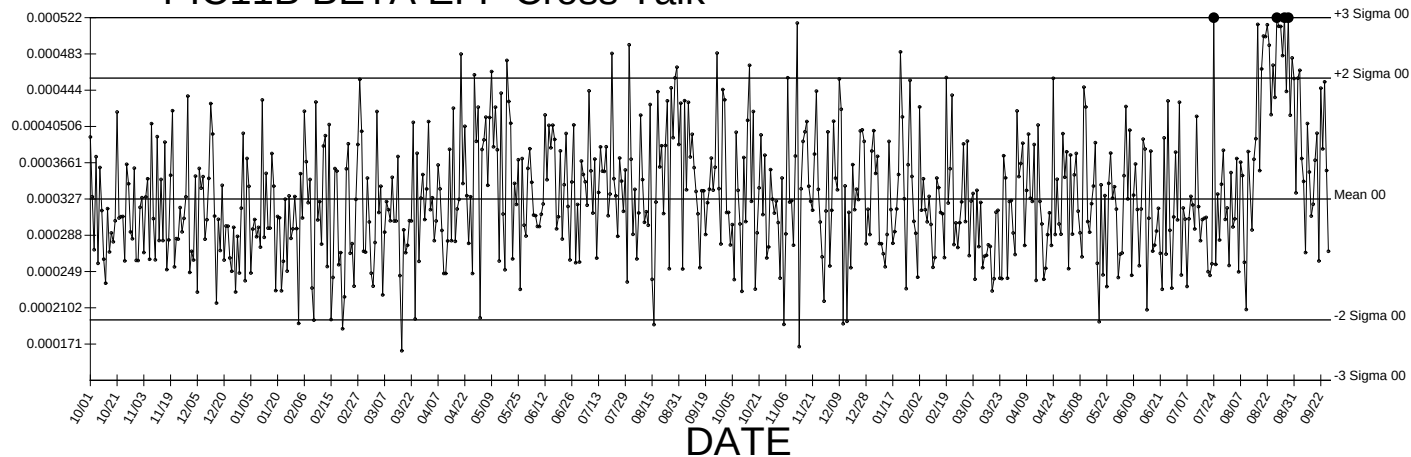
● Denotes Outlier

PIC11B BETA EFF

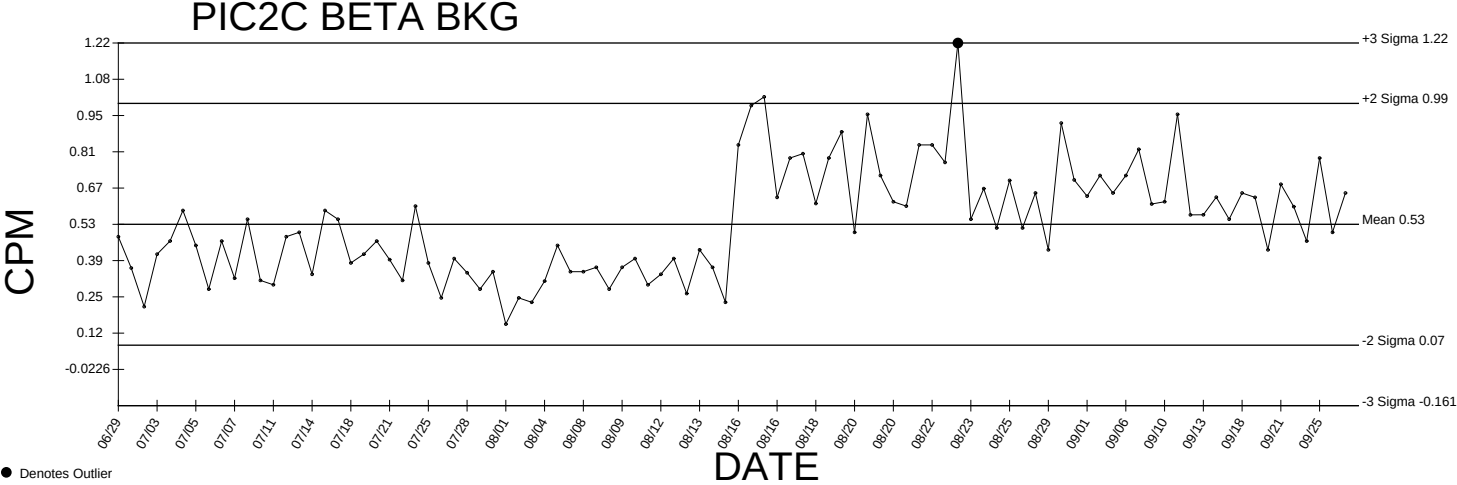
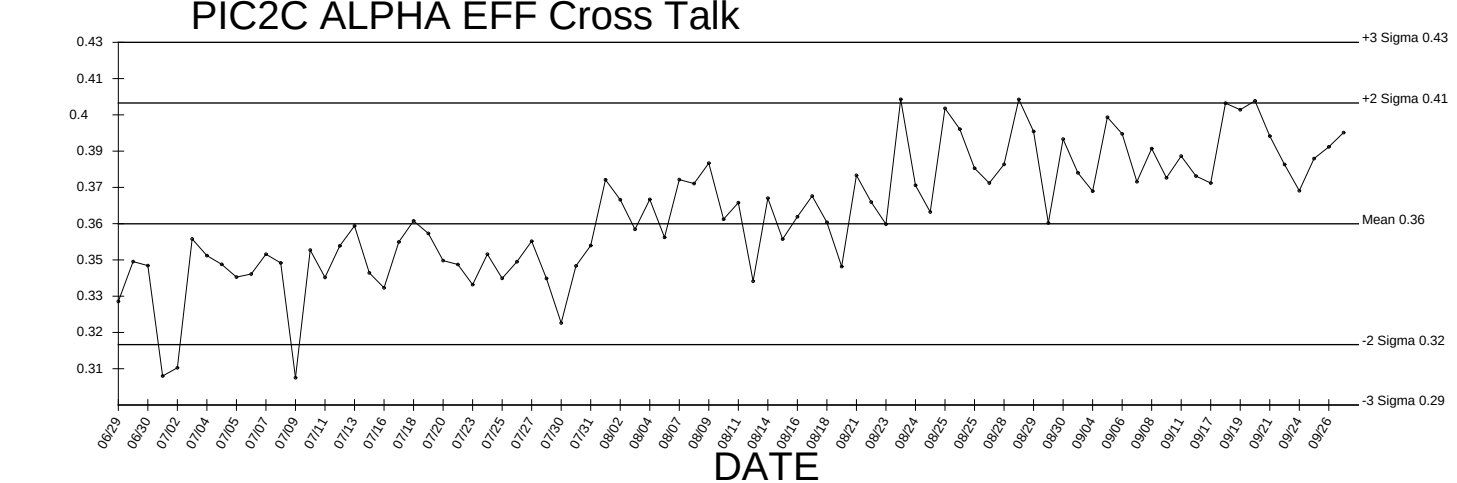
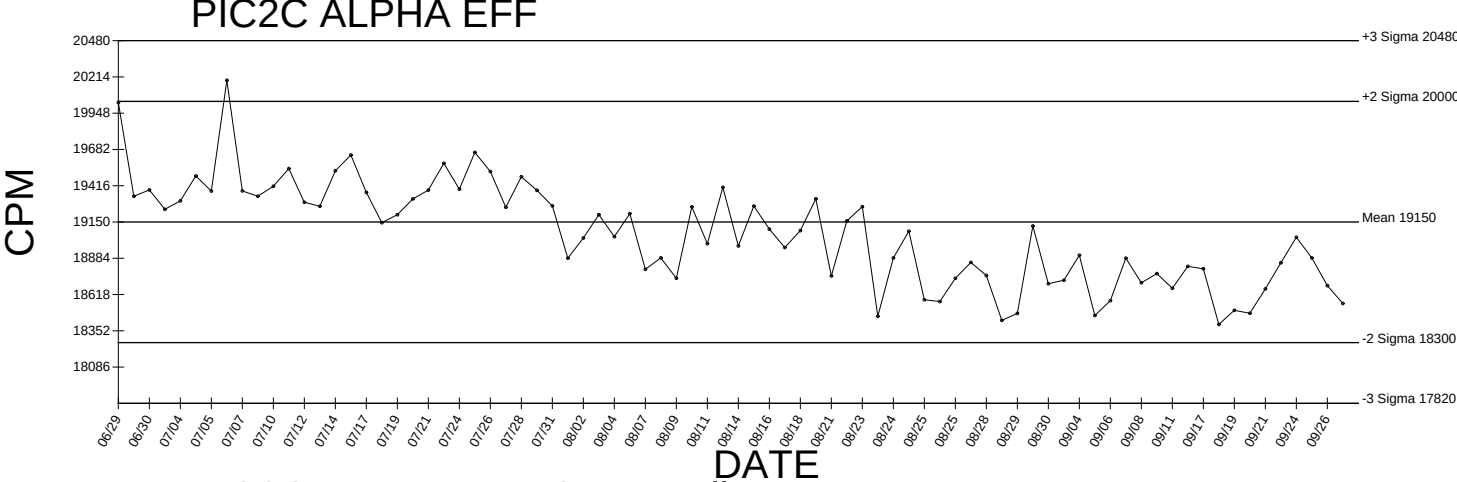
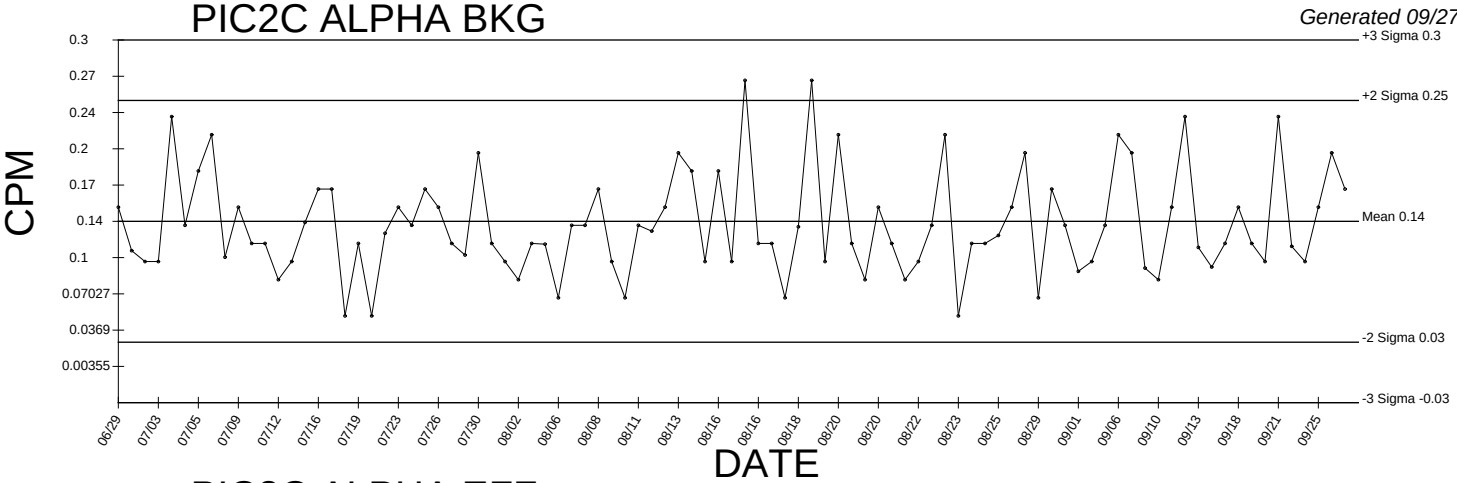
Generated 09/27/2018
+3 Sigma 24160



PIC11B BETA EFF Cross Talk

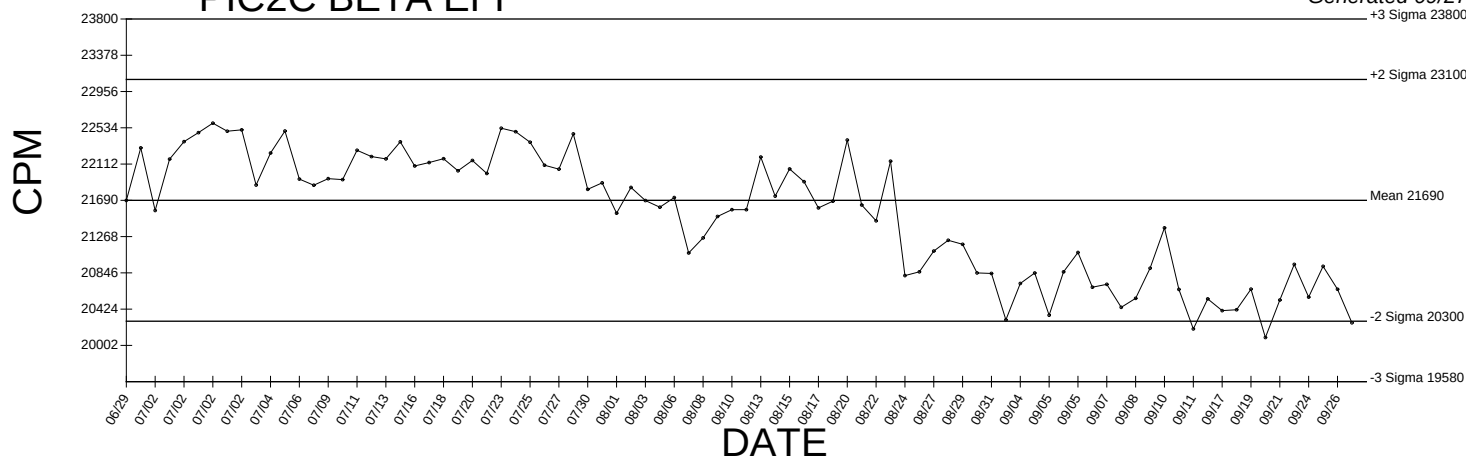


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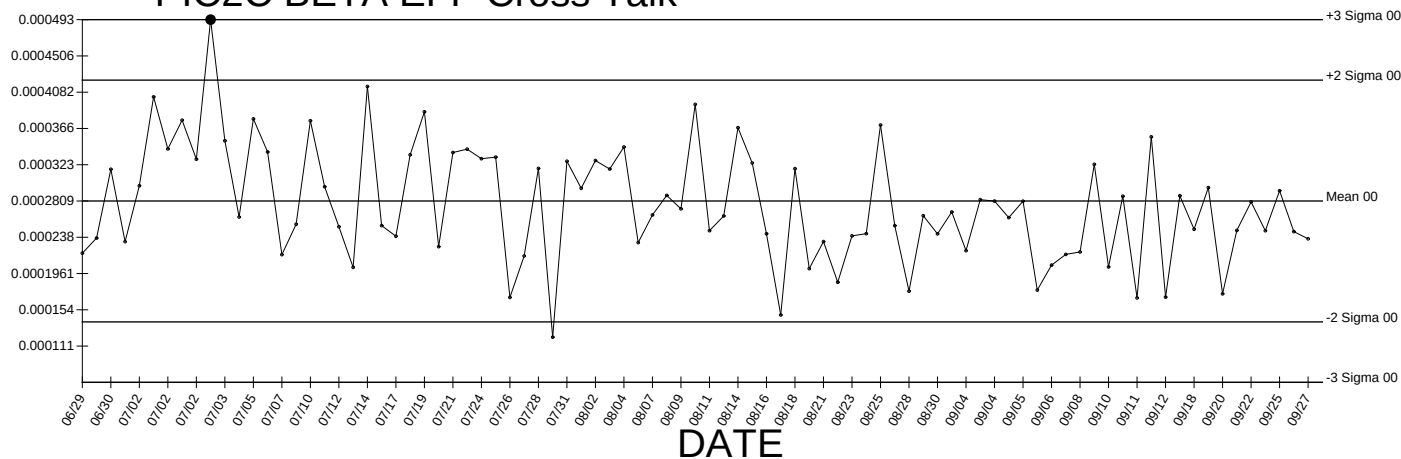


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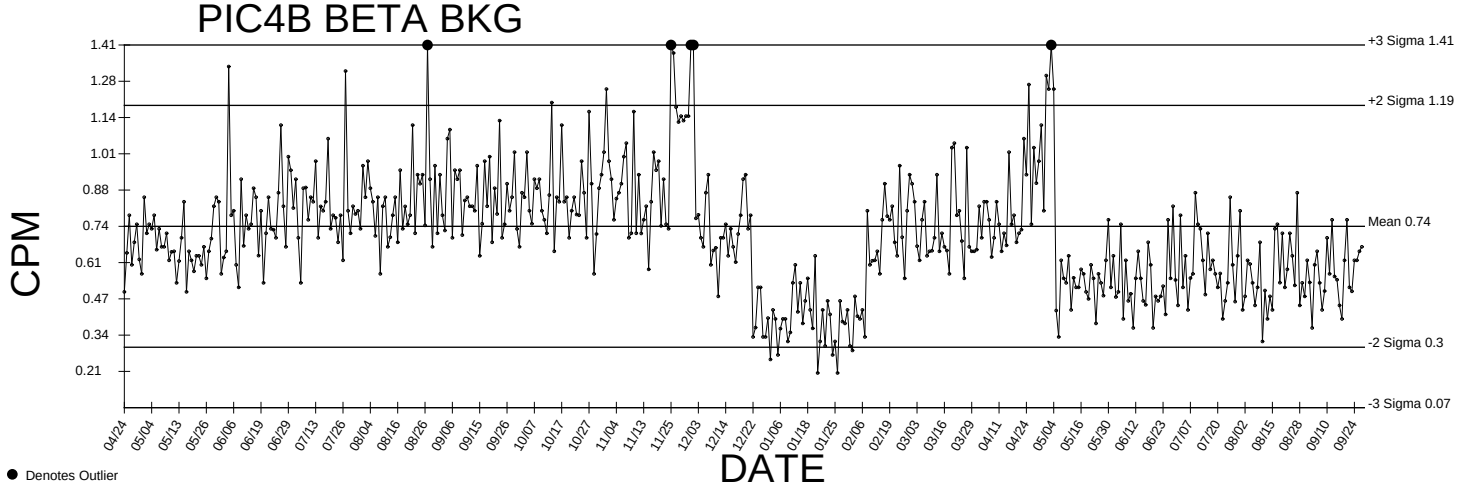
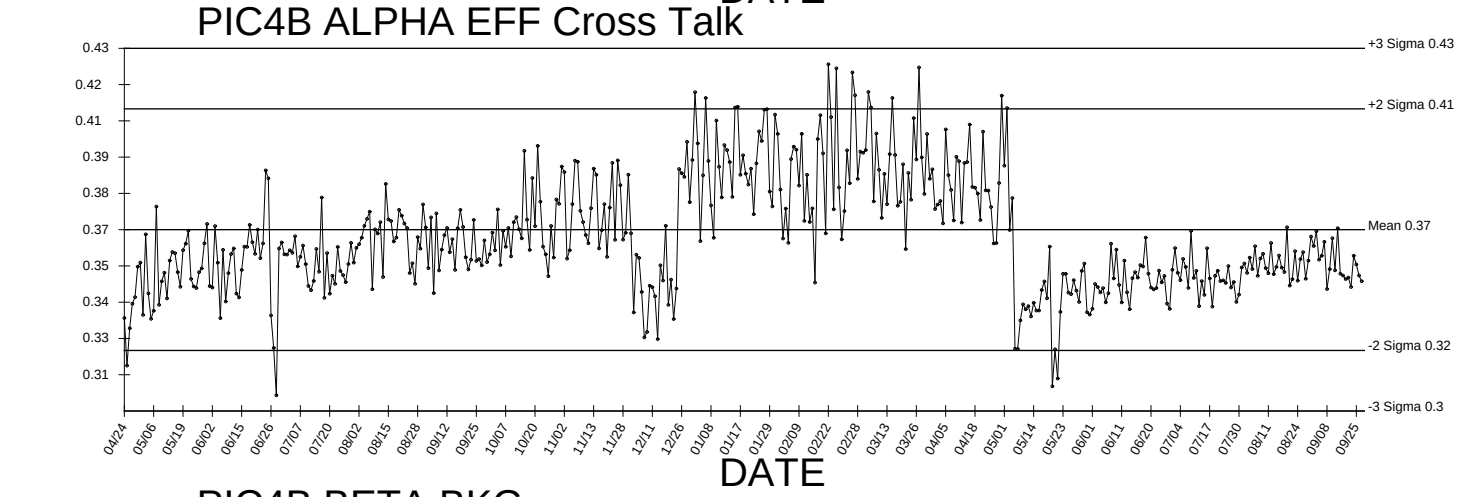
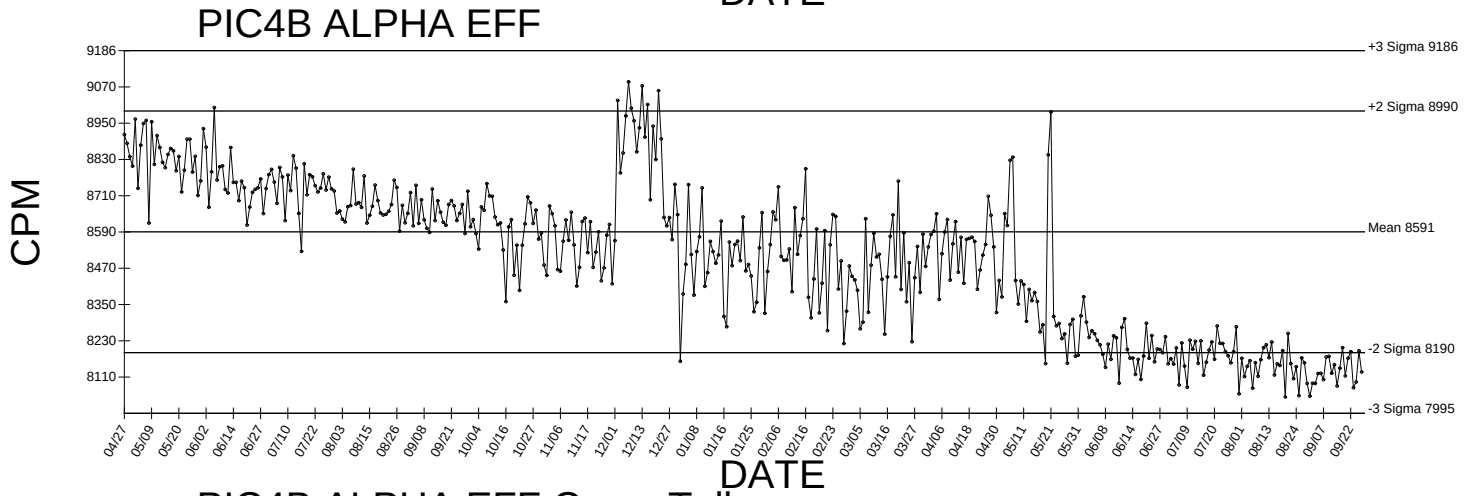
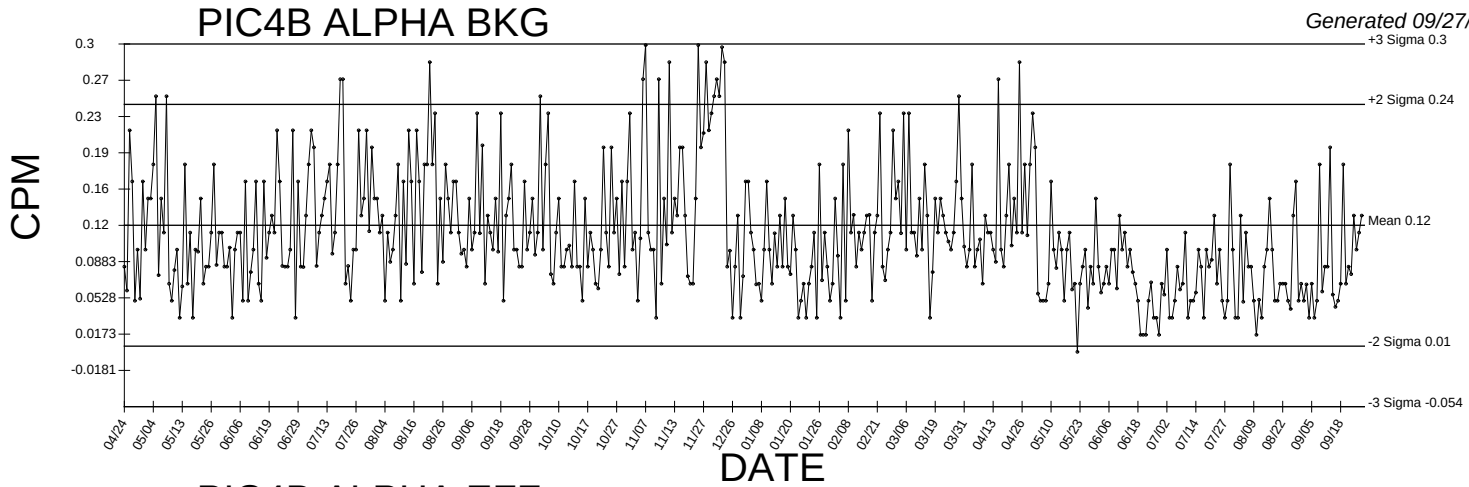
Generated 09/27/2018



PIC2C BETA EFF Cross Talk

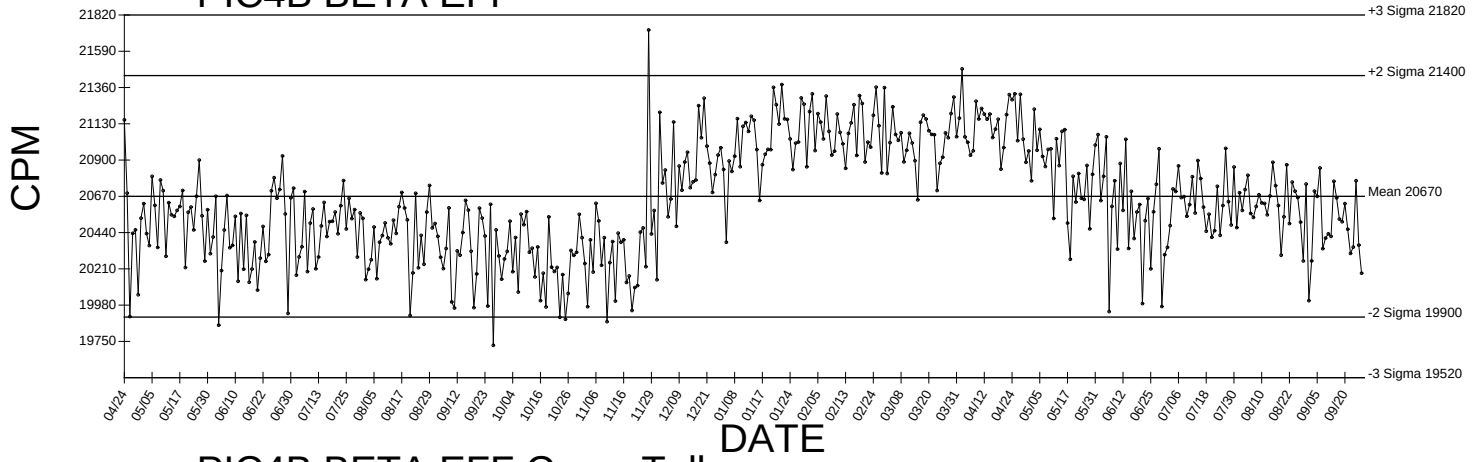


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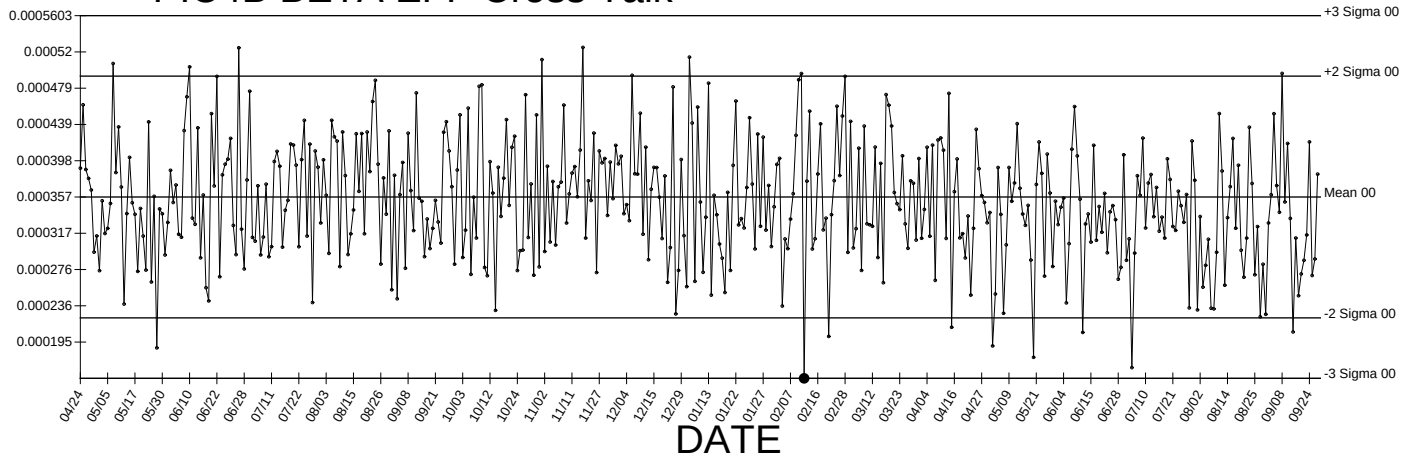


PIC4B BETA EFF

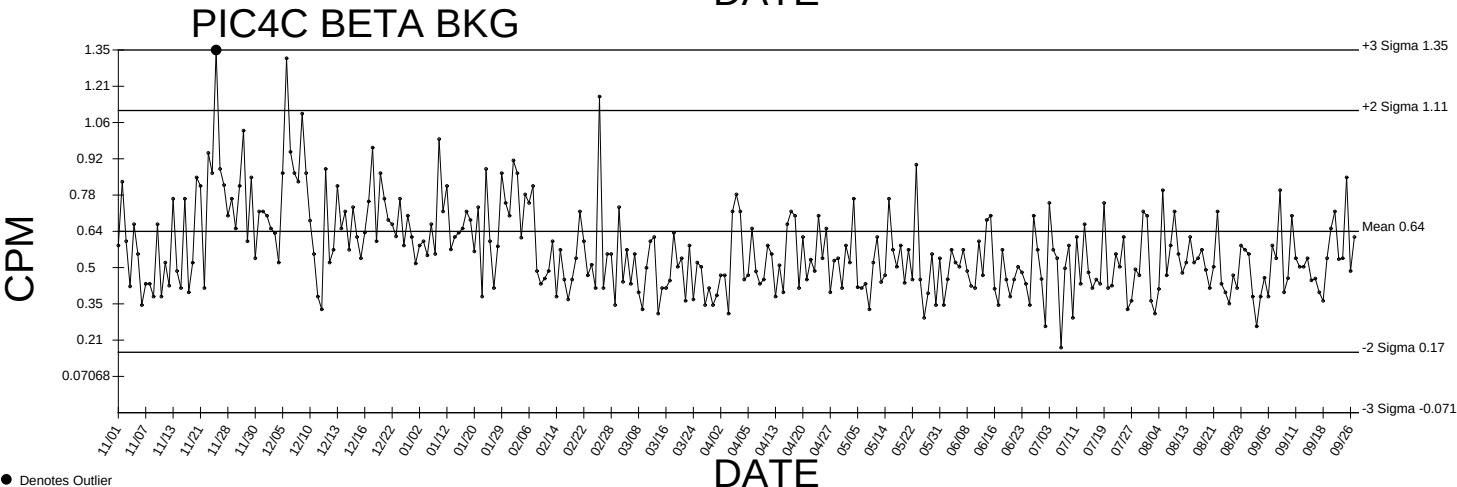
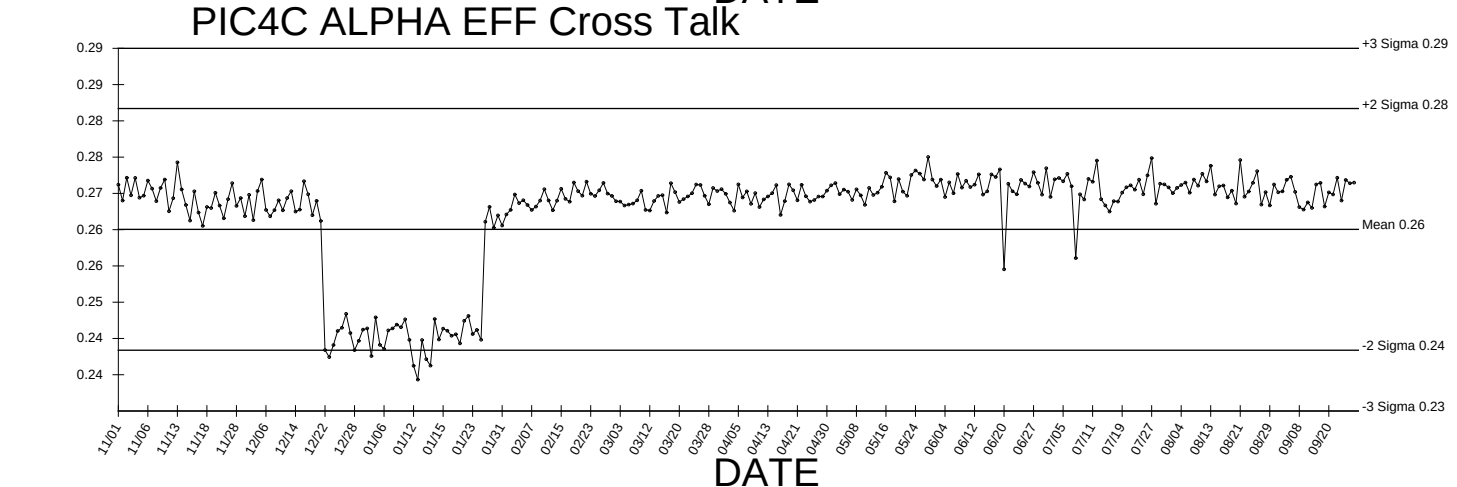
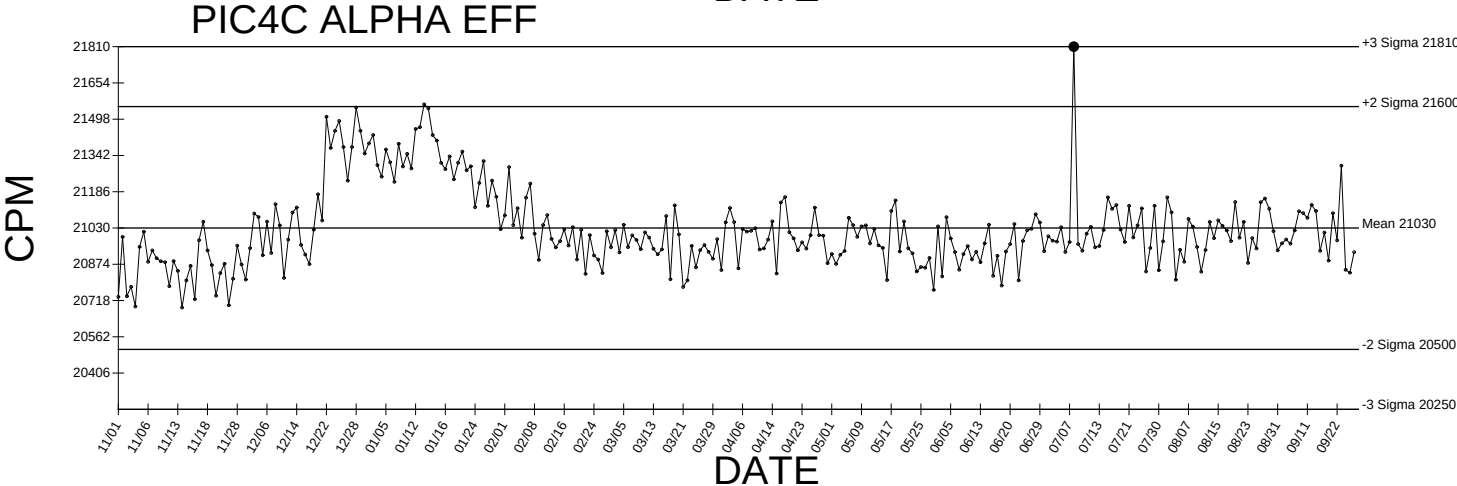
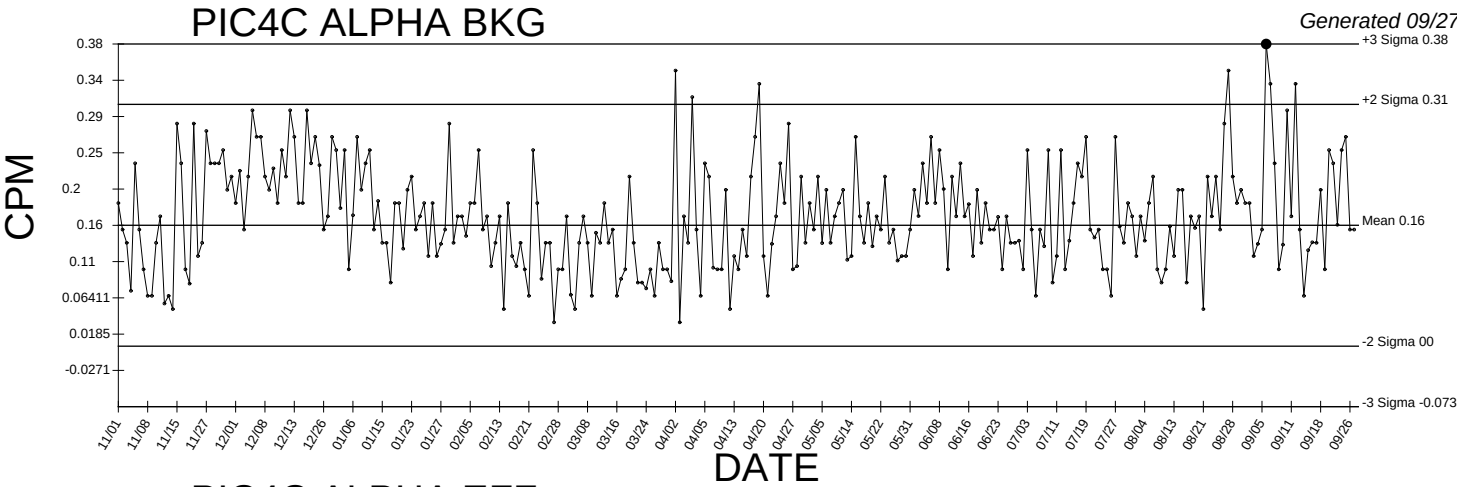
Generated 09/27/2018
+3 Sigma 21820



PIC4B BETA EFF Cross Talk



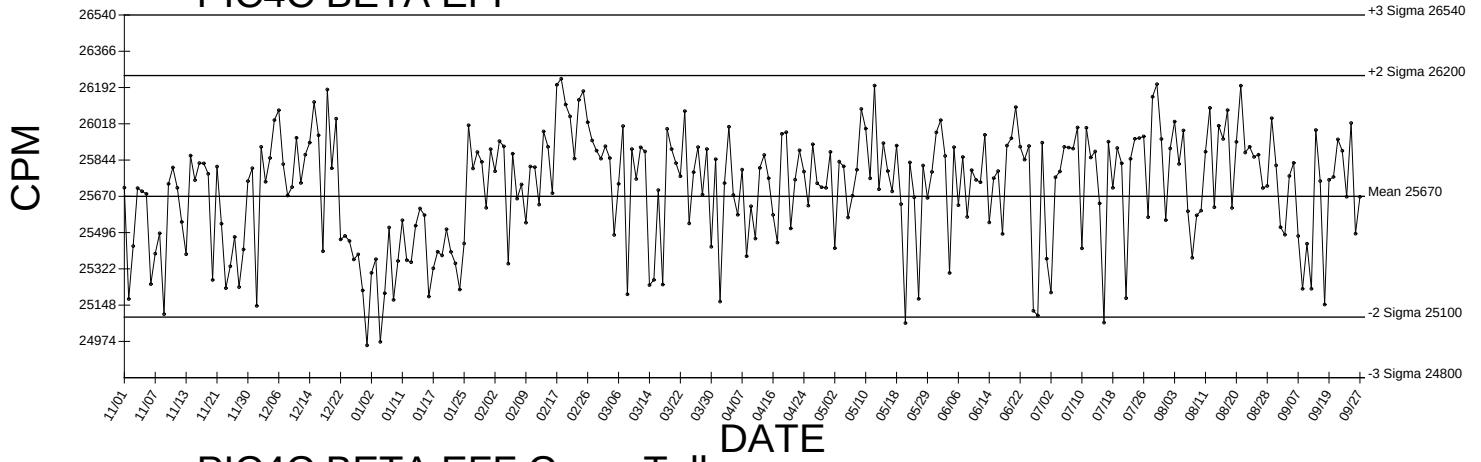
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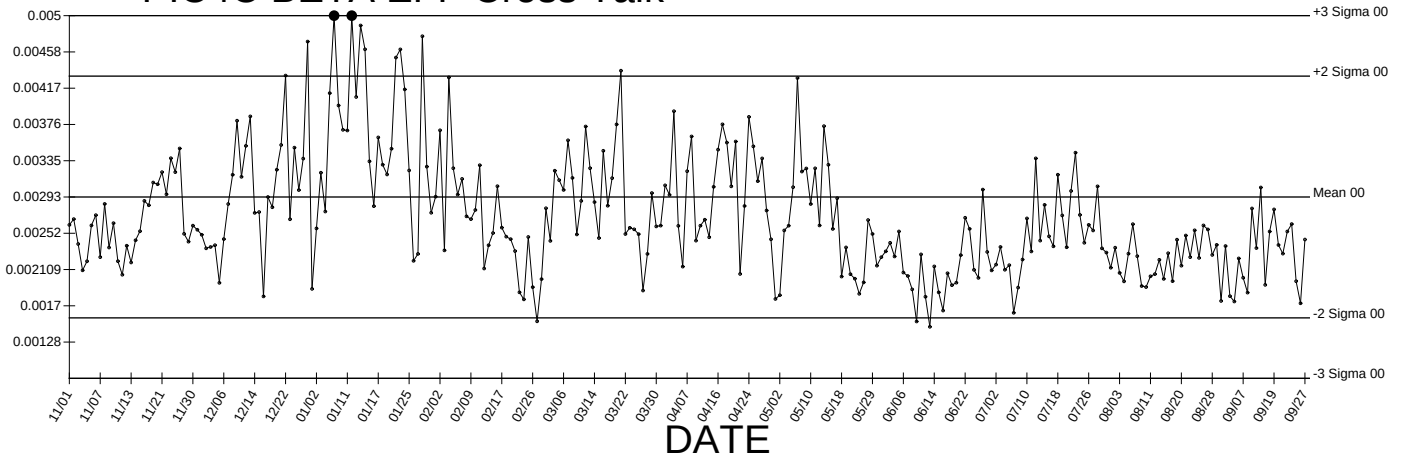
● Denotes Outlier

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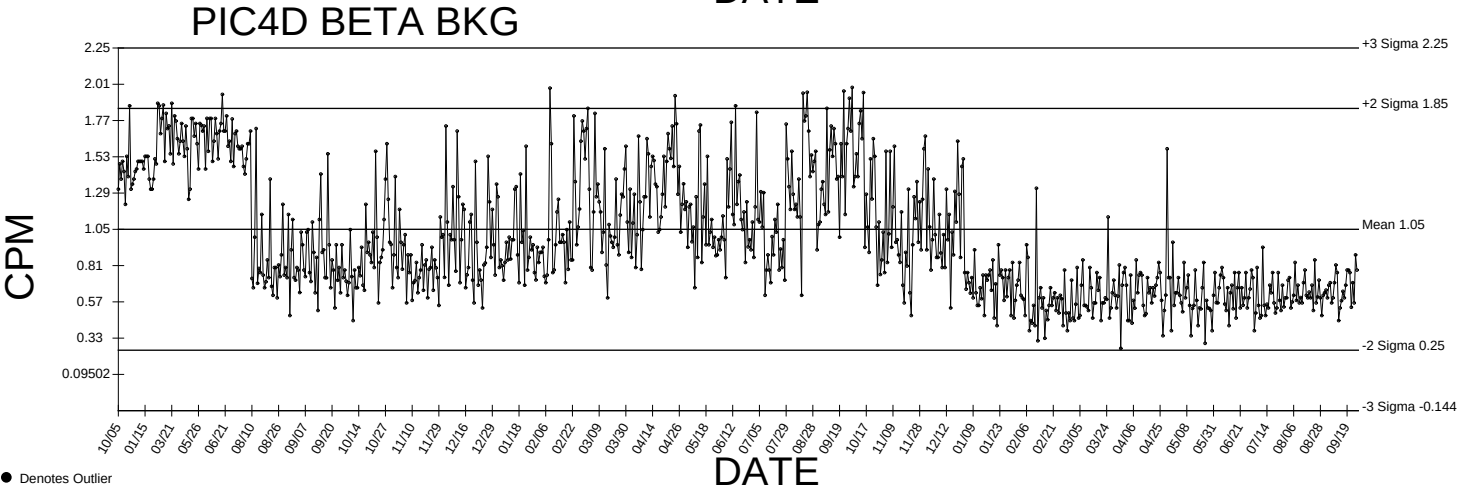
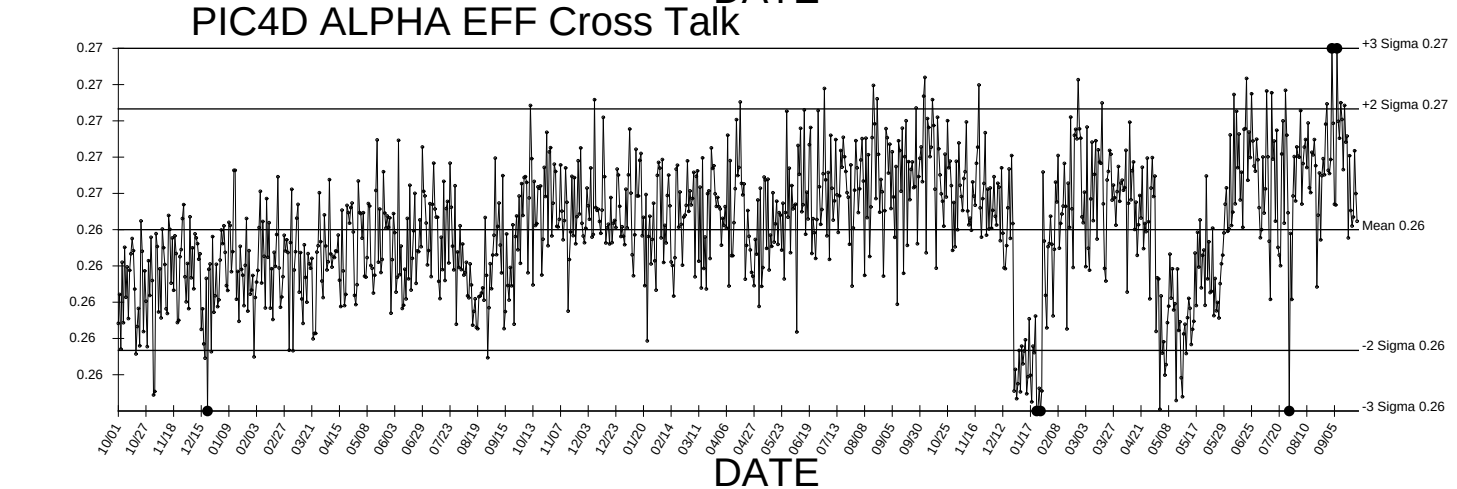
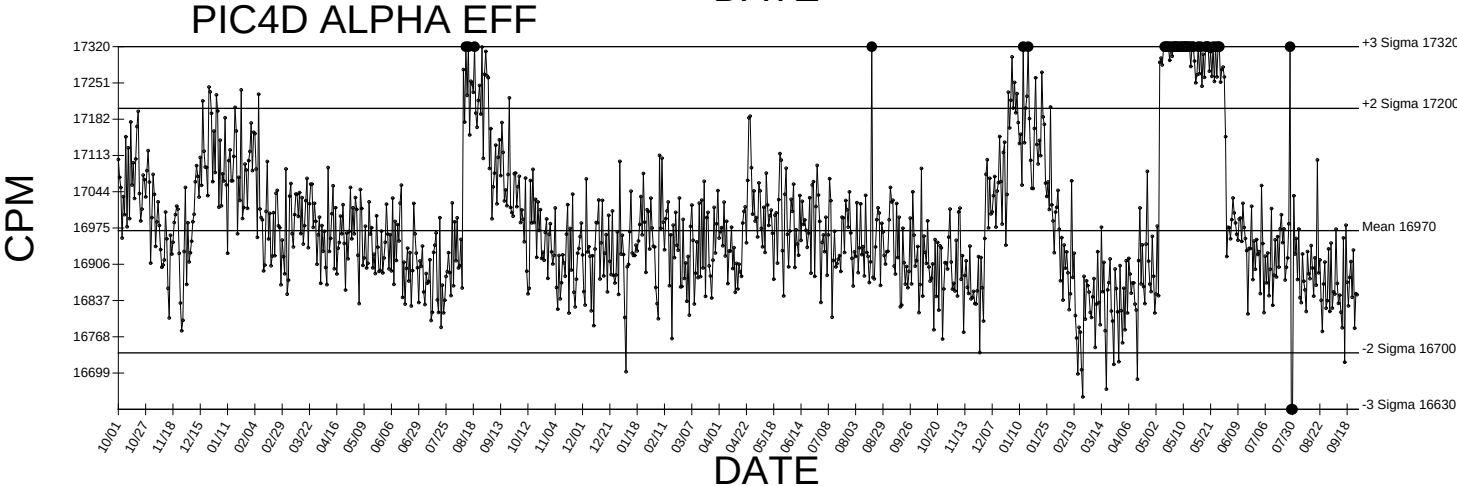
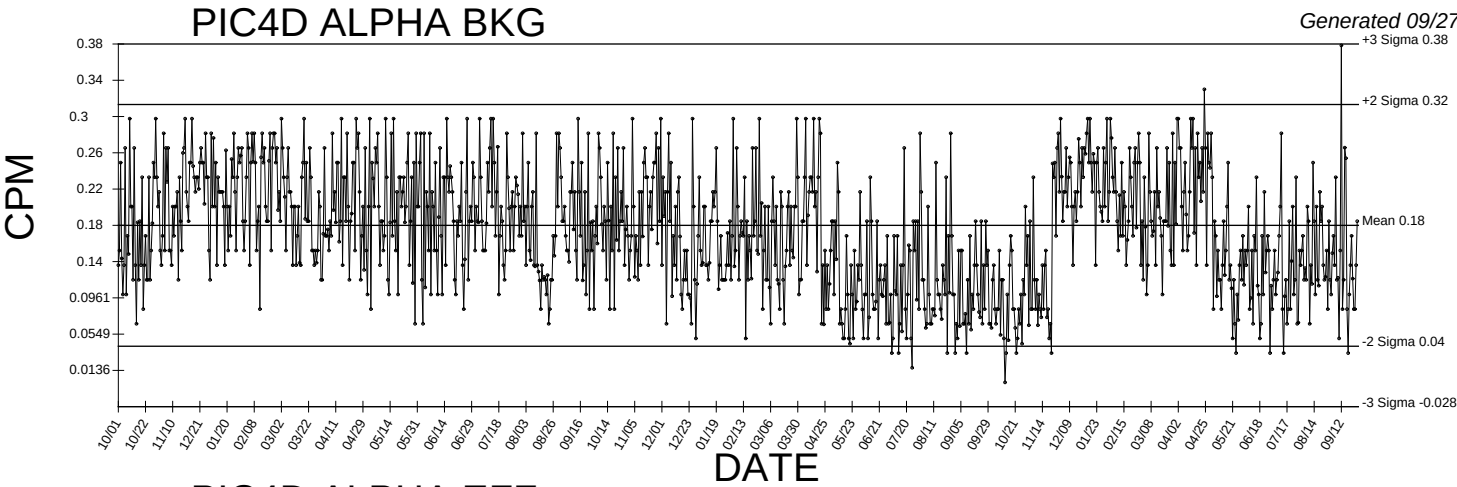
Generated 09/27/2018



PIC4C BETA EFF Cross Talk



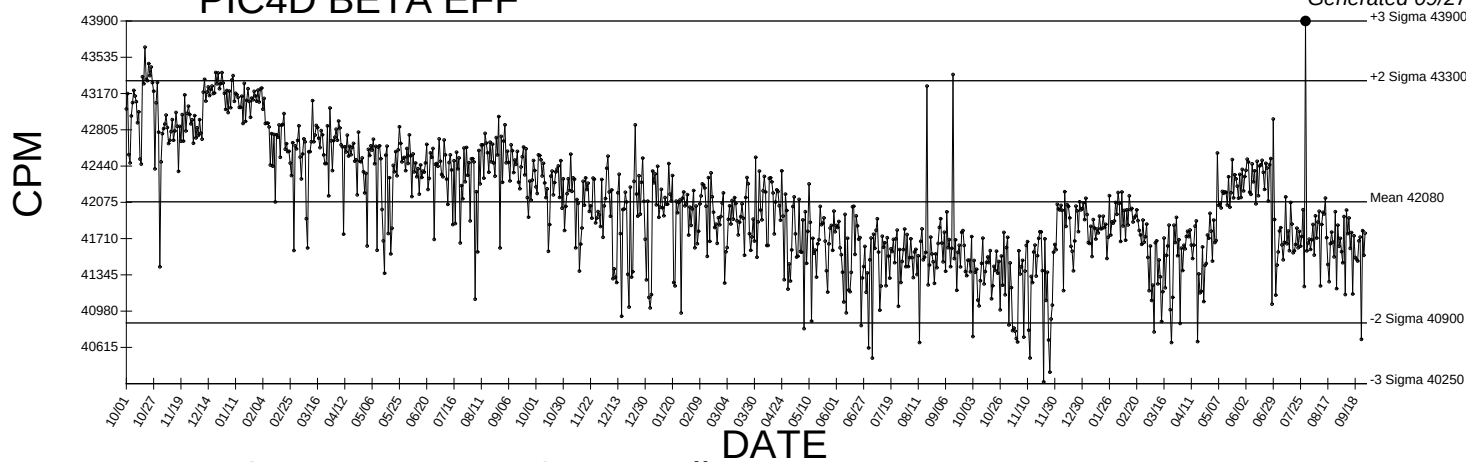
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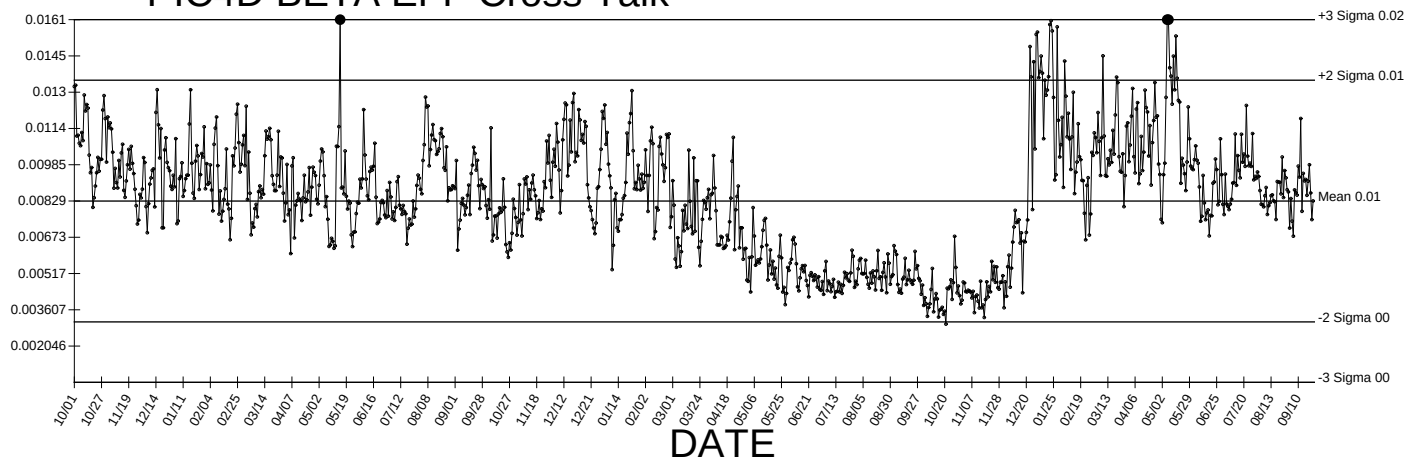
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PIC4D BETA EFF

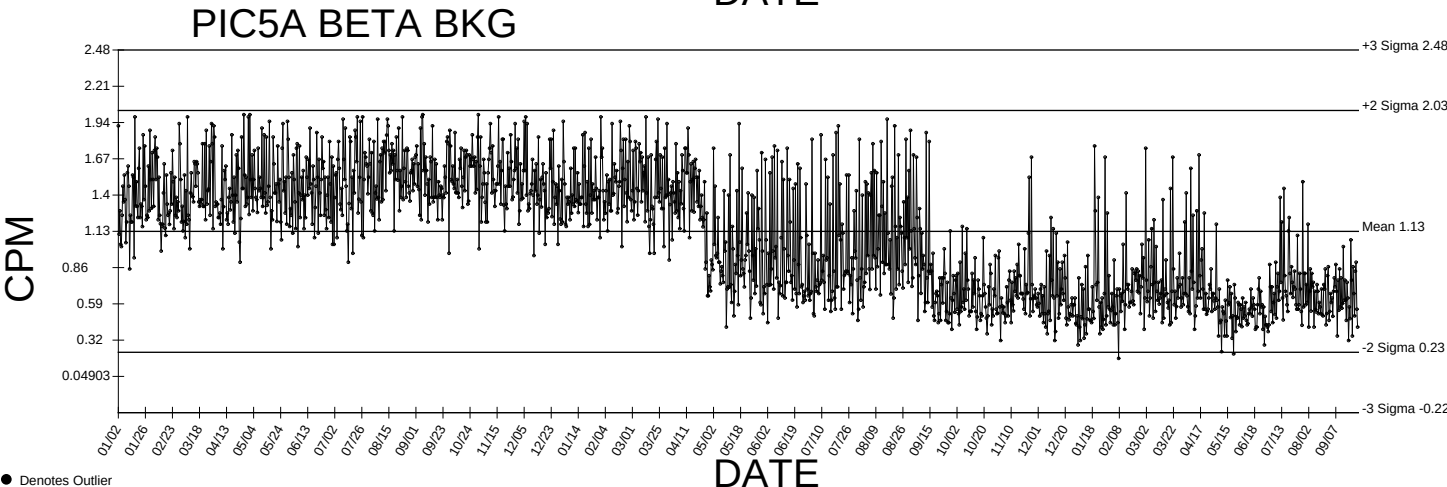
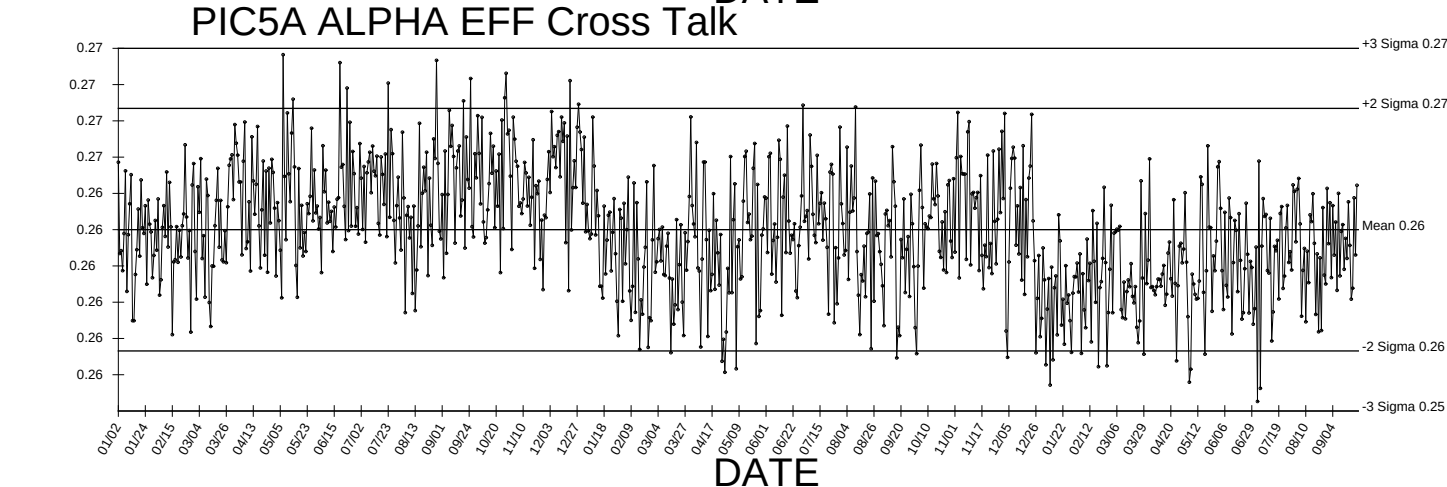
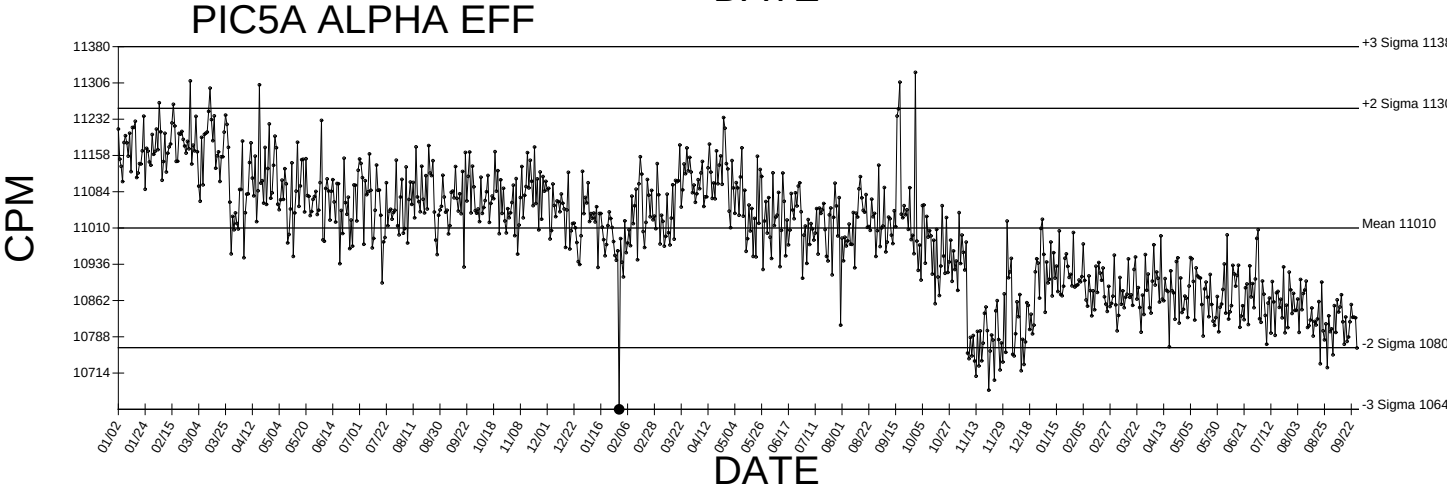
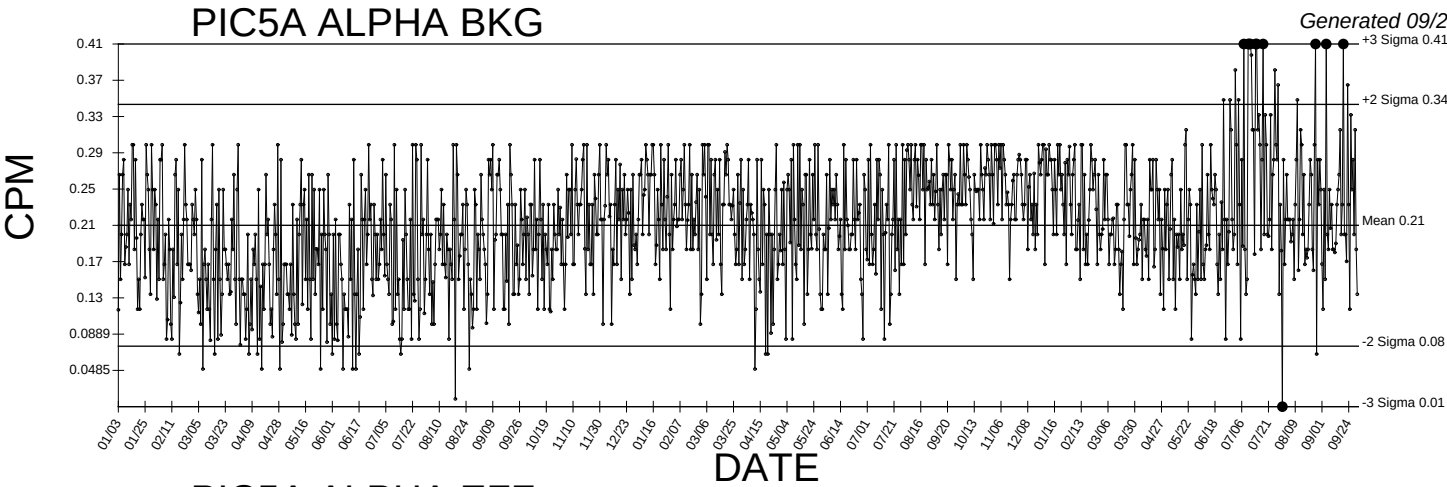
Generated 09/27/2018



PIC4D BETA EFF Cross Talk



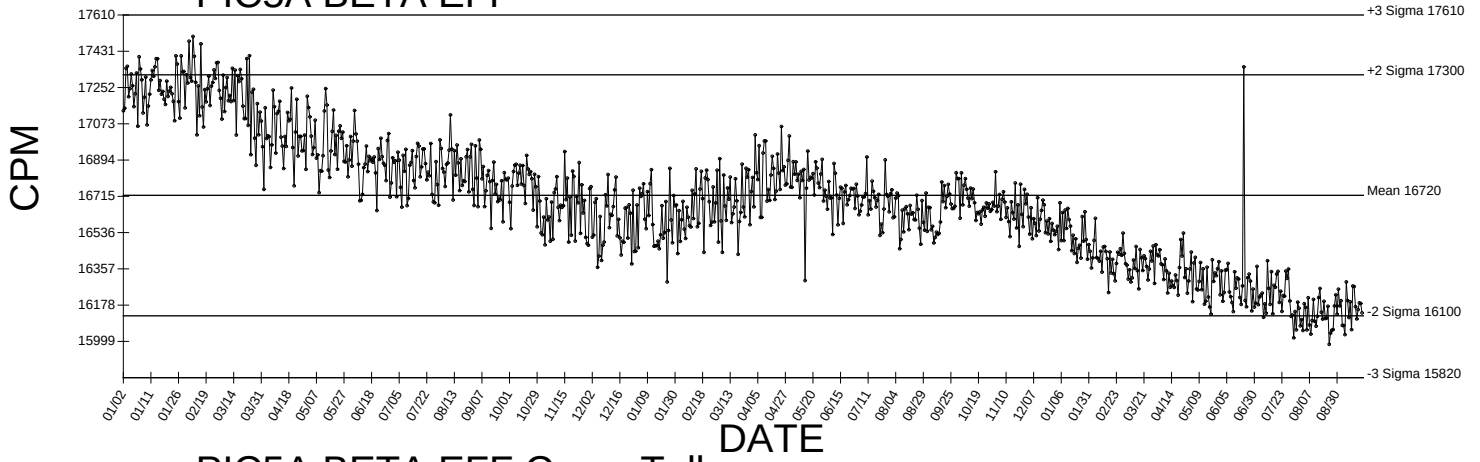
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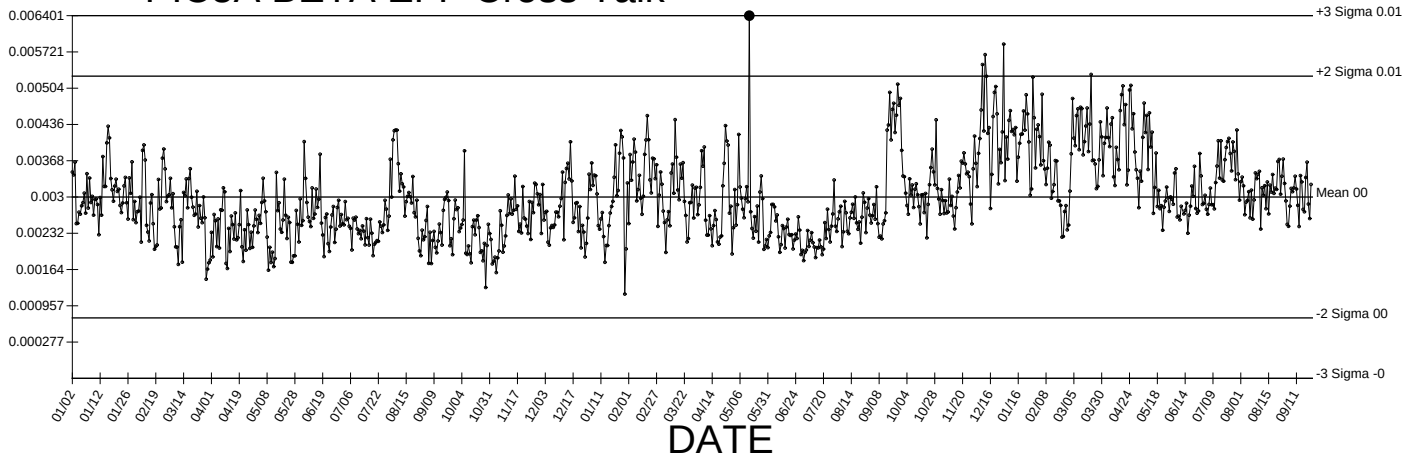
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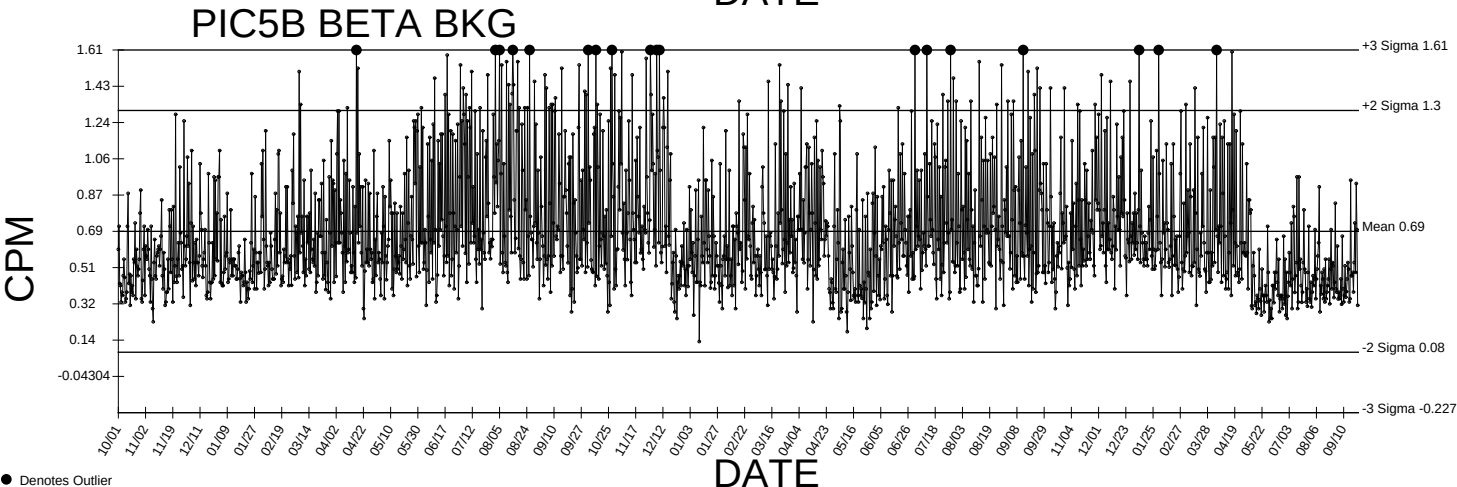
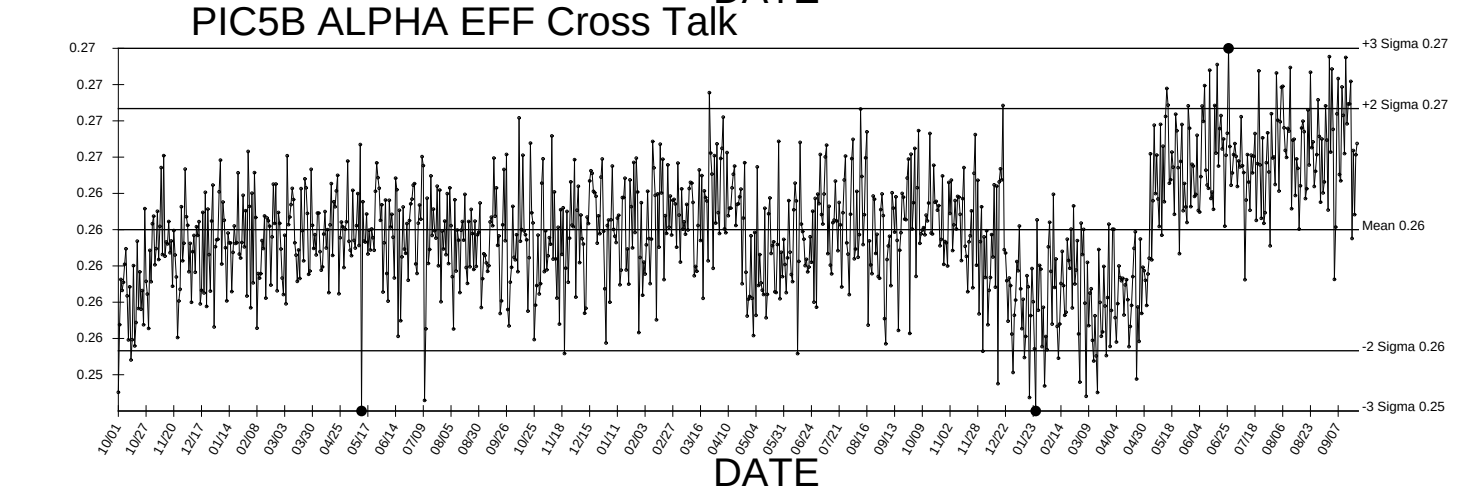
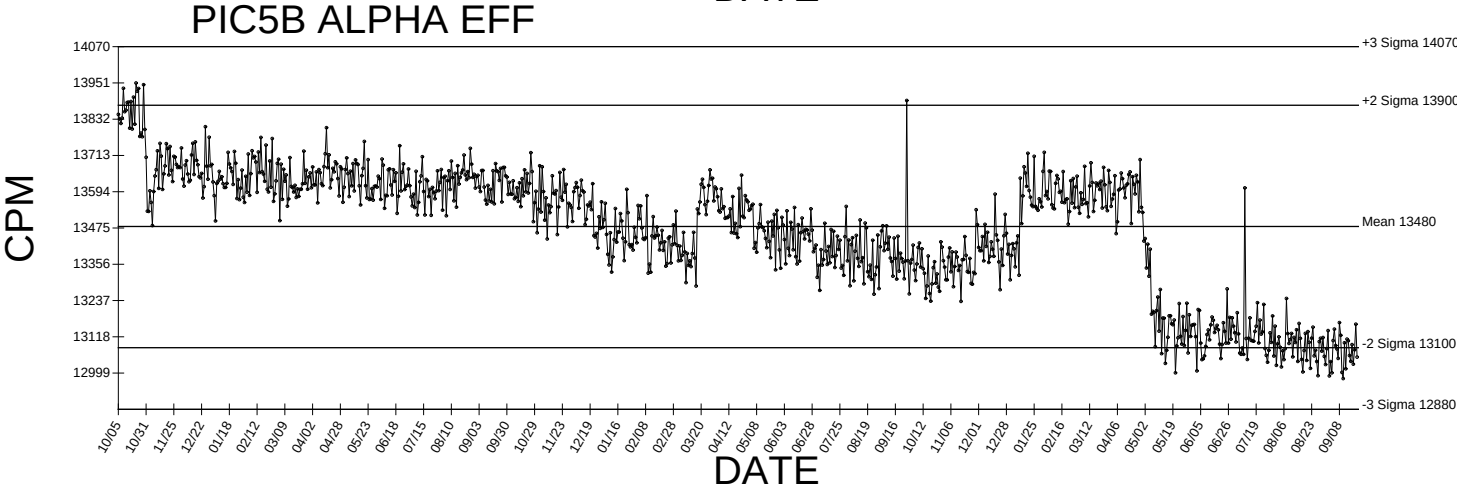
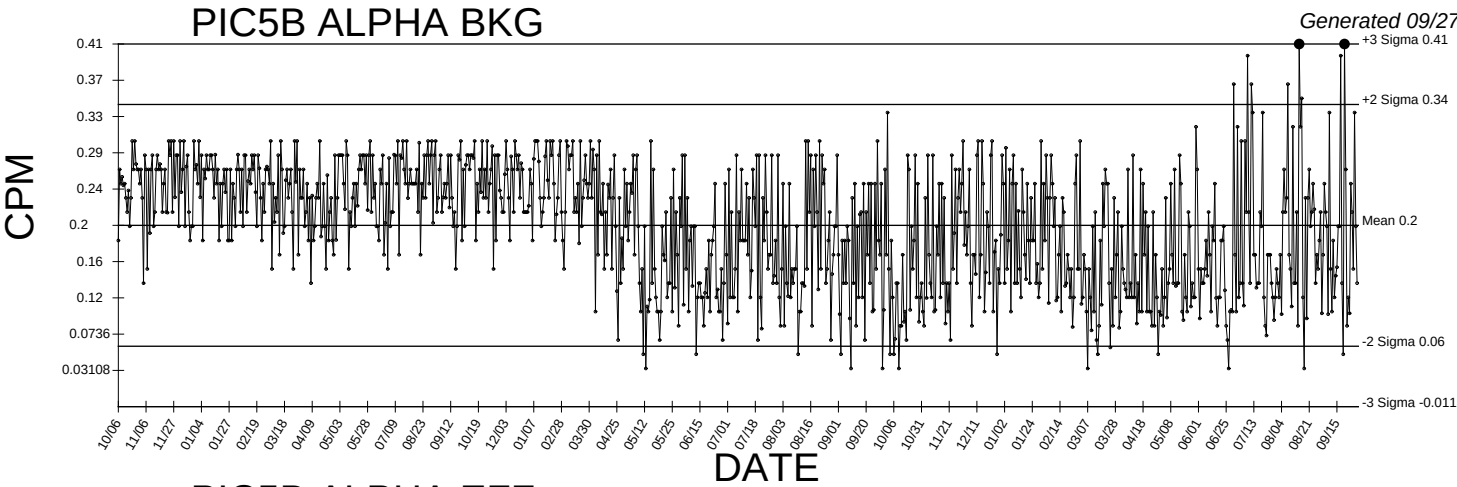
Generated 09/27/2018
+3 Sigma 17610



PIC5A BETA EFF Cross Talk



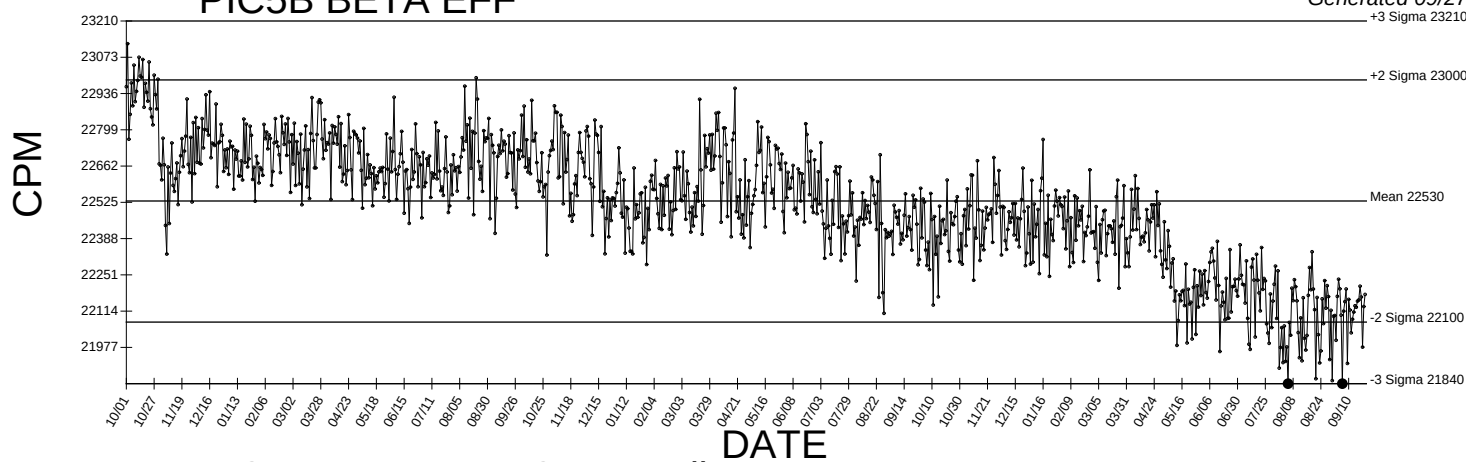
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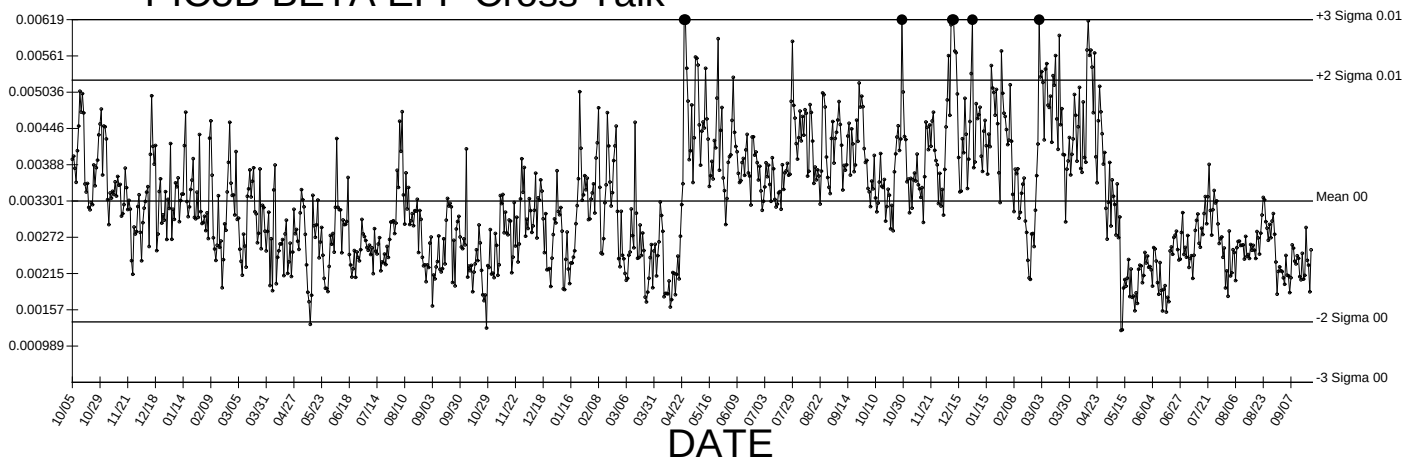
● Denotes Outlier

PIC5B BETA EFF

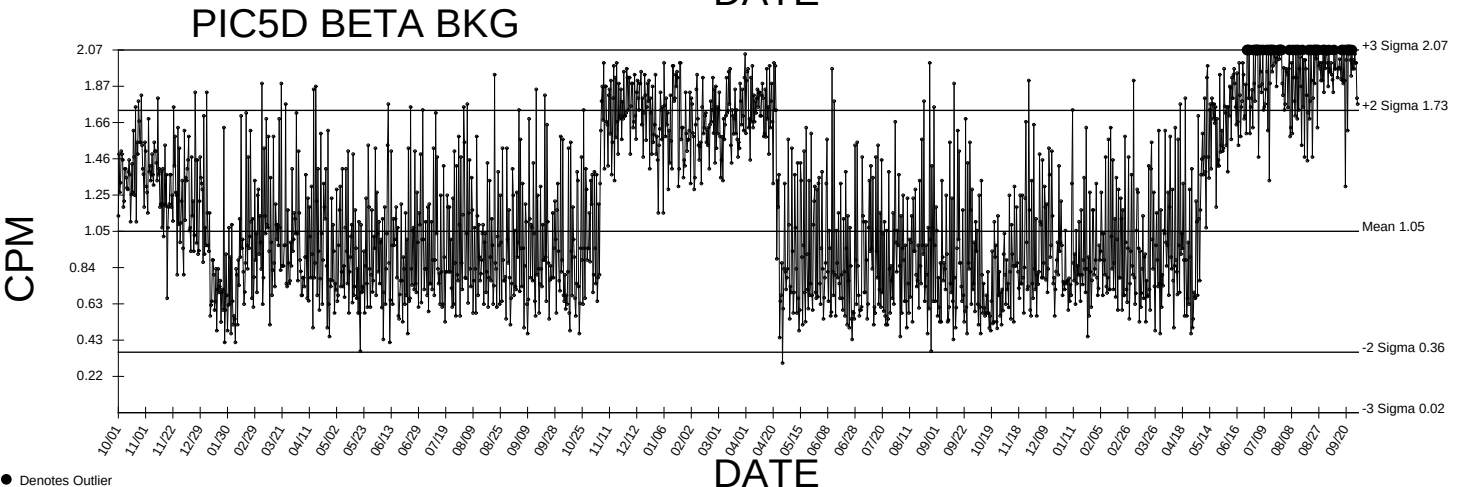
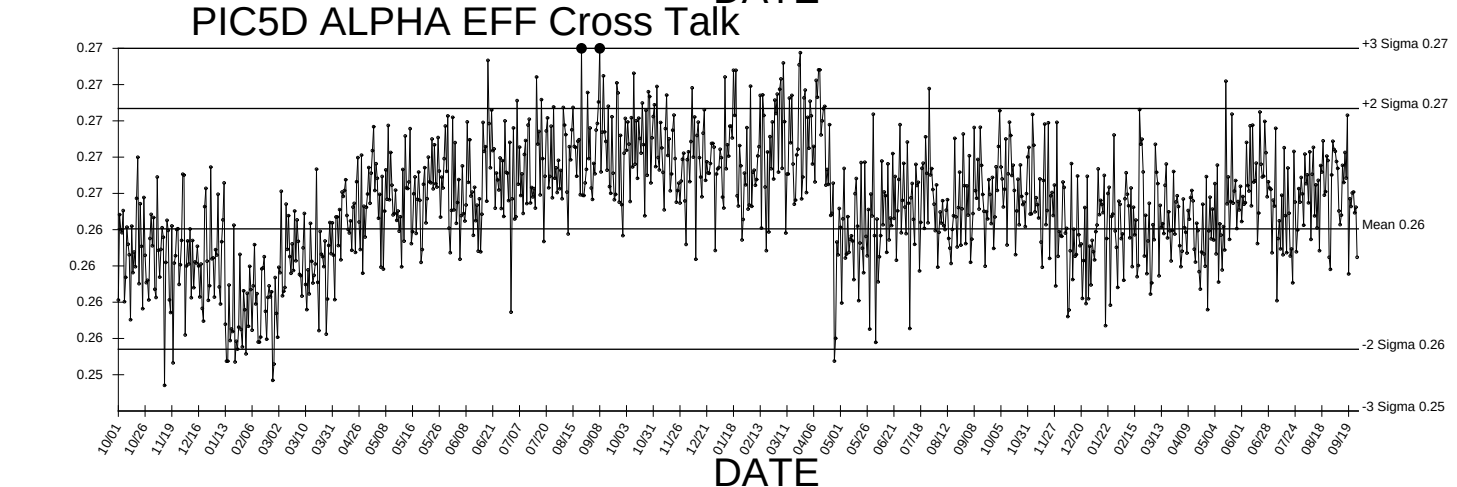
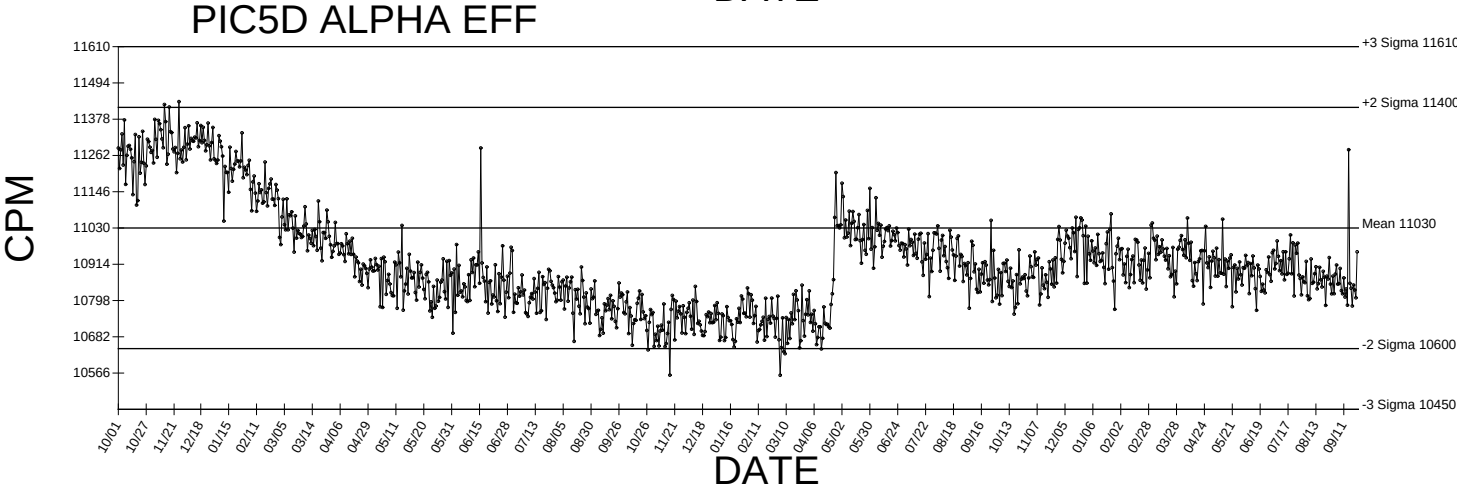
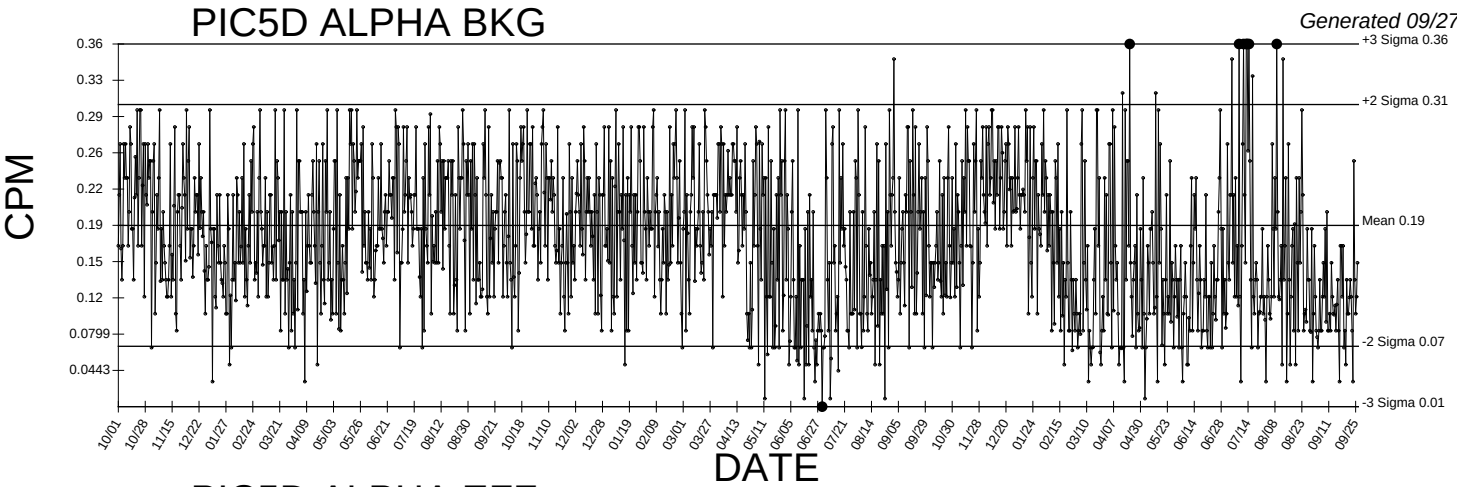
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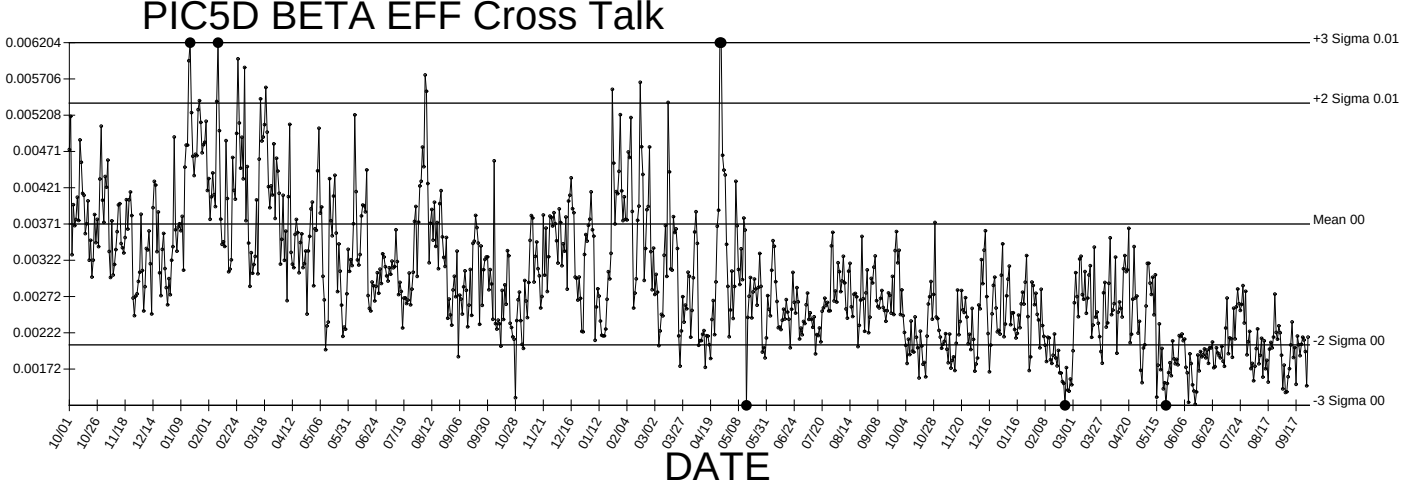
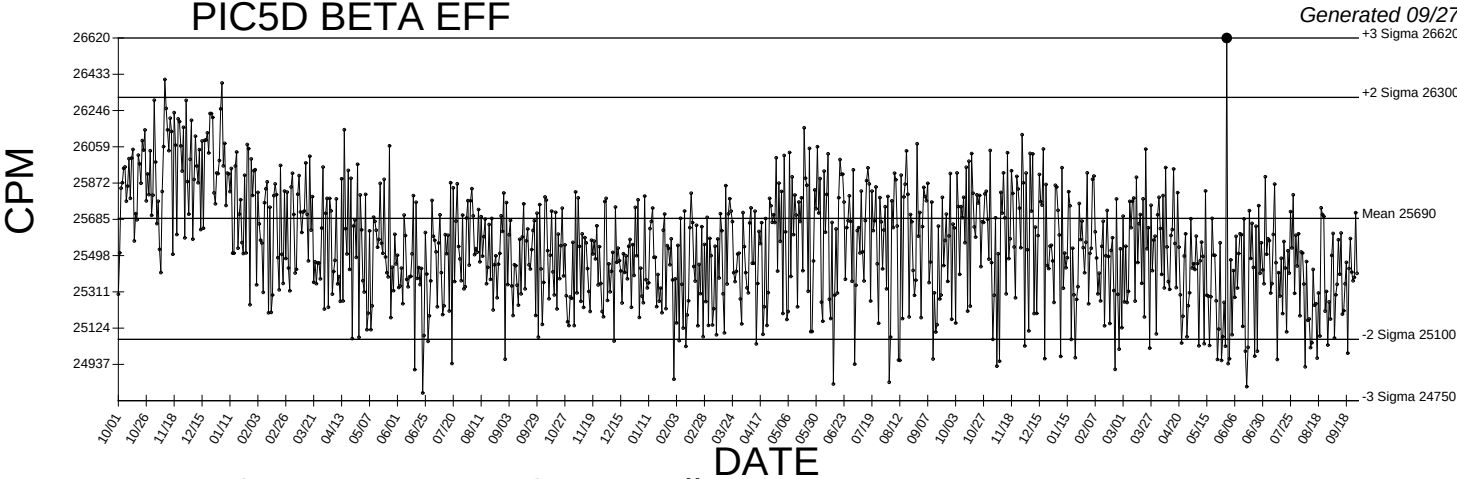
PIC5B BETA EFF Cross Talk



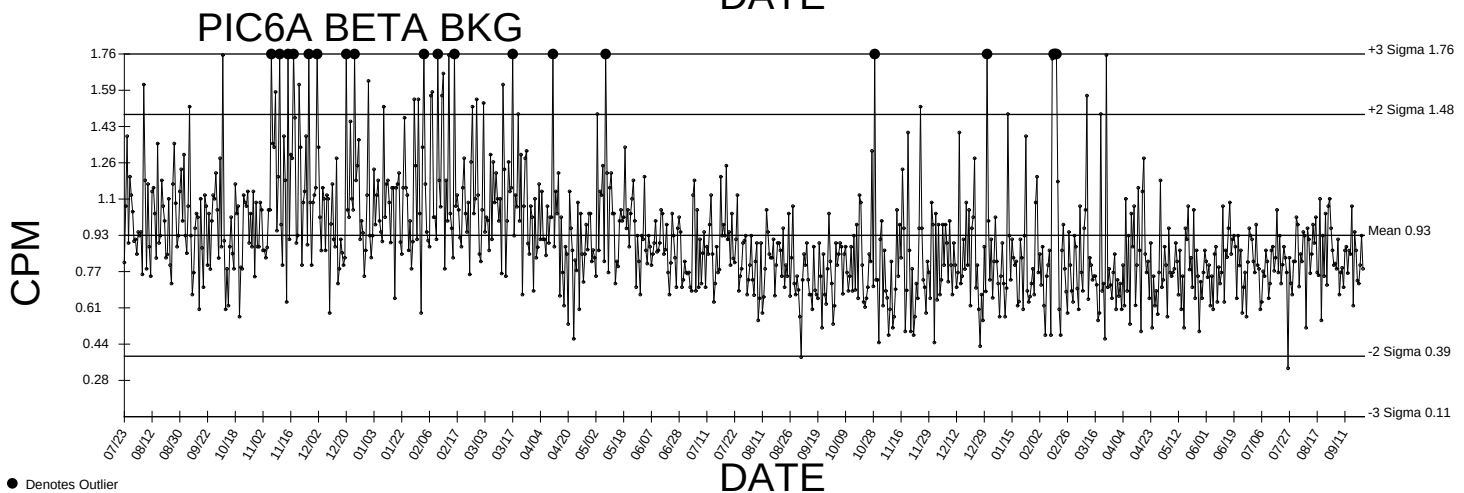
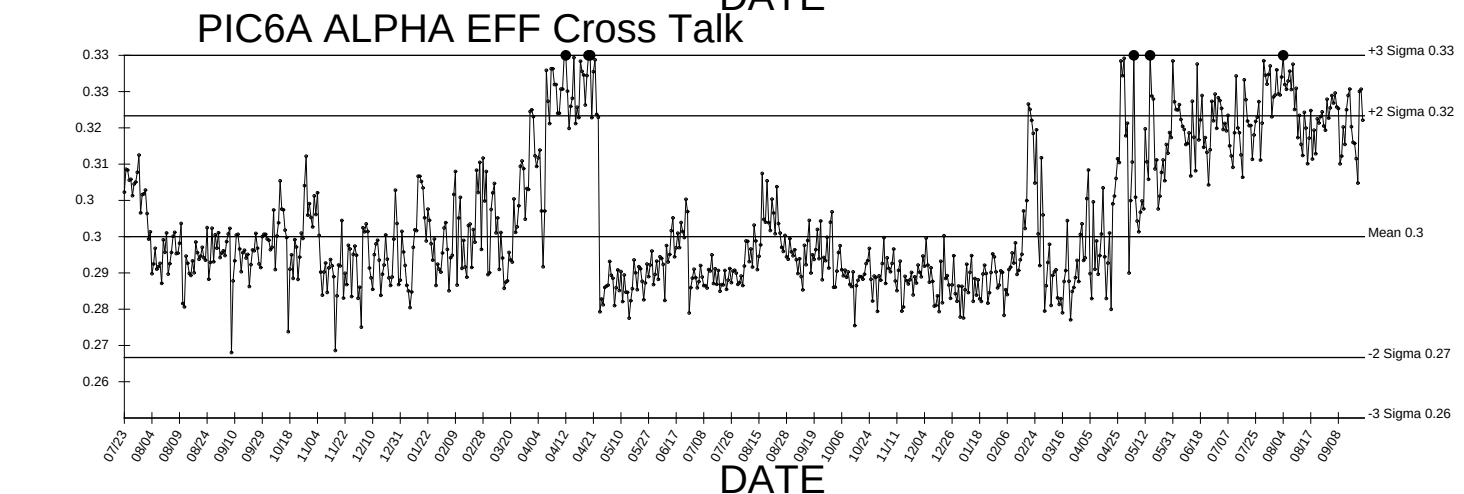
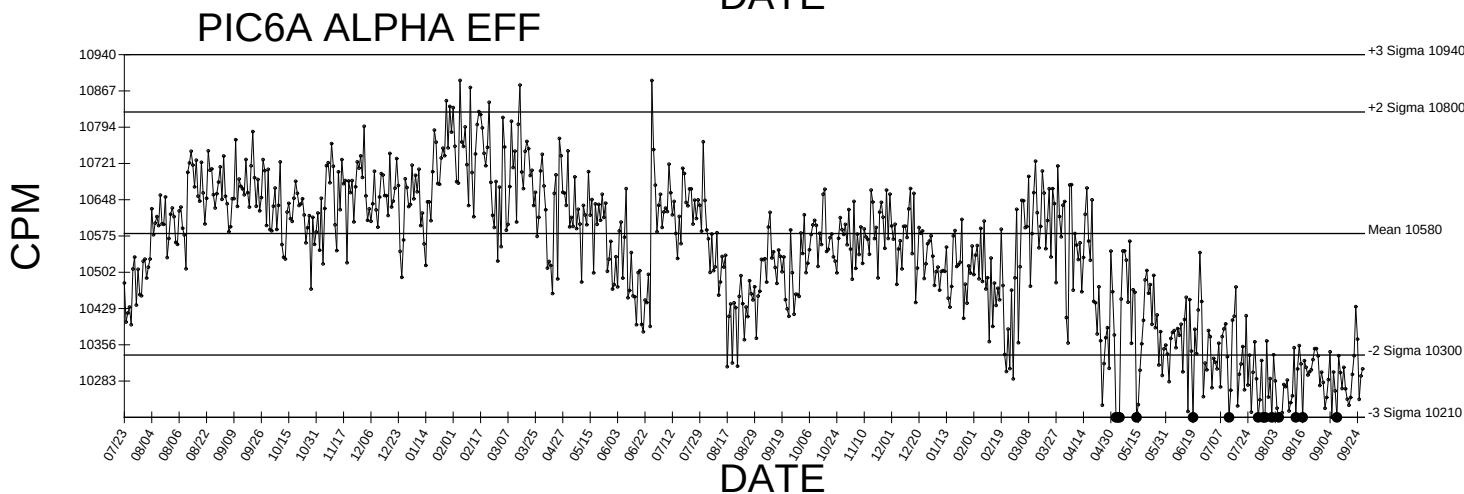
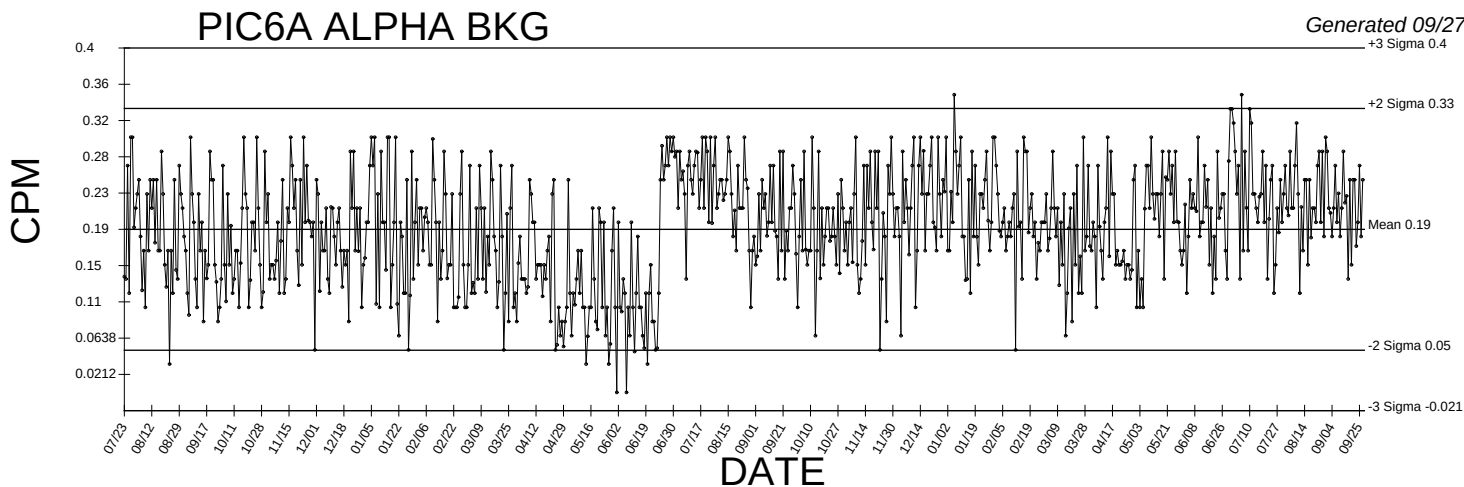
● Denotes Outlier



● Denotes Outlier



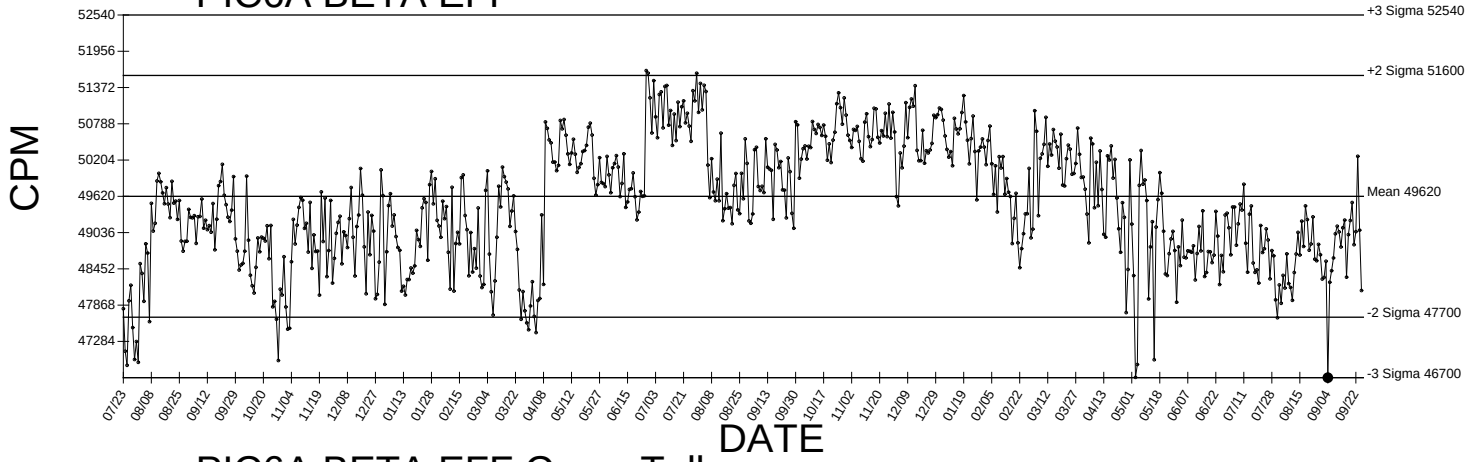
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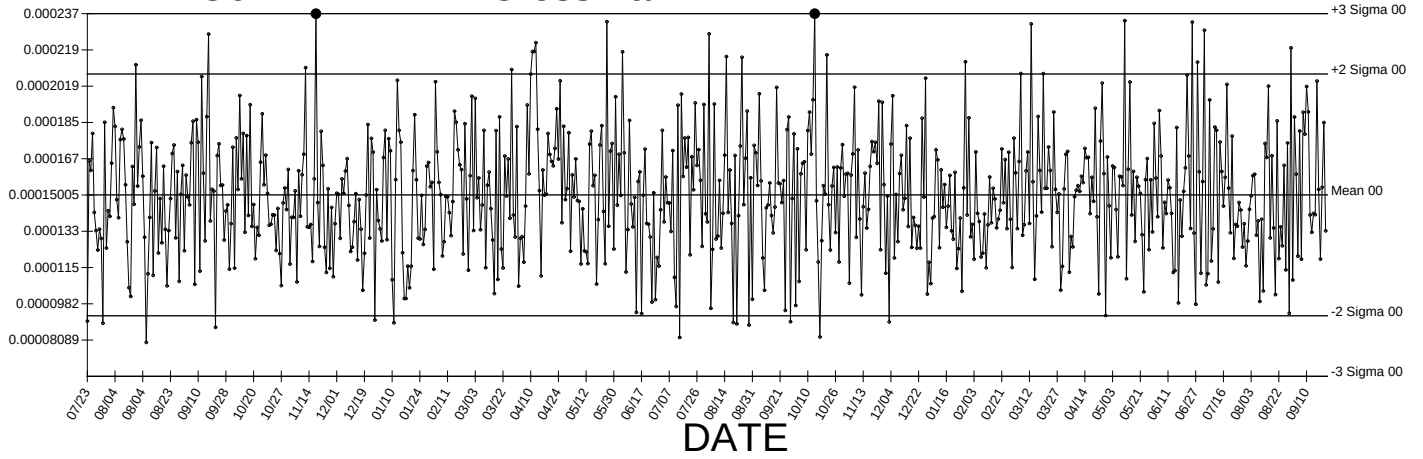
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PIC6A BETA EFF

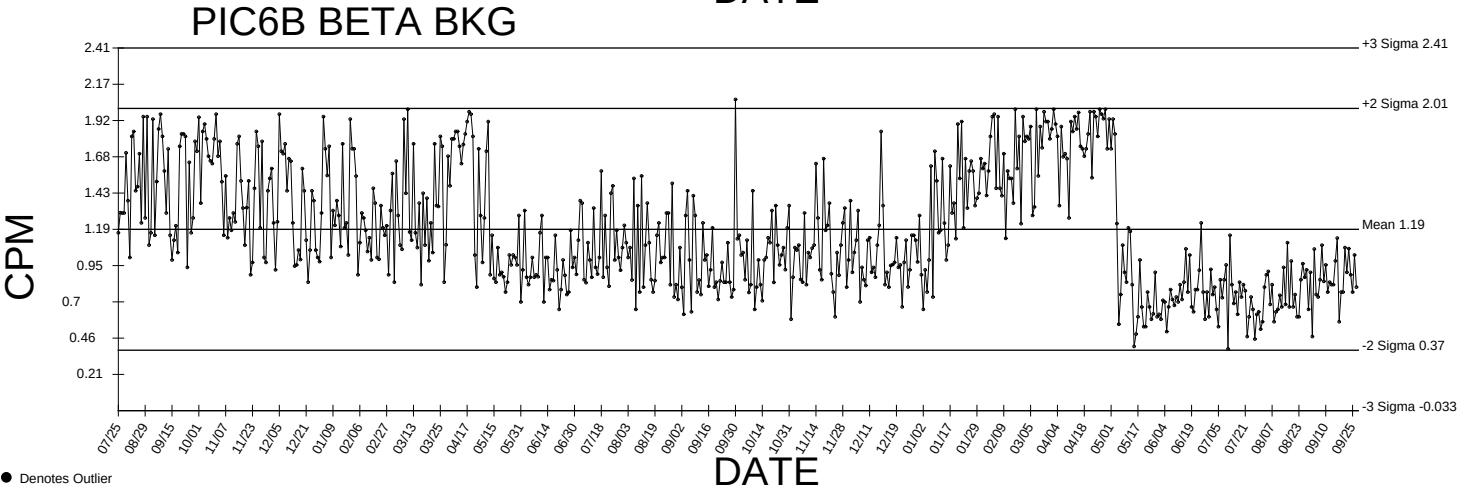
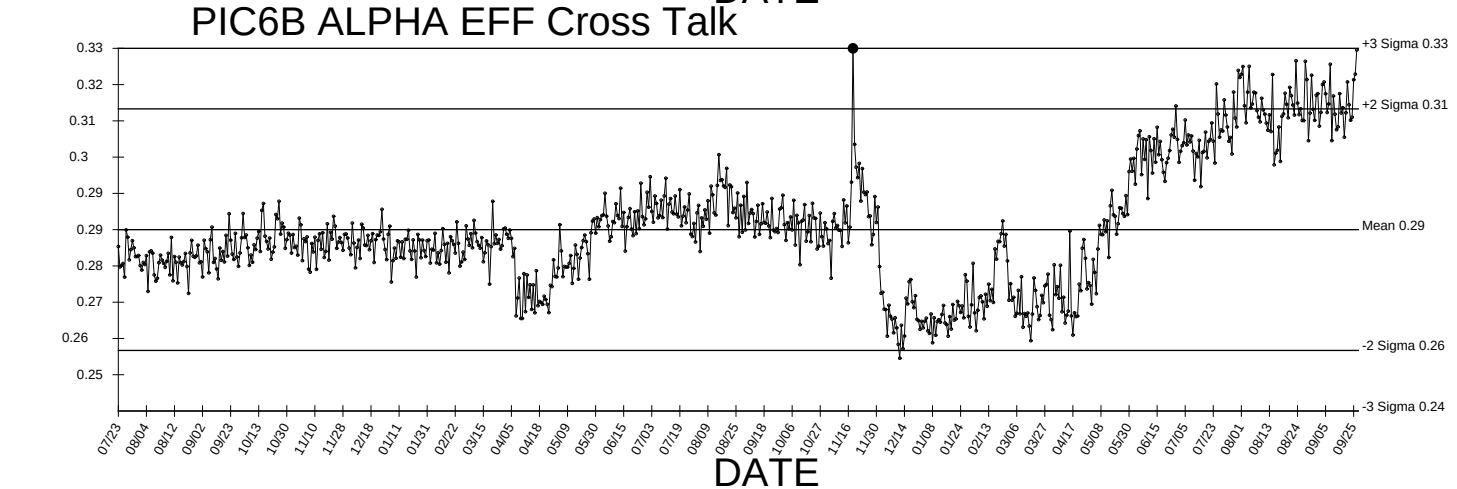
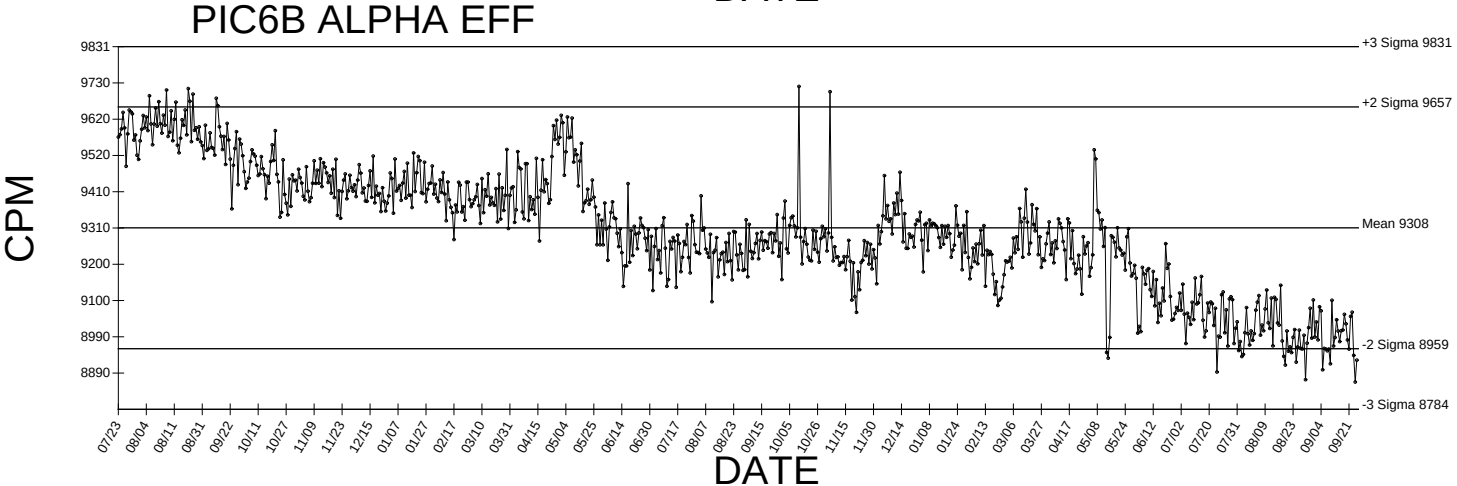
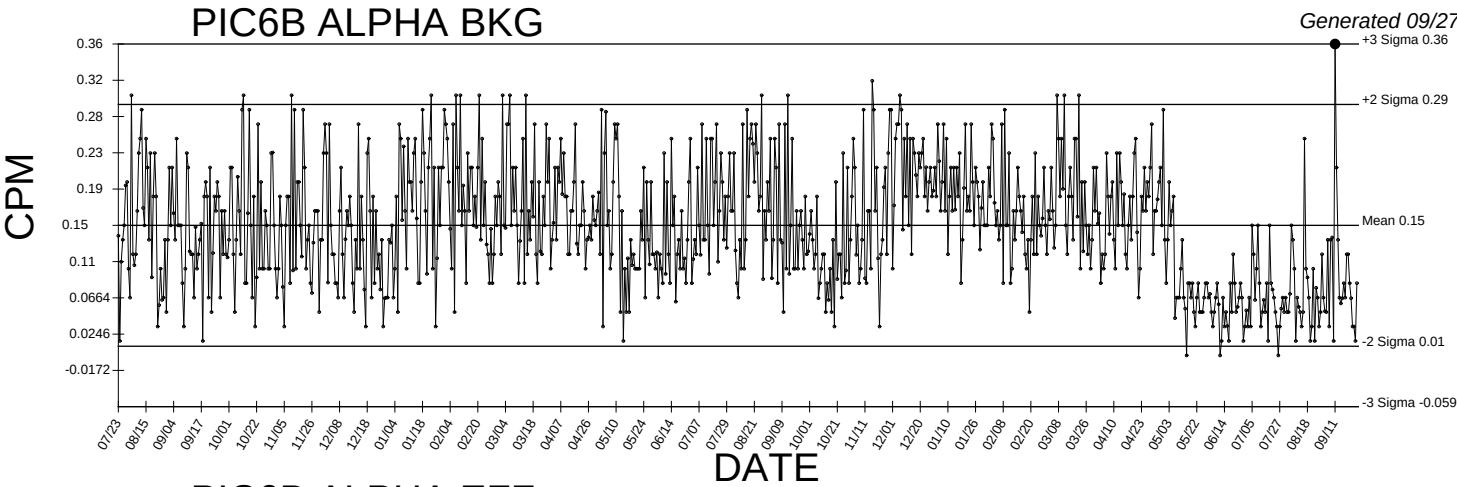
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+3 Sigma 52540



PIC6A BETA EFF Cross Talk



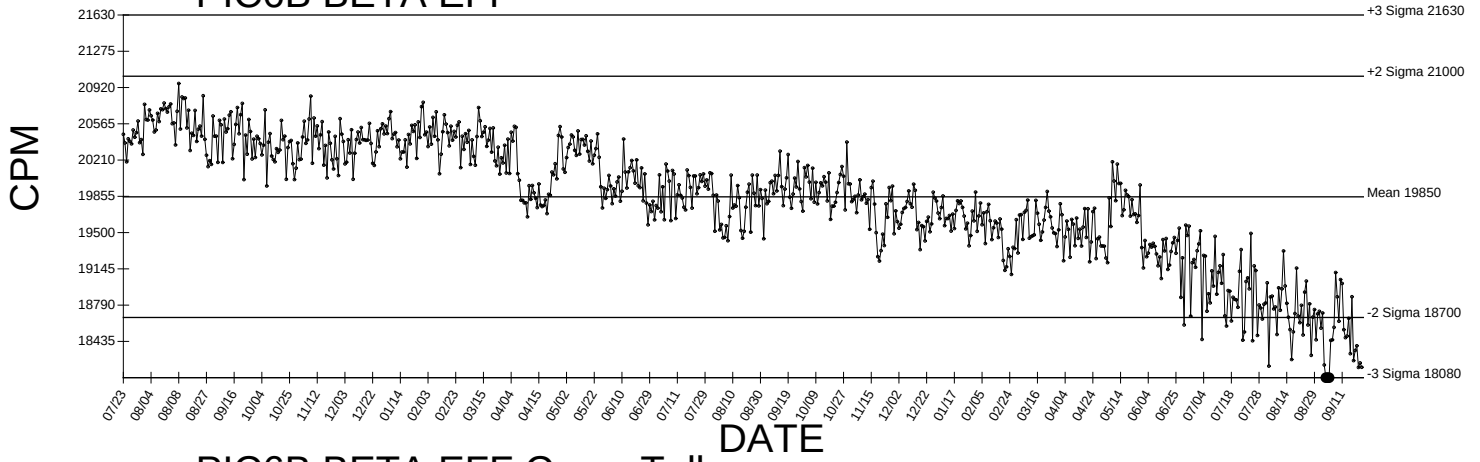
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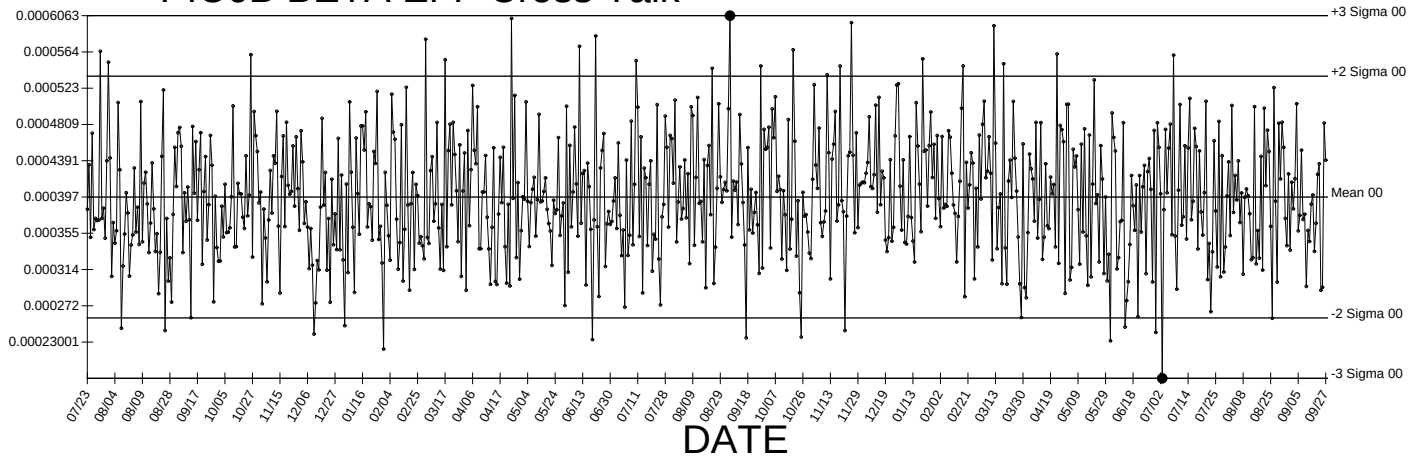
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PIC6B BETA EFF

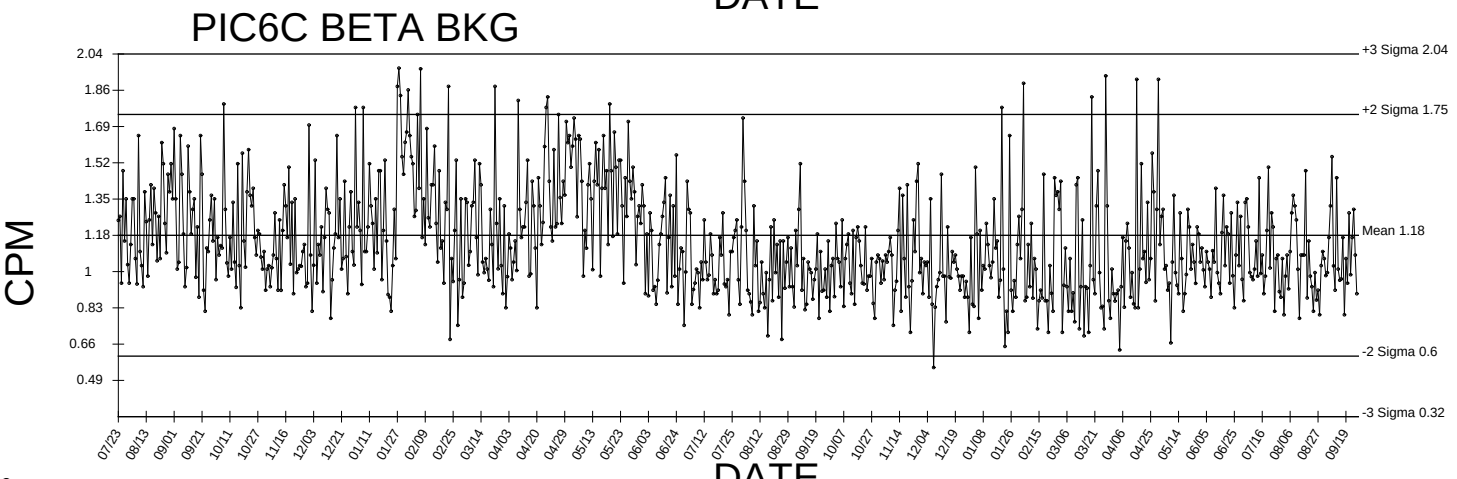
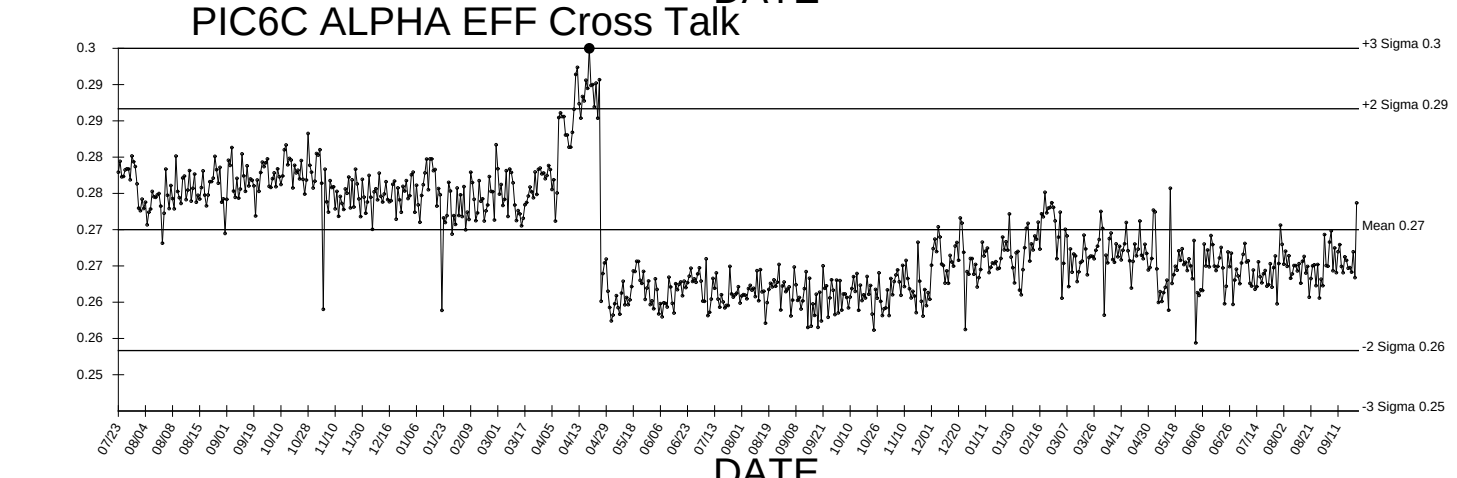
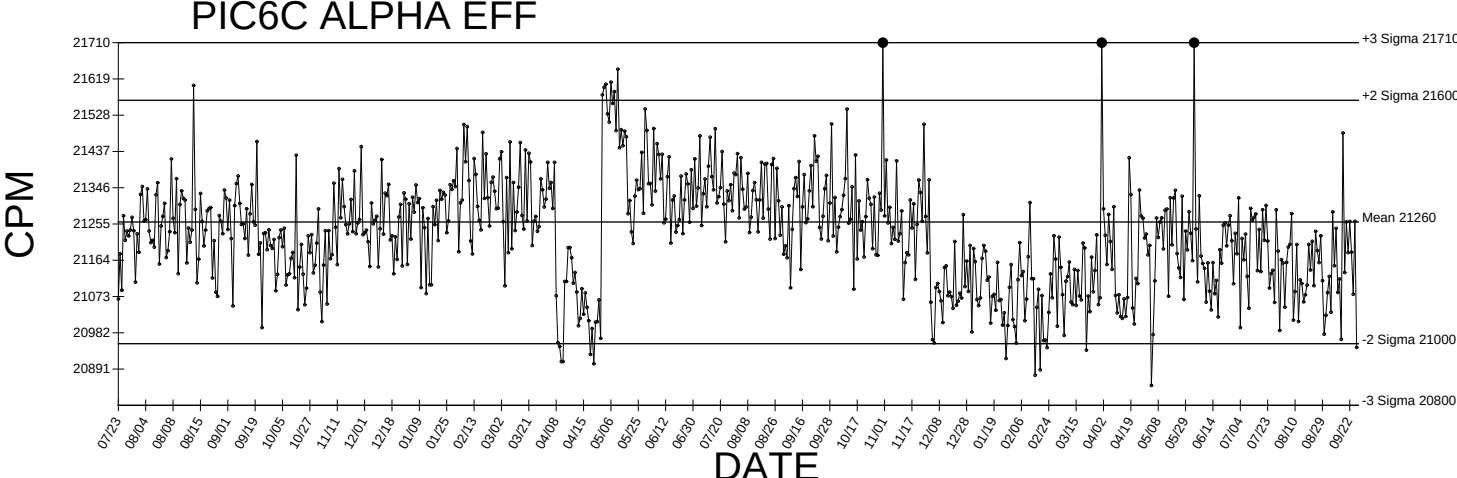
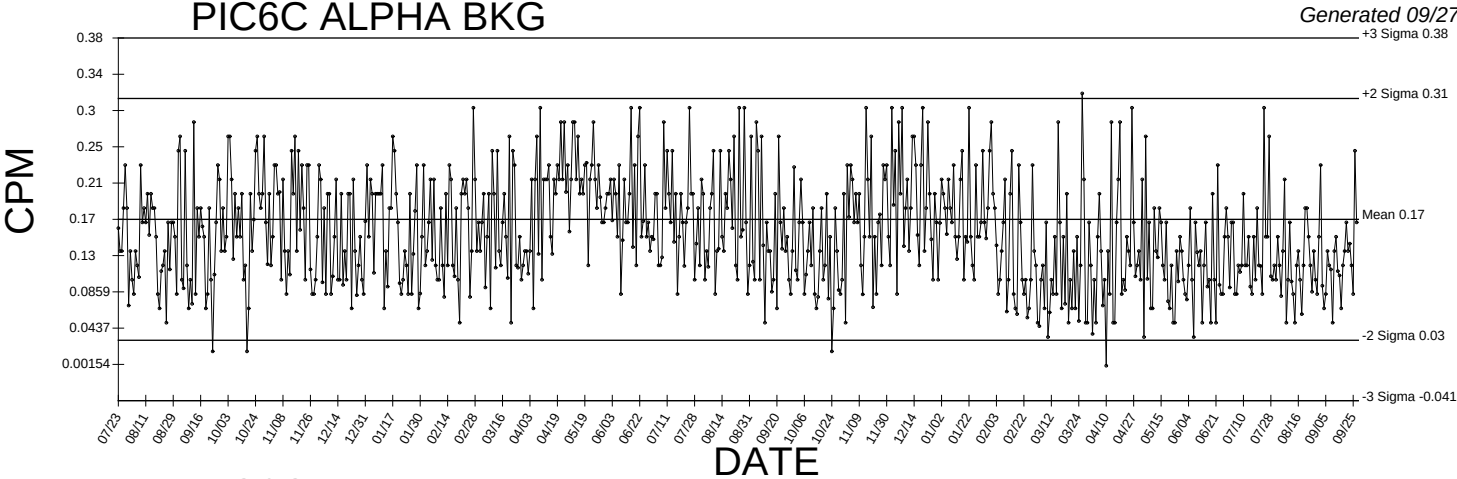
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PIC6B BETA EFF Cross Talk



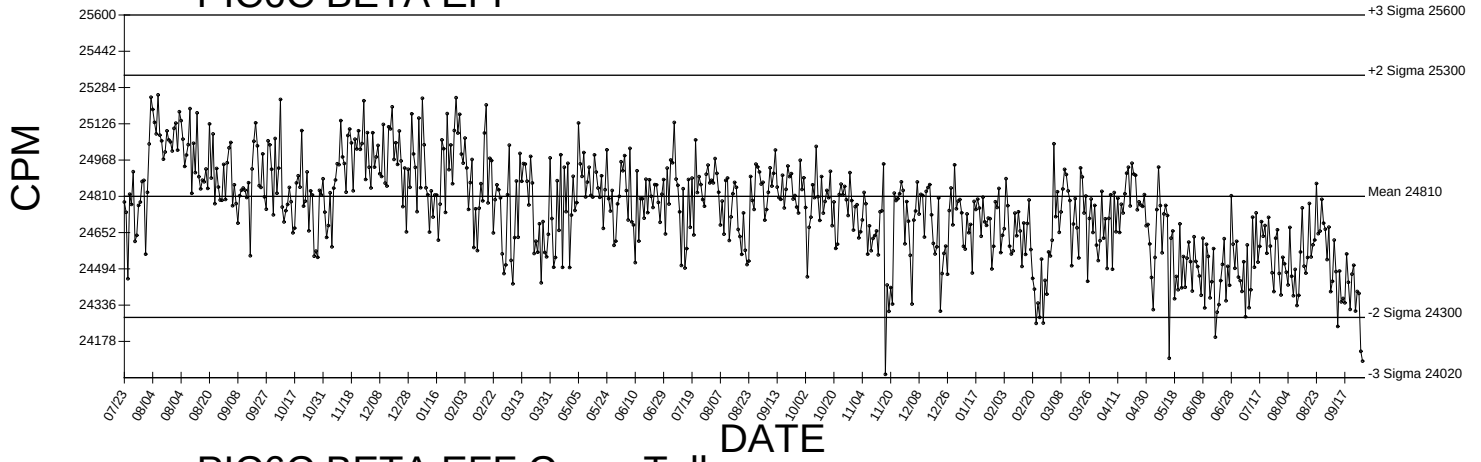
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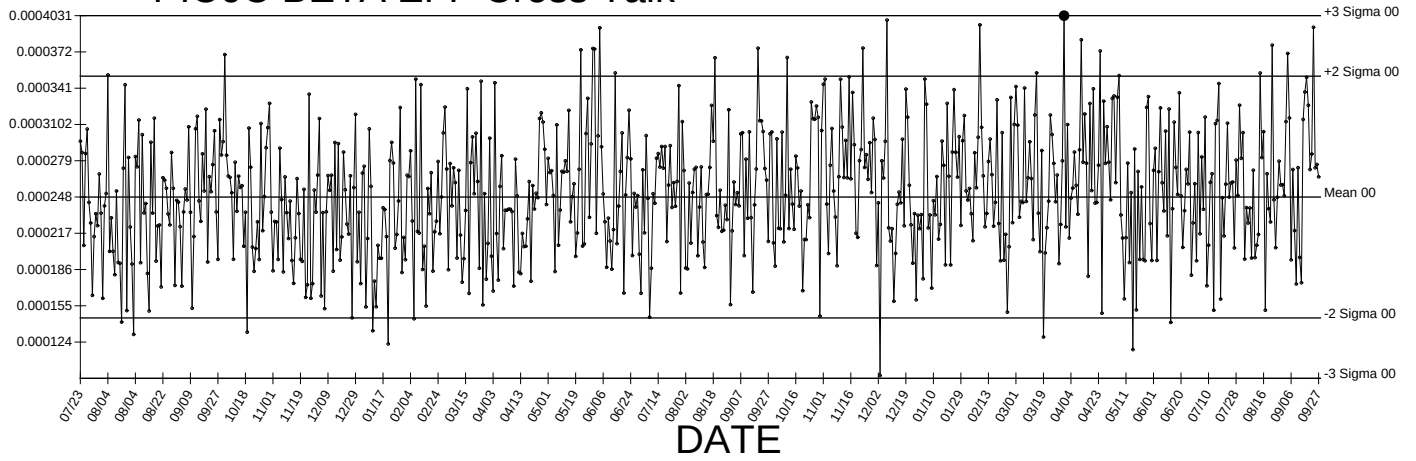
● Denotes Outlier

PIC6C BETA EFF

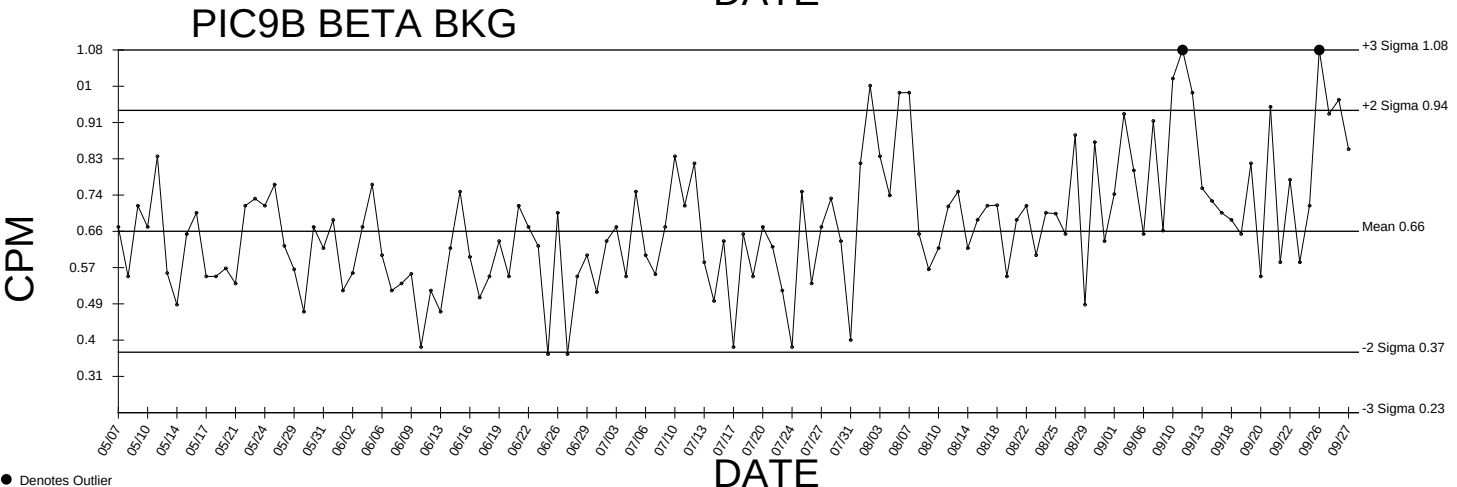
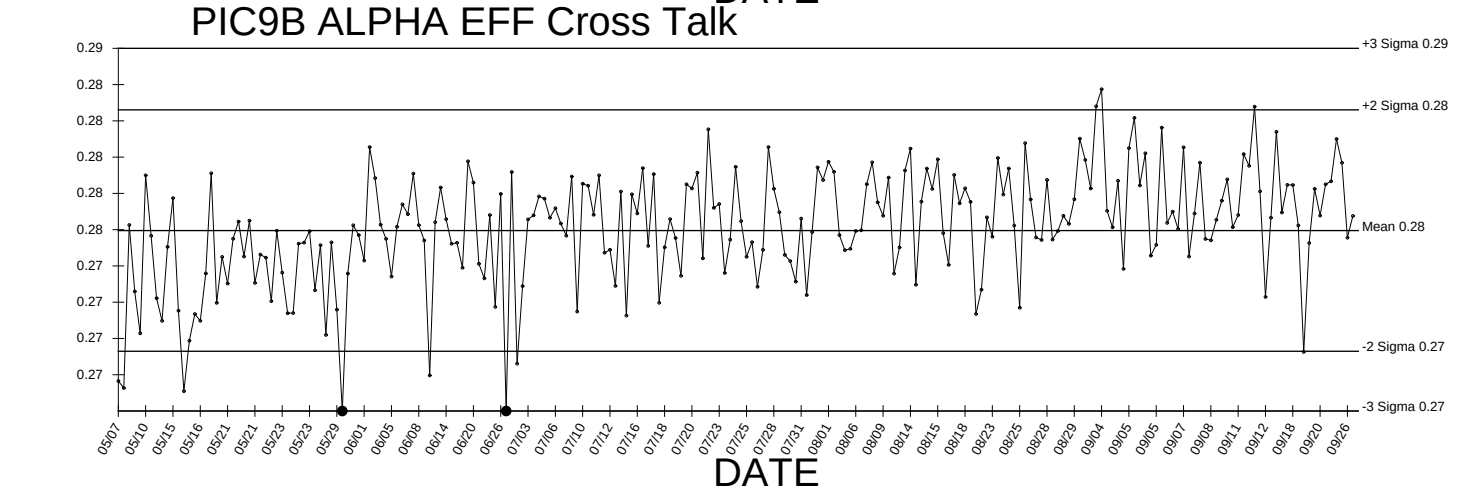
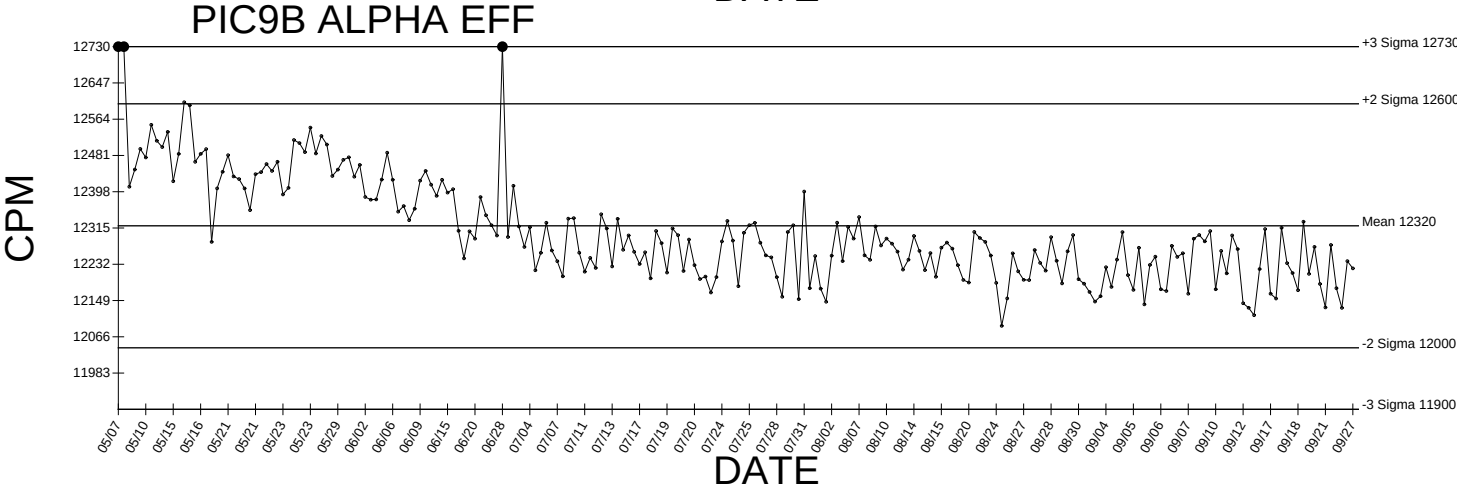
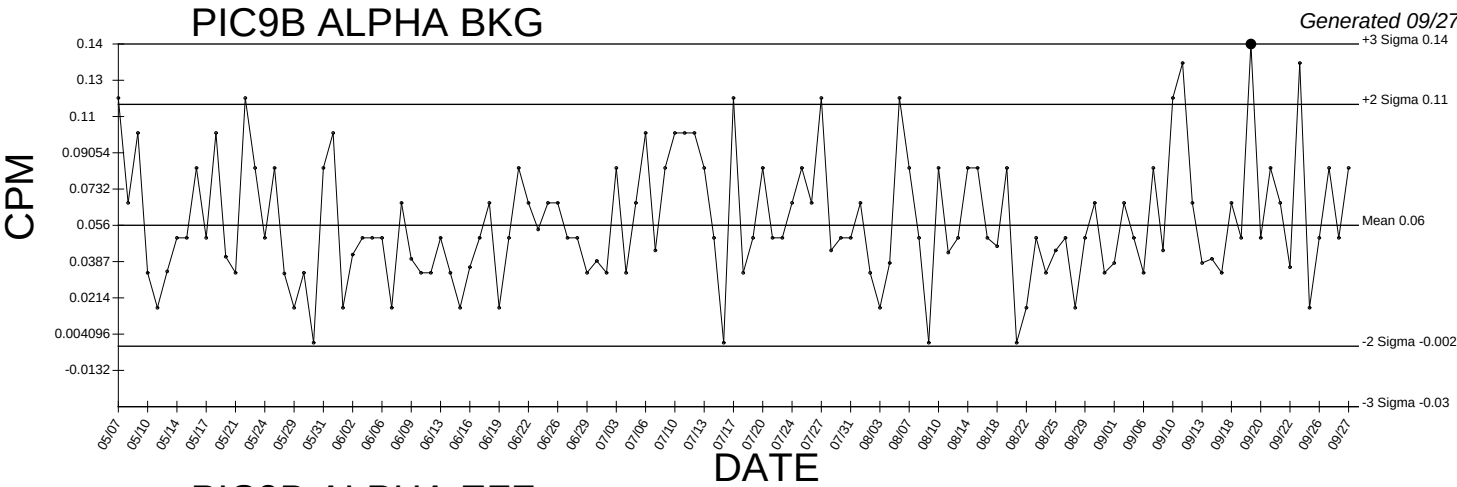
Generated 09/27/2018



PIC6C BETA EFF Cross Talk



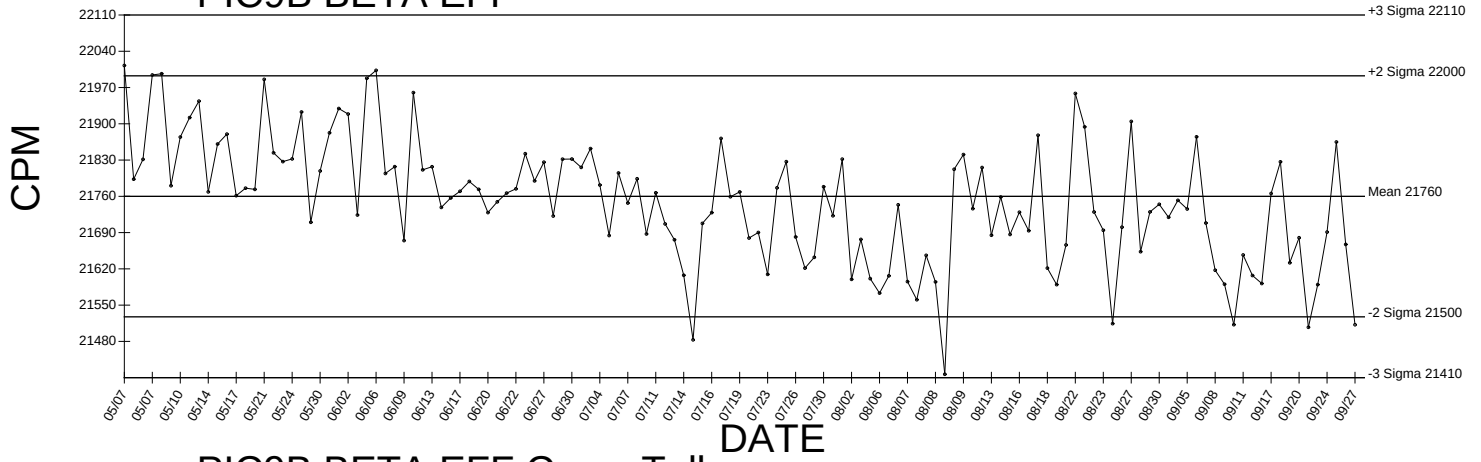
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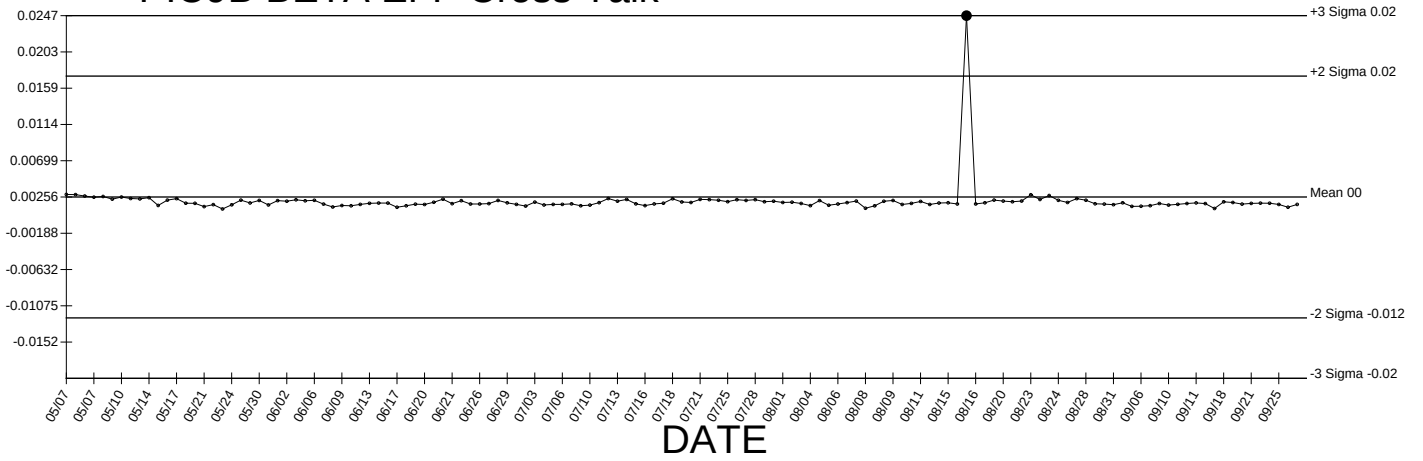
● Denotes Outlier

PIC9B BETA EFF

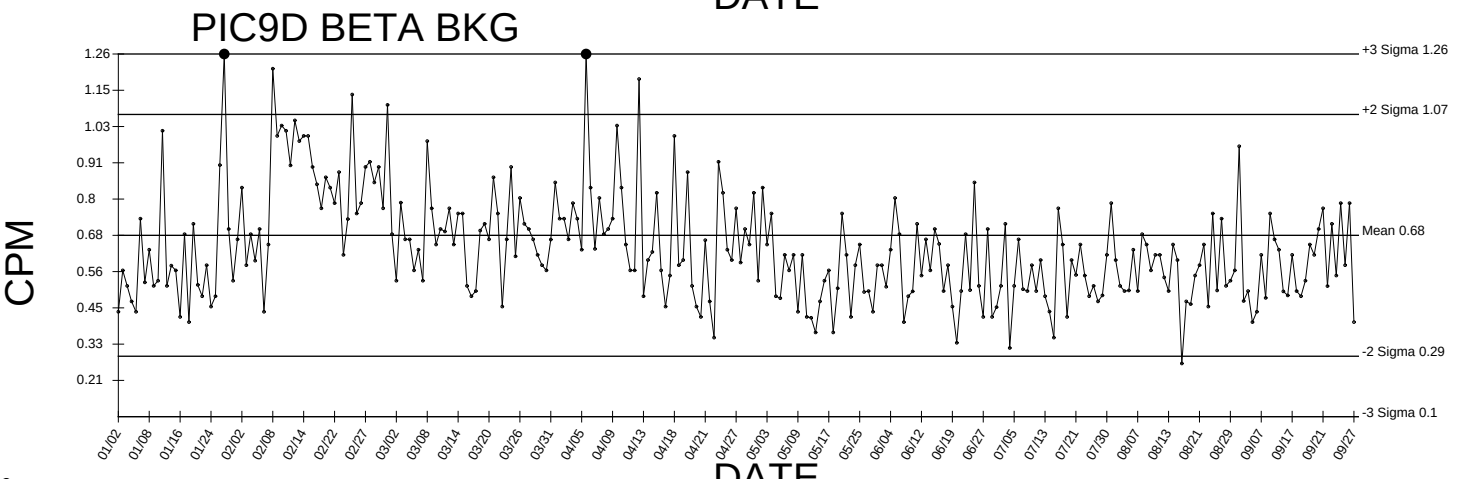
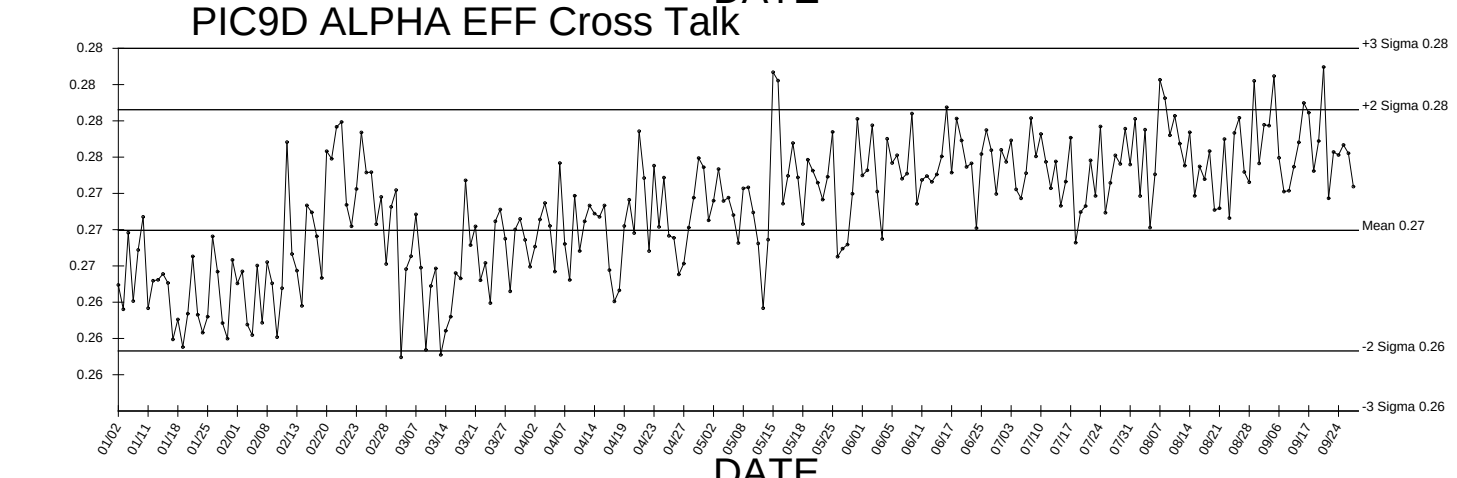
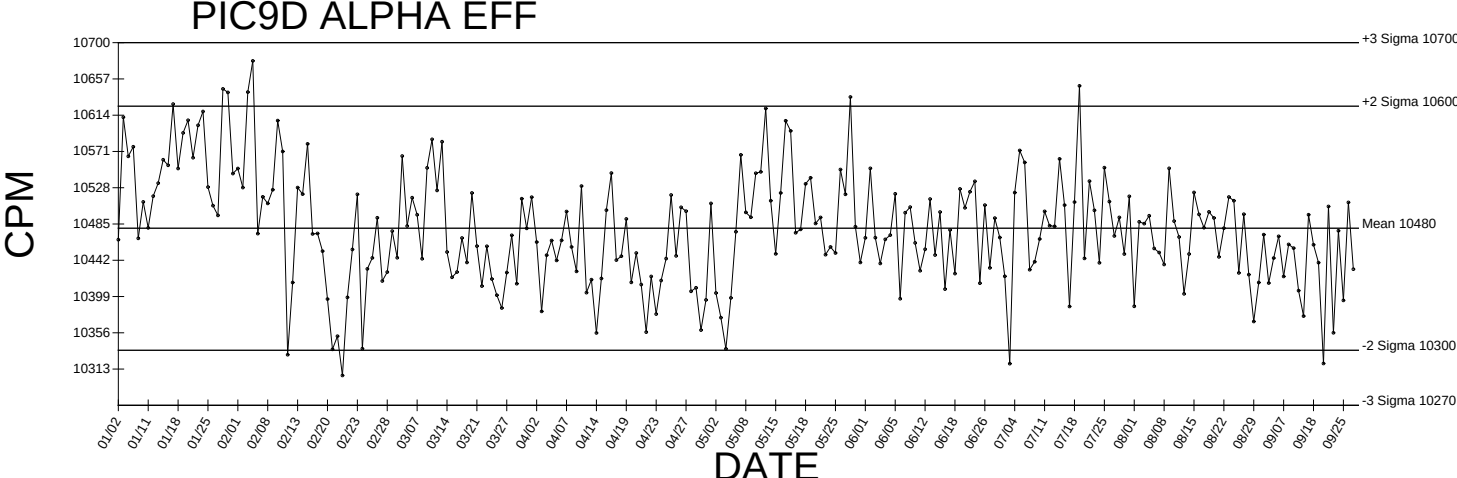
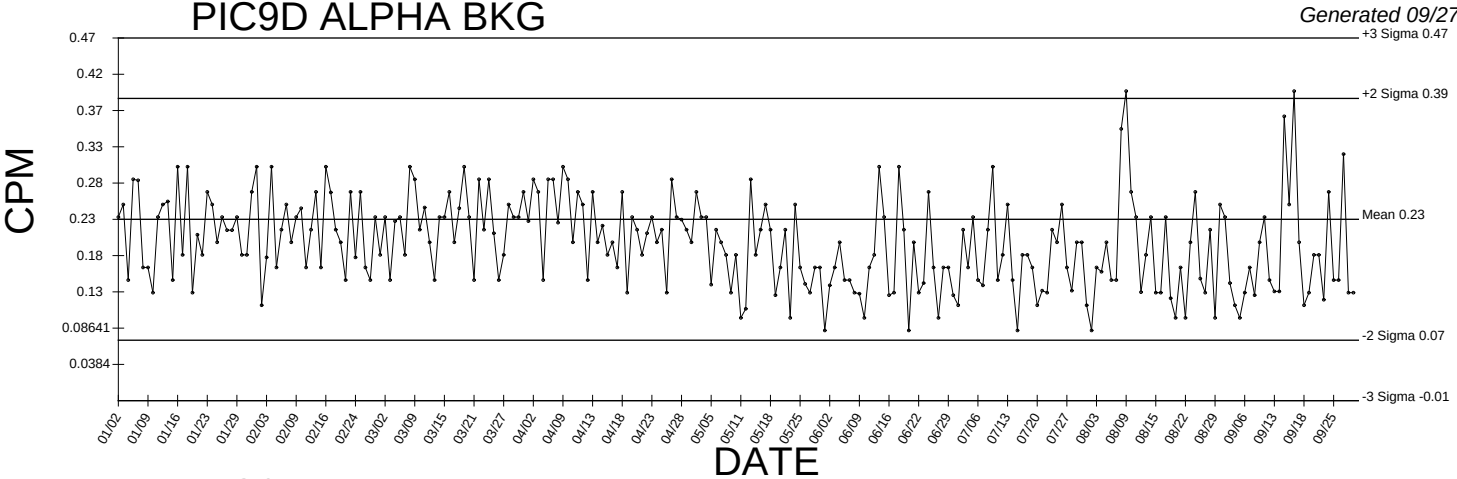
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+3 Sigma 22110



PIC9B BETA EFF Cross Talk

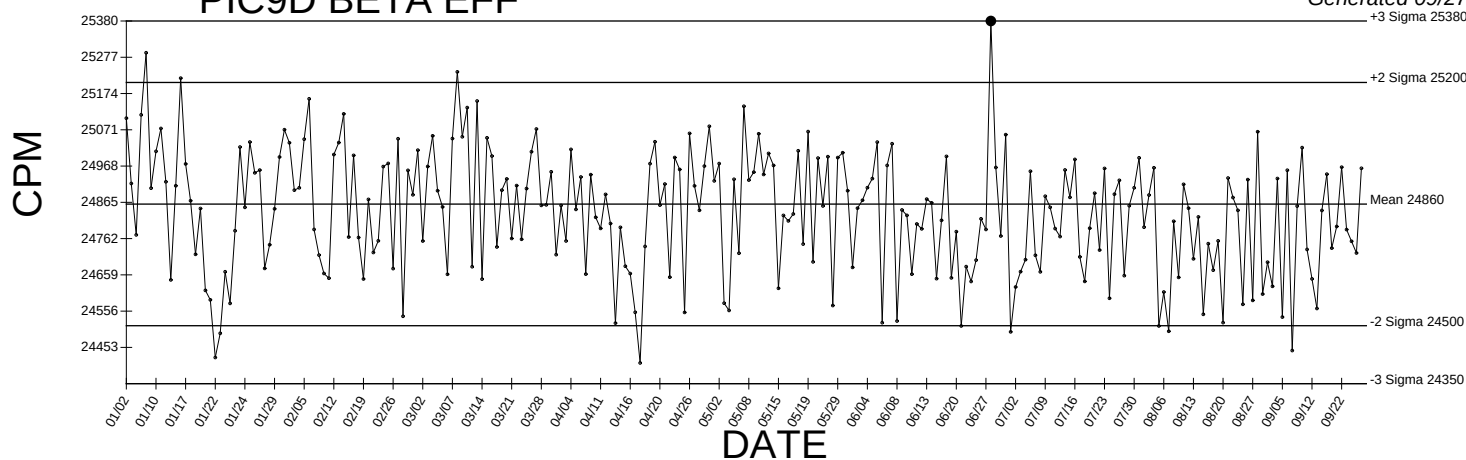


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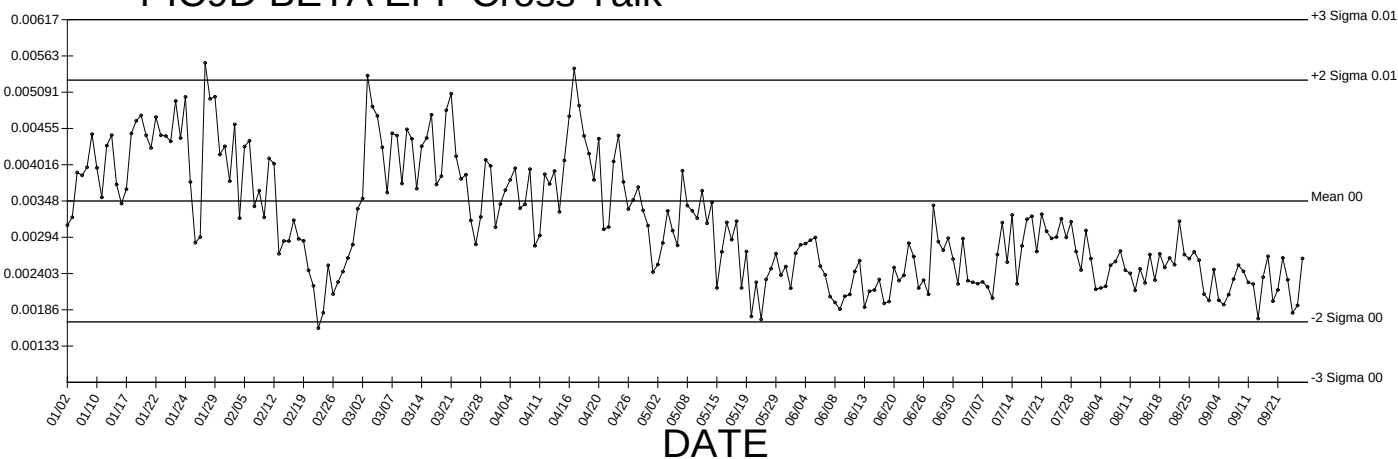


PIC9D BETA EFF

Generated 09/27/2018



PIC9D BETA EFF Cross Talk



● Denotes Outlier

RAD Standards Traceability



National Institute of Standards & Technology

Certificate

Standard Reference Material 4251C Barium-133 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation:

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
October 1994

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have an acid concentration and a carrier concentration comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4251C
(Certified values are shown in bold type)

(Certified values are shown in bold type)

Source identification number	NIST SRM 4251C		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.015 ± 0.002) g·mL ⁻¹ at 22.1 °C [b]*		
Solution mass	(5.054 ± 0.001) g [b]		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O	54	0.96
	HCl	1.0	0.04
	BaCl ₂	6×10^{-4}	1.2×10^{-4}
	¹³³ BaCl ₂	4×10^{-7}	8×10^{-8}
Radiological Properties:			
Radionuclide	Barium-133		
Reference time	1200 EST, 1 September 1993		
Massic activity of the solution [c] (Activity per unit mass of solution)	4.876×10^5 Bq·g ⁻¹		
Relative expanded uncertainty (k=2)	0.52% [d]		
Photon-emitting impurities	None detected [e]		
Half-lives used	Barium-133: (10.52 ± 0.13) a [f]		
	Radium-226: (1600 ± 7) a [f]		
Measuring instrument	Pressurized ⁴ πγ ionization chamber. A calibrated using a barium-133 solution whose activity was determined by 4π(e+X)-γ-anticoincidence counting		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [g]	Relative Sensitivity Factor, $ \partial y/\partial x_i \cdot (x_i/y)$ [h]	Relative Uncertainty Of Output Quantity, $u_c(y)/y$, (%) [i]
PIC A net response per gram of SRM 4251C, measured relative to RRS20 [j]	Standard deviation of the mean for 1000 repeated measurements (A)	0.008	1.0	0.01
PIC A background response, measured relative to RRS20	Standard deviation of the mean for >150 repeated measurements (A)	0.25	0.001 [k]	0.00
PIC A net response for RRS200, measured relative to RRS20	Standard deviation of the mean for >100 repeated measurements (A)	0.06	1.0	0.06
PIC A net response per Bq of barium-133 in solution, measured relative to RRS200.	Standard deviation of the mean for 240 repeated measurements (A)	0.02	1.0	0.02
Gravimetric measurements	Estimated (B)	0.01	1.0	0.01
Half life of barium-133 Half life of radium-226	Standard uncertainty of the half life (A)	1.24 [m] 0.44 [m]	0.004 [n] 0.004 [n]	0.00 0.00
Activity used to calibrate PIC A net response per Bq of barium-133 in solution	Standard uncertainty of the activity determined by $4\pi(\epsilon+X)$ - γ -anticoincidence counting. (B)	0.22	1.0	0.22
Live-time [p]	Estimated (B)	0.10	1.0	0.10
PIC A charge collection	Estimated (B)	0.05	1.0	0.05
Source Positioning	Estimated (B)	0.05	1.0	0.05
Photon-emitting impurities	Limit of detection for Cs-134 (B) [q]	100	0.00002	0.00
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.16
Coverage Factor, k				$\times 2$
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.32

* Notes and references are on pages 5 and 6.

NOTES

- (a) The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): 100 1.5 0.2
- (b) The stated uncertainty is two times the standard uncertainty.
- (c) **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [3].
- (d) The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.
- The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .
- The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.
- The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the **expanded uncertainty** of y .
- Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.
- For further information on the expression of uncertainties, see references [2] and [3].
- (e) Estimated limits of detection for photon-emitting impurities are:
 $600 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 12 and 75 keV,
 $150 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 84 and 379 keV, and
 $3 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 387 and 2700 keV, provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of barium-133.
- (f) The stated uncertainty is the standard uncertainty. See reference [5].
- (g) Relative standard uncertainty of the input quantity x_i .
- (h) The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y / \partial x_i| \cdot (x_i / y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y / \partial x_i| \cdot (x_i / y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- (i) Relative component of combined standard uncertainty of output quantity y , rounded to two decimal places. The relative component of combined standard uncertainty of y is given by $u_i(y) / y = |\partial y / \partial x_i| \cdot u(x_i) / y = |\partial y / \partial x_i| \cdot (x_i / y) \cdot u(x_i) / x_i$. The numerical values of $u(x_i) / x_i$, $|\partial y / \partial x_i| \cdot (x_i / y)$, and $u_i(y) / y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

- [j] The response of pressurized ionization chamber A (PIC A) is determined from measurement of the time required to collect a given amount of charge on a stable fixed capacitor. All of the response measurements in the NIST pressurized ionization chambers are made relative to the response of one or more artifact standards. These artifact standards consist of microgram quantities of aged radium-226 in small welded stainless-steel capsules. These capsules are encapsulated in plastic rods whose dimensions are similar to those of the standard NIST ampoule. The artifact standards are called **Radium Reference Sources** and are designated as RRSx, where x is the nominal mass (in micrograms) of radium-226 in the capsule.
- [k] $|\partial y / \partial x_i| \cdot (x_i / y) = (\text{average background response}) / (\text{average net sample response})$
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y / \partial x_i| \cdot (x_i / y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i) / x_i = 100\%$. $|\partial y / \partial x_i| \cdot (x_i / y) = \{(\text{response per Bq of impurity}) / (\text{response per Bq of Ba-133})\} \cdot \{(\text{Bq of impurity}) / (\text{Bq of Ba-133})\}$. Thus $u(y) / y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] Evaluated Nuclear Structure Data File (ENSDF), April 1994.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	0487
Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL
Reference Date:	09/01/1993
Ampoule Mass (g):	5.054 g
Uncertainty:	+/- .26 %
LogBook No:	RC S 035 002

A Solution Material Info		
Isotope:	Barium-133	
Prepared By:	Angela Johnson	
Prep Date:	10/31/2002	
Verification Date:	11/08/2017	
Expiration Date:	11/08/2018	
Primary Code:	0487-A	
Dilution(mL):	100 mL	
Mass of Parent(g):	4.7696 g	
Density(g/mL):	0.9984	Balance ID:

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (100 \text{ mL}) = 1395394.1760 \text{ dpm/mL}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (0.9984 \text{ g/mL}) / (100 \text{ mL}) = 1397609.3930 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
12/18/2015	Gregory Ramsay	15.0062	1000	0487-B	20972.806 dpm/mL	11/18/2016	11/18/2017
01/17/2017	Bethany Fiem	15.1795	1000	0487-C	21215.0117 dpm/mL	01/17/2017	01/17/2018
11/08/2017	Bethany Fiem	15.5573	1000	0487-D	21708.5658 dpm/mL	11/08/2017	11/08/2018

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ba-133 Standard 0487-D

Assignment	BLUE
Analyst	RPZ
Verification Prep Date	

Standard Information	
Isotope	Ba-133
Stock Number	
Source Value	0.500E+03 D
Recovery Date	
Ref Act (DPM/mL)	
Amount of Std. Unit	
Standard Prep Date	

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1				
2				
3				

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	5668.75	0.818570	6927.5	4497.1
2	3622.28	0.818570	4426.93	4628.58
3	3625.44	0.818570	4431.90	4431.9

Mean Value = 4460.14
 Stdev = 1.02933E+06
 Certificate Value* = 4467.7
 Two sigma = 34.165
 10 % of Mean = 446.014
 Rule A (Pass/Fail) Pass
 % Recovery 109.747
 Rule B (Pass/Fail) Pass
 Expiration Date 11-8-2018

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value

* Certificate Value is decay corrected to Count Date.

The analyst prepared three standard verification sources for Ba-133 source 0487-D by transferring 1 mL portions of the standard into 5 assay vials containing vials 10 mL of Econcent Ultra liquid scintillation cocktail and the vials were shaken to mix. A blank vial was prepared in a similar fashion using 10 mL of Econcent Ultra liquid scintillation cocktail. The standard verification vials and blank vial source were dark adapted for at least two hours and counted on LSCELE for Ba-133 source standard verification. The Ba-133 efficiency calibration which was used for verification calculations was performed on 11-26-17 using Ba-133 source 1501-A.

Standard results for each verification source was calculated as follows

$$\text{Source dpm/mL} = (A - B) / (C \times D)$$

where

A = Net source cpm

B = BKG cpm

C = System efficiency (cpm/dpm), and

D = Volume used for standard verification

HA01-M-001

[Handwritten signature]



National Institute of Standards & Technology

Certificate

Received
3.11.17

Standard Reference Material[®] 4339b

1810

Radium-228 Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive radium-228 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. A unit of SRM 4339b consists of approximately 5 mL of a solution, whose composition is specified in Tables 1 and 2, contained in a flame-sealed borosilicate-glass ampoule [1].

The certified radium-228 massic activity value, at a Reference Time of 1200 EST, 07 October 2010, is:

$$(195 \pm 14) \text{ Bq}\cdot\text{g}^{-1}$$

A NIST certified value, as used within the context of this certificate, is a value for which NIST has the highest confidence in its uncertainty assessment. It is a "measurement result" [2] obtained directly or indirectly from a "primary reference measurement procedure" [3]. The certified value is traceable to the derived SI unit, Becquerel (Bq).

Additional physical, chemical, and radiological properties for this SRM, as well as details on the standardization method, are given in Tables 1 and 2. Uncertainties for the certified quantities are expanded ($k=2$). The uncertainties are calculated according to the ISO and NIST Guides [4,5]. Table 3 contains a specification of the components that comprise the uncertainty analyses.

Expiration of Certification: The certification of SRM 4339b is valid indefinitely, within the measurement uncertainty specified, provided that the SRM is handled and stored properly and that no evaporation or change in composition has occurred. The solution matrix, in an unopened ampoule, is homogeneous and stable within its half-life-dependent useful lifetime provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Handling and Storage"). Periodic recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Radiological and Chemical Hazard: Consult the Safety Data Sheet (SDS), enclosed with the SRM shipment, for radiological and chemical hazard information.

This SRM was prepared in the Physical Measurement Laboratory, Radiation and Biomolecular Physics Division, Radioactivity Group, M.P. Unterwiesing, Group Leader. The overall technical direction and physical measurement leading to certification and photon-emitting impurity analyses were provided by L. Pibida of the NIST Radioactivity Group, with production assistance by J. LaRosa, R. Collé, and L. Laureano-Pérez. Alpha-emitting impurity analyses were provided by J. LaRosa.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Lisa R. Katon, Chief
Radiation and Biomolecular Physics Division

Gaithersburg, Maryland 20899
Certificate Issue Date: 14 November 2012
SRM 4339b

Robert L. Walters, Jr., Director
Office of Reference Materials

Page 1 of 4

Table 1. Certified Massic Activity of SRM 4339b

Radionuclide	Radium-228 ^{1a)}
Reference time	1200 EST, 07 October 2010
Massic activity of the solution	195 Bq g ⁻¹
Relative expanded uncertainty ($k \approx 2$)	7.2 % ^{1b)}

^{1a)} The final ²²⁸Ra purification from the ²³²Th mother solution was performed on 02 September 2010 (0920 EST).

^{1b)} The uncertainties on certified values are expanded uncertainties, $U = k u_c$. The quantity u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides [4,5]. The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ and was chosen to obtain what is assumed to be an approximate 95 % level of confidence.

Table 2. Uncertified Information of SRM 4339b

Source description	Liquid in a flame-sealed 5 mL borosilicate-glass ampoule [1]
Solution composition	1.3 mol L ⁻¹ HNO ₃ with 19.8 μg g ⁻¹ Ba ²⁺
Solution density	(1.014 ± 0.002) g mL ⁻¹ at 20.8 °C ^{1a)}
Solution mass	(5.180 ± 0.003) g ^{1b)}
Photon-emitting impurities	²²⁶ Ra: < 0.5 Bq g ^{-1b)}
Alpha-emitting impurities	²³² Th: < 0.08 Bq g ^{-1b)}
Half-lives used	²²⁶ Ra: (5.75 ± 0.04) a [6] ²²⁶ Ac: (6.15 ± 0.02) h [7] ²²⁶ Ra: (1600 ± 7) a [8] ²³² Th: (14.02 ± 0.06) × 10 ⁹ a [9]
Calibration methods (and instruments)	The certified massic activity for ²²⁶ Ra was obtained by high-resolution gamma-ray spectrometry of three master solution ampoules (eleven separate determinations), as measured on three to five different spectrometers and geometries on each ampoule, and used assumed nuclear data for probabilities per decay for 16 gamma-ray transitions. Confirmatory measurements were performed by 2πα spectrometry of ingrown ²²⁶ Ra with a planar, ion-implanted Si detector.

^{1a)} The stated uncertainty is two times the standard uncertainty. See reference 5.

^{1b)} Based on gamma-ray spectrometry of forced-fitted peak at 186.2 keV and assuming a probability per decay of 0.0355 [6].

^{1c)} The maximum ²³²Th activity concentration in ²²⁶Ra.

^{1d)} The stated uncertainty is the standard uncertainty. See reference 5.

Table 3. Uncertainty Evaluation for the Massic Activity of SRM 4339b

Uncertainty component		Assessment Type ^(a)	Relative standard uncertainty contribution on massic activity of ²²⁶ Ra (%)
1	Gamma-ray spectrometry precision; relative standard deviation of the grand mean on the average massic gamma-ray emission rates for 16 measured ²²⁶ Ac gamma-ray transitions. Each mean in the grand mean is based on 11 determinations with three sources in three to five different detectors. The uncertainty in the determination of the massic gamma-ray emission rate for any one transition in a given determination ranged from typically 0.5 % to 1.5 %. The relative standard deviation of the mean for the average of the 16 lines, for any one determination, was typically 1 %; whereas the relative standard deviation of the grand mean for the average of the 16 lines across all 11 determinations is 0.34 % ^(b) . Data passes normality test.	A	11.84
2	Uncertainty due to assumed gamma-ray probabilities per decay for the measured ²²⁶ Ac transitions [7]. The uncertainty on each transition has a shared (correlated) component of 2.5 % (see comments in [7]).	B	3.5
3	Detection efficiencies not embodied within component 1	B	0.4
4	Mass determinations for dilution factors and counting source preparations	B	0.1
5	Decay corrections for ²²⁶ Ra half-life uncertainty of 0.7 % [6]	B	0.003
6	Effect of ²²⁶ Ra and ²²⁶ Ac half-life uncertainties on secular equilibrium ratio	B	0.02
Relative combined standard uncertainty			3.6
Relative expanded uncertainty (k = 2)			7.2

^(a) Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^(b) Average massic gamma-ray emission rates of 11 geometries (R_g) for 16 measured ²²⁶Ac gamma-ray transitions with their respective energy (E_γ); assumed gamma-ray probabilities per decay (P_γ) and standard deviation of the mean (S_m).

E_γ (keV)	Assumed P_γ (%) [1]	Mean R_g (s ⁻¹ g ⁻¹) ^(a)	S_m (%) ^(b)
129.065	2.50	1347	0.38
153.967	0.754	421.6	0.40
219.249	3.97	2264	0.55
270.245	3.55	2014	0.73
328.084	3.04	1822	0.43
378.52	12.4	6712	0.43
409.46	2.02	1185	0.29
463.062	4.45	2645	0.33
755.313	1.03	593.3	0.46
772.291	1.52	599.2	0.53
794.942	4.31	2588	0.35
835.704	1.7	945.3	0.42
911.396	26.2	15609	0.29
964.786	4.99	3067	0.35
968.96	15.9	9582	0.30
1588.2	5.06	1889	0.28

(a) Grand mean for $n = 11$ determinations with three sources in three to five different detectors.

(b) Relative standard deviation of the grand mean on R_g for $n = 11$.

INSTRUCTIONS FOR HANDLING AND STORAGE

Handling: If the ampoule is transported, it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of both the radioactivity and the strong acid. The ampoule should be opened only by persons qualified to handle both radioactive material and alkaline and/or acidic solutions. Appropriate shielding and/or distance should be used to minimize personnel exposure. Refer to SDS for further information.

Storage: SRM 4339b should be stored and used at a temperature between 5 °C and 65 °C. The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material.

REFERENCES

- [1] NIST Physical Measurement Laboratory; *Storage and Handling of Radioactive Standard Reference Materials, Ampoule Specifications and Opening Procedure*, available at <http://www.nist.gov/pml/div682/gsp04/srm.cfm> (accessed Nov 2012). Note: This SRM is contained in a generic borosilicate-glass ampoule and not in the standard NIST ampoule.
- [2] JCGM 200:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 19 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [3] JCGM 100:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 18 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2012.pdf (accessed Nov 2012).
- [4] JCGM 100:2008: *Guide to the Expression of Uncertainty in Measurement*; (ISO GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Nov 2012).
- [5] Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/> (accessed Nov 2012).
- [6] Luca, A.; June 2009, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [7] Pearce, A.; January 2010, ^{228}Ac . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ac-228_tables.pdf (accessed Nov 2012).
- [8] Christé, V. and M.M. Bé; December 2006, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [9] Arino, A.; September 2008, ^{232}Th . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Th-232_tables.pdf (accessed Nov 2012).

Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program; telephone (301) 975-2200; fax (301) 948-3710; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.



Standard Traceability Log Rad

Source Material Info		A Solution Material Info			
Parent Code:	1810	Isotope:	Radium-228 SPIKE		
Prepared By:	Tim Chandler	Prepared By:	Bethany Fiem		
Carrier Conc:	1.3M HNO ₃	Prep Date:	05/23/2018		
Reference Date:	10/07/2010	Verification Date:	05/23/2018		
Ampoule Mass (g):	5.18 g	Expiration Date:	05/23/2019		
Uncertainty:	+/- 3.6 %	Primary Code:	1810-A		
LogBook No:	GL-CED-297-103	Dilution(mL):	200 mL		
		Mass of Parent(g):	5.1447 g		
		Density(g/mL):	1.0178	Balance ID:	B733529066

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (200 \text{ mL}) = 300.9650 \text{ dpm/mL}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (1.0178 \text{ g/mL}) / (200 \text{ mL}) = 295.7015 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-228 Standard

1810-A

Jar

4/1/12
MJE
5/23/2010

Isotope	Result
Ra-228	pCi/L
Ra-228 N1	29340
Ra-228 N2	28310
Ra-228 N3	29320

Mean Value (Counting) =
Stdev =

107.165

Rule B (Pass/Fail)

* Exception: taken due to the high uncertainty of the certified value

Certificate Value =
Two sigma =
10 % of Mean =
Rule A (Pass/Fail)

27714.0
547.0656436
2905.666667
Pass

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

27714.0
547.0656436
2905.666667
Pass

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1802264

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
459187004	SAMPLE	JXC9	PIC1A	SEP-27-18 09:11:42	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187005	SAMPLE	JXC9	PIC1B	SEP-27-18 09:11:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187006	SAMPLE	JXC9	PIC1C	SEP-27-18 09:11:49	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187007	SAMPLE	JXC9	PIC2A	SEP-27-18 09:11:54	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187008	SAMPLE	JXC9	PIC2C	SEP-27-18 09:11:58	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187009	SAMPLE	JXC9	PIC3C	SEP-27-18 09:12:02	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187010	SAMPLE	JXC9	PIC3D	SEP-27-18 09:12:10	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187011	SAMPLE	JXC9	PIC4A	SEP-27-18 09:13:03	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193001	SAMPLE	JXC9	PIC4B	SEP-27-18 09:13:05	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193002	SAMPLE	JXC9	PIC4C	SEP-27-18 09:13:07	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193003	SAMPLE	JXC9	PIC4D	SEP-27-18 09:13:10	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193004	SAMPLE	JXC9	PIC5A	SEP-27-18 09:13:16	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193005	SAMPLE	JXC9	PIC5B	SEP-27-18 09:13:21	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193006	SAMPLE	JXC9	PIC5D	SEP-27-18 09:13:22	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204113227	LCS	JXC9	PIC11B	SEP-27-18 09:20:33	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459193007	SAMPLE	JXC9	PIC6A	SEP-27-18 09:21:27	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204113223	MB	JXC9	PIC6B	SEP-27-18 09:21:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204113224	DUP	JXC9	PIC6C	SEP-27-18 09:21:44	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204113225	MS	JXC9	PIC9B	SEP-27-18 09:21:52	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204113226	MSD	JXC9	PIC9D	SEP-27-18 09:21:56	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187001	SAMPLE	JXC9	LB4100A1	SEP-27-18 09:25:47	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187002	SAMPLE	JXC9	LB4100A2	SEP-27-18 09:25:48	DONE	CeF on 25mm Filter	01-JUN-17 00:00
459187003	SAMPLE	JXC9	LB4100A3	SEP-27-18 09:25:48	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1802180 Check-list

This check-list was completed on 27-SEP-18 by Elizabeth Krouse

This batch was reviewed by Elizabeth Krouse on 27-SEP-18 and Lyndsey Pace on 27-SEP-18.

Batch ID:
1802180

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?		No	
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Radium-226 Queue Sheet

17-SEP-18

GEI Laboratories, Radiochemistry Division

Batch #: 1802180

Analyst: PCW

First Client Due Date: 10/09/2018

Internal Due Date: 10/05/2018

Spike Isotope: Radium-226 Spike Code: 1715A

Expiration Date: 12/16/18

Vol: 0.1

End Initial/Degas Date/Time: 9/24/18

L'CN Isotope: Radium-226 L'CN Code: 1715B

Expiration Date: 12/16/18

Vol: 0.1

End L'N Decont Date: 9/24/18

Bkg Count Time: 20 (Min)

Sample Count Time: 30 (Min)

Start Count Date: 9/24/18

Prep Date: 9/24/18

Pipet ID: 2-60-953

Balance ID: 1806255

Initials: PLW

Witness: H/O

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDI	Client	Position (Label)	Aspirated (mL or g)	End L'N Decont Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
459187001-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	1	500	0536	0920	105	1	7	10
459187002-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	2	500	0536	0920	204	2	6	11
459187003-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	3	500	0536	0920	307	3	7	13
459187004-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	4	500	0536	0920	408	4	7	9
459187005-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	5	500	0536	0920	507	5	7	20
459187006-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	6	500	0536	0920	607	6	7	23
459187007-1	MW-2	SAMPLE		GROUNDWATER	1.5	LANC006	7	500	0536	0920	701	7	7	44
459187008-1	MW-3	SAMPLE		GROUNDWATER	1.5	LANC006	8	500	0536	0920	801	8	4	9
459187009-1	MW-4	SAMPLE		GROUNDWATER	1.5	LANC006	9	500	0536	0920	901	9	5	5
459187010-1	FILE 09052018	SAMPLE		GROUNDWATER	1.5	LANC006	10	500	0536	0920	1002	10	5	6
459187011-1	FILE 09062018	SAMPLE		GROUNDWATER	1.5	LANC006	11	500	0536	0920	1101	11	7	5
459197001-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	12	500	0536	0920	1201	12	7	10
459197002-1	MW-2	SAMPLE		GROUNDWATER	1.5	LANC006	13	500	0536	0920	1301	13	2	11
459197003-1	MW-2	SAMPLE		GROUNDWATER	1.5	LANC006	14	500	0536	0920	1404	14	6	11
459197004-1	MW-3	SAMPLE		GROUNDWATER	1.5	LANC006	15	500	0536	0920	1501	15	5	16
459197005-1	MW-1	SAMPLE		GROUNDWATER	1.5	LANC006	16	500	0536	0920	1601	16	6	11
459197006-1	MW-3	SAMPLE		GROUNDWATER	1.5	LANC006	17	500	0536	0920	1701	17	1	23
459197007-1	FILE 09092018	SAMPLE		GROUNDWATER	1.5	LANC006	18	500	0536	0920	1801	18	6	4
1204113013-1	MIS for batch 1802180	MIS		GROUNDWATER	1.5	QC ACCOUNT	19	500	0620	1630	1901	19	8	6
1204113014-1	MW-8, 459187001(MS1)	MIS		GROUNDWATER	1.5	QC ACCOUNT	20	500	0620	1630	2002	20	2	19
1204113015-1	MW-8, 459187001(MS1)	MIS		GROUNDWATER	1.5	QC ACCOUNT	21	100	0620	1630	2101	21	8	699
1204113016-1	MW-8, 459187001(MS1)	MIS		GROUNDWATER	1.5	QC ACCOUNT	22	100	0620	1630	2201	22	8	673
1204113017-1	L'CN for batch 1802180	L'CN		GROUNDWATER	1.5	QC ACCOUNT	23	500	0620	1630	2301	23	7	586

Comments:

Data Reviewed By:

Page 1 of 1

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1802180
Analyst : PCW
Prep Date : 9/24/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Half-life of Ra-226 : 1600 years
Ra-226 Abundance : 1.00
Half-life of Rn-222 : 3.8235 days
Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Background Counts	Background CPM	Count Time (min.)	Cell Efficiency (cpm/dpm)
1	459187001.1	0.5000	2.0256E-05	9/5/2018 11:30	105	30	10	0.333	7	0.233	30	2.0440
2	459187002.1	0.5000	2.0256E-05	9/5/2018 11:40	204	30	11	0.367	6	0.200	30	2.0820
3	459187003.1	0.5000	2.0256E-05	9/5/2018 13:00	307	30	13	0.433	2	0.067	30	1.8050
4	459187004.1	0.5000	2.0256E-05	9/5/2018 13:30	408	30	9	0.300	2	0.067	30	1.8510
5	459187005.1	0.5000	2.0256E-05	9/5/2018 14:40	507	30	28	0.933	5	0.167	30	1.9970
6	459187006.1	0.5000	2.0256E-05	9/6/2018 9:55	607	30	33	1.100	2	0.067	30	2.1300
7	459187007.1	0.5000	2.0256E-05	9/6/2018 10:00	701	30	44	1.467	2	0.067	30	1.9520
8	459187008.1	0.5000	2.0256E-05	9/6/2018 11:55	801	30	9	0.300	4	0.133	30	1.7120
9	459187009.1	0.5000	2.0256E-05	9/6/2018 12:00	106	30	5	0.167	8	0.267	30	2.1070
10	459187010.1	0.5000	2.0256E-05	9/5/2018 14:00	202	30	6	0.200	5	0.167	30	1.8580
11	459187011.1	0.5000	2.0256E-05	9/6/2018 12:30	301	30	5	0.167	3	0.100	30	1.8290
12	459193001.1	0.5000	2.0256E-05	9/4/2018 11:25	401	30	10	0.333	7	0.233	30	1.9020
13	459193002.1	0.5000	2.0256E-05	9/4/2018 11:30	505	30	11	0.367	3	0.100	30	1.5140
14	459193003.1	0.5000	2.0256E-05	9/4/2018 13:30	604	30	11	0.367	6	0.200	30	2.0460
15	459193004.1	0.5000	2.0256E-05	9/4/2018 13:50	705	30	10	0.333	8	0.267	30	1.9830
16	459193005.1	0.5000	2.0256E-05	9/4/2018 15:45	805	30	11	0.367	6	0.200	30	1.9810
17	459193006.1	0.5000	2.0256E-05	9/4/2018 15:50	203	30	23	0.767	1	0.033	30	1.8290
18	459193007.1	0.5000	2.0256E-05	9/4/2018 13:15	306	30	4	0.133	6	0.200	30	1.7820
19	1204113013.1	0.5000	2.0256E-05	9/24/2018 0:00	402	30	6	0.200	8	0.267	30	2.0200
20	1204113014.1	0.5000	2.0256E-05	9/5/2018 11:30	503	30	19	0.633	3	0.100	30	1.9410
21	1204113015.1	0.1000	1.1370E-05	9/5/2018 11:30	601	30	699	23.300	8	0.267	30	1.9080
22	1204113016.1	0.1000	1.1370E-05	9/5/2018 11:30	706	30	673	22.433	8	0.267	30	1.9130
23	1204113017.1	0.5000	2.0256E-05	9/24/2018 0:00	806	30	586	19.533	2	0.067	30	1.9730

RA1802180.xls

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-008
Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
9.300%	5/1/2018	4/30/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
1.700%	8/1/2018	7/31/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
6.300%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
7.000%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
5.300%	6/1/2018	5/31/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
2.900%	7/1/2018	6/30/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
1.900%	11/1/2017	10/31/2018	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
3.700%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:36	9/27/2018 9:20	0.404	0.972	1.002	1.000
4.700%	5/1/2018	4/30/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
9.300%	8/1/2018	7/31/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
8.200%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
0.500%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
4.000%	6/1/2018	5/31/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
1.700%	7/1/2018	6/30/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
2.700%	11/1/2017	10/31/2018	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
3.100%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 5:58	9/27/2018 9:55	0.406	0.971	1.002	1.000
9.900%	8/1/2018	7/31/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
3.900%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
1.600%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
8.100%	6/1/2018	5/31/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
8.500%	7/1/2018	6/30/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
3.000%	11/1/2017	10/31/2018	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000
6.000%	3/1/2018	2/28/2019	9/24/2018 9:00	9/27/2018 6:20	9/27/2018 10:30	0.408	0.969	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1715-D

Spike Exp Date : 12/19/2018

Spike Activity (dpm/ml): 288.43

Spike Volume Added: 0.10

LCS S/N : 1715-D

LCS Exp Date : 12/19/2018

LCS Activity (dpm/ml): 288.43

LCS Volume Added: 0.10

Results																
	Decision Level	Critical Level	Required MDA	MDA	Sample Act. Conc.	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty	2 SIGMA Total Prop. Uncertainty	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
Pos.	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	%	CPM	CPM	pCi/L	pCi/L						
1	0.3264	0.2305	1	0.5732	0.1123	137.75%	0.1000	0.1374	0.3026	0.3037		SAMPLE				
2	0.2967	0.2095	1	0.5292	0.1838	82.48%	0.1667	0.1374	0.2970	0.2983		SAMPLE				
3	0.1976	0.1395	1	0.4062	0.4664	35.77%	0.3667	0.1291	0.3218	0.3338		SAMPLE				
4	0.1927	0.1360	1	0.3961	0.2894	47.89%	0.2333	0.1106	0.2688	0.2749		SAMPLE				
5	0.2824	0.1993	1	0.5137	0.8814	25.53%	0.7667	0.1915	0.4315	0.4591		SAMPLE				
6	0.1674	0.1182	1	0.3442	1.1138	19.30%	1.0333	0.1972	0.4166	0.4510		SAMPLE				
7	0.1827	0.1290	1	0.3756	1.6466	16.26%	1.4000	0.2261	0.5212	0.5761		SAMPLE				
8	0.2946	0.2080	1	0.5501	0.2235	72.21%	0.1667	0.1202	0.3159	0.3180		SAMPLE				
9	0.3377	0.2384	1	0.5855	-0.1087	120.28%	-0.1000	0.1202	0.2561	0.2561		SAMPLE				
10	0.3027	0.2137	1	0.5508	0.0411	331.79%	0.0333	0.1106	0.2671	0.2673		SAMPLE				
11	0.2382	0.1682	1	0.4616	0.0835	141.66%	0.0667	0.0943	0.2314	0.2321		SAMPLE				
12	0.3499	0.2471	1	0.6145	0.1204	137.44%	0.1000	0.1374	0.3244	0.3248		SAMPLE				
13	0.2878	0.2032	1	0.5576	0.4034	46.94%	0.2667	0.1247	0.3698	0.3757		SAMPLE				
14	0.3012	0.2126	1	0.5372	0.1866	82.48%	0.1667	0.1374	0.3015	0.3028		SAMPLE				
15	0.3588	0.2533	1	0.6221	0.0770	212.15%	0.0667	0.1414	0.3201	0.3204		SAMPLE				
16	0.3111	0.2196	1	0.5548	0.1927	82.52%	0.1667	0.1374	0.3114	0.3129		SAMPLE				
17	0.1372	0.0969	1	0.3187	0.9161	24.37%	0.7333	0.1633	0.3998	0.4571		SAMPLE				
18	0.3450	0.2435	1	0.6153	-0.0855	158.16%	-0.0667	0.1054	0.2649	0.2650		SAMPLE				
19	0.3514	0.2481	1	0.6093	-0.0754	187.09%	-0.0667	0.1247	0.2765	0.2766		MB				
20	0.2239	0.1581	1	0.4339	0.6278	30.41%	0.5333	0.1563	0.3607	0.3851	459187001.1	DUP	139.3%	2.0602		
21	1.8601	1.3133	1	3.2252	137.9113	9.33%	23.0333	0.8863	10.4013	32.1309	459187001.1	MS			129.9275	106.1%
22	1.8552	1.3098	1	3.2168	132.3753	4.94%	22.1667	0.8699	10.1816	23.0083	459187001.1	MSD	4.1%	0.2746	129.9275	101.9%
23	0.1799	0.1270	1	0.3698	22.5427	7.30%	19.4667	0.8083	1.8346	4.5807		LCS			25.9849	86.8%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 27-SEP-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	07:20	1	1.27E+05	126753	-2.18		
LUCAS2	EFF	07:20	1	1.33E+05	133112	2.01		
LUCAS3	EFF	07:20	1	1.38E+05	138045	-1.4		
LUCAS4	EFF	07:20	1	1.32E+05	131528	-0.13		
LUCAS5	EFF	07:20	1	1.35E+05	134865	0.77		
LUCAS6	EFF	07:20	1	1.34E+05	133948	-0.78		
LUCAS7	EFF	07:20	1	1.42E+05	142440	1.63		
LUCAS8	EFF	07:20	1	1.37E+05	137481	-0.55		

Reviewed by:

Lyndsey Pace

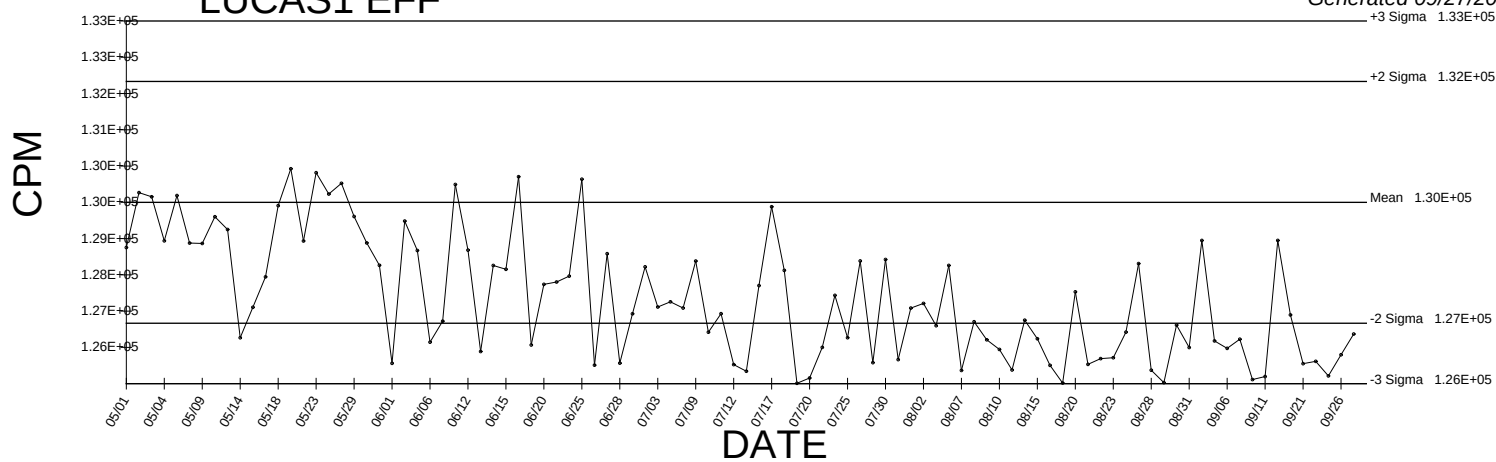
Date: 27-SEP-18

GEL Laboratories LLC

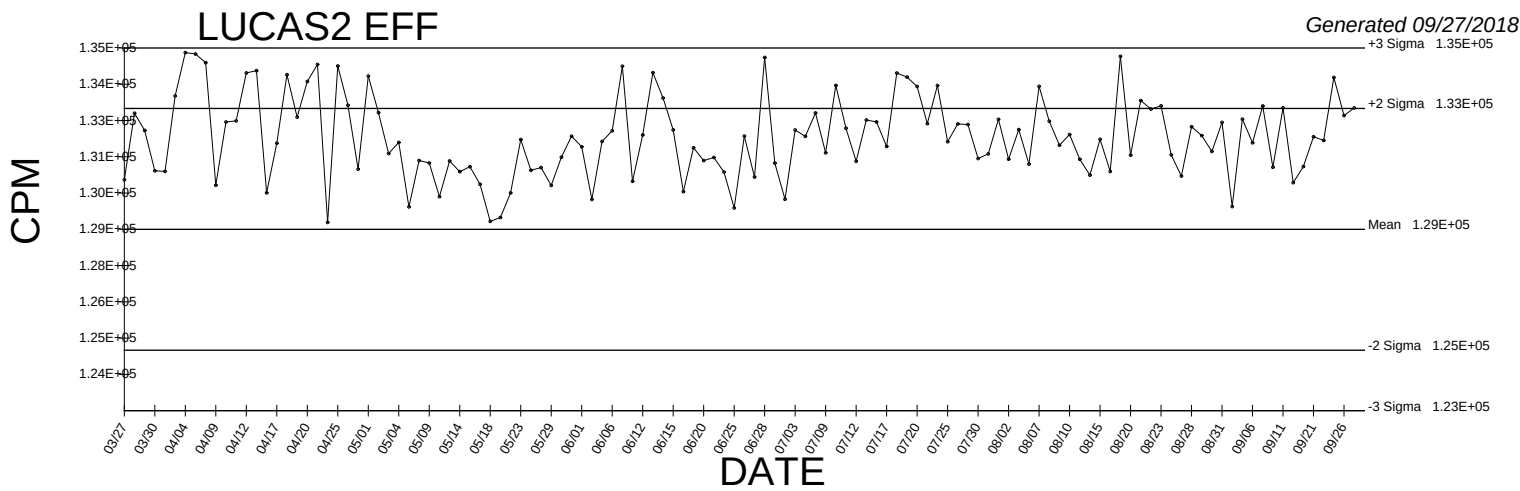
Efficiency Data

LUCAS1 EFF

Generated 09/27/2018



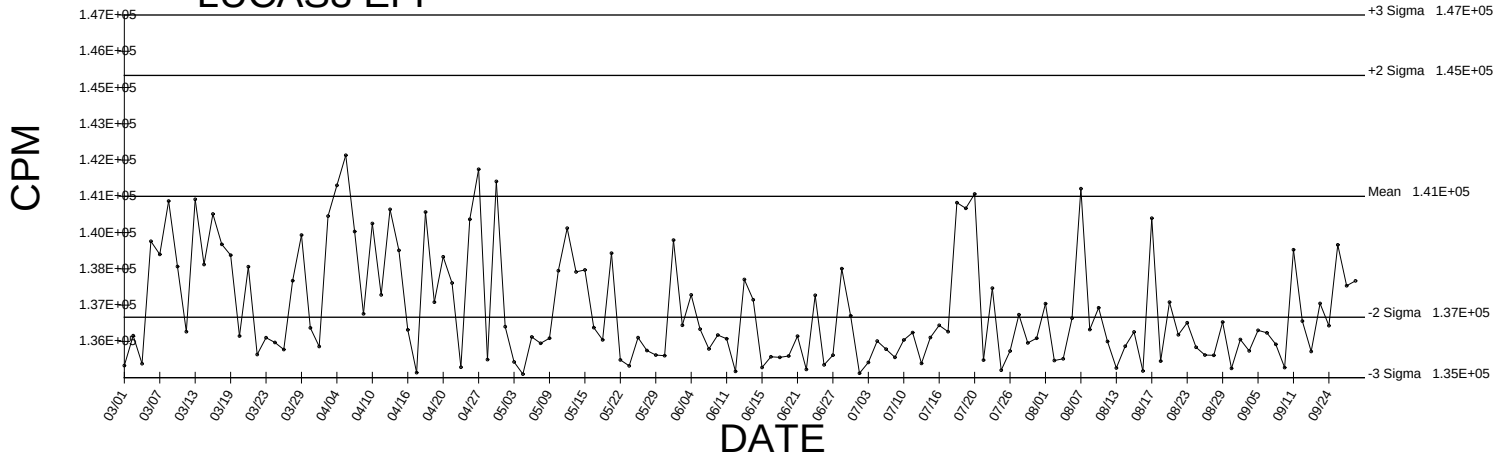
● Denotes Outlier



● Denotes Outlier

LUCAS3 EFF

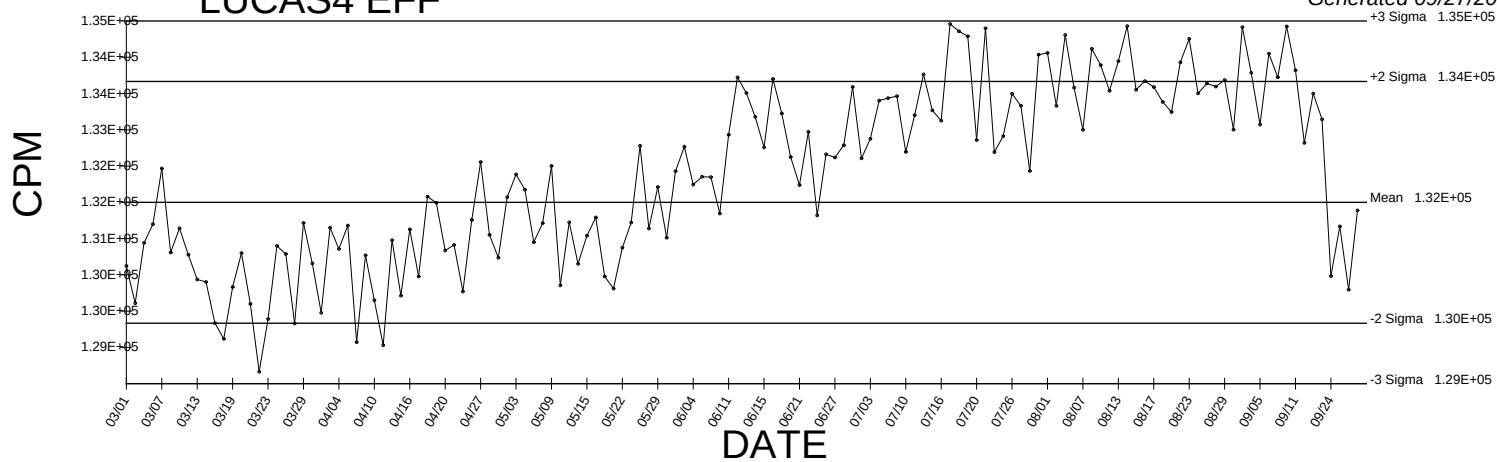
Generated 09/27/2018



● Denotes Outlier

LUCAS4 EFF

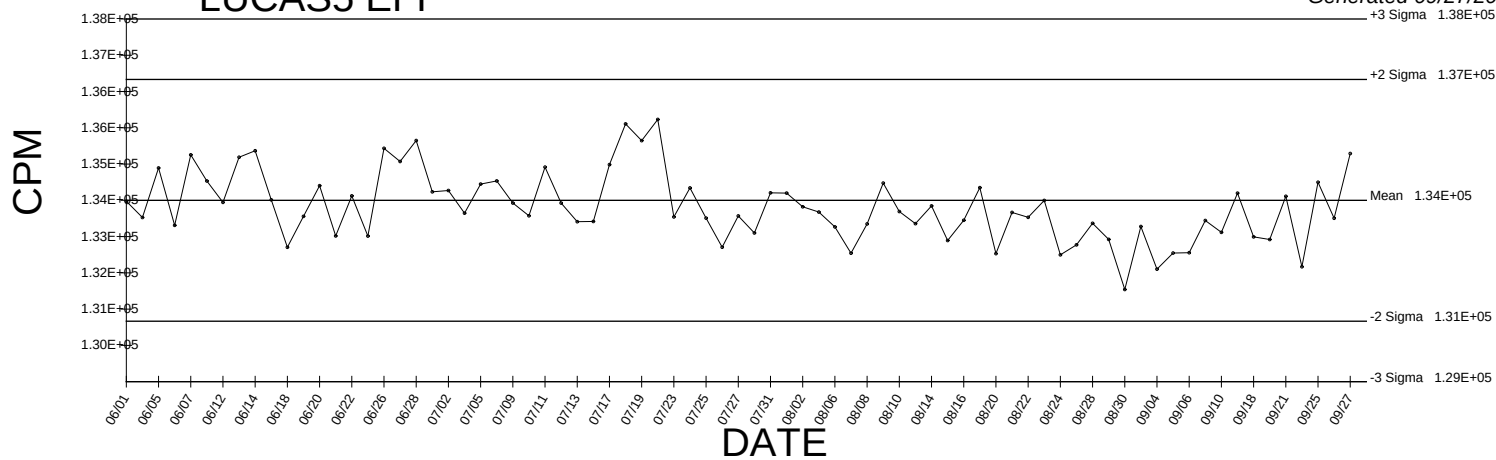
Generated 09/27/2018



● Denotes Outlier

LUCAS5 EFF

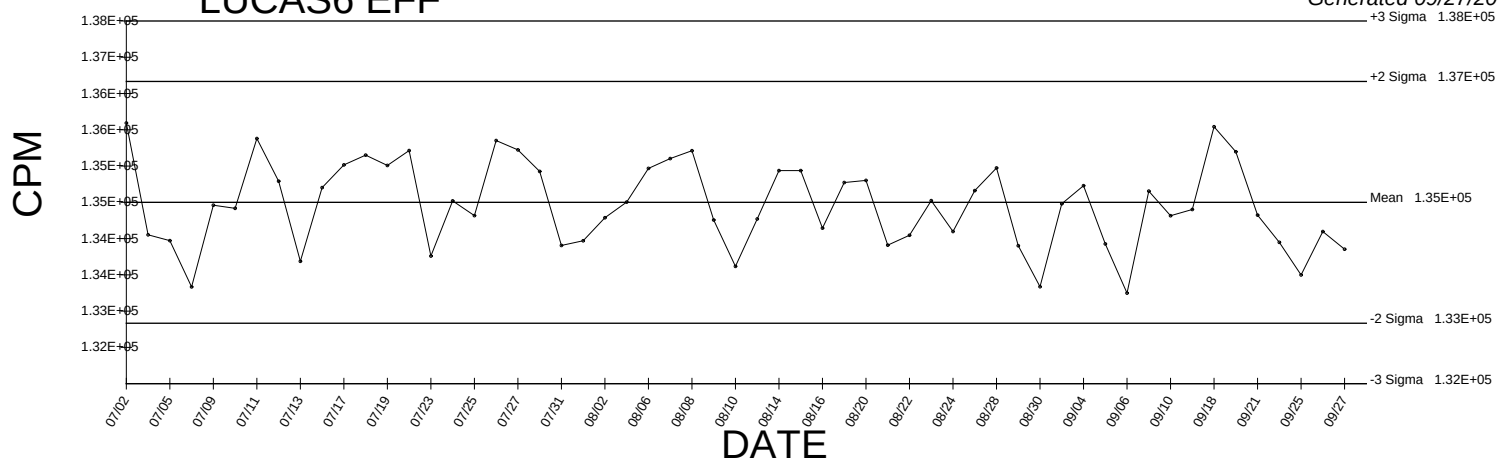
Generated 09/27/2018



● Denotes Outlier

LUCAS6 EFF

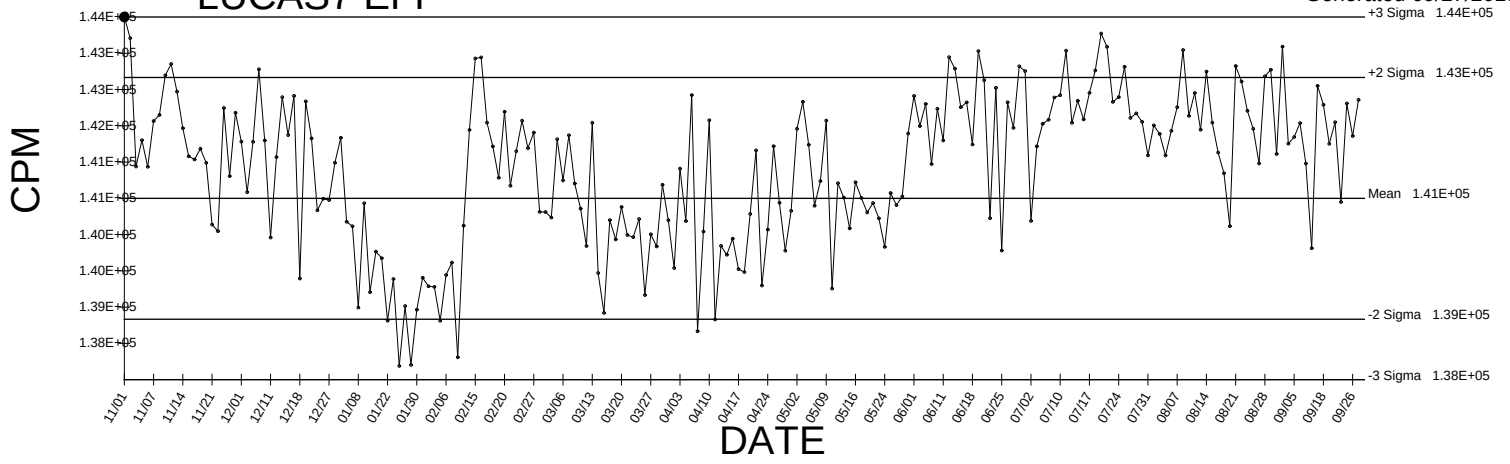
Generated 09/27/2018



● Denotes Outlier

LUCAS7 EFF

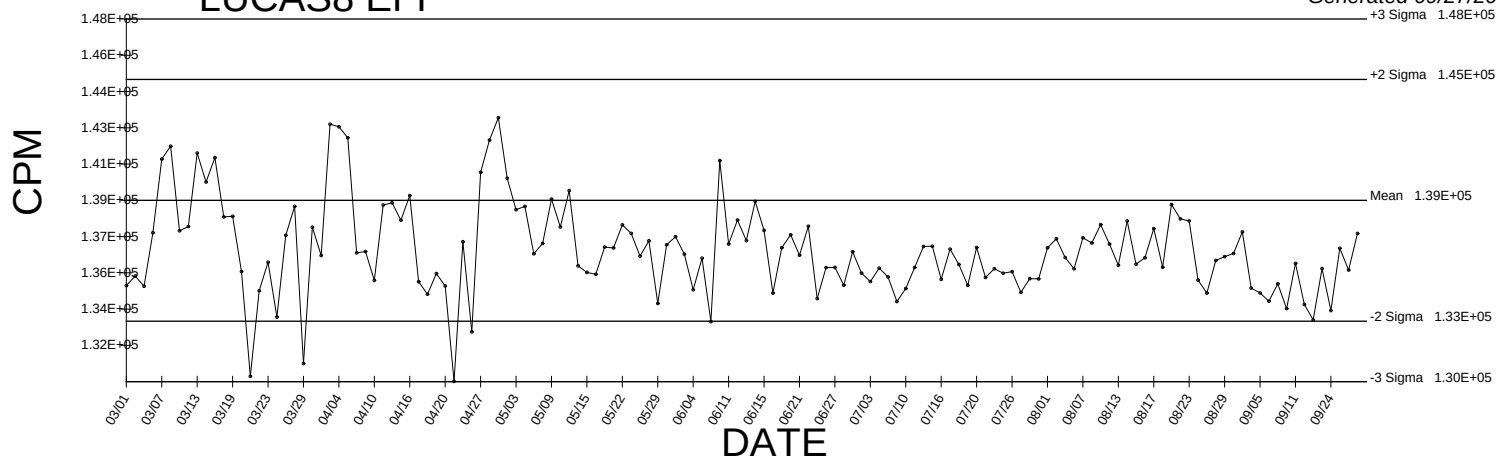
Generated 09/27/2018



● Denotes Outlier

LUCAS8 EFF

Generated 09/27/2018



● Denotes Outlier

RAD Standards Traceability



Eckert & Ziegler

Analytics

1100 Peachard Industrial Blvd.
Atlanta, Georgia 30318
Tel: 404-352-8677
Fax: 404-352-2817
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

1215

98307

Ra-226 5 mL Liquid in Flame Sealed Vial

Customer: GEL Laboratories, LLC

P.O. No.: GEL 1409800, Item 7

Product Code: 8825

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked by germanium gamma ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.19, Revision 2, July 2007, and compliance with ANSI N42.22-1989, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Delfray Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty ^a , %			Reference Date (12:00 PM EST)
			σ_A	σ_b	U	
Ra-226	5.844E+05	3.576E+04	1.0	2.1	4.7	09/09/2014

^aUncertainty: U = Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities (other than decay products) < 0.1%.

5.02193 g 0.1M HCl solution with approximately 30 $\mu\text{g/g}$ Ba carrier.

Source Prepared by:

R. Ormsby
R. Ormsby, Radiochemist

QC Approved:

L. Trivelpiece
L. Trivelpiece, Nuclear Metrologist

Date: 9 Sep 14

[Signature]





Standard Traceability Log Rad

Source Material Info	
Parent Code:	1715
Prepared By:	Gregory Ramsay
Carrier Conc:	0.1M HCl
Reference Date:	09/09/2014
Ampoule Mass (g):	5.02193 g
Uncertainty:	+/- 2.35 %
LogBook No:	GL-CED-297-008

A Solution Material Info			
Isotope:	Radium-226		
Prepared By:	Gregory Ramsay		
Prep Date:	07/06/2016		
Verification Date:	02/08/2017		
Expiration Date:	02/08/2018		
Primary Code:	1715-A		
Dilution(mL):	100 mL		
Mass of Parent(g):	4.9865 g		
Density(g/mL):	0.9967	Balance ID:	C31514

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21900.3937 \text{ dpm/mL}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (0.9967 \text{ g/mL}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21972.4854 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
07/06/2016	Gregory Ramsay	2.6261	200	1715-B	288.51 dpm/ml	01/25/2017	11/10/2018
02/08/2017	Gregory Ramsay	21.96	250	1715-C	1930.063 dpm/ml	02/08/2017	02/08/2018
12/19/2017	Gregory Ramsay	2.63	200	1715-D	288.938 dpm/ml	12/19/2017	12/19/2018

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-226 Standard 1715-D

Page 2

Instrument	Yellow
Analyst	CSR
Verification Prep Date	12/18/2013

Standard Information	
Isotope	Ra-226
Serial Number	1715-D
Isotope Half-life	1600E+03 Y
Reference Date	01/01/2006
Ref Act (dpm/mL)	286.47
Amount of Std (mL)	1.0
Standard Prep Date	12/18/2013

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	12/18/2013	1715-D	1715-D	1715-D
2	12/18/2013	1715-D	1715-D	1715-D
3	12/18/2013	1715-D	1715-D	1715-D

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	59.40	0.422157	286.47	140.71
2	59.70	0.422157	286.47	141.42
3	62.30	0.422157	286.47	147.68

Mean Value =	286.47
Stddev =	1.95642063
Certificate Value* =	286.5
Two sigma =	15.171
10 % of Mean =	28.647
Rule A (Pass/Fail)	Pass
% Recovery	59.23%
Rule B (Pass/Fail)	Pass
Expiration Date	12/18/2013

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
 Rule B = The determined mean value shall be within 5% of the certificate value.

* Certificate Value is decay corrected to Count Date.

The analysis prepared three standard verification sources for Ra-226 source 1715-D by transferring 0.5 mL portions of the standard into glass liquid scintillation vials 10 mL of Ecosint Ultra liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A blank vial was prepared in a similar fashion using 10 mL of Ecosint Ultra liquid scintillation cocktail. The standard verification vials and background source were dark adapted for at least two hours and counted on LSC Yellow for Ra-226 source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 12/20/2013 using Ra-226 source 0299-1.

Standard results for each verification source was calculated as follows

$$\text{Source dpm/mL} = (A - B) / (C/D)$$

where:

- A = Ver source cpm
- B = Bkg cpm
- C = System efficiency (cpm/dpm), and
- D = volume used for standard verification

RAD-M-031

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1802180

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
459187001	SAMPLE	PCW	LUCAS1	SEP-27-18 09:20:00	DONE	Lucas Cell	01-MAY-18 00:00
459187002	SAMPLE	PCW	LUCAS2	SEP-27-18 09:20:00	DONE	Lucas Cell	01-AUG-18 00:00
459187003	SAMPLE	PCW	LUCAS3	SEP-27-18 09:20:00	DONE	Lucas Cell	01-MAR-18 00:00
459187004	SAMPLE	PCW	LUCAS4	SEP-27-18 09:20:00	DONE	Lucas Cell	01-MAR-18 00:00
459187005	SAMPLE	PCW	LUCAS5	SEP-27-18 09:20:00	DONE	Lucas Cell	01-JUN-18 00:00
459187006	SAMPLE	PCW	LUCAS6	SEP-27-18 09:20:00	DONE	Lucas Cell	01-JUL-18 00:00
459187007	SAMPLE	PCW	LUCAS7	SEP-27-18 09:20:00	DONE	Lucas Cell	01-NOV-17 00:00
459187008	SAMPLE	PCW	LUCAS8	SEP-27-18 09:20:00	DONE	Lucas Cell	01-MAR-18 00:00
459187009	SAMPLE	PCW	LUCAS1	SEP-27-18 09:55:00	DONE	Lucas Cell	01-MAY-18 00:00
459187010	SAMPLE	PCW	LUCAS2	SEP-27-18 09:55:00	DONE	Lucas Cell	01-AUG-18 00:00
459187011	SAMPLE	PCW	LUCAS3	SEP-27-18 09:55:00	DONE	Lucas Cell	01-MAR-18 00:00
459193001	SAMPLE	PCW	LUCAS4	SEP-27-18 09:55:00	DONE	Lucas Cell	01-MAR-18 00:00
459193002	SAMPLE	PCW	LUCAS5	SEP-27-18 09:55:00	DONE	Lucas Cell	01-JUN-18 00:00
459193003	SAMPLE	PCW	LUCAS6	SEP-27-18 09:55:00	DONE	Lucas Cell	01-JUL-18 00:00
459193004	SAMPLE	PCW	LUCAS7	SEP-27-18 09:55:00	DONE	Lucas Cell	01-NOV-17 00:00
459193005	SAMPLE	PCW	LUCAS8	SEP-27-18 09:55:00	DONE	Lucas Cell	01-MAR-18 00:00
459193006	SAMPLE	PCW	LUCAS2	SEP-27-18 10:30:00	DONE	Lucas Cell	01-AUG-18 00:00
459193007	SAMPLE	PCW	LUCAS3	SEP-27-18 10:30:00	DONE	Lucas Cell	01-MAR-18 00:00
1204113013	MB	PCW	LUCAS4	SEP-27-18 10:30:00	DONE	Lucas Cell	01-MAR-18 00:00
1204113014	DUP	PCW	LUCAS5	SEP-27-18 10:30:00	DONE	Lucas Cell	01-JUN-18 00:00
1204113015	MS	PCW	LUCAS6	SEP-27-18 10:30:00	DONE	Lucas Cell	01-JUL-18 00:00
1204113016	MSD	PCW	LUCAS7	SEP-27-18 10:30:00	DONE	Lucas Cell	01-NOV-17 00:00
1204113017	LCS	PCW	LUCAS8	SEP-27-18 10:30:00	DONE	Lucas Cell	01-MAR-18 00:00

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Mercer
Groundwater and Water Samples
Collected on 10/04/18

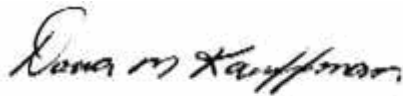
SDG# GEJ56

GROUP	SAMPLE NUMBERS
1995508	9839632-9839638

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-18-27
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 10/31/2018

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ56
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Mercer

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9839632	FB-20181004	10/04/2018 12:00	10/05/2018 16:45
9839633	MW-4	10/04/2018 10:20	10/05/2018 16:45
9839634	MW-6	10/04/2018 10:20	10/05/2018 16:45
9839635	MW-5	10/04/2018 12:40	10/05/2018 16:45
9839636	MW-2	10/04/2018 11:45	10/05/2018 16:45
9839637	MW-3	10/04/2018 13:40	10/05/2018 16:45
9839638	MW-1	10/04/2018 14:25	10/05/2018 16:45

Sample pH Log

SDG: GEJ56

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9839632	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:36:32PM	13165
9839632	015A	8	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:08:18AM	25804
9839632	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:14:48PM	13165
9839632	055B	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:16:02PM	13165
9839632	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:38:04PM	13165
9839632	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:56:58PM	12665
9839632	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:36:32PM	13165
9839632	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:36:32PM	13165
9839633	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:34:13PM	13165
9839633	015A	8	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:09:53AM	25804
9839633	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:13:46PM	13165
9839633	055B	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:12:31PM	13165
9839633	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:29:29PM	13165
9839633	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:47:00PM	12665
9839633	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:54:55PM	12665
9839633	148A	8	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:05:19AM	25804
9839633	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:34:13PM	13165
9839633	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:29:29PM	13165
9839634	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:33:28PM	13165
9839634	015A	8	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:06:52AM	25804
9839634	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:15:11PM	13165
9839634	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:15:46PM	13165
9839634	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:28:08PM	13165
9839634	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:40:18PM	12665
9839634	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:33:28PM	13165
9839634	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:28:08PM	13165
9839635	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:31:52PM	13165
9839635	015A	9	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:10:36AM	25804
9839635	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:15:30PM	13165
9839635	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:12:05PM	13165
9839635	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:27:26PM	13165
9839635	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:36:40PM	12665
9839635	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:31:52PM	13165
9839635	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:27:26PM	13165
9839636	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:34:55PM	13165
9839636	015A	5	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:05:59AM	25804
9839636	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:14:10PM	13165
9839636	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:13:29PM	13165

LLI Sample Number	Bottle Code	Actual pH	Exp. pH	*pH Check Code	Adj. pH	Adjusted Date	Adjusted Time	Preservative Added	Preservative Lot #	LLI Supplied Bottle?	Sulfide Present?	Corrective Substance	CS Lot #	**Chlorine Present?	Corrective Substance	CS Lot #	Record Date	Employee
9839636	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:28:48PM	13165
9839636	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:20:55PM	12665
9839636	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:34:55PM	13165
9839636	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:28:48PM	13165
9839637	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:30:43PM	13165
9839637	015A	9	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:09:03AM	25804
9839637	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:14:31PM	13165
9839637	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:16:22PM	13165
9839637	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:25:32PM	13165
9839637	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:25:03PM	12665
9839637	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:30:43PM	13165
9839637	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:25:32PM	13165
9839638	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:32:32PM	13165
9839638	015A	8	5-7	UP	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/6/2018 9:07:38AM	25804
9839638	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:13:11PM	13165
9839638	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:12:55PM	13165
9839638	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:26:31PM	13165
9839638	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/10/2018 3:38:28PM	12665
9839638	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:32:32PM	13165
9839638	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/5/2018 11:26:31PM	13165

*pH Check Code Key	**Chlorine Present Code Key
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

00259 Mercury

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U5

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U5

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: October 19, 2018 16:11

Project: PSEG Mercer

Account #: 07701
Group Number: 1995508
SDG: GEJ56
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
FB-20181004 Grab Water	10/04/2018 12:00	9839632
MW-4 Grab Groundwater	10/04/2018 10:20	9839633
MW-6 Grab Groundwater	10/04/2018 10:20	9839634
MW-5 Grab Groundwater	10/04/2018 12:40	9839635
MW-2 Grab Groundwater	10/04/2018 11:45	9839636
MW-3 Grab Groundwater	10/04/2018 13:40	9839637
MW-1 Grab Groundwater	10/04/2018 14:25	9839638

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Mercer

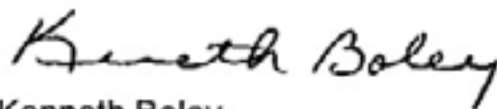
Sampling Date(s): 10/04/18

Laboratory Sample ID(s): 9839632-9839638

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	<u>EPH Method:</u> Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	No
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Kenneth Boley
Senior Specialist, Quality Assurance

10/19/2018



Project Name: PSEG Mercer
ELLE Group #: 1995508

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9839632, 9839633, 9839634, 9839635, 9839636, 9839637, 9839638

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

Sample #s: 9839632, 9839633, 9839634, 9839635, 9839636, 9839637, 9839638

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.

EPA 300.0, Wet Chemistry

Batch #: 18288520109A (Sample number(s): 9839633-9839638 UNSPK: 9839633 BKG: 9839633)

The recovery(ies) for the following analyte(s) in the MS exceeded the acceptance window indicating a positive bias: Fluoride

Sample Description: FB-20181004 Grab Water
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839632
ELLE Group #: 1995508
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:00
SDG#: GEJ56-01FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0050	1
08014	Boron	7440-42-8	N.D.	0.0120	0.0500	1
01750	Calcium	7440-70-2	0.0407 J	0.0330	0.500	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20181004 Grab Water
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9839632
ELLE Group #: 1995508
Matrix: Water**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:00
SDG#: GEJ56-01FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	5.9	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:51	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:11	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:01	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:01	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:01	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:01	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:01	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:21	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520115B	10/16/2018 02:46	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18288520115B	10/16/2018 23:16	Ashlynn M Cornelius	1

*This limit was used in the evaluation of the final result

Analysis Report

Sample Description: FB-20181004 Grab Water
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839632
ELLE Group #: 1995508
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:00
SDG#: GEJ56-01FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520115B	10/16/2018 02:46	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921203A	10/10/2018 16:56	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 04:42	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 04:42	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839633
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 10:20
SDG#: GEJ56-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0090	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0336 J	0.0120	0.0500	1
01750	Calcium	7440-70-2	2.92	0.0330	0.500	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0017 J	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.1 J	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	N.D.	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	29.0 J	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.9	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839633
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 10:20
SDG#: GEJ56-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.8	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:35	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 13:58	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 19:44	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 19:44	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 19:44	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 19:44	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 19:44	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:23	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 13:05	Ashlynn M Cornelius	5
01504	Fluoride	EPA 300.0	1	18288520109A	10/15/2018 13:05	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839633
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 10:20
SDG#: GEJ56-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 13:05	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921201A	10/10/2018 16:00	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 04:34	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 04:34	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839634
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 10:20
SDG#: GEJ56-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved			SW-846 6010D Rev.4, July 2014	mg/l	mg/l	
07046	Barium	7440-39-3	0.166	0.0010	0.0050	1
08014	Boron	7440-42-8	0.224	0.0120	0.0500	1
01750	Calcium	7440-70-2	34.3	0.0330	0.500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
			SW-846 6020B Rev.2, July 2014	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0035	0.00031	0.0020	1
			SW-846 7470A	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry			EPA 300.0	mg/l	mg/l	
00224	Chloride	16887-00-6	136	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	6.5	1.5	5.0	5
			SM 2540 C-2011	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	309	40.0	120	1
			SM 2550 B-2010	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9839634
ELLE Group #: 1995508
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/05/2018 16:45**Collection Date/Time:** 10/04/2018 10:20**SDG#:** GEJ56-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.5	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 06:54	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:18	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:10	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:10	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:10	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:10	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:10	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:25	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 14:16	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18288520109A	10/15/2018 13:58	Ashlynn M Cornelius	5

*This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839634
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 10:20
SDG#: GEJ56-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 13:58	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921201A	10/10/2018 16:00	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 05:20	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 05:20	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839635
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:40
SDG#: GEJ56-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.212	0.0010	0.0050	1
08014	Boron	7440-42-8	0.427	0.0120	0.0500	1
01750	Calcium	7440-70-2	101	0.0330	0.500	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0211	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	102	10.0	20.0	50
01504	Fluoride	16984-48-8	0.72	0.25	0.50	5
00228	Sulfate	14808-79-8	135	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	602	80.0	240	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9839635
ELLE Group #: 1995508
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:40
SDG#: GEJ56-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	8.0	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:02	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:20	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:12	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:12	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:12	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:12	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:12	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:27	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 14:51	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18288520109A	10/15/2018 14:34	Ashlynn M Cornelius	5

*This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839635
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 12:40
SDG#: GEJ56-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 14:51	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921201A	10/10/2018 16:00	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 05:09	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 05:09	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839636
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 11:45
SDG#: GEJ56-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0368	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0639	0.0120	0.0500	1
01750	Calcium	7440-70-2	38.3	0.0330	0.500	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	0.00075 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0038	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0033	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.5 J	1.0	2.0	5
01504	Fluoride	16984-48-8	0.69	0.25	0.50	5
00228	Sulfate	14808-79-8	4.6 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	140	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839636
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 11:45
SDG#: GEJ56-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.9	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:04	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:22	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:15	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:15	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:15	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:15	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:15	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:29	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 15:09	Ashlynn M Cornelius	5
01504	Fluoride	EPA 300.0	1	18288520109A	10/15/2018 15:09	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839636
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45

Collection Date/Time: 10/04/2018 11:45

SDG#: GEJ56-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 15:09	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921203A	10/10/2018 16:56	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 04:38	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 04:38	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839637
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 13:40
SDG#: GEJ56-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.186	0.0010	0.0050	1
08014	Boron	7440-42-8	0.276	0.0120	0.0500	1
01750	Calcium	7440-70-2	47.4	0.0330	0.500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0231 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0014 J	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0098	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	113	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	14.7	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	398	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839637
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 13:40
SDG#: GEJ56-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.7	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:07	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:24	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:18	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:18	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:18	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:18	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:18	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:09	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 16:37	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18288520109A	10/15/2018 15:44	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839637
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 13:40
SDG#: GEJ56-06

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 15:44	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921201A	10/10/2018 16:00	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 05:16	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 05:16	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839638
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 14:25
SDG#: GEJ56-07

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.180	0.0010	0.0050	1
08014	Boron	7440-42-8	1.10	0.0120	0.0500	1
01750	Calcium	7440-70-2	208	0.0330	0.500	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0036	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	146	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	297	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,070	160	480	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9839638
ELLE Group #: 1995508
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/05/2018 16:45**Collection Date/Time:** 10/04/2018 14:25**SDG#:** GEJ56-07

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.7	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182841404402	10/16/2018 07:10	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/18/2018 14:26	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:21	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:21	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:21	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182841404702A	10/15/2018 20:21	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182841404702C	10/15/2018 20:21	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	2	182840571302	10/12/2018 08:31	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182841404402	10/12/2018 06:20	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182841404702	10/12/2018 03:59	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182840571302	10/11/2018 16:25	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18288520109A	10/15/2018 17:13	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18288520109A	10/17/2018 00:27	Ashlynn M Cornelius	5

* = This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9839638
ELLE Group #: 1995508
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/05/2018 16:45
Collection Date/Time: 10/04/2018 14:25
SDG#: GEJ56-07

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18288520109A	10/15/2018 17:13	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18283921203A	10/10/2018 16:56	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18281003203A	10/09/2018 05:13	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18281003203A	10/09/2018 05:13	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 10/19/2018 16:11

Group Number: 1995508

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 182840571302	Sample number(s): 9839632-9839638		
Mercury	N.D.	0.000050	0.00020
Batch number: 182841404402	Sample number(s): 9839632-9839638		
Barium	N.D.	0.0010	0.0050
Boron	N.D.	0.0120	0.0500
Calcium	0.0886 J	0.0330	0.500
Chromium	N.D.	0.0053	0.0150
Cobalt	N.D.	0.0015	0.0050
Lithium	N.D.	0.0110	0.0500
Selenium	N.D.	0.0210	0.0500
Thallium	N.D.	0.0140	0.0300
Batch number: 182841404702A	Sample number(s): 9839632-9839638		
Antimony	N.D.	0.00041	0.0020
Arsenic	N.D.	0.00068	0.0020
Beryllium	N.D.	0.000091	0.00050
Cadmium	N.D.	0.00015	0.0010
Lead	N.D.	0.0011	0.0030
Batch number: 182841404702C	Sample number(s): 9839632-9839638		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 18288520109A	Sample number(s): 9839633-9839638		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18288520115B	Sample number(s): 9839632		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18283921201A	Sample number(s): 9839633-9839635,9839637		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18283921203A	Sample number(s): 9839632,9839636,9839638		
Total Dissolved Solids	N.D.	20.0	60.0

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 10/19/2018 16:11

Group Number: 1995508

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 182840571302 Mercury	Sample number(s): 9839632-9839638 0.00100	0.000801			80		80-120		
Batch number: 182841404402	Sample number(s): 9839632-9839638								
Barium	2.00	1.94			97		80-120		
Boron	2.00	1.88			94		80-120		
Calcium	4.00	4.03			101		80-120		
Chromium	0.200	0.193			96		80-120		
Cobalt	0.500	0.509			102		80-120		
Lithium	1.00	1.01			101		80-120		
Selenium	0.150	0.146			97		80-120		
Thallium	0.150	0.154			103		80-120		
Batch number: 182841404702A	Sample number(s): 9839632-9839638								
Antimony	0.00600	0.00658			110		80-120		
Arsenic	0.0100	0.00993			99		80-120		
Beryllium	0.00400	0.00398			100		80-120		
Cadmium	0.00500	0.00430			86		80-120		
Lead	0.0150	0.0156			104		80-120		
Batch number: 182841404702C	Sample number(s): 9839632-9839638								
Molybdenum	0.0500	0.0501			100		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18288520109A	Sample number(s): 9839633-9839638								
Chloride	3.00	2.73			91		90-110		
Fluoride	0.750	0.810			108		90-110		
Sulfate	7.50	7.34			98		90-110		
Batch number: 18288520115B	Sample number(s): 9839632								
Chloride	3.00	2.85			95		90-110		
Fluoride	0.750	0.745			99		90-110		
Sulfate	7.50	7.00			93		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18283921201A	Sample number(s): 9839633-9839635,9839637								
Total Dissolved Solids	200	192			96		62-127		
Batch number: 18283921203A	Sample number(s): 9839632,9839636,9839638								
Total Dissolved Solids	200	194			97		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18281003203A	Sample number(s): 9839632-9839638								
pH	7.00	7.01			100		95-105		

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 10/19/2018 16:11

Group Number: 1995508

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 182840571302 Mercury	Sample number(s): 9839632-9839638 UNSPK: 9839637 N.D.	0.00100	0.000787	0.00100	0.000790	79	79	75-125	0	20
Batch number: 182841404402	Sample number(s): 9839632-9839638 UNSPK: 9839633									
Barium	0.00899	2.00	2.03	2.00	1.99	101	99	75-125	2	20
Boron	0.0336	2.00	1.99	2.00	1.93	98	95	75-125	3	20
Calcium	2.92	4.00	6.99	4.00	6.91	102	100	75-125	1	20
Chromium	N.D.	0.200	0.201	0.200	0.195	101	98	75-125	3	20
Cobalt	N.D.	0.500	0.512	0.500	0.503	102	101	75-125	2	20
Lithium	N.D.	1.00	1.01	1.00	1.01	101	101	75-125	0	20
Selenium	N.D.	0.150	0.143	0.150	0.149	95	100	75-125	4	20
Thallium	N.D.	0.150	0.154	0.150	0.155	103	103	75-125	0	20
Batch number: 182841404702A	Sample number(s): 9839632-9839638 UNSPK: 9839633									
Antimony	N.D.	0.00600	0.00681	0.00600	0.00658	114	110	75-125	3	20
Arsenic	N.D.	0.0100	0.0105	0.0100	0.0111	105	111	75-125	6	20
Beryllium	N.D.	0.00400	0.00406	0.00400	0.00416	102	104	75-125	2	20
Cadmium	N.D.	0.00500	0.00545	0.00500	0.00446	109	89	75-125	20	20
Lead	N.D.	0.0150	0.0150	0.0150	0.0159	100	106	75-125	5	20
Batch number: 182841404702C	Sample number(s): 9839632-9839638 UNSPK: 9839633									
Molybdenum	0.00166	0.0500	0.0507	0.0500	0.0515	98	100	75-125	1	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18288520109A	Sample number(s): 9839633-9839638 UNSPK: 9839633									
Chloride	1.10	10	10.13			90		90-110		
Fluoride	N.D.	2.50	2.82			113*		90-110		
Sulfate	N.D.	25	26.75			107		90-110		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 182840571302 Mercury	Sample number(s): 9839632-9839638 BKG: 9839637 N.D.	N.D.	0 (1)	20
Batch number: 182841404402 Barium	Sample number(s): 9839632-9839638 BKG: 9839633 0.00899	0.00868	4 (1)	20

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 10/19/2018 16:11

Group Number: 1995508

Laboratory Duplicate (continued)

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Boron	0.0336	0.0304	10 (1)	20
Calcium	2.92	2.94	1	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	N.D.	N.D.	0 (1)	20
Lithium	N.D.	N.D.	0 (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20
Batch number: 182841404702A	Sample number(s): 9839632-9839638 BKG: 9839633			
Antimony	N.D.	N.D.	0 (1)	20
Arsenic	N.D.	N.D.	0 (1)	20
Beryllium	N.D.	N.D.	0 (1)	20
Cadmium	N.D.	N.D.	0 (1)	20
Lead	N.D.	N.D.	0 (1)	20
Batch number: 182841404702C	Sample number(s): 9839632-9839638 BKG: 9839633			
Molybdenum	0.00166	0.00142	16 (1)	20
	mg/l	mg/l		
Batch number: 18288520109A	Sample number(s): 9839633-9839638 BKG: 9839633			
Chloride	1.10	1.01	8 (1)	15
Fluoride	N.D.	N.D.	0 (1)	15
Sulfate	N.D.	N.D.	0 (1)	15

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Asset # 7701

For Eurofins Lancaster Laboratories Environmental Use only

Group # 1495500 Sample # 9834632-38

COC # 568948

Client Information				Matrix				Analysis Requested										For Lab Use Only	
Project Name				Matrix				Preservation and Filtration Codes										SC	
Project Manager				Matrix				Preservation Codes										Remarks	
GEI Consultants, Inc.				Soil ☐ Tissue ☐														232050	
1504710 / DSEG Mercer				Ground ☒ Surface ☐															
Jason Kehl				Potable ☐ NPDES ☐															
Anthony J. Shields				Other: ☐															
NJ				Yes ☒ No ☐															
Sample Identification		Collected		Grab	Composite	Soil	Water	Other	Total # of Containers	Site Code of Metals	Mercury	Chloride	Fluoride	Sulfate	NH	TDS	Re 226 + 228	Metals QC	
Date	Time																		
FB 20181004	10.4.18	1200							FB										
MW-4	10.4.18	1020																	
MW-6	10.4.18	1020																	
MW-5	10.4.18	1240																	
MW-2	10.4.18	1145																	
MW-3	10.4.18	840																	
MW-1	10.4.18	1125																	
Turnaround Time (TAT) Requested (please circle)				Bottle Storage				10/5/18 1215				10/5/18 1215				10/5/18 1215			
Standard				Rush				10/5/18 1145				10/5/18 1145				10/5/18 1145			
Request TAT in business days				10/5/18 1145				10/5/18 1145				10/5/18 1145				10/5/18 1145			
E-mail address: Jason Kehl				10/5/18 1145				10/5/18 1145				10/5/18 1145				10/5/18 1145			
Data Package Options (circle if required)				EUC Required? (Yes/No)				Requested by Commercial Carrier				Temperature upon receipt: 16 °C							
Type I (EPA Level 3 Equivalent/Non-CLP)				Yes/No				LPS				Fedex				Other			
Type VI (Raw Data Only)				Site Specific OC (MS/MSD/Dup)?				Yes/No											
Type III (Reduced non-CLP)				NJ DKQP															
TX TRRP 13																			
NYDEC Category A or B				MA MCP															
CT RCP																			



Client: GEI Consultings, Inc

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>10/05/2018 16:45</u>
Number of Packages:	<u>2</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>NJ</u>		

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace $\geq$ 6mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Cory Jeremiah (10469) at 19:10 on 10/05/2018

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT42-03	1.4	DT	Wet	Y	Bagged	N
2	DT42-03	1.6	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9839632	FB-20181004	X		1	Field Blank
9839633	MW-4	X		1	
9839634	MW-6	X		1	
9839635	MW-5	X		1	
9839636	MW-2	X		1	
9839637	MW-3	X		1	
9839638	MW-1	X		1	

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Method Blank

For noncompliant preparation/method blanks, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.

SDG: GEJ56

ICP Metals

Fraction: Metals in Liquid

SAMPLE ANALYSIS:

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9839632-9839638: Analysis: 07036)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium.

(Sample number(s): 9839632-9839638: Analysis: 01750)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike
P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839632
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	12.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839633, 9839633BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	9.0			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	33.6	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	2920			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	1.7	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839634
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	166			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	224			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	34300			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.5			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839635
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	212			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	427			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	101000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	21.1			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839636
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.75	B		MS
7440-38-2	Arsenic	3.8			MS
7440-39-3	Barium	36.8			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	63.9			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	38300			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.3			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839637, 9839637BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.4	B		MS
7440-39-3	Barium	186			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	276			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	47400			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	23.1	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	9.8			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9839638
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/05/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	180			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1100			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	208000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.6			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ56

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182841404402	9839632
Boron		9839633BKG
Calcium		9839633MS
Chromium		9839633MSD
Cobalt		9839633DUP
Lithium		9839634
Selenium		9839635
Thallium		9839636
		9839637
		9839638
		P28404BB
		P28404BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ56

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182841404702	9839632
Arsenic		9839633BKG
Beryllium		9839633MS
Cadmium		9839633MSD
Lead		9839633DUP
Molybdenum		9839634
		9839635
		9839636
		9839637
		9839638
		P28404BB
		P28404BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ56

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182840571302	9839632
		9839633
		9839634
		9839635
		9839636
		9839637BKG
		9839637MS
		9839637MSD
		9839637DUP
		9839638
		P28471BB
		P28471BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: P
Run Name: 1828901T73
Calibration Date(s): 10/16/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	593.43	98.9	500.0	489.27	97.9	500.0	490.79	98.2
Boron		600.0	622.14	103.7	500.0	510.76	102.2	500.0	514.99	103.0
Calcium		30000.0	29702.18	99.0	25000.0	24533.23	98.1	25000.0	24739.85	99.0
Chromium		600.0	571.49	95.2	500.0	470.47	94.1	500.0	474.53	94.9
Cobalt		600.0	576.65	96.1	500.0	482.85	96.6	500.0	485.35	97.1
Lithium		600.0	605.18	100.9	500.0	501.36	100.3	500.0	505.66	101.1
Selenium		600.0	576.13	96.0	500.0	497.84	99.6	500.0	492.53	98.5
Thallium		600.0	585.05	97.5	500.0	487.29	97.5	500.0	496.89	99.4

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: P
Run Name: 1828901T73
Calibration Date(s): 10/16/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	483.86	96.8	500.0	484.12	96.8
Boron					500.0	507.11	101.4	500.0	506.99	101.4
Calcium					25000.0	24588.75	98.4	25000.0	24770.97	99.1
Chromium					500.0	469.01	93.8	500.0	472.23	94.4
Cobalt					500.0	476.20	95.2	500.0	480.41	96.1
Lithium					500.0	494.07	98.8	500.0	495.71	99.1
Selenium					500.0	479.40	95.9	500.0	475.57	95.1
Thallium					500.0	487.42	97.5	500.0	490.86	98.2

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: MS

Run Name: 1828806E05

Calibration Date(s): 10/15/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75	500.0	492.13	98.4	250.0	260.83	104.3	250.0	265.95	106.4
Beryllium	9	50.0	49.81	99.6	25.0	25.74	103.0	25.0	26.28	105.1
Cadmium	111	50.0	46.20	92.4	25.0	24.88	99.5	25.0	24.09	96.4
Lead	208	50.0	51.56	103.1	25.0	26.80	107.2	25.0	25.52	102.1
Molybdenum	98	50.0	48.50	97.0	25.0	25.61	102.4	25.0	24.47	97.9

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: MS
Run Name: 1828806E05
Calibration Date(s): 10/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75				250.0	257.95	103.2			
Beryllium	9				25.0	26.90	107.6			
Cadmium	111				25.0	23.39	93.6			
Lead	208				25.0	27.07	108.3			
Molybdenum	98				25.0	24.62	98.5			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: MS
Run Name: 1829104E07
Calibration Date(s): 10/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	53.19	106.4	25.0	26.56	106.2	25.0	25.17	100.7
Arsenic										
Beryllium										
Cadmium	111	50.0	51.73	103.5	25.0	25.57	102.3	25.0	26.34	105.4
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: MS
Run Name: 1829104E07
Calibration Date(s): 10/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	25.19	100.8			
Arsenic										
Beryllium										
Cadmium										
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: CV
Run Name: 1828501M09
Calibration Date(s): 10/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.43	97.2	1.0	0.98	98.0	1.0	0.96	96.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: CV
Run Name: 1828501M09
Calibration Date(s): 10/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.97	97.0	1.0	0.96	96.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ56

Method: CV
Run Name: 1828501M09
Calibration Date(s): 10/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.95	95.0	1.0	0.96	96.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ56

Method: P
Run Name: 1828901T73
Calibration Date(s): 10/16/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	5.05	101.0		
Boron		50.0	49.76	99.5		
Calcium		500.0	502.34	100.5		
Chromium		15.0	14.82	98.8		
Cobalt		5.0	5.38	107.6		
Lithium		50.0	58.13	116.3		
Selenium		50.0	55.28	110.6		
Thallium		30.0	33.35	111.2		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ56

Method: MS

Run Name: 1828806E05

Calibration Date(s): 10/15/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic	75	2.0	2.26	113.0		
Beryllium	9	0.5	0.48	96.0		
Cadmium	111	1.0	0.84	84.0		
Lead	208	3.0	3.31	110.3		
Molybdenum	98	2.0	2.24	112.0		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ56

Method: MS

Run Name: 1829104E07

Calibration Date(s): 10/18/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	2.01	100.5		
Arsenic						
Beryllium						
Cadmium	111	1.0	1.01	101.0		
Lead						
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ56

Method: CV

Run Name: 1828501M09

Calibration Date(s): 10/12/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.19	95.0		

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ56

Method: P

Run Name: 1828901T73

Calibration Date(s): 10/16/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Barium		0.33	U	0.33	U	0.33	U	0.33	U		1.000	U182841404402
Boron		8.4	U	8.4	U	8.4	U	8.4	U		12.000	U182841404402
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		88.640	B182841404402
Chromium		0.55	U	0.55	U	0.55	U	0.55	U		5.300	U182841404402
Cobalt		0.40	U	0.43	B	0.40	U	0.40	U		1.500	U182841404402
Lithium		5.3	U	5.3	U	5.3	U	5.3	U		11.000	U182841404402
Selenium		9.2	U	9.2	U	9.2	U	9.2	U		21.000	U182841404402
Thallium		3.1	U	3.1	U	3.1	U	3.1	U		14.000	U182841404402

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ56

Method: P
Run Name: 1828901T73
Calibration Date(s): 10/16/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium				0.33	U						
Boron				8.4	U						
Calcium				33.4	U						
Chromium				0.55	U						
Cobalt				0.40	U						
Lithium				5.3	U						
Selenium				9.8	B						
Thallium				-5.4	B						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ56

Method: MS

Run Name: 1828806E05

Calibration Date(s): 10/15/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony											
Arsenic	75	0.40U		0.40U		0.40U		0.40U		75	0.680U182841404702A
Beryllium	9	0.067U		0.099B		0.067U		0.067U		9	0.091U182841404702A
Cadmium	111	0.18U		0.18U		0.18U		0.18U		111	0.150U182841404702A
Lead	208	0.21U		0.21U		0.21U		0.21U		208	1.100U182841404702A
Molybdenum	98	0.36U		0.36U		0.36U		0.36U		98	0.310U182841404702A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ56

Method: MS

Run Name: 1829104E07

Calibration Date(s): 10/18/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony	121	0.29U		0.72B		0.32B		0.29U		121	0.410U182841404702A
Arsenic											
Beryllium											
Cadmium	111	0.18U		0.18U		0.18U					
Lead											
Molybdenum											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ56

Method: CV

Run Name: 1828501M09

Calibration Date(s): 10/12/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)				Preparation Blank (UG/L)					
		C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury		0.050U		0.050U		0.050U		0.050U			0.050U	182840571302

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ56

Method: CV

Run Name: 1828501M09

Calibration Date(s): 10/12/2018

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)			
			C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury				0.050	U	0.050	U	0.050	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
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QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ56

Instrument ID: 18255
Run Name: 1828901T73
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		484075	96.8						
Barium	0		0							
Boron	0		4							
Calcium	500000		491973	98.4						
Chromium	0		0							
Cobalt	0		0							
Iron	200000		197191	98.6						
Lithium	0		-10							
Magnesium	500000		511954	102.4						
Selenium	0		1							
Thallium	0		6							

Control Limits: All Metals 80%-120%

Instrument ID: 19204
 Run Name: 1828806E05
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		87064	87.1		
Antimony							
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		254856	85.0		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		218946	87.6		
Lead	208	0		1			
Magnesium	24	100000		91526	91.5		
Molybdenum	98	2000		1919	96.0		
Phosphorus	31	10000		NA			
Potassium	39	100000		87657	87.7		
Sodium	23	250000		219677	87.9		
Sulfur	34	10000		NA			
Titanium	47	2000		1830	91.5		

Control Limits: All Metals 80%-120%

Instrument ID: 27813
Run Name: 1829104E07
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		106904	106.9		
Antimony	121	0		1			
Arsenic							
Beryllium							
Cadmium	111	0		0			
Calcium	44	300000		312916	104.3		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		248028	99.2		
Lead							
Magnesium	24	100000		100721	100.7		
Molybdenum	98	2000		2203	110.2		
Phosphorus	31	10000		NA			
Potassium	39	100000		107144	107.1		
Sodium	23	250000		253448	101.4		
Sulfur	34	10000		NA			
Titanium	47	2000		2127	106.4		

Control Limits: All Metals 80%-120%



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QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9839633BKG Matrix Spike Lab Sample ID: 9839633MS Matrix Spike Duplicate Lab Sample ID: 9839633MSD
Batch Number(s): 182841404702, 182841404402

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		M
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	
Antimony	121	0.4060	U	6.8141		6.5829		6.0000	6.0000	UG/L	114		110		3		75 - 125	20	MS
Arsenic	75	0.6800	U	10.5400		11.1450		10.0000	10.0000	UG/L	105		111		6		75 - 125	20	MS
Barium		8.9900		2026.2200		1987.5100		2000.0000	2000.0000	UG/L	101		99		2		75 - 125	20	P
Beryllium	9	0.0910	U	4.0630		4.1560		4.0000	4.0000	UG/L	102		104		2		75 - 125	20	MS
Boron		33.5500	B	1986.7300		1930.2400		2000.0000	2000.0000	UG/L	98		95		3		75 - 125	20	P
Cadmium	111	0.1510	U	5.4463		4.4590		5.0000	5.0000	UG/L	109		89		20		75 - 125	20	MS
Calcium		2915.1800		6990.9800		6908.2000		4000.0000	4000.0000	UG/L	102		100		1		75 - 125	20	P
Chromium		5.3000	U	201.1800		195.0800		200.0000	200.0000	UG/L	101		98		3		75 - 125	20	P
Cobalt		1.5000	U	512.0100		502.5600		500.0000	500.0000	UG/L	102		101		2		75 - 125	20	P
Lead	208	1.0700	U	15.0400		15.8520		15.0000	15.0000	UG/L	100		106		5		75 - 125	20	MS
Lithium		11.0000	U	1011.1700		1010.3900		1000.0000	1000.0000	UG/L	101		101		0		75 - 125	20	P
Molybdenum	98	1.6640	B	50.7160		51.4800		50.0000	50.0000	UG/L	98		100		1		75 - 125	20	MS
Selenium		21.0000	U	142.7300		149.2900		150.0000	150.0000	UG/L	95		100		4		75 - 125	20	P
Thallium		14.0000	U	154.0400		154.7800		150.0000	150.0000	UG/L	103		103		0		75 - 125	20	P

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS: P = ICP Atomic Emission Spectrometer CV = Cold Vapor MS = ICP Mass Spectrometry AF = Cold Vapor Atomic Fluorescence		CONCENTRATION QUALIFIERS: U= Below MDL, B= Below LOQ FLAGS: N = Matrix Spike OOS, * = Duplicate OOS



Lancaster Laboratories
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QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9839637BKG Matrix Spike Lab Sample ID: 9839637MS Matrix Spike Duplicate Lab Sample ID: 9839637MSD

Batch Number(s): 182840571302

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	M
Mercury		0.0500	U	0.7872		0.7898		1.0000	1.0000	UG/L	79		79		0		75 - 125	20	CV

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS: P = ICP Atomic Emission Spectrometer CV = Cold Vapor MS = ICP Mass Spectrometry AF = Cold Vapor Atomic Fluorescence		CONCENTRATION QUALIFIERS: U= Below MDL, B= Below LOQ FLAGS: N = Matrix Spike OOS, * = Duplicate OOS



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9839633BKG

Duplicate Lab Sample ID: 9839633DUP

Batch Number(s): 182841404702, 182841404402

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Antimony	121		0.4060	U	0.4060	U			MS
Arsenic	75		0.6800	U	0.6800	U			MS
Barium		5.0	8.9900		8.6800		4		P
Beryllium	9		0.0910	U	0.0910	U			MS
Boron			33.5500	B	30.3900	B	10		P
Cadmium	111		0.1510	U	0.1510	U			MS
Calcium			2915.1800		2937.8600		1		P
Chromium			5.3000	U	5.3000	U			P
Cobalt			1.5000	U	1.5000	U			P
Lead	208		1.0700	U	1.0700	U			MS
Lithium			11.0000	U	11.0000	U			P
Molybdenum	98		1.6640	B	1.4170	B	16		MS
Selenium			21.0000	U	21.0000	U			P
Thallium			14.0000	U	14.0000	U			P

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > 20% OR |(S) - (D)| > LOQ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: * = Duplicate Out of Spec



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ56

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9839637BKG

Duplicate Lab Sample ID: 9839637DUP

Batch Number(s): 182840571302

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Mercury			0.0500	U	0.0500	U			CV

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > 20% OR $|S - D| > LOQ$ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: ** = Duplicate Out of Spec

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ56
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182841404702	UG/L	6.000	6.583		80 - 120	110	MS	Yes
Arsenic	75	182841404702	UG/L	10.000	9.928		80 - 120	99	MS	Yes
Barium		182841404402	UG/L	2000.000	1944.780		80 - 120	97	P	Yes
Beryllium	9	182841404702	UG/L	4.000	3.982		80 - 120	100	MS	Yes
Boron		182841404402	UG/L	2000.000	1882.640		80 - 120	94	P	Yes
Cadmium	111	182841404702	UG/L	5.000	4.298		80 - 120	86	MS	Yes
Calcium		182841404402	UG/L	4000.000	4028.080		80 - 120	101	P	Yes
Chromium		182841404402	UG/L	200.000	192.950		80 - 120	96	P	Yes
Cobalt		182841404402	UG/L	500.000	509.300		80 - 120	102	P	Yes
Lead	208	182841404702	UG/L	15.000	15.637		80 - 120	104	MS	Yes
Lithium		182841404402	UG/L	1000.000	1007.470		80 - 120	101	P	Yes
Mercury		182840571302	UG/L	1.000	0.801		80 - 120	80	CV	Yes
Molybdenum	98	182841404702	UG/L	50.000	50.117		80 - 120	100	MS	Yes
Selenium		182841404402	UG/L	150.000	146.020		80 - 120	97	P	Yes
Thallium		182841404402	UG/L	150.000	154.240		80 - 120	103	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ56

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9839633BKG Serial Dilution Lab Sample ID: 9839633L

Batch Number(s): 182841404702, 182841404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	0.4060	U	2.0300	U			MS
Arsenic	75	0.6800	U	3.4000	U			MS
Barium		8.9900		9.2500	B	3		P
Beryllium	9	0.0910	U	0.4550	U			MS
Boron		33.5500	B	63.0000	B	88		P
Cadmium	111	0.1510	U	0.7550	U			MS
Calcium		2915.1800		2887.2500		1		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		1.5000	U	7.5000	U			P
Lead	208	1.0700	U	5.3500	U			MS
Lithium		11.0000	U	55.0000	U			P
Molybdenum	98	1.6640	B	2.5600	B	54		MS
Selenium		21.0000	U	105.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 18255
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.33
Boron	249.67		8.4
Calcium	317.93		33.4
Chromium	267.72		0.55
Cobalt	228.62		0.40
Lithium	670.78		5.3
Selenium	196.09		9.2
Thallium	190.86		3.1

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 19204
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony			
Arsenic	75		0.40
Beryllium	9		0.067
Cadmium	111		0.17
Lead	208		0.21
Molybdenum	98		0.36

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 27813
Date: 09/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.29
Arsenic			
Beryllium			
Cadmium	111		0.18
Lead			
Molybdenum			

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 23283
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury			0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ56
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		5.0	1.0
Boron	249.67		50.0	12.0
Calcium	317.93		500	33.0
Chromium				
Cobalt	228.62		5.0	1.5
Lithium	670.78		50.0	11.0
Selenium				
Thallium				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ56
Matrix: WATER

Method: P
Date: 09/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium				
Boron				
Calcium				
Chromium	267.72		15.0	5.3
Cobalt				
Lithium				
Selenium	196.09		50.0	21.0
Thallium	190.86		30.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ56
Matrix: WATER

Method: MS
Date: 07/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony				
Arsenic				
Beryllium	9		0.50	0.091
Cadmium	111		1.0	0.15
Lead				
Molybdenum	98		2.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ56
Matrix: WATER

Method: MS
Date: 09/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		2.0	0.41
Arsenic	75		2.0	0.68
Beryllium				
Cadmium	111		1.0	0.15
Lead	208		3.0	1.1
Molybdenum				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ56
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury			0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Tune Report

Batch Folder D:\Agilent\ICPMH\1\DATA\~EPATUNEaa.b
Report Comment ICP-MS #19204 (E05) Daily Tune Check
Instrument Name G3281A JP12071581

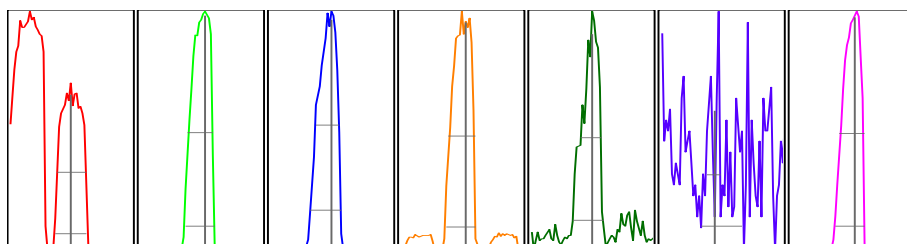
[No Gas]

Mass	Range	Count (Actual)	Response (Actual) [cps/ug/l]	Response (Required) [cps/ug/l]	Response (Flag)	Resp Ratio (Actual)	Resp Ratio (Required)	Resp Ratio (Flag)
7		1771	17708.56	2000.00		0.04	-	
89		5830	58301.73	6000.00		0.13	-	
205		2244	22436.34	3000.00		0.05	-	
70		2370	23697.49	0.00		0.05	0 - 0.015	[F]
156		127	1266.09	0.00		0.00	0 - 0.03	
220		21	207.01	0.00		0.00	-	
140		43665	436653.72	0.00		1.00	1 - 1	

Mass	RSD% (Actual)	RSD% (Required)	RSD% (Flag)	Background (Actual)	Background (Required)	Background (Flag)
7	3.18	5.00				
89	1.99	5.00				
205	2.62	5.00				
70	11.18					
156	10.15					
220	19.37					
140	1.83					

Mass	Replicate 1 Count	Replicate 2 Count	Replicate 3 Count	Replicate 4 Count	Replicate 5 Count
7	1856	1791	1749	1707	1751
89	5815	5941	5907	5846	5642
205	2245	2277	2295	2256	2144
70	2745	2511	2333	2173	2086
156	137	111	130	140	116
220	20	16	26	19	24
140	44100	43404	44366	44075	42381

Integration Time [sec] 0.1



Mass	Peak Height	Axis (Actual)	Axis (Required)	Axis (Flag)	W-50%	W-X% (Actual)	W-X% (Required)	W-X% (Flag)
7	265.96	7.00	6.9 - 7.1		0.69	0.772	0.800	
89	1012.68	89.10	88.9 - 89.1		0.60	0.726	0.800	
205	407.65	205.00	204.9 - 205.1		0.56	0.733	0.800	
70	402.00	70.10	-		0.62	0.734		
156	23.88	156.00	-		0.51	0.722		
220	2.96	219.80	-		0.32	0.988		
140	8080.87	140.05	-		0.57	0.715		

X = 10 Integration Time [sec] 0.1 Acquisition Time [sec] 260.3 Y Axis Linear

Tune Parameters

Plasma Paramters

RF Power	1600 W	Carrier Gas	0.25 L/min	S/C Temp	20 °C
RF Matching	1.60 V	Option Gas	0.0 %	Makeup/Dilution Gas	0.70 L/min
Smpl Depth	10.0 mm	Nebulizer Pump	0.10 rps	Gas Switch	Dilution Gas

Lenses Parameters

Tune Report

Extract 1	0.0 V	Omega Lens	8.1 V	Deflect	16.4 V
Extract 2	-190.0 V	Cell Entrance	-32 V	Plate Bias	-40 V
Mass	Peak	Axis	Axis	Axis	Axis
	Height	(Actual)	(Required)	(Flag)	
Omega Bias	-90 V	Cell Exit	-58 V		
 ## Cell Parameters ##					
OctP Bias	-8.0 V	He Flow	0.0 mL/min	Energy Discrimination	5.0 V
OctP RF	200 V	H2 Flow	0.0 mL/min		
Use Gas	false	3rd Gas Flow	0 %		

US EPA Tune Check Report

Operator Name US19_USR_INS27814
 Acq/Data Batch D:\Agilent\ICPMH\1\DATA\EPA_Tune.b
 Acq. Date-Time 2018-10-18 05:21:17
 Report Comment ---
 Instrument Name G8403A SG18254097

[No Gas]

Sensitivity

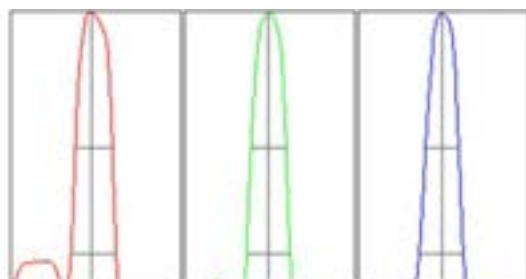
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	932	9318.16			0.504	5.000
89	10.00	5983	59827.49			0.410	5.000
205	10.00	2866	28661.41			0.667	5.000

Mass	RSD% (Flag)
7	
89	
205	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	931	938	930	933	925
89	5987	5964	5952	6001	6009
205	2889	2880	2861	2860	2840

Integration Time [sec] 0.1

Resolution/Axis



Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	1476.17	6.95	6.90 - 7.10	
89	9978.90	89.00	88.90 - 89.10	
205	5039.43	205.00	204.90 - 205.10	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.66	0.797	0.800	
89	0.63	0.765	0.800	
205	0.59	0.780	0.800	

Integration Time [sec] 0.1

Acquisition Time [sec] 113.7

Y Axis Linear

US EPA Tune Check Report

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	0.65 L/min	Dilution Gas	0.45 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.10 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	10.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	11.4 V	Deflect	15.6 V
Extract 2	-240.0 V	Cell Entrance	-40 V	Plate Bias	-50 V
Omega Bias	-85 V	Cell Exit	-60 V		

Cell Parameters

Use Gas	No	3rd Gas Flow	---	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OctP Bias	-8.0 V		
H2 Flow	0.0 mL/min	OctP RF	200 V		

QP Parameters

Mass Gain	124	Axis Gain	0.9993	QP Bias	-3.0 V
Mass Offset	124	Axis Offset	0.06		

Hardware Settings

Torch

Torch H	0.2 mm	Torch V	-0.2 mm

EM

Discriminator	4.0 mV	Analog HV	2139 V	Pulse HV	1393 V

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ56

Instrument ID: 19204

Start Date: 10/15/2018

Run Name: 1828806E05

End Date: 10/15/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	GE-1-72	AS,MO
IN-1-115	CD	SC-2-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element GE-1-72	Q	Element IN-1-115	Q	Element BI-1-209	Q	Element	Q	Element	Q
S0	19:05	100		100		100		100					
S	19:07	100		102		88		102					
ICV	19:10	101		105		97		99					
ICB	19:13	99		104		95		96					
LLC	19:16	101		103		94		98					
ICSA	19:19	94		95		87		92					
LRS2	19:22	98		96		90		91					
LRS3	19:24	101		102		94		95					
CCS	19:27	88		90		82		84					
CCS	19:30	98		99		94		95					
CCV	19:33	99		97		84		95					
CCB	19:36	96		97		87		92					
P28404BB	19:39	95		98		98		95					
P28404BQ	19:41	96		97		92		94					
9839633BKG	19:44	99		95		91		95					
9839633A	19:47	103		98		91		95					
9839633DUP	19:50	103		101		96		100					
9839633MS	19:53	101		101				100					
9839633MSD	19:55	101		101		95		98					
9839633L	19:58	101		101		101		97					
9839632	20:01	99		103		91		101					
CCV	20:04	100		101		97		99					
CCB	20:07	103		98		93		91					
9839634	20:10	102		101		93		99					
9839635	20:12	101		101		95		100					
9839636	20:15	102		103		93		96					
9839637	20:18	99		101		97		96					
9839638	20:21	101		100		91		96					
ZZZZZZ	20:24												
ZZZZZZ	20:27												
CCV	20:29	102		103		96		100					
CCB	20:32	102		103		99		99					

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Instrument ID: 27813

Start Date: 10/18/2018

Run Name: 1829104E07

End Date: 10/18/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-3-115	CD, SB		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-3-115	Q	Element	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	13:28	100											
S	13:30	100											
ICV	13:32	96											
ICB	13:35	96											
LLC	13:37	97											
ICSA	13:39	90											
LRS2	13:41	92											
LRS3	13:43	95											
CCS	13:45	96											
CCS	13:47	95											
CCV	13:50	98											
CCB	13:52	96											
P28404BB	13:54	98											
P28404BQ	13:56	97											
9839633BKG	13:58	98											
9839633A	14:00	91											
9839633DUP	14:03	98											
9839633MS	14:05	96											
9839633MSD	14:07	96											
9839633L	14:09	98											
9839632	14:11	97											
CCV	14:13	100											
CCB	14:15	97											
9839634	14:18	97											
9839635	14:20	88											
9839636	14:22	99											
9839637	14:24	97											
9839638	14:26	95											
CCV	14:28	100											
CCB	14:30	97											

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Preparation and Run Logs

Metals in Liquid

Method: P

Batch Number: 182841404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9839632	10/12/2018	50.00	50
9839634	10/12/2018	50.00	50
9839635	10/12/2018	50.00	50
9839636	10/12/2018	50.00	50
9839637	10/12/2018	50.00	50
9839638	10/12/2018	50.00	50
9839633BKG	10/12/2018	50.00	50
9839633DUP	10/12/2018	50.00	50
9839633MSD	10/12/2018	50.00	50
9839633MS	10/12/2018	50.00	50
P28404BB	10/12/2018	50.00	50
P28404BQ	10/12/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Method: MS
Batch Number: 182841404702

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9839632	10/12/2018	50.00	50
9839634	10/12/2018	50.00	50
9839635	10/12/2018	50.00	50
9839636	10/12/2018	50.00	50
9839637	10/12/2018	50.00	50
9839638	10/12/2018	50.00	50
9839633BKG	10/12/2018	50.00	50
9839633DUP	10/12/2018	50.00	50
9839633MSD	10/12/2018	50.00	50
9839633MS	10/12/2018	50.00	50
P28404BB	10/12/2018	50.00	50
P28404BQ	10/12/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Method: CV
Batch Number: 182840571302

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9839632	10/11/2018	40.00	40
9839633	10/11/2018	40.00	40
9839634	10/11/2018	40.00	40
9839635	10/11/2018	40.00	40
9839636	10/11/2018	40.00	40
9839638	10/11/2018	40.00	40
9839637BKG	10/11/2018	40.00	40
9839637DUP	10/11/2018	40.00	40
9839637MSD	10/11/2018	40.00	40
9839637MS	10/11/2018	40.00	40
P28471BB	10/11/2018	40.00	40
P28471BQ	10/11/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ56

Method: P

Instrument ID: 18255

Run Name: 1828901T73

Run Start Date: 10/16/2018

Run End Date: 10/16/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	05:48			X		X		X	X	X		X			X	X													
S	1.00	05:50							X																					
S	1.00	05:53			X		X				X	X				X	X													
S	1.00	05:56								X																				
ICV	1.00	05:58			X		X		X	X	X		X			X	X													
ICB	1.00	06:01			X		X		X	X	X		X			X	X													
LLC	1.00	06:04			X		X		X	X	X		X			X	X													
ICSA	1.00	06:06			X		X		X	X	X		X			X	X													
CCV	1.00	06:09			X		X		X	X	X		X			X	X													
CCB	1.00	06:11			X		X		X	X	X		X			X	X													
LRS2	1.00	06:14			X		X		X	X	X		X			X	X													
LRS4	1.00	06:17			X		X		X	X	X		X			X	X													
LRS3	1.00	06:19			X		X		X	X	X		X			X	X													
LRS5	1.00	06:22			X		X		X	X	X		X			X	X													
CCV	1.00	06:25			X		X		X	X	X		X			X	X													
CCB	1.00	06:27			X		X		X	X	X		X			X	X													
P28404BB	1.00	06:30			X		X		X	X	X		X			X	X													
P28404BQ	1.00	06:33			X		X		X	X	X		X			X	X													
9839633BKG	1.00	06:35			X		X		X	X	X		X			X	X													
9839633A	1.00	06:38																												
9839633DUP	1.00	06:40			X		X		X	X	X		X			X	X													
9839633MS	1.00	06:43			X		X		X	X	X		X			X	X													
9839633MSD	1.00	06:46			X		X		X	X	X		X			X	X													
9839633L	5.00	06:48			X		X		X	X	X		X			X	X													
9839632	1.00	06:51			X		X			X	X		X			X	X													
9839634	1.00	06:54			X		X		X	X	X		X			X	X													
CCV	1.00	06:56			X		X		X	X	X		X			X	X													
CCB	1.00	06:59			X		X		X	X	X		X			X	X													
9839635	1.00	07:02			X		X		X	X	X		X			X	X													
9839636	1.00	07:04			X		X		X	X	X		X			X	X													
9839637	1.00	07:07			X		X		X	X	X		X			X	X													
9839638	1.00	07:10			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	07:12																												
ZZZZZZ	1.00	07:15																												
ZZZZZZ	1.00	07:17																												
CCV	1.00	07:20			X		X		X	X	X		X			X	X													
CCB	1.00	07:22			X		X		X	X	X		X			X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ56

Method: MS

Instrument ID: 19204

Run Name: 1828806E05

Run Start Date: 10/15/2018

Run End Date: 10/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	19:05	X		X		X					X			X															
S	1.00	19:07	X		X		X					X			X															
ICV	1.00	19:10	X		X		X					X			X															
ICB	1.00	19:13	X		X		X					X			X															
LLC	1.00	19:16	X		X		X					X			X															
ICSA	1.00	19:19	X		X		X					X			X															
LRS2	1.00	19:22	X		X		X					X			X															
LRS3	1.00	19:24	X		X		X					X			X															
CCS	1.00	19:27	X		X		X					X			X															
CCS	1.00	19:30	X		X		X					X			X															
CCV	1.00	19:33	X		X		X					X			X															
CCB	1.00	19:36	X		X		X					X			X															
P28404BB	1.00	19:39	X		X		X					X			X															
P28404BQ	1.00	19:41	X		X		X					X			X															
9839633BKG	1.00	19:44	X		X		X					X			X															
9839633A	1.00	19:47																												
9839633DUP	1.00	19:50	X		X		X					X			X															
9839633MS	1.00	19:53	X		X							X			X															
9839633MSD	1.00	19:55	X		X		X					X			X															
9839633L	5.00	19:58	X		X		X					X			X															
9839632	1.00	20:01	X		X		X					X			X															
CCV	1.00	20:04	X		X		X					X			X															
CCB	1.00	20:07	X		X		X					X			X															
9839634	1.00	20:10	X		X		X					X			X															
9839635	1.00	20:12	X		X		X					X			X															
9839636	1.00	20:15	X		X		X					X			X															
9839637	1.00	20:18	X		X		X					X			X															
9839638	1.00	20:21	X		X		X					X			X															
ZZZZZZ	1.00	20:24																												
ZZZZZZ	1.00	20:27																												
CCV	1.00	20:29	X		X		X					X			X															
CCB	1.00	20:32	X		X		X					X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
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MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ56

Method: MS

Instrument ID: 27813

Run Name: 1829104E07

Run Start Date: 10/18/2018

Run End Date: 10/18/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	13:28	X					X																						
S	1.00	13:30	X					X																						
ICV	1.00	13:32	X					X																						
ICB	1.00	13:35	X					X																						
LLC	1.00	13:37	X					X																						
ICSA	1.00	13:39	X					X																						
LRS2	1.00	13:41	X					X																						
LRS3	1.00	13:43	X					X																						
CCS	1.00	13:45	X					X																						
CCS	1.00	13:47	X					X																						
CCV	1.00	13:50	X					X																						
CCB	1.00	13:52	X					X																						
P28404BB	1.00	13:54	X																											
P28404BQ	1.00	13:56	X																											
9839633BKG	1.00	13:58	X																											
9839633A	1.00	14:00																												
9839633DUP	1.00	14:03	X																											
9839633MS	1.00	14:05	X					X																						
9839633MSD	1.00	14:07	X																											
9839633L	5.00	14:09	X																											
9839632	1.00	14:11	X																											
CCV	1.00	14:13	X					X																						
CCB	1.00	14:15	X					X																						
9839634	1.00	14:18	X																											
9839635	1.00	14:20	X																											
9839636	1.00	14:22	X																											
9839637	1.00	14:24	X																											
9839638	1.00	14:26	X																											
CCV	1.00	14:28	X																											
CCB	1.00	14:30	X																											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ56

Method: CV

Instrument ID: 23283

Run Name: 1828501M09

Run Start Date: 10/12/2018

Run End Date: 10/12/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	06:19												X																
S0.2	1.00	06:21												X																
S0.5	1.00	06:23												X																
S1.0	1.00	06:25												X																
S2.5	1.00	06:27												X																
S5.0	1.00	06:29												X																
ICV	1.00	06:31												X																
ICB	1.00	06:33												X																
CRA	1.00	06:35												X																
CCV	1.00	06:37												X																
CCB	1.00	06:39												X																
ZZZZZZ	1.00	06:41																												
ZZZZZZ	1.00	06:43																												
ZZZZZZ	1.00	06:45																												
ZZZZZZ	1.00	06:47																												
ZZZZZZ	1.00	06:50																												
ZZZZZZ	1.00	06:52																												
ZZZZZZ	1.00	06:54																												
ZZZZZZ	1.00	06:56																												
ZZZZZZ	1.00	06:58																												
ZZZZZZ	1.00	07:00																												
CCV	1.00	07:02												X																
CCB	1.00	07:04												X																
ZZZZZZ	1.00	07:06																												
ZZZZZZ	1.00	07:08																												
ZZZZZZ	1.00	07:10																												
ZZZZZZ	1.00	07:12																												
ZZZZZZ	1.00	07:14																												
ZZZZZZ	1.00	07:16																												
ZZZZZZ	1.00	07:18																												
ZZZZZZ	1.00	07:20																												
ZZZZZZ	1.00	07:22																												
ZZZZZZ	1.00	07:24																												
CCV	1.00	07:26												X																
CCB	1.00	07:28												X																
ZZZZZZ	1.00	07:30																												
ZZZZZZ	1.00	07:32																												
ZZZZZZ	1.00	07:34																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ56

Method: CV

Instrument ID: 23283

Run Name: 1828501M09

Run Start Date: 10/12/2018

Run End Date: 10/12/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	07:36																												
ZZZZZZ	1.00	07:38																												
ZZZZZZ	1.00	07:40																												
ZZZZZZ	1.00	07:42																												
ZZZZZZ	1.00	07:44																												
ZZZZZZ	1.00	07:46																												
ZZZZZZ	1.00	07:49																												
CCV	1.00	07:51												X																
CCB	1.00	07:53												X																
ZZZZZZ	1.00	07:55																												
ZZZZZZ	1.00	07:57																												
ZZZZZZ	1.00	07:59																												
ZZZZZZ	1.00	08:01																												
ZZZZZZ	1.00	08:03																												
P28471BB	1.00	08:05												X																
P28471BQ	1.00	08:07												X																
9839637BKG	1.00	08:09												X																
9839637DUP	1.00	08:11												X																
9839637MS	1.00	08:13												X																
CCV	1.00	08:15												X																
CCB	1.00	08:17												X																
9839637MSD	1.00	08:19												X																
9839632	1.00	08:21												X																
9839633	1.00	08:23												X																
9839634	1.00	08:25												X																
9839635	1.00	08:27												X																
9839636	1.00	08:29												X																
9839638	1.00	08:31												X																
CCV	1.00	08:35												X																
CCB	1.00	08:37												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9839632	FB-20181004	X		Field Blank
9839633	MW-4	X		
9839634	MW-6	X		
9839635	MW-5	X		
9839636	MW-2	X		
9839637	MW-3	X		
9839638	MW-1	X		

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Method defined actions are taken for any failed matrix QC.

Batch#: 18288520109A (Sample number(s): 9839633-9839638, UNSPK: 9839633, BKG: 9839633)
The recovery(ies) for the following analyte(s) in the MS exceeded the acceptance window indicating a positive bias: Fluoride

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9839632	DF1	DF1	DF1
9839633	UNSPK, MS, D/ DF5	UNSPK, MS, D/ DF5	UNSPK, MS, D/ DF5
9839634	DF50	DF5	DF5
9839635	DF50	DF5	DF50
9839636	DF5	DF5	DF5
9839637	DF50	DF5	DF5
9839638	DF50	DF5	DF50

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18288520109A	9839633 BKG	10/15/2018 13:05:00	X	X	X
	9839633 DUP	10/15/2018 13:23:00	X	X	X
	9839633 MS	10/15/2018 13:40:00	X	X	X
	9839634	10/15/2018 13:58:00		X	X
	9839634	10/15/2018 14:16:00	X		
	9839635	10/15/2018 14:34:00		X	
	9839635	10/15/2018 14:51:00	X		X
	9839636	10/15/2018 15:09:00	X	X	X
	9839637	10/15/2018 15:44:00		X	X
	9839637	10/15/2018 16:37:00	X		
	9839638	10/15/2018 17:13:00	X		X
	9839638	10/17/2018 00:27:00		X	
	P28820IB	10/16/2018 01:10:00	X	X	X
	P28820IQ	10/16/2018 00:53:00	X	X	X
18288520115A	P28820OB	10/15/2018 12:17:00	X		X
	P28820OB	10/18/2018 11:31:00		X	
	P28820OQ	10/15/2018 12:01:00	X		X
	P28820OQ	10/18/2018 11:13:00		X	
18288520115B	9839632	10/16/2018 02:46:00	X		X
	9839632	10/16/2018 23:16:00		X	

Fraction: Instrumental Wet Chemistry

18288520109A / P28820IB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	10/16/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	10/16/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	10/16/18	N.D.	mg/l	0.30	1.0

18288520115A / P28820OB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	10/15/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	10/18/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	10/15/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

UNSPK: 9839633	Batch: 18288520109A (Sample number(s): 9839633-9839638)									
MS: 9839633		Spike Added	Unspiked	MS	MSD					
	ME	mg/l	Conc	Conc	Conc	MS	MSD	%Rec	%RPD	%RPD
Parameter			mg/l	mg/l	mg/l	%Rec	%Rec	Limits		Limits
Chloride	IC	10	1.10 J	10.13	NA	90	NA	90-110	NA	NA
Fluoride	IC	2.50	N.D.	2.82	NA	113 *	NA	90-110	NA	NA
Sulfate	IC	25	N.D.	26.75	NA	107	NA	90-110	NA	NA

Comments:

(2) The unspiked sample result is greater than four times the spike added.

* = Out of Specification

Results are being reported on an as received basis.

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

BKG: 9839633 DUP: 9839633	Batch: 18288520109A (Sample number(s): 9839633-9839638)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Chloride	IC	1.1 J	1.01 J	8 (1)	15
Fluoride	IC	N.D.	N.D.	0 (1)	15
Sulfate	IC	N.D.	N.D.	0 (1)	15

Comments:

(1) The sample and/or duplicate result is less than five times the LOQ.

* = Out of Specification

Results are being reported on an as received basis.

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P28820IQ	Batch: 18288520109A (Sample number(s): 9839633-9839638)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.73	NA	91	NA	90-110	NA	NA
Fluoride	IC	0.750	0.810	NA	108	NA	90-110	NA	NA
Sulfate	IC	7.50	7.34	NA	98	NA	90-110	NA	NA

LCS: P28820OQ	Batch: 18288520115B (Sample number(s): 9839632)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.85	NA	95	NA	90-110	NA	NA
Fluoride	IC	0.750	0.745	NA	99	NA	90-110	NA	NA
Sulfate	IC	7.50	7.00	NA	93	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ56

Instrument ID: 18919
Calibration Date: 09/21/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Fluoride	0.145206	0.494347	1.238762	2.616398	4.000046	0.9997	0.9998

Acceptance Range:

ICV/CCV: 90%-110%

ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18288520109A

Run Start Dates: 10/16/2018

Run Names: 1828901D12

Sample	Fluoride		
	True	Result	%Rec
ICV	0.75	0.7264	97
ICB	0	ND	NA
Low Chk	0.75	2.2960	306
High Chk	2.25	0.7746	34
CCV2	0.75	0.7806	104
CCB	0	ND	NA
CCV2	0.75	0.7993	107
CCB	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ56

Instrument ID: 24811
Calibration Date: 09/21/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Fluoride	0.214472	0.799734	2.100835	4.484078	6.993469	0.9994	0.9997

Acceptance Range:

ICV/CCV: 90%-110%

ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18288520115B

Run Start Dates: 10/16/2018

Run Names: 1828901D17

Sample	Fluoride		
	True	Result	%Rec
ICV	0.75	0.7918	106
ICB	0	ND	NA
Low Chk	0.75	0.8481	113
High Chk	2.25	2.4074	107
CCV2	0.75	0.8560	114
CCB	0	ND	NA
CCV2	0.75	1.0144	135
CCB	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ56

Instrument ID: 17694
Calibration Date: 09/21/2018

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.730945	1.150491	2.791808	5.746708	8.922221	0.9964	0.9982
Fluoride	0.111799	0.630133	1.612750	3.375325	5.314184	0.9988	0.9994
Sulfate	0.370067	0.713432	1.821674	3.807377	5.921426	0.9995	0.9998

Concentration units: mg/L

Batch Numbers: 18288520109A
Run Start Dates: 10/15/2018
Run Names: 1828801D09

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9738	99	7.5	7.5571	101	0.75	0.7933	106
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.8005	93	7.5	7.4287	99	0.75	0.8276	110
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7255	91	7.5	7.3084	97	0.75	0.8001	107
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7788	93	7.5	7.4341	99			
CCB	0	ND	NA	0	ND	NA			
CCV2	3	2.7352	91	7.5	7.3116	97	0.75	0.7820	104
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7212	91	7.5	7.2822	97	0.75	0.8060	107
CCB	0	ND	NA	0	ND	NA	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ56

Instrument ID: 12115
Calibration Date: 09/29/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	1.037403	2.041477	5.219284	10.851470	17.490093	0.9954	0.9977
Sulfate	0.625176	1.274492	3.246368	6.855216	11.396219	0.9963	0.9981

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18288520115B
Run Start Dates: 10/15/2018
Run Names: 1828801D15

Sample	Chloride			Sulfate		
	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9780	99	7.5	7.4559	99
ICB	0	ND	NA	0	ND	NA
CCV2	3	2.9111	97	7.5	7.2768	97
CCB	0	ND	NA	0	ND	NA
CCV2	3	2.8956	97	7.5	7.2565	97
CCB	0	ND	NA	0	ND	NA
CCV2	3	2.8838	96	7.5	7.2927	97
CCB	0	ND	NA	0	ND	NA
CCV2	3	2.9020	97	7.5	7.1909	96
CCB	0	ND	NA	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ56

Instrument ID: 24811
Calibration Date: 10/17/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Fluoride	0.207718	0.766276	1.954591	4.133266	6.534954	0.9991	0.9996

Acceptance Range:

ICV/CCV: 90%-110%

ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18288520115B

Run Start Dates: 10/18/2018

Run Names: 1829101D17

Sample	Fluoride		
	True	Result	%Rec
ICV	0.75	0.7584	101
ICB	0	ND	NA
CCV2	0.75	0.7397	99
CCB	0	ND	NA
Low Chk	0.75	0.7954	106
High Chk	2.25	2.3805	106
CCV2	0.75	0.7288	97
CCB	0	ND	NA

* = Out of Specifications

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9839632	FB-20181004	X		1	Field Blank
9839633	MW-4	X		1	
9839634	MW-6	X		1	
9839635	MW-5	X		1	
9839636	MW-2	X		1	
9839637	MW-3	X		1	
9839638	MW-1	X		1	

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

No problems were encountered with the analysis of the samples.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Water Quality

Fraction: Wet Chemistry

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ56

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18283921201A	B283871B	10/10/2018 16:00
		L283871Q	10/10/2018 16:00
		9839633	10/10/2018 16:00
		9839634	10/10/2018 16:00
		9839635	10/10/2018 16:00
		9839637	10/10/2018 16:00
Total Dissolved Solids	18283921203A	B283873B	10/10/2018 16:56
		L283873Q	10/10/2018 16:56
		9839632	10/10/2018 16:56
		9839636	10/10/2018 16:56
		9839638	10/10/2018 16:56

Quality Control Reference List
Water Quality**CLIENT: GEI Consultants, Inc.**
SDG: GEJ56**Fraction: Wet Chemistry**

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18281003203A	9839632	10/09/2018 04:42:00	X	X
	9839633	10/09/2018 04:34:00	X	X
	9839634	10/09/2018 05:20:00	X	X
	9839635	10/09/2018 05:09:00	X	X
	9839636	10/09/2018 04:38:00	X	X
	9839637	10/09/2018 05:16:00	X	X
	9839638	10/09/2018 05:13:00	X	X
	P003203Q	10/09/2018 03:42:00	X	

Fraction: Wet Chemistry

18283921201A / B283871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/10/18	N.D.	mg/l	20.0	60.0

18283921203A / B283873B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/10/18	N.D.	mg/l	20.0	60.0

Water Quality
Fraction: Wet Chemistry

LCS: P003203Q	Batch: 18281003203A (Sample number(s): 9839632-9839638)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.01	NA	100	NA	95-105	NA	NA

LCS: L283871Q	Batch: 18283921201A (Sample number(s): 9839633-9839635, 9839637)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	192	NA	96	NA	62-127	NA	NA

LCS: L283873Q	Batch: 18283921203A (Sample number(s): 9839632, 9839636, 9839638)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	194	NA	97	NA	62-127	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

November 05, 2018

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994

Re: NJ Radiochemistry Analyses
Work Order: 461244

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 09, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Taylor Cannon for
Julie Robinson
Project Manager

Purchase Order: 1995509
Chain of Custody: 1995509
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 461244**

November 05, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on October 09, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
461244001	FB-20181004 Grab Water
461244002	MW-4 Grab Groundwater
461244003	MW-6 Grab Groundwater
461244004	MW-5 Grab Groundwater
461244005	MW-2 Grab Groundwater
461244006	MW-3 Grab Groundwater
461244007	MW-1 Grab Groundwater

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.



Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

Laboratory Certifications

There are no "Data Exception Reports" associated with this analytical report.

List of current GEL Certifications as of 05 November 2018

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-27
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LANC)
SDG #: 461244**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1811253

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
461244001	FB-20181004 Grab Water
461244002	MW-4 Grab Groundwater
461244003	MW-6 Grab Groundwater
461244004	MW-5 Grab Groundwater
461244005	MW-2 Grab Groundwater
461244006	MW-3 Grab Groundwater
461244007	MW-1 Grab Groundwater
1204133162	Method Blank (MB)
1204133163	461244004(MW-5 Grab Groundwater) Sample Duplicate (DUP)
1204133164	461244004(MW-5 Grab Groundwater) Matrix Spike (MS)
1204133165	461244004(MW-5 Grab Groundwater) Matrix Spike Duplicate (MSD)
1204133166	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Sample 1204133164 (MW-5 Grab GroundwaterMS) was recounted due to high recovery. The recount is reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204133164 (MW-5 Grab GroundwaterMS) and 1204133165 (MW-5 Grab GroundwaterMSD), aliquots were reduced to conserve sample volume.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1810204

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
461244001	FB-20181004 Grab Water
461244002	MW-4 Grab Groundwater
461244003	MW-6 Grab Groundwater
461244004	MW-5 Grab Groundwater
461244005	MW-2 Grab Groundwater
461244006	MW-3 Grab Groundwater
461244007	MW-1 Grab Groundwater
1204130926	Method Blank (MB)
1204130927	461244002(MW-4 Grab Groundwater) Sample Duplicate (DUP)
1204130928	461244002(MW-4 Grab Groundwater) Matrix Spike (MS)
1204130929	Laboratory Control Sample (LCS)
1204132247	461244002(MW-4 Grab Groundwater) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information**Duplication Criteria between MS and MSD**

The Matrix Spike and Matrix Spike Duplicate (See Below) do not meet the duplication requirement; however, they both meet the spiked recovery requirement.

Sample	Analyte	Value
1204130928MS and 1204132247MSD (MW-4 Grab Groundwater)	Radium-226	RPD 20.5* (0%-20%)

Miscellaneous Information**Additional Comments**

The matrix spike and matrix spike duplicate, 1204130928 (MW-4 Grab GroundwaterMS) and 1204132247 (MW-4 Grab GroundwaterMSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

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Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 461244 GEL Work Order: 461244

The Qualifiers in this report are defined as follows:

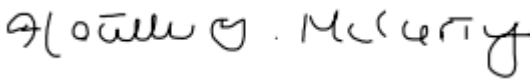
- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:



Name: Heather McCarty

Date: 02 NOV 2018

Title: Analyst II

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 2, 2018

Client Sample ID: FB-20181004 Grab Water
Sample ID: 461244001
Matrix: Water
Collect Date: 04-OCT-18
Receive Date: 09-OCT-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	-0.271	+/-0.989	1.88	+/-0.989	3.00	pCi/L			JXC9	10/22/18	1127	1811253	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.245	+/-0.192	0.271	+/-0.195	1.00	pCi/L			PCW	10/16/18	0940	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	89.5	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-4 Grab Groundwater

Project: LANC00115

Sample ID: 461244002

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	-0.804	+/-0.733	1.55	+/-0.733	3.00	pCi/L			JXC9	10/22/18	1136	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.365	+/-0.239	0.326	+/-0.245	1.00	pCi/L			PCW	10/16/18	0940	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	103	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-6 Grab Groundwater

Project: LANC00115

Sample ID: 461244003

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.550	+/-0.917	1.59	+/-0.930	3.00	pCi/L			JXC9	10/22/18	1137	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.482	+/-0.283	0.389	+/-0.297	1.00	pCi/L			PCW	10/16/18	0940	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	96.9	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-5 Grab Groundwater

Project: LANC00115

Sample ID: 461244004

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.0835	+/-0.690	1.29	+/-0.690	3.00	pCi/L			JXC9	10/22/18	1137	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.661	+/-0.365	0.482	+/-0.383	1.00	pCi/L			PCW	10/16/18	1015	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	104	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-2 Grab Groundwater

Project: LANC00115

Sample ID: 461244005

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.132	+/-0.565	1.06	+/-0.567	3.00	pCi/L			JXC9	10/22/18	1137	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.337	+/-0.200	0.231	+/-0.206	1.00	pCi/L			PCW	10/16/18	1015	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	101	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3 Grab Groundwater

Project: LANC00115

Sample ID: 461244006

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	-0.0298	+/-0.606	1.20	+/-0.606	3.00	pCi/L			JXC9	10/22/18	1137	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.747	+/-0.286	0.204	+/-0.311	1.00	pCi/L			PCW	10/16/18	1015	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	89.5	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 2, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-1 Grab Groundwater

Project: LANC00115

Sample ID: 461244007

Client ID: LANC006

Matrix: Water

Collect Date: 04-OCT-18

Receive Date: 09-OCT-18

Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.898	+/-0.883	1.44	+/-0.918	3.00	pCi/L			JXC9	10/22/18	1137	1811253	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.13	+/-0.341	0.196	+/-0.409	1.00	pCi/L			PCW	10/16/18	1015	1810204	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1811253	73.8	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

Quality Control Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: November 2, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 461244

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1811253										
QC1204133163	461244004 DUP										
Radium-228		U	0.0835	U	0.243	pCi/L	0		N/A	JXC9	10/22/1811:36
		Uncert:	+/-0.690		+/-0.679						
		TPU:	+/-0.690		+/-0.682						
QC1204133166	LCS										
Radium-228		17.2			16.5	pCi/L	96.3	(75%-125%)	JXC9	10/22/1811:36	
		Uncert:			+/-2.04						
		TPU:			+/-5.04						
QC1204133162	MB										
Radium-228				U	0.223	pCi/L			JXC9	10/22/1811:36	
		Uncert:			+/-0.568						
		TPU:			+/-0.571						
QC1204133164	461244004 MS										
Radium-228		51.7	U	0.0835	39.0	pCi/L	75.5	(75%-125%)	JXC9	10/22/1813:19	
		Uncert:			+/-6.44						
		TPU:			+/-12.5						
QC1204133165	461244004 MSD										
Radium-228		51.7	U	0.0835	41.5	pCi/L	6.13	80.2	(0%-20%)	JXC9	10/22/1811:36
		Uncert:			+/-5.07						
		TPU:			+/-12.3						
Rad Ra-226											
Batch	1810204										
QC1204130927	461244002 DUP										
Radium-226			0.365	U	0.299	pCi/L	20	(0% - 100%)	PCW	10/16/1810:15	
		Uncert:	+/-0.239		+/-0.249						
		TPU:	+/-0.245		+/-0.258						
QC1204130929	LCS										
Radium-226		26.0			26.1	pCi/L	101	(75%-125%)	PCW	10/16/1811:00	
		Uncert:			+/-1.77						
		TPU:			+/-6.33						
QC1204130926	MB										
Radium-226				U	0.167	pCi/L			PCW	10/16/1810:15	
		Uncert:			+/-0.181						
		TPU:			+/-0.183						
QC1204130928	461244002 MS										
Radium-226		130		0.365	102	pCi/L	78.3	(75%-125%)	PCW	10/16/1810:15	
		Uncert:			+/-6.72						
		TPU:			+/-16.8						
QC1204132247	461244002 MSD										
Radium-226		130		0.365	125	pCi/L	20.5*	96.3	(0%-20%)	PCW	10/16/1810:15
		Uncert:			+/-7.61						

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QC Summary

Workorder: 461244

Page 2 of 2

Parmname	NOM	Sample Qual	QC	Units	RPD %	REC %	Range	Anlst	Date	Time
Rad Ra-226										
Batch	1810204									
		TPU:	+/-0.245				+/-21.1			

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
 - < Result is less than value reported
 - > Result is greater than value reported
 - BD Results are either below the MDC or tracer recovery is low
 - FA Failed analysis.
 - H Analytical holding time was exceeded
 - J Value is estimated
 - K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
 - L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
 - M M if above MDC and less than LLD
 - M REMF Result > MDC/CL and < RDL
 - N/A RPD or %Recovery limits do not apply.
 - N1 See case narrative
 - ND Analyte concentration is not detected above the detection limit
 - NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
 - R Sample results are rejected
 - U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
 - UI Gamma Spectroscopy--Uncertain identification
 - UJ Gamma Spectroscopy--Uncertain identification
 - UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
 - X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Y Other specific qualifiers were required to properly define the results. Consult case narrative.
 - ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
 - h Preparation or preservation holding time was exceeded
- N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
- ** Indicates analyte is a surrogate/tracer compound.
- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1811253 Check-list

This check-list was completed on 22-OCT-18 by Nat Long

This batch was reviewed by Nat Long on 22-OCT-18 and Kenshalla Oston on 24-OCT-18.

Batch ID:
1811253

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-009

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID: 1811253

Analyst: Jasmine Conley (JXC9)

Method: EPA 904.0/SW846 9320 Modified

Lab SOP: GL-RAD-A-063 REV# 2

Instrument: GFC-51204863

Due Dates for Lab: 02-NOV-2018

Package: 04-NOV-2018

SDG: 06-NOV-2018

Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units
LCS	1204133166	Radium-228 SPIKE	1810-A	.1	mL
MS	1204133164	Radium-228 SPIKE	1810-A	.1	mL
MSD	1204133165	Radium-228 SPIKE	1810-A	.1	mL

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	461244001	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
2	461244002	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
3	461244003	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
4	461244004	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
5	461244005	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
6	461244006	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
7	461244007	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
8	1204133162 MB	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
9	1204133163 DUP (461244004)	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30
10	1204133164 MS (461244004)	17-OCT-2018	3	100	10/18/18 14:00	10/22/18 09:30
11	1204133165 MSD (461244004)	17-OCT-2018	3	100	10/18/18 14:00	10/22/18 09:30
12	1204133166 LCS	17-OCT-2018	3	300	10/18/18 14:00	10/22/18 09:30

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 17-OCT-2018 00:00
REGNT 2662331.3	cerium 500 mg/L in 2%HCl	.2 mL	
REGNT 2672182	RGF-1.5 Ammonium Sulfate	10 mL	
REGNT 2801523.7	Hydrofluoric Acid Poly Bottle	3 mL	
REGNT 2832203.5	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 2833686	RGF-7M Nitric Acid	25 mL	
REGNT 2836171.10	HNO3	5 mL	
REGNT 2838193	RGF-50% Potassium Carbonate	2 mL	
REGNT 2840709	RGF-16mg/mL Barium Chloride	1 mL	
REGNT 2841696	2M HCl	20 mL	
REGNT 2843889	RGF-1M Citric Acid	5 mL	
WORK 0487-D	Barium-133 TRACER	.1 mL	

RA1811253r1.xls

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.4.2

Tracer S/N : 0487-D
Tracer Exp Date : 11/8/2018
Tracer Volume Added: 0.10

Batch : 1811253
Analyst : JAS02031
Prep Date : 10/17/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 3 pCi/L
Ra-228 Abundance : 1.00
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.15 hours

Geometry: CeF on 25mm Filter

Sample Characteristics					Tracer Calculations					
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Tracer Ref. Activity (CPM)	Tracer Ref. Count Uncertainty (%)	Tracer Samp. Activity (CPM)	Tracer Samp. Count Uncertainty (%)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)
1	461244001.1	0.3000	1.8459E-05	10/4/2018 12:00	156.4	8.00%	140.0	8.45%	0.1	0.000200
2	461244002.1	0.3000	1.8459E-05	10/4/2018 10:20	156.4	8.00%	161.5	7.87%	0.1	0.000200
3	461244003.1	0.3000	1.8459E-05	10/4/2018 10:20	156.4	8.00%	151.6	8.12%	0.1	0.000200
4	461244004.1	0.3000	1.8459E-05	10/4/2018 12:40	156.4	8.00%	162.0	7.86%	0.1	0.000200
5	461244005.1	0.3000	1.8459E-05	10/4/2018 11:45	156.4	8.00%	158.2	7.95%	0.1	0.000200
6	461244006.1	0.3000	1.8459E-05	10/4/2018 13:40	156.4	8.00%	140.1	8.45%	0.1	0.000200
7	461244007.1	0.3000	1.8459E-05	10/4/2018 14:25	156.4	8.00%	115.5	9.30%	0.1	0.000200
8	1204133162.1	0.3000	1.8459E-05	10/17/2018 0:00	156.4	8.00%	150.8	8.14%	0.1	0.000200
9	1204133163.1	0.3000	1.8459E-05	10/4/2018 12:40	156.4	8.00%	157.3	7.97%	0.1	0.000200
10	1204133164.1	0.1000	1.1370E-05	10/4/2018 12:40	156.4	8.00%	151.9	8.11%	0.1	0.000200
11	1204133165.1	0.1000	1.1370E-05	10/4/2018 12:40	156.4	8.00%	174.6	7.57%	0.1	0.000200
12	1204133166.1	0.3000	1.8459E-05	10/17/2018 0:00	156.4	8.00%	136.9	8.55%	0.1	0.000200

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
Instrument SOP: GL-RAD-I-016, GL-RAD-I-006

Count raw Data														Calculated Sample Recovery %	Sample Recovery Error %
Pos.	Detector ID	Counting Time (min.)	Gross Counts		Beta cpm	Count Start Date/Time	Ac-228 Ingrowth Date/Time	Ac-228 Decay Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Ingrowth	Ac-228 Count Correction			
			Alpha	Beta											
1	5D	60	11	73	1.217	10/22/2018 11:27	10/18/2018 14:00	10/22/2018 9:30	0.994	0.802	1.000	1.057	89.5%	5.83%	
2	6B	60	4	47	0.783	10/22/2018 11:36	10/18/2018 14:00	10/22/2018 9:30	0.994	0.788	1.000	1.057	103%	5.62%	
3	6C	60	8	71	1.183	10/22/2018 11:37	10/18/2018 14:00	10/22/2018 9:30	0.994	0.788	1.000	1.057	96.9%	5.71%	
4	7A	60	4	45	0.750	10/22/2018 11:37	10/18/2018 14:00	10/22/2018 9:30	0.994	0.787	1.000	1.057	104%	5.61%	
5	7B	60	8	30	0.500	10/22/2018 11:37	10/18/2018 14:00	10/22/2018 9:30	0.994	0.787	1.000	1.057	101%	5.65%	
6	7C	60	11	26	0.433	10/22/2018 11:37	10/18/2018 14:00	10/22/2018 9:30	0.994	0.787	1.000	1.057	89.5%	5.83%	
7	8B	60	3	41	0.683	10/22/2018 11:37	10/18/2018 14:00	10/22/2018 9:30	0.994	0.787	1.000	1.057	73.8%	6.14%	
8	8C	60	4	27	0.450	10/22/2018 11:36	10/18/2018 14:00	10/22/2018 9:30	0.998	0.789	1.000	1.057	96.4%	5.71%	
9	9A	60	8	43	0.717	10/22/2018 11:36	10/18/2018 14:00	10/22/2018 9:30	0.994	0.788	1.000	1.057	101%	5.65%	
10	A1	60	5	264	4.400	10/22/2018 13:19	10/18/2018 14:00	10/22/2018 9:30	0.994	0.650	1.000	1.057	97.1%	5.70%	
11	9C	60	9	326	5.433	10/22/2018 11:36	10/18/2018 14:00	10/22/2018 9:30	0.994	0.788	1.000	1.057	112%	5.51%	
12	9D	60	16	307	5.117	10/22/2018 11:36	10/18/2018 14:00	10/22/2018 9:30	0.998	0.788	1.000	1.057	87.5%	5.86%	

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	PIC	6/1/2017	5/31/2019	0.6669	0.00925	1.298	10/19/2018 16:01	500
2	PIC	6/1/2017	5/31/2019	0.6465	0.00851	1.048	10/19/2018 16:05	500
3	PIC	6/1/2017	5/31/2019	0.6594	0.01970	1.010	10/19/2018 16:05	500
4	PIC	6/1/2017	5/31/2019	0.6570	0.00594	0.722	10/19/2018 16:05	500
5	PIC	6/1/2017	5/31/2019	0.6688	0.00627	0.456	10/19/2018 16:05	500
6	PIC	6/1/2017	5/31/2019	0.6600	0.00790	0.442	10/19/2018 16:05	500
7	PIC	6/1/2017	5/31/2019	0.6773	0.02148	0.462	10/19/2018 16:06	500
8	PIC	6/1/2017	5/31/2019	0.6559	0.01955	0.380	10/19/2018 16:06	500
9	PIC	6/1/2017	5/31/2019	0.6688	0.00758	0.636	10/19/2018 16:06	500
10	LB4100	6/1/2017	5/31/2019	0.6357	0.02044	1.134	10/19/2018 16:34	500
11	PIC	6/1/2017	5/31/2019	0.6373	0.00584	0.580	10/19/2018 16:07	500
12	PIC	6/1/2017	5/31/2019	0.6494	0.02610	0.464	10/19/2018 16:07	500

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1810-A
Spike Exp Date : 5/23/2019
Spike Activity (dpm/ml): 114.36
Spike Volume Added: 0.10

* - RPD changed to 0% due to sample & dup activity below MDA

LCS S/N : 1810-A
LCS Exp Date : 5/23/2019
LCS Activity (dpm/ml): 114.36
LCS Volume Added: 0.10

Results															
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L Recovery
1	1.2099	0.8542	3	1.8752	-0.2713	186.05%	-0.0813	0.1512	0.9889	0.9890		SAMPLE			
2	0.9903	0.6992	3	1.5503	-0.8043	46.85%	-0.2647	0.1231	0.7331	0.7333		SAMPLE			
3	1.0153	0.7168	3	1.5923	0.5501	85.28%	0.1733	0.1475	0.9172	0.9296		SAMPLE			
4	0.8064	0.5693	3	1.2878	0.0835	421.77%	0.0280	0.1181	0.6900	0.6904		SAMPLE			
5	0.6449	0.4553	3	1.0606	0.1320	218.60%	0.0440	0.0962	0.5654	0.5665		SAMPLE			
6	0.7267	0.5130	3	1.1978	-0.0298	1038.88%	-0.0087	0.0900	0.6059	0.6061		SAMPLE			
7	0.8782	0.6200	3	1.4429	0.8983	50.55%	0.2213	0.1110	0.8827	0.9176		SAMPLE			
8	0.6259	0.4419	3	1.0432	0.2233	129.98%	0.0700	0.0909	0.5681	0.5714		MB			
9	0.7648	0.5399	3	1.2305	0.2430	142.63%	0.0807	0.1150	0.6788	0.6820	461244004.1	DUP	* 0.0%		
10	4.0508	2.8599	3	6.3172	39.0264	10.37%	3.2660	0.2750	6.4397	12.5306	461244004.1	MS			51.7241 75.5%
11	2.0728	1.4634	3	3.3543	41.4943	8.35%	4.8533	0.3028	5.0749	12.3466	461244004.1	MSD	6.1%		51.7241 80.2%
12	0.7704	0.5439	3	1.2654	16.5297	9.00%	4.6527	0.2936	2.0445	5.0376		LCS			17.1705 96.3%

1811253r1.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
461244001	5D	60	11	73	10/22/2018 11:27	10/22/2018 12:27	PIC	1811253
461244002	6B	60	4	47	10/22/2018 11:36	10/22/2018 12:36	PIC	1811253
461244003	6C	60	8	71	10/22/2018 11:37	10/22/2018 12:37	PIC	1811253
461244004	7A	60	4	45	10/22/2018 11:37	10/22/2018 12:37	PIC	1811253
461244005	7B	60	8	30	10/22/2018 11:37	10/22/2018 12:37	PIC	1811253
461244006	7C	60	11	26	10/22/2018 11:37	10/22/2018 12:37	PIC	1811253
461244007	8B	60	3	41	10/22/2018 11:37	10/22/2018 12:37	PIC	1811253
1204133162	8C	60	4	27	10/22/2018 11:36	10/22/2018 12:36	PIC	1811253
1204133163	9A	60	8	43	10/22/2018 11:36	10/22/2018 12:36	PIC	1811253
1204133164	A1	60	5	264	10/22/2018 13:19	10/22/2018 14:19	LB4100	1811253
1204133165	9C	60	9	326	10/22/2018 11:36	10/22/2018 12:36	PIC	1811253
1204133166	9D	60	16	307	10/22/2018 11:36	10/22/2018 12:36	PIC	1811253

ASSAY 18-Oct-18 14:43:40

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 10/18/2018
Run id. 1931

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	96	1	180.04	554.71	156.44	8		02:43:40
2	96	2	180.06	505.34	139.97	8.45	89.47	02:46:53
3	96	3	180.04	569.77	161.45	7.87	103.20	02:50:07
4	96	4	180.03	540.17	151.61	8.12	96.91	02:53:21
5	96	5	180.04	571.48	162.02	7.86	103.57	02:56:35
1	87	1	180.06	560.05	158.2	7.95	101.13	03:00:20
2	87	2	180.04	505.6	140.07	8.45	89.54	03:03:33
3	87	3	180.04	431.88	115.5	9.3	73.83	03:06:47
4	87	4	180.03	537.88	150.84	8.14	96.42	03:10:01
5	87	5	180.06	557.43	157.32	7.97	100.56	03:13:15
1	70	1	180.03	541.02	151.89	8.11	97.09	03:16:52
2	70	2	180.04	609.14	174.58	7.57	111.60	03:20:06
3	70	3	180.04	496.05	136.89	8.55	87.50	03:23:20

END OF ASSAY

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 22-Oct-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

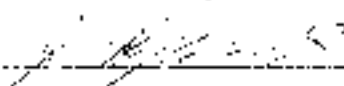
Short Name	Status	Parmname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Sdev
G5400W1Y	Below	Alpha eff	22-Oct 09:01	5	8578	8722	9230	-4.70
G5400W1Y	Above	Alpha XTalk	22-Oct 09:01	5	0.375	0.325	0.358	+6.19
LB4100A2	Below	Beta eff	22-Oct 07:52	5	20881	20920	22890	-3.12
LB4100A2	need 2nd	Beta XTalk	22-Oct 07:52	5	3.32E-4	1.06E-4	4.89E-4	+0.55
LB4100A3	Below	Beta eff	22-Oct 07:52	5	19041	20120	22250	-6.04
LB4100B3	Missing	Alpha bkg	22-Oct 06:18	60	0.00E+0	-6.61E-2	0.276	-1.84
LB4100B3	Missing	Alpha eff	22-Oct 08:20	5	0.00E+0	8427	16430	-9.30
LB4100B3	Missing	Alpha XTalk	22-Oct 08:20	5	0.00E+0	0.270	0.653	-7.22
LB4100B3	Missing	Beta bkg	22-Oct 06:18	60	0.00E+0	-2.44E+2	261	-0.10
LB4100B3	Missing	Beta eff	22-Oct 07:52	5	0.00E+0	22590	31610	-16.03
LB4100B3	Missing	Beta XTalk	22-Oct 07:52	5	0.00E+0	-4.93E-1	0.516	-0.07
LB4100B4	Below	Alpha eff	22-Oct 08:20	5	11208	11560	15170	-3.59
LB4100B4	need 2nd	Beta bkg	22-Oct 06:18	60	1.100	0.607	2.163	+1.10
LB4100C2	need 2nd	Beta XTalk	22-Oct 09:05	5	2.94E-4	1.13E-4	4.85E-4	-0.08
LB4100C4	Above	Beta bkg	22-Oct 06:20	60	2.517	0.686	2.113	+4.70
LB4100E2	need 2nd	Beta bkg	22-Oct 06:17	60	1.667	0.261	3.241	-0.17
LB4100F4	Above	Alpha XTalk	22-Oct 07:36	5	0.555	0.260	0.530	+3.62
LB4100G1	Above	Alpha XTalk	22-Oct 07:44	5	0.275	0.226	0.275	+3.03
LB4100G2	need 2nd	Alpha XTalk	22-Oct 07:44	5	0.351	0.256	0.413	-0.64
LB4100G2	need 2nd	Beta bkg	22-Oct 06:18	60	1.253	0.414	2.180	-0.16
LB4100G2	need 2nd	Beta eff	22-Oct 07:36	5	16726	15140	19980	+1.03
LB4100I2	need 2nd	Alpha bkg	22-Oct 06:17	60	0.100	-5.90E-2	0.235	+0.24
LB4100I2	need 2nd	Beta bkg	22-Oct 06:17	60	1.117	-1.65E+1	28.950	-0.65
LB4100I3	need 2nd	Beta bkg	22-Oct 06:17	60	0.767	-5.60E-1	3.474	-1.03
PIC1A	Above	Alpha bkg	22-Oct 06:05	60	0.333	-4.72E-2	0.390	+2.12
PIC3C	Above	Alpha bkg	22-Oct 04:57	60	0.617	-9.57E-4	0.359	+7.28
PIC3C	Above	Beta bkg	22-Oct 04:57	60	1.633	0.008	1.299	+4.55
PIC4D	Below	Alpha XTalk	22-Oct 08:26	5	0.249	0.256	0.273	-5.20

PIC6A	Above	Alpha bkg	22-Oct 07:37	60	0.333	-2.15E-2	0.405	+1.99
PIC7D	Below	Alpha off	22-Oct 08:35	5	10368	10380	11080	-3.18
PIC8A	Above	Beta off	22-Oct 08:39	5	54260	49370	54080	+3.23
PIC8A	Above	Beta XTalk	22-Oct 08:39	5	3.15E-4	5.74E-5	2.92E-4	+3.58
PIC11A	Above	Alpha bkg	22-Oct 06:25	60	0.317	-1.07E-1	0.344	+2.63
PIC12A	Above	Alpha bkg	22-Oct 06:25	60	0.317	-1.44E-2	0.356	+2.36
PIC12D	Good 2nd	Alpha bkg	22-Oct 09:09	60	0.133	-3.86E-2	0.228	+0.86
PIC12D	Below	Alpha XTalk	22-Oct 04:44	5	0.319	0.325	0.395	-3.48
PIC12D	Above	Beta bkg	22-Oct 09:09	60	2.050	0.504	1.615	+5.35
PIC14B	Above	Beta bkg	22-Oct 09:09	60	3.250	-6.12E-1	2.082	+5.60

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

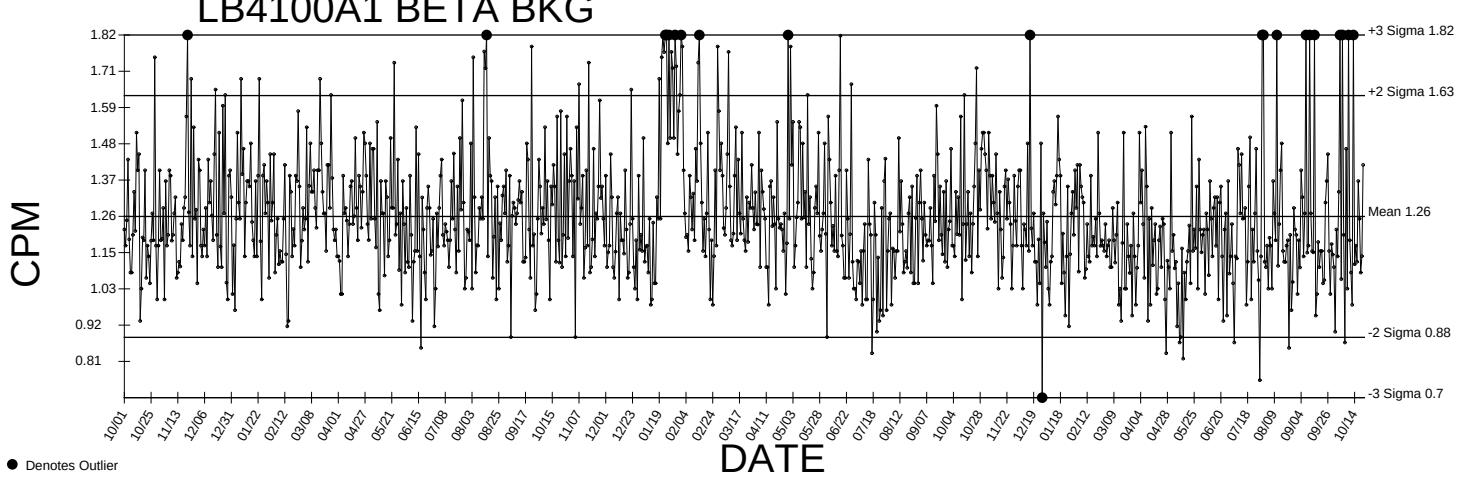
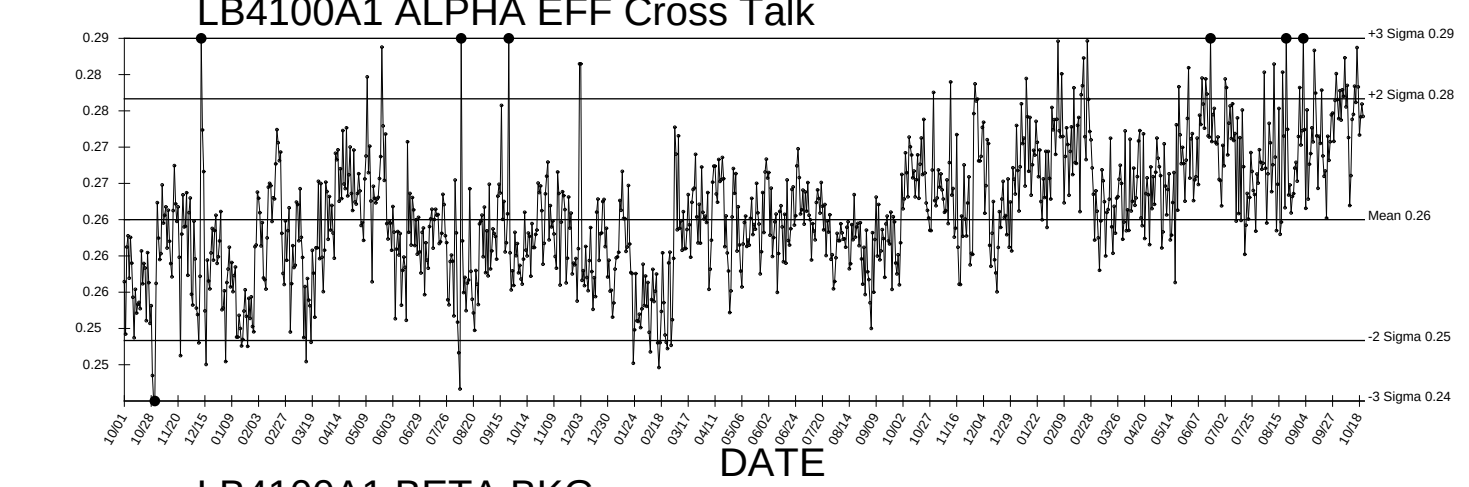
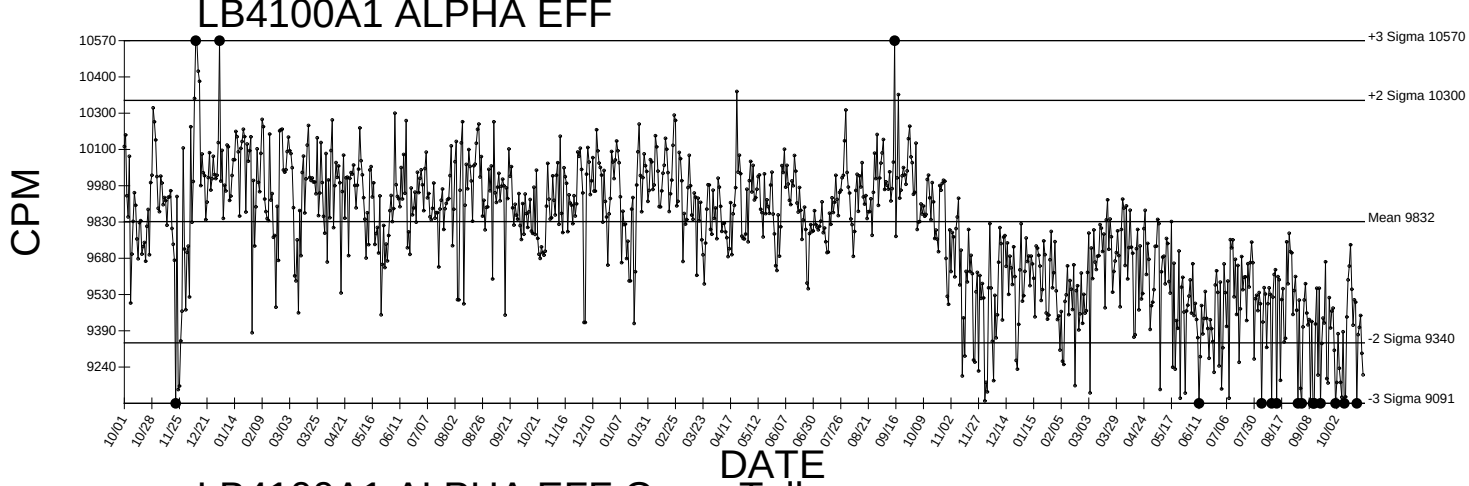
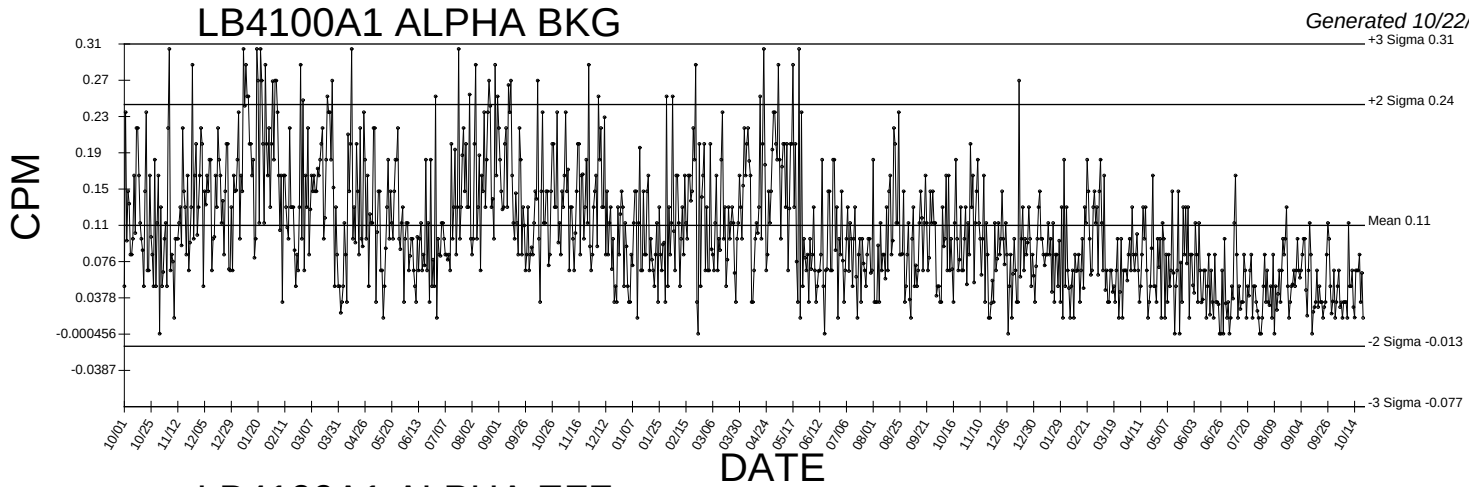
LB4100D1	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D2	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D3	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D4	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
PIC3A	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
PIC6D	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
PIC13C	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk

Reviewed by 

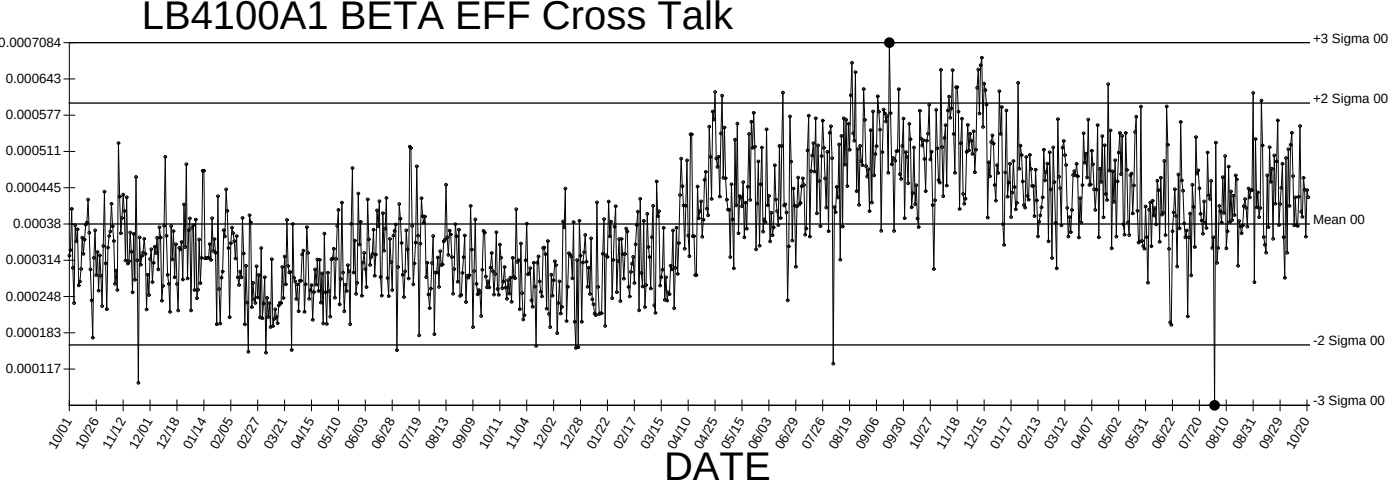
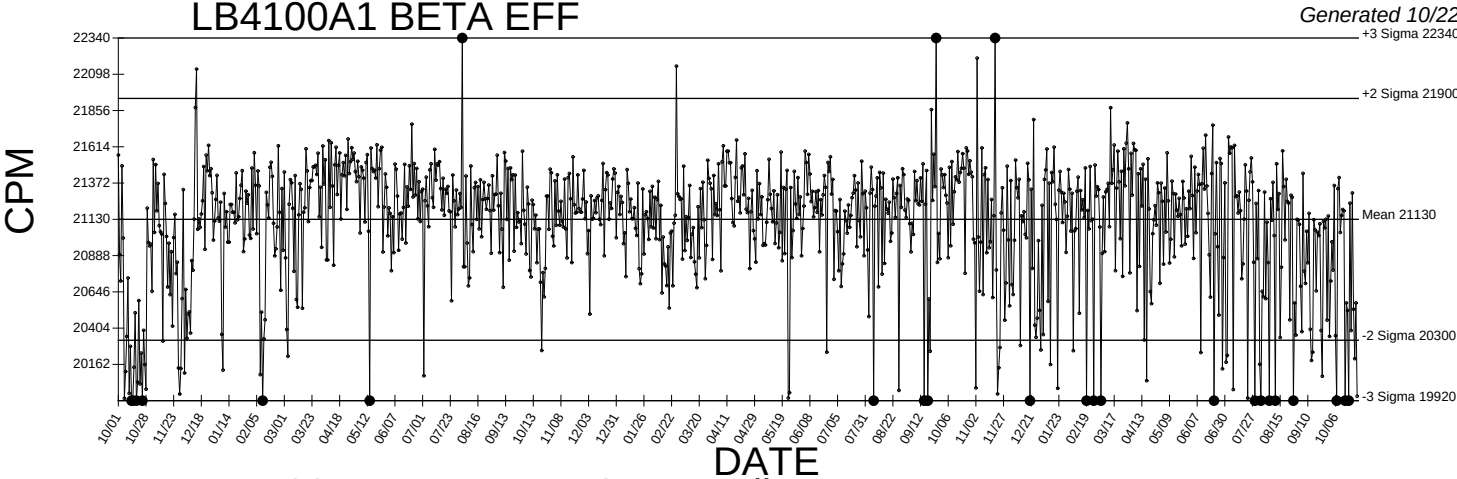
Date 10/12/07

GE - Laboratories L.C.

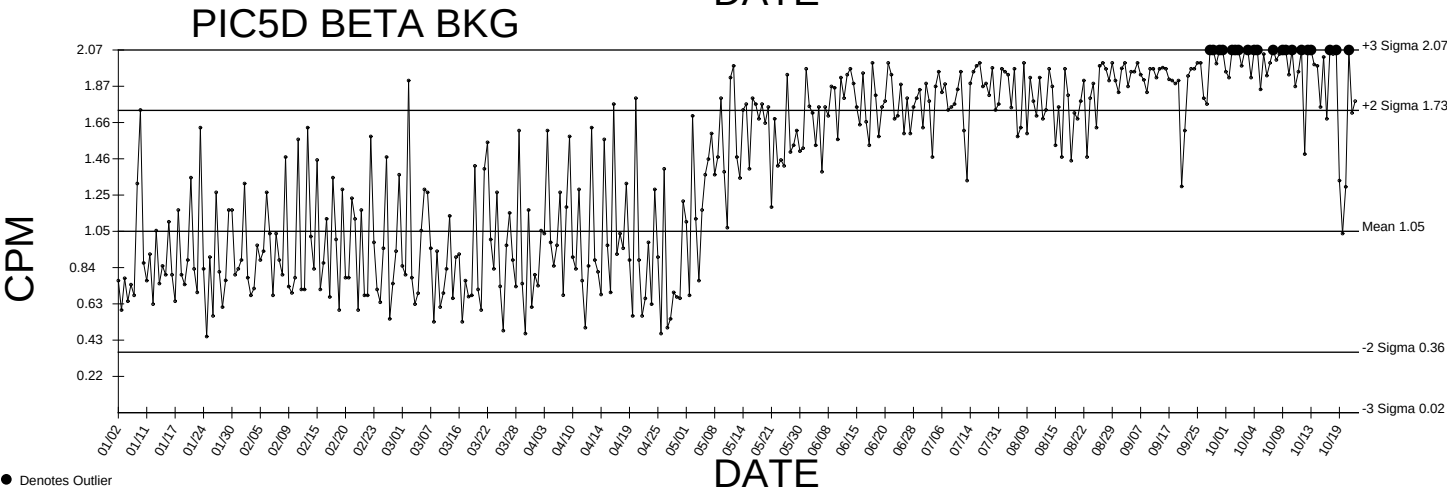
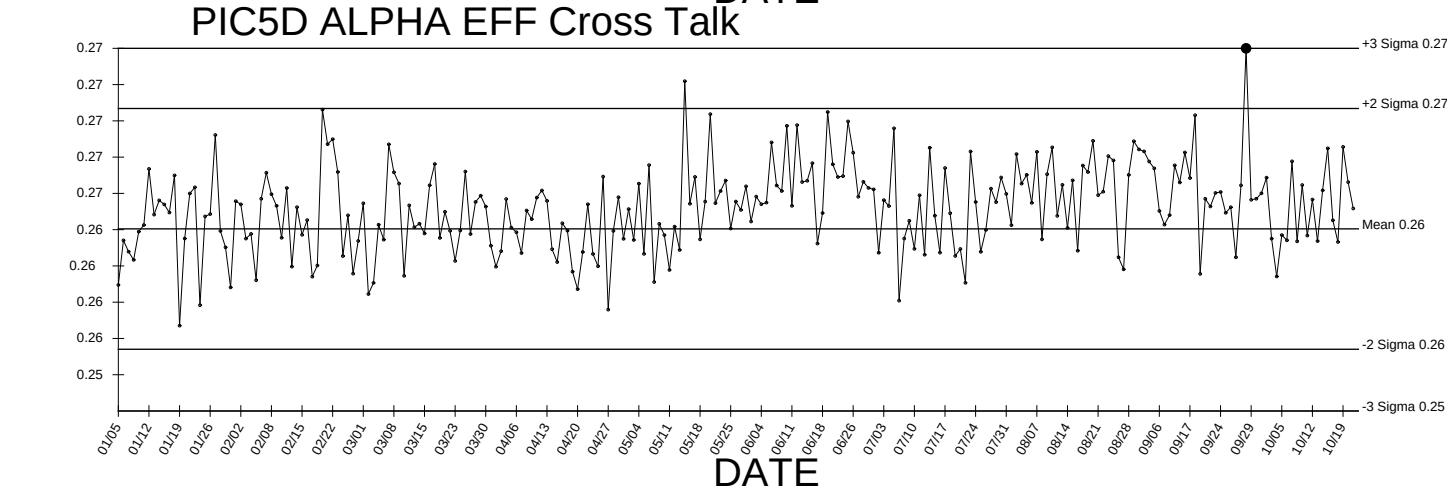
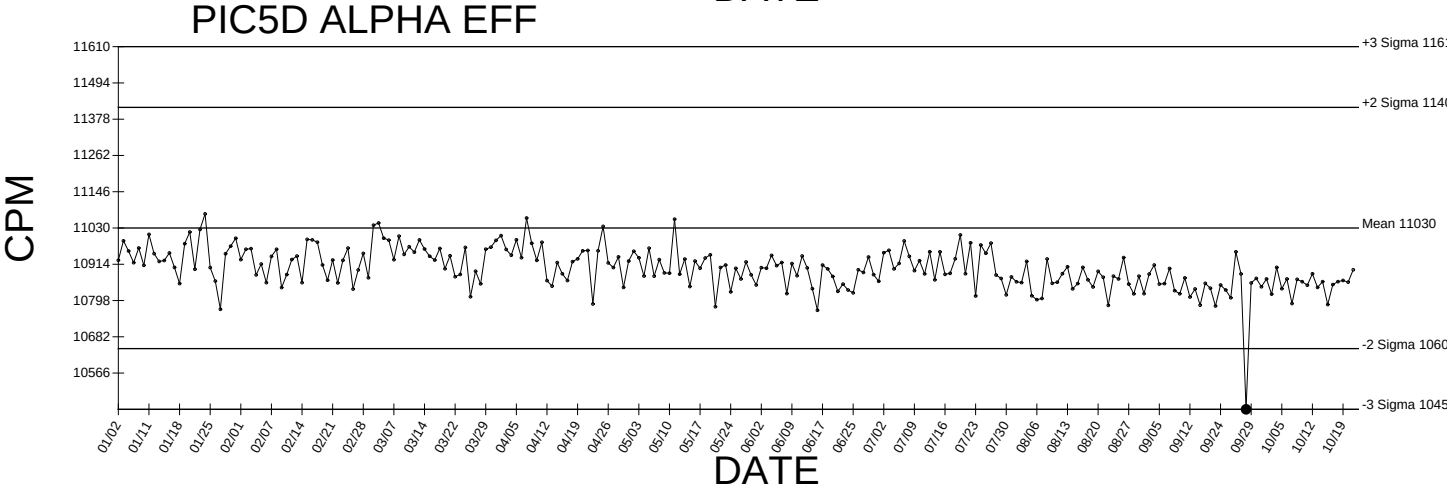
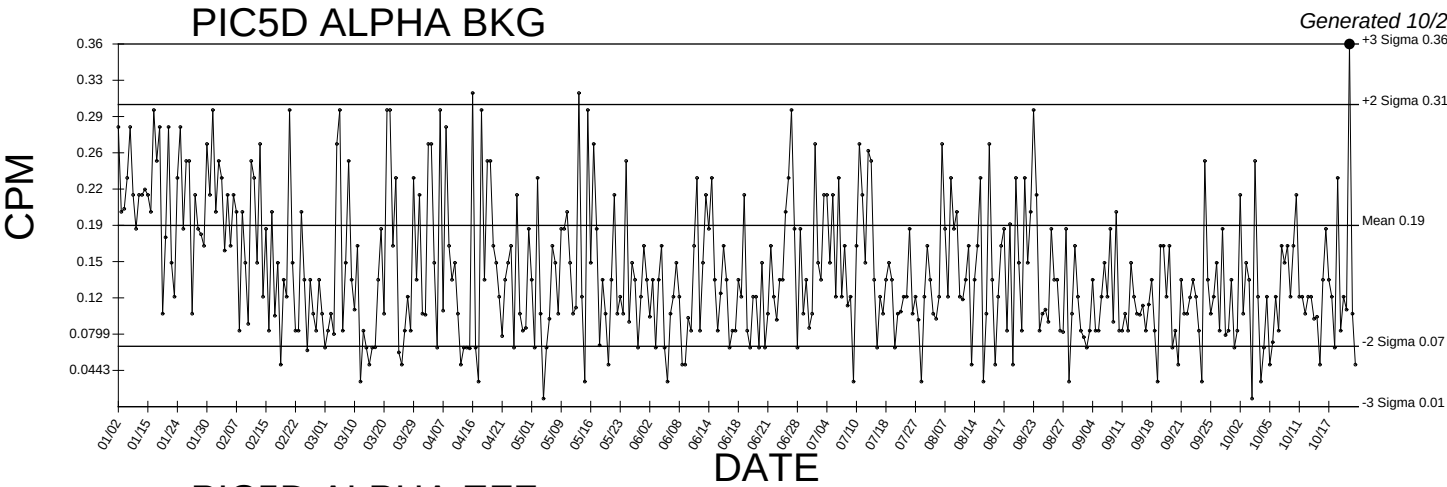
Background and Efficiency Data



● Denotes Outlier



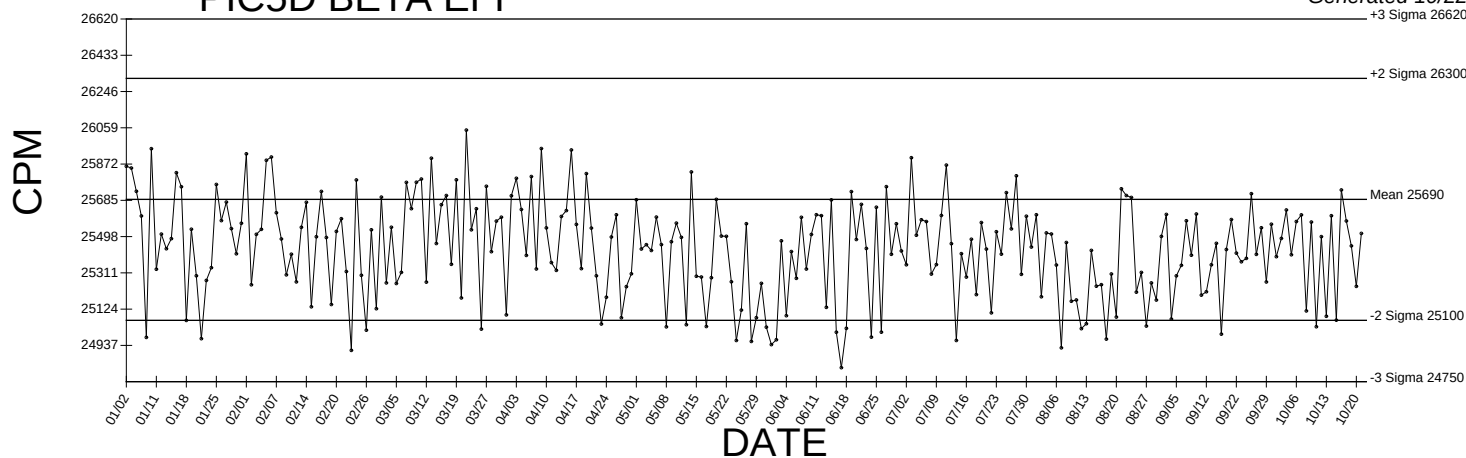
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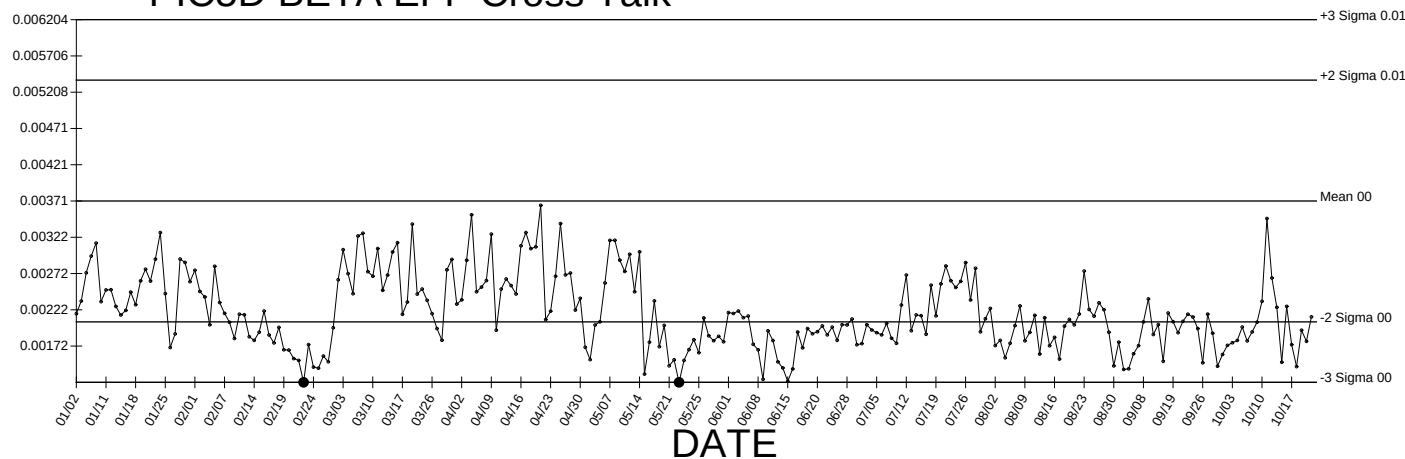
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PIC5D BETA EFF

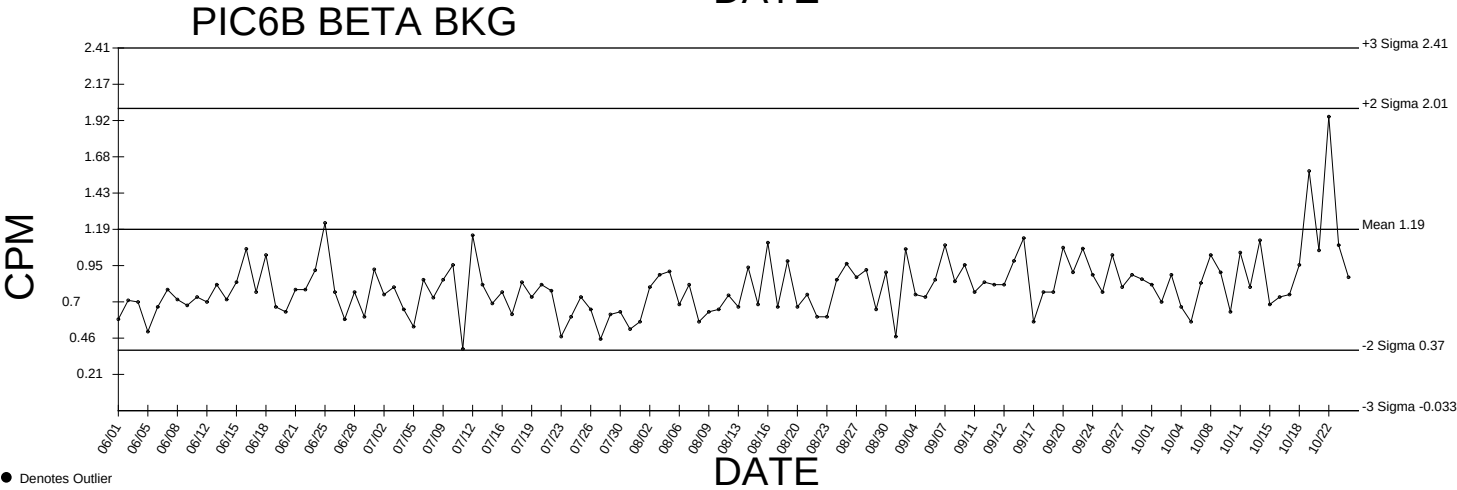
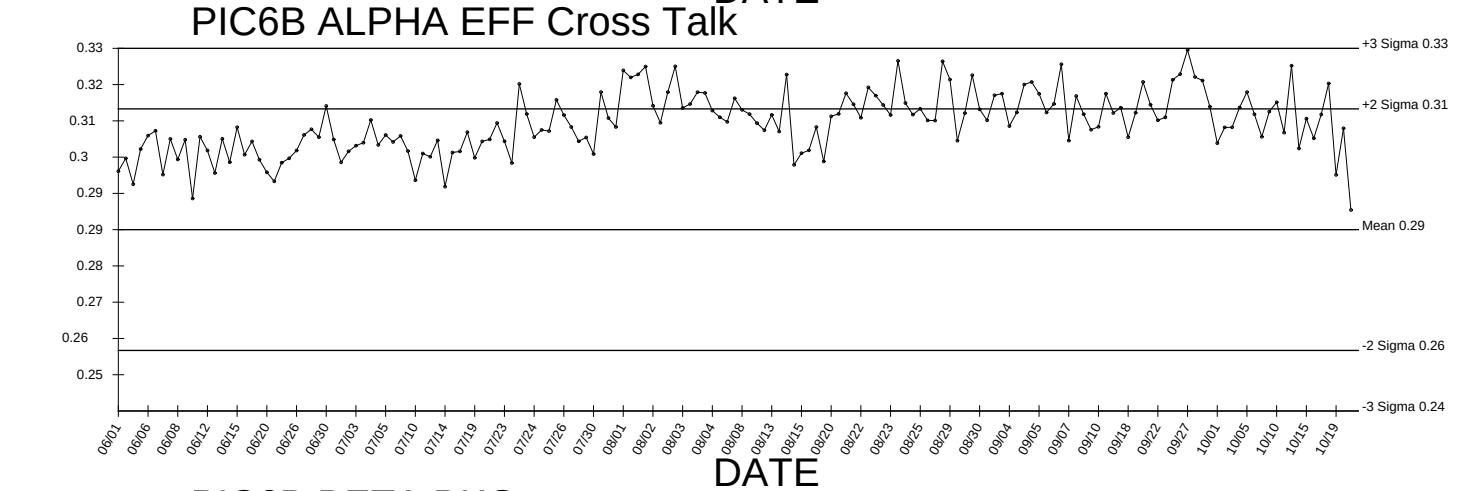
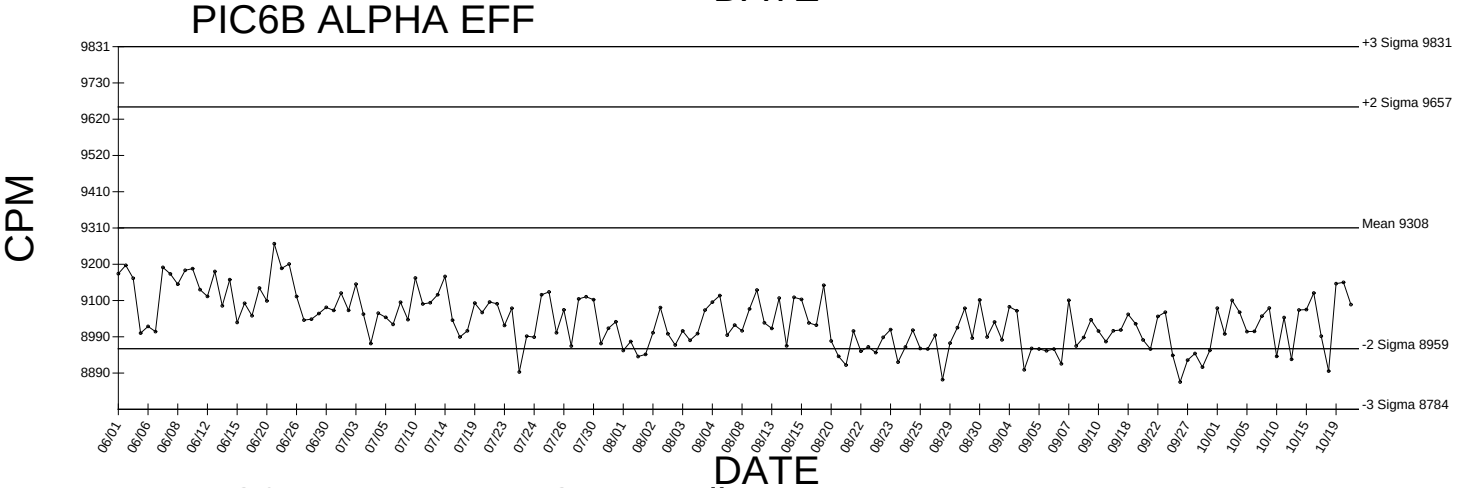
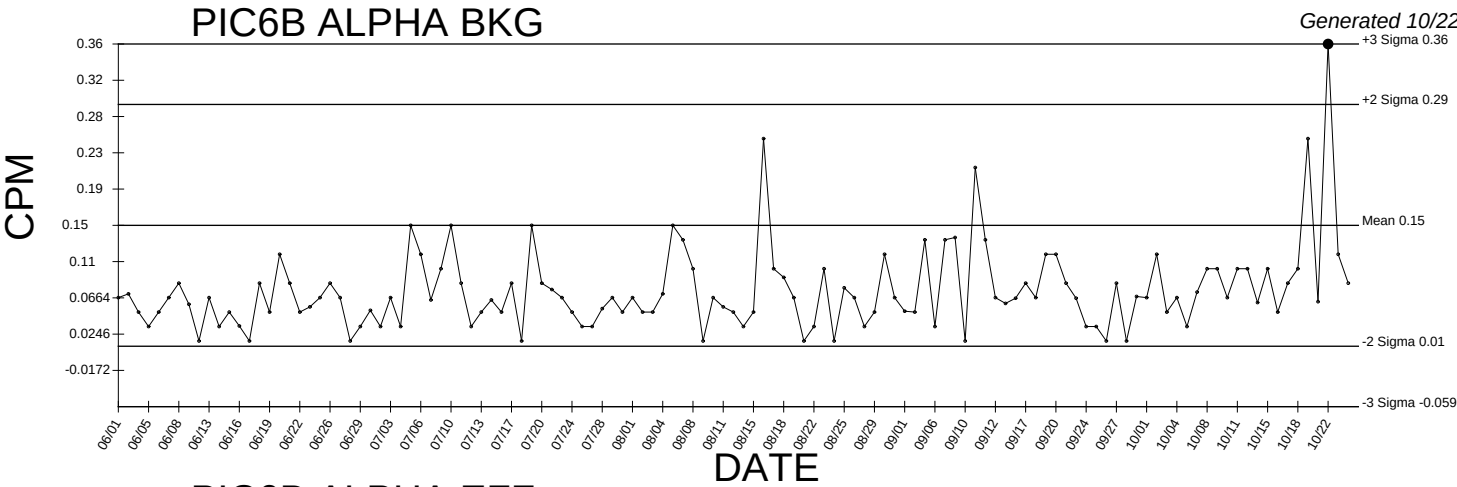
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+3 Sigma 26620



PIC5D BETA EFF Cross Talk



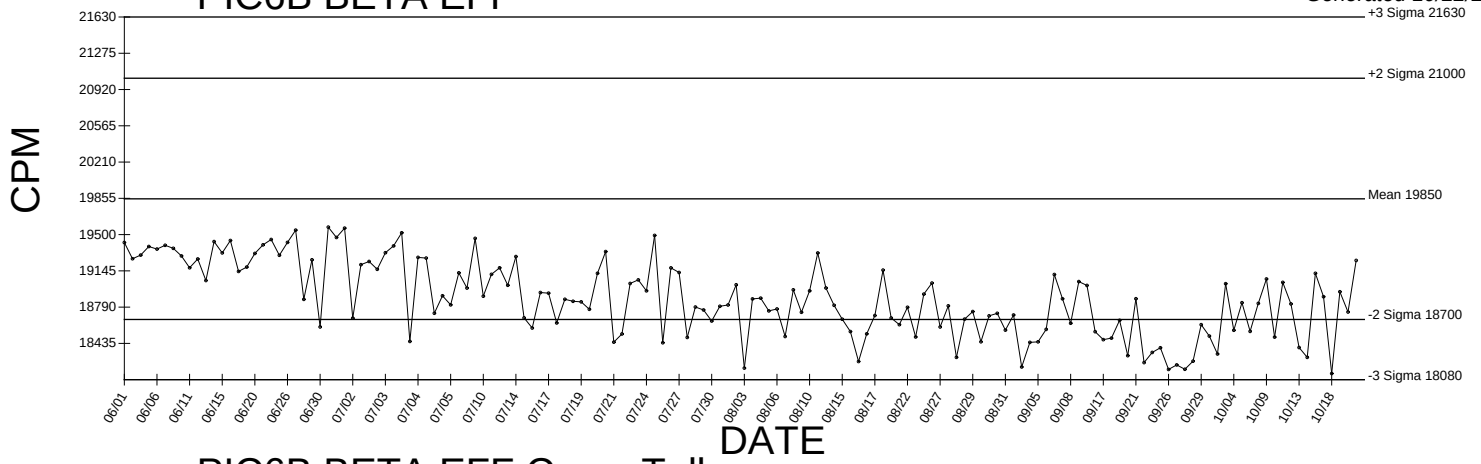
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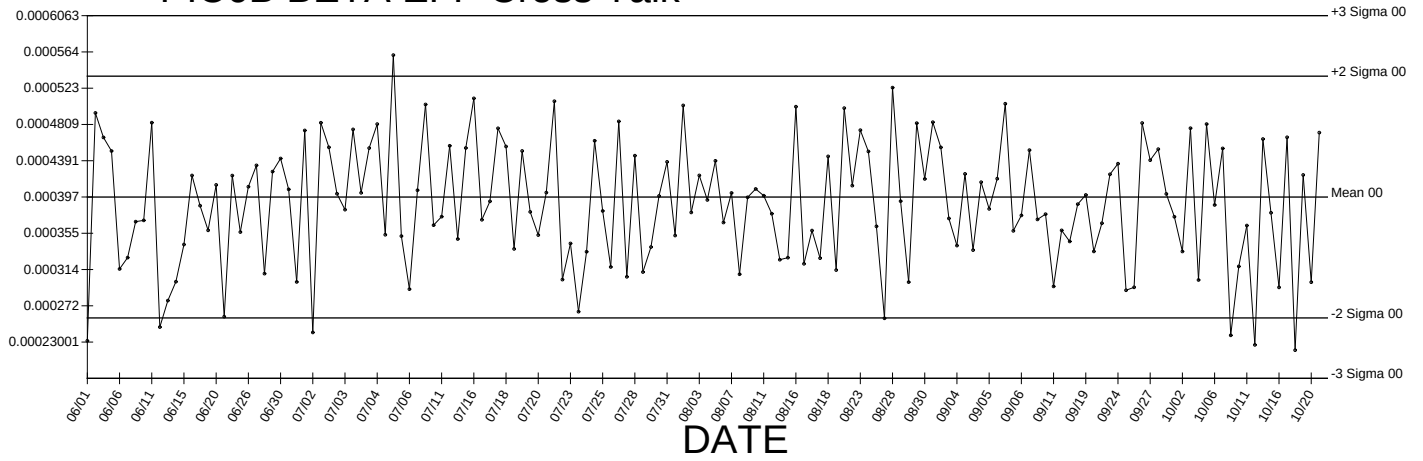
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PIC6B BETA EFF

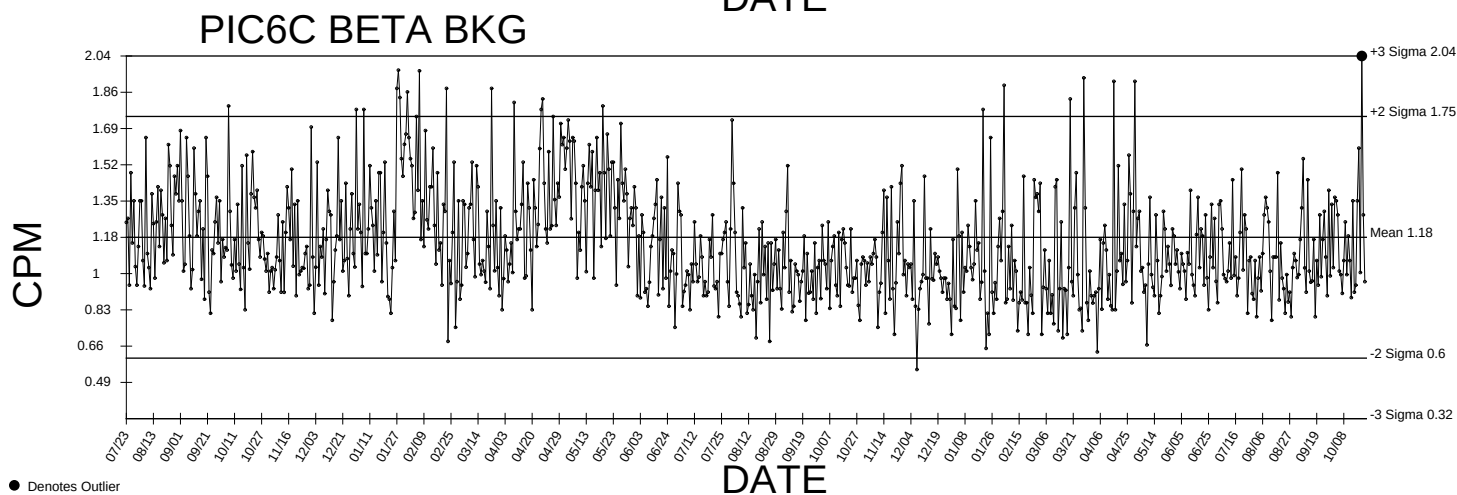
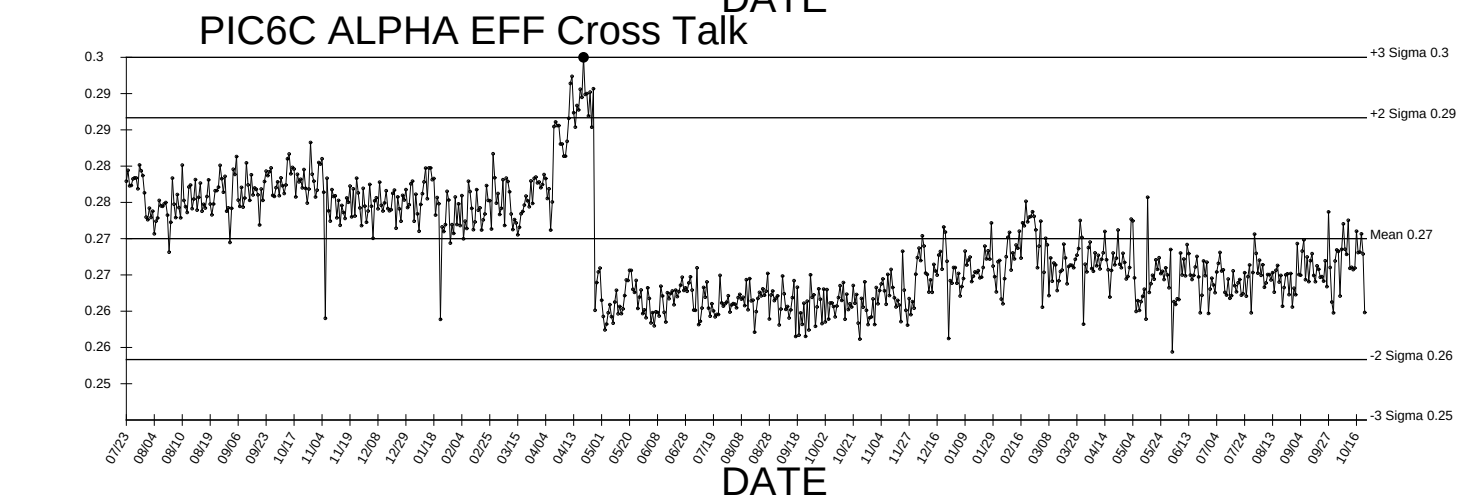
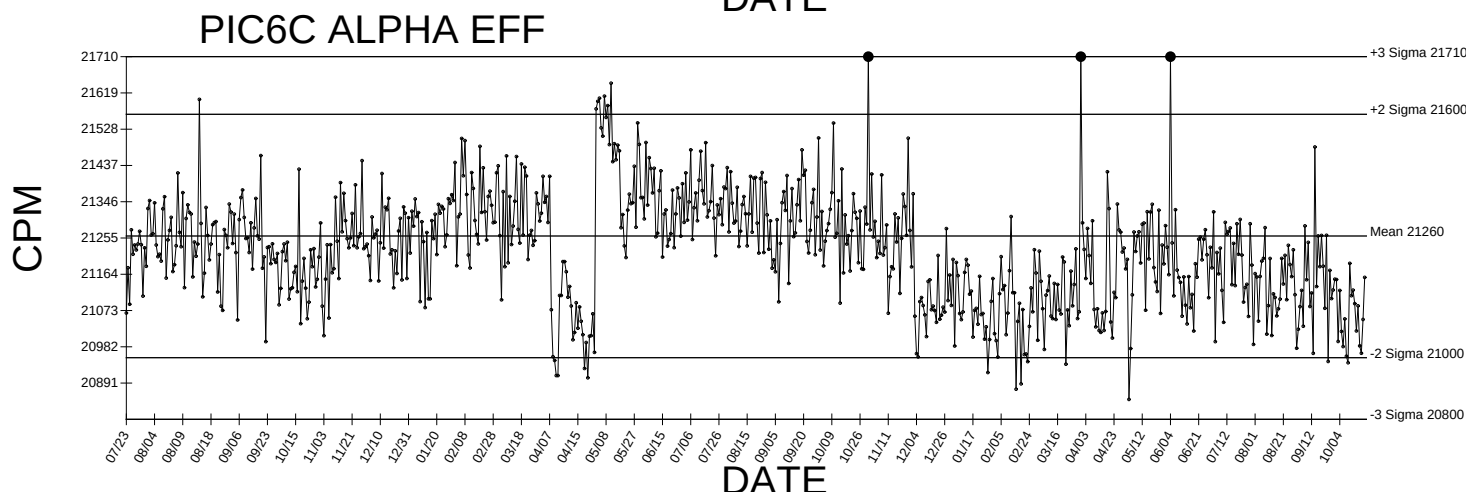
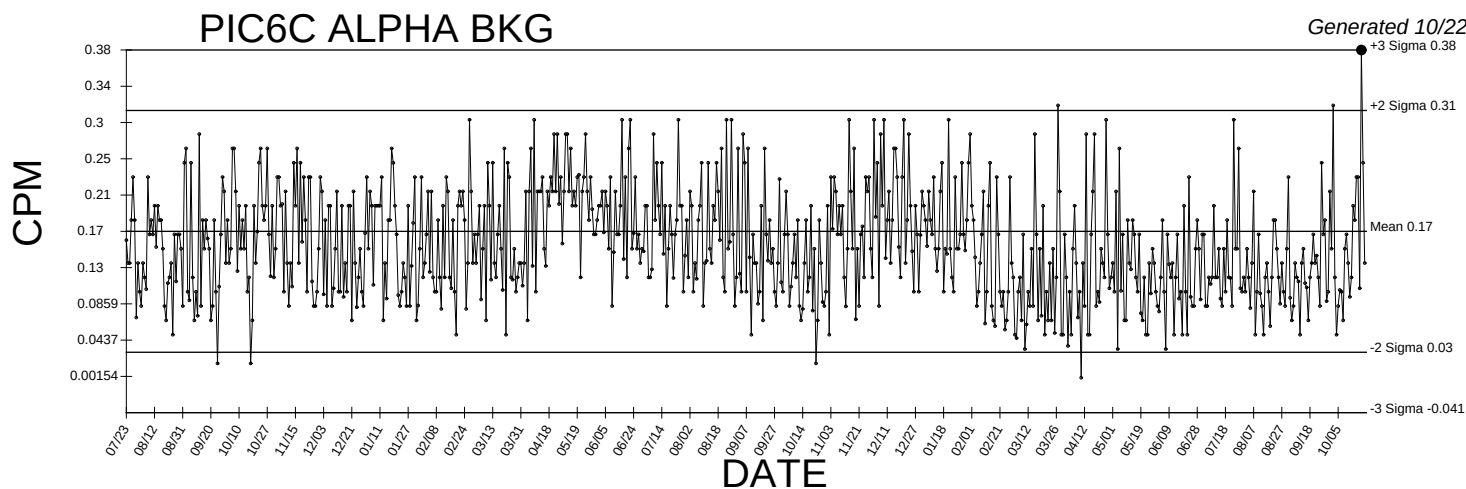
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PIC6B BETA EFF Cross Talk



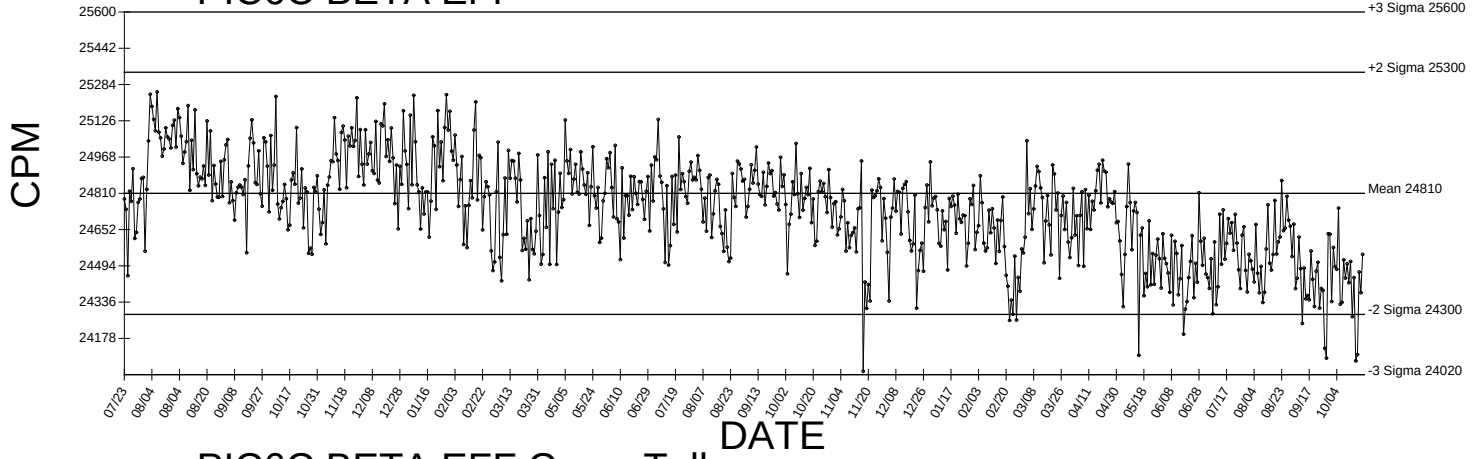
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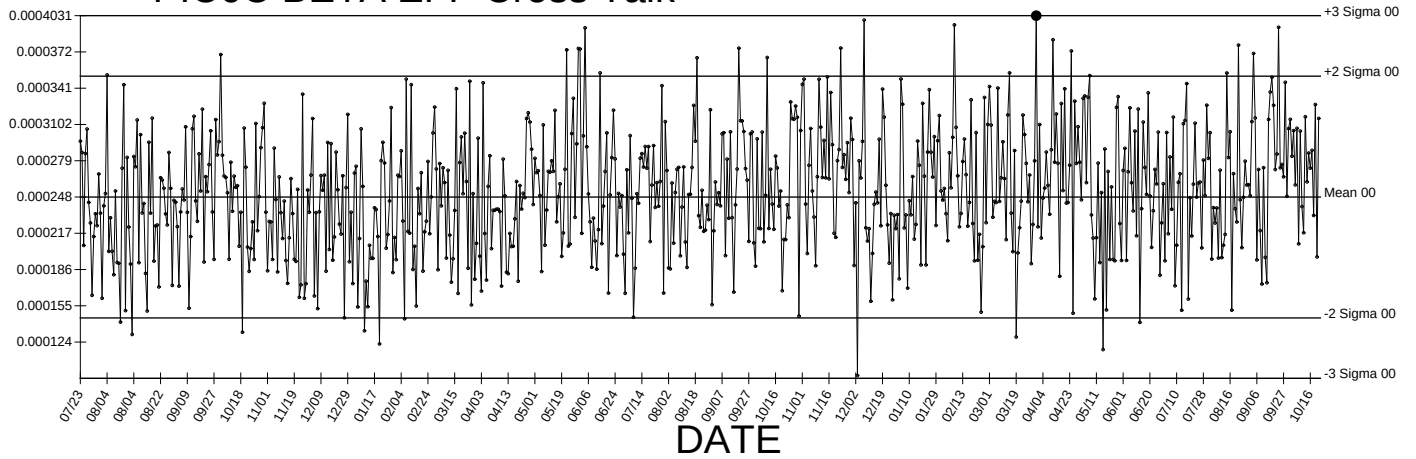
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PIC6C BETA EFF

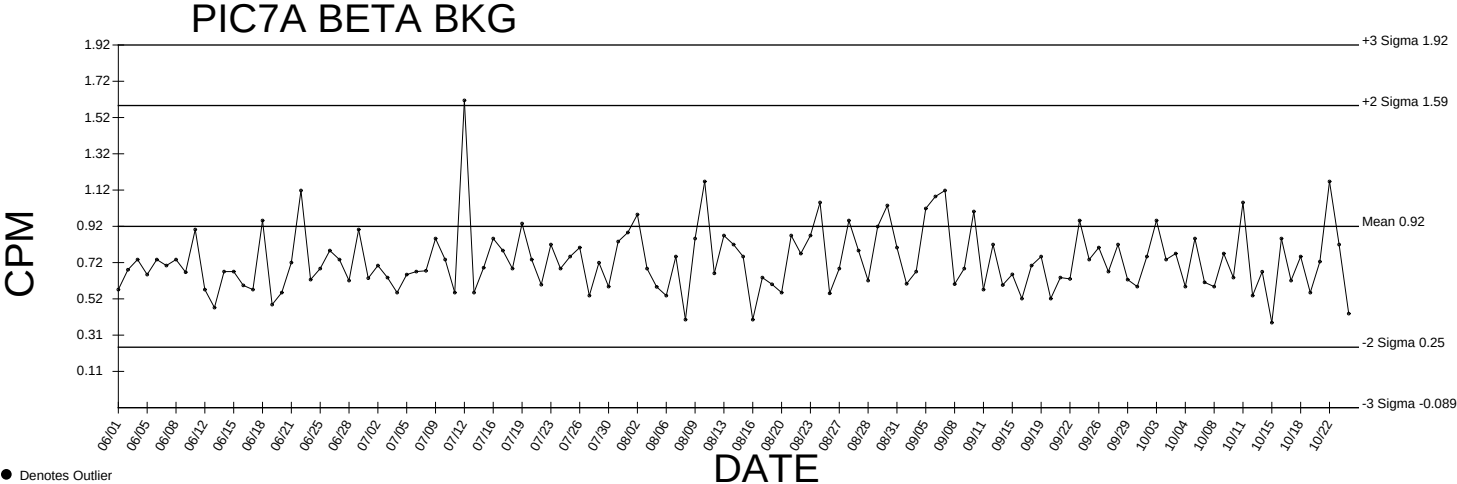
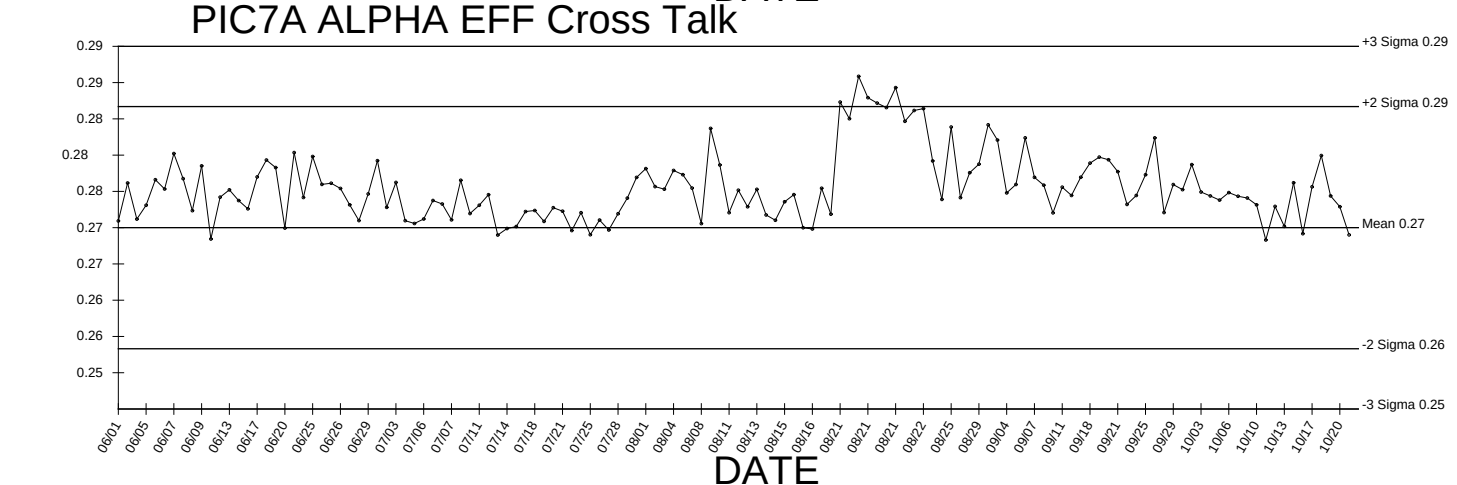
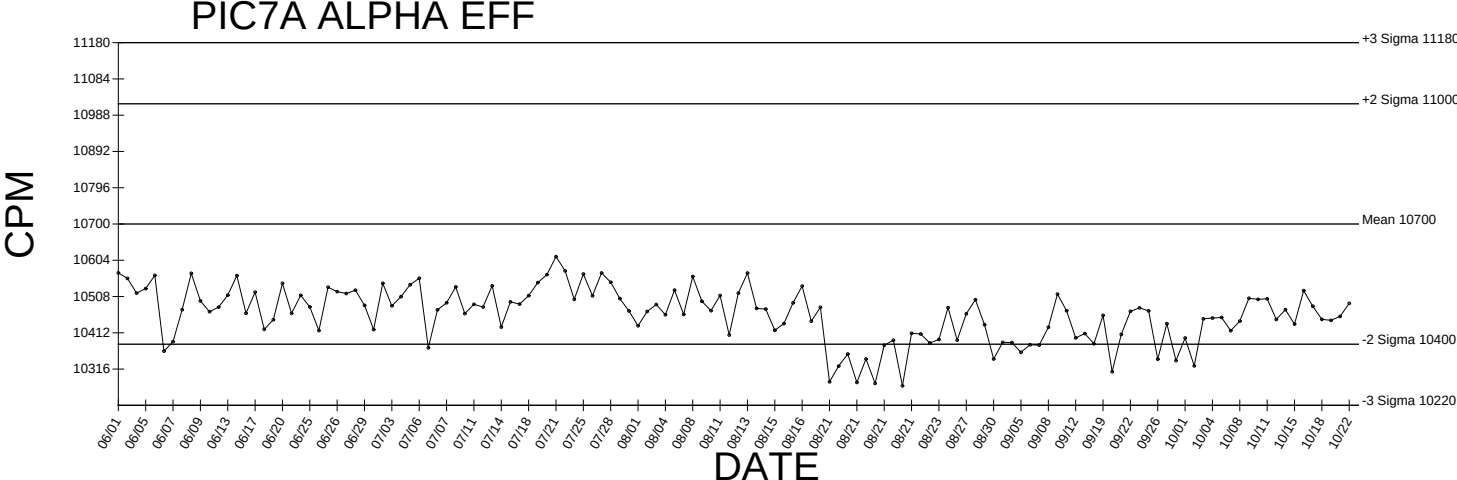
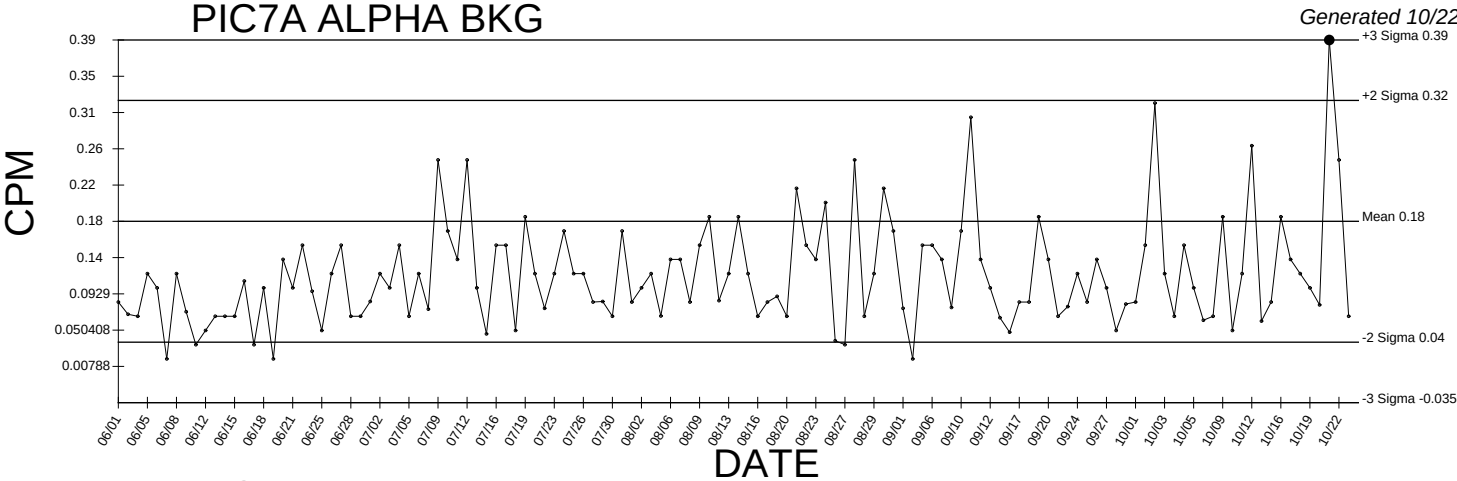
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+3 Sigma 25600



PIC6C BETA EFF Cross Talk



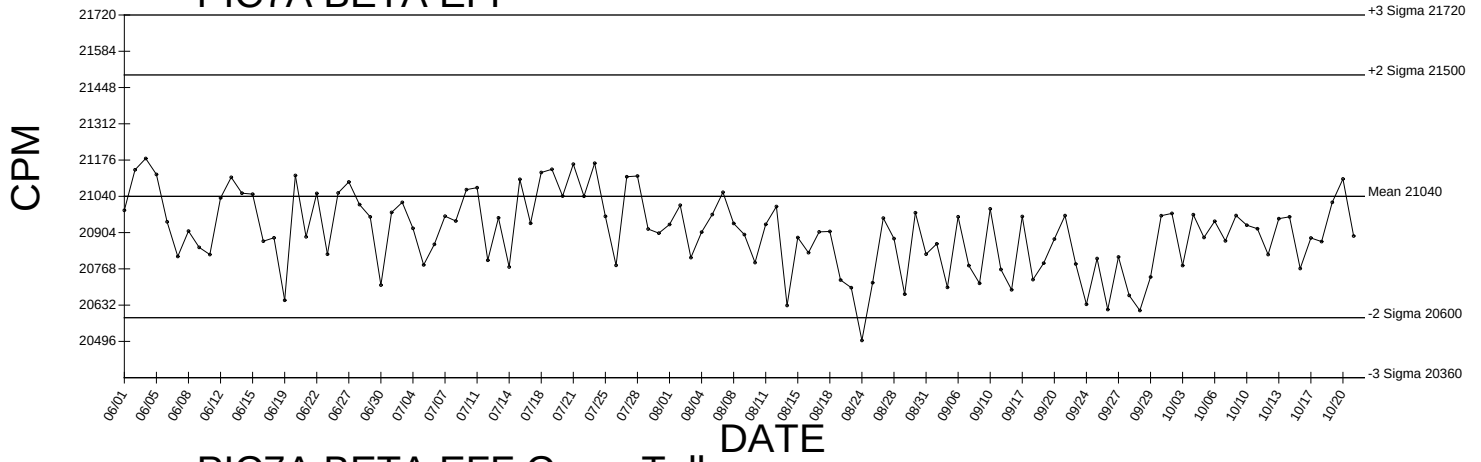
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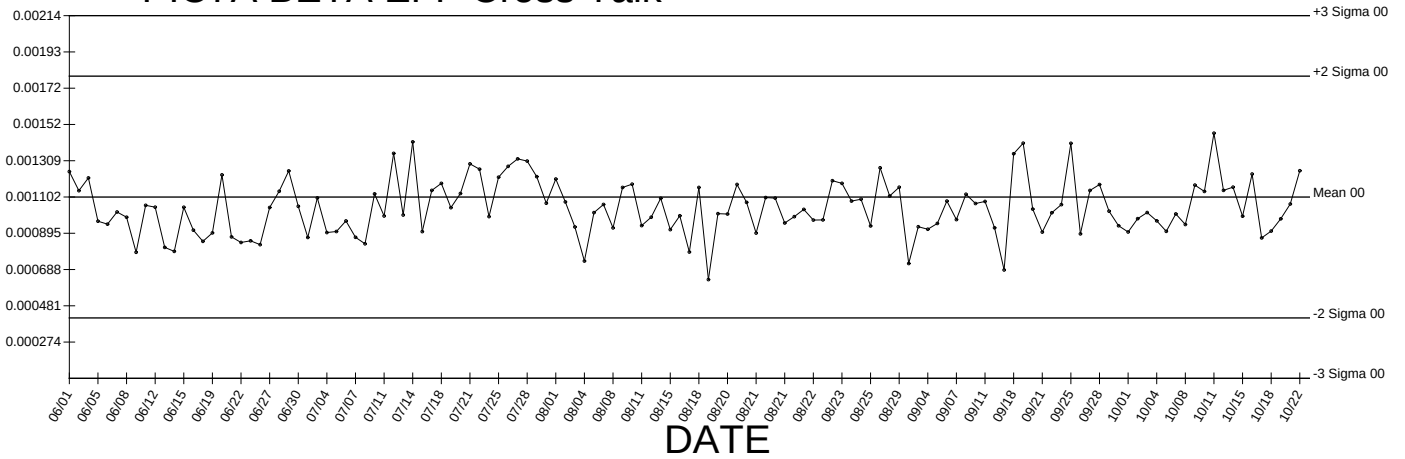
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PIC7A BETA EFF

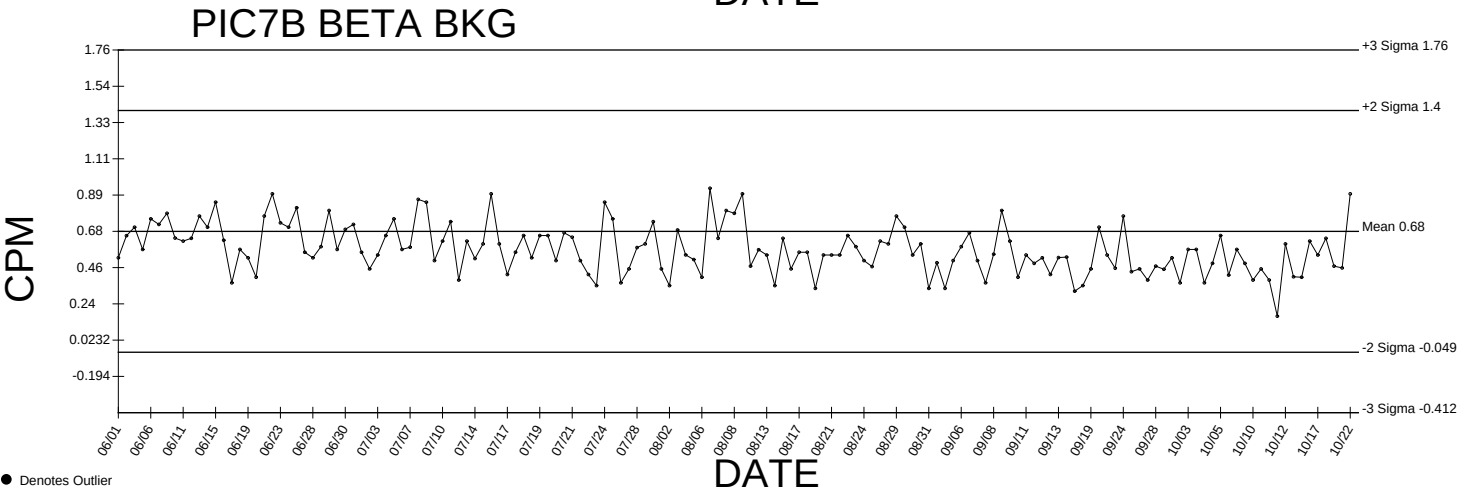
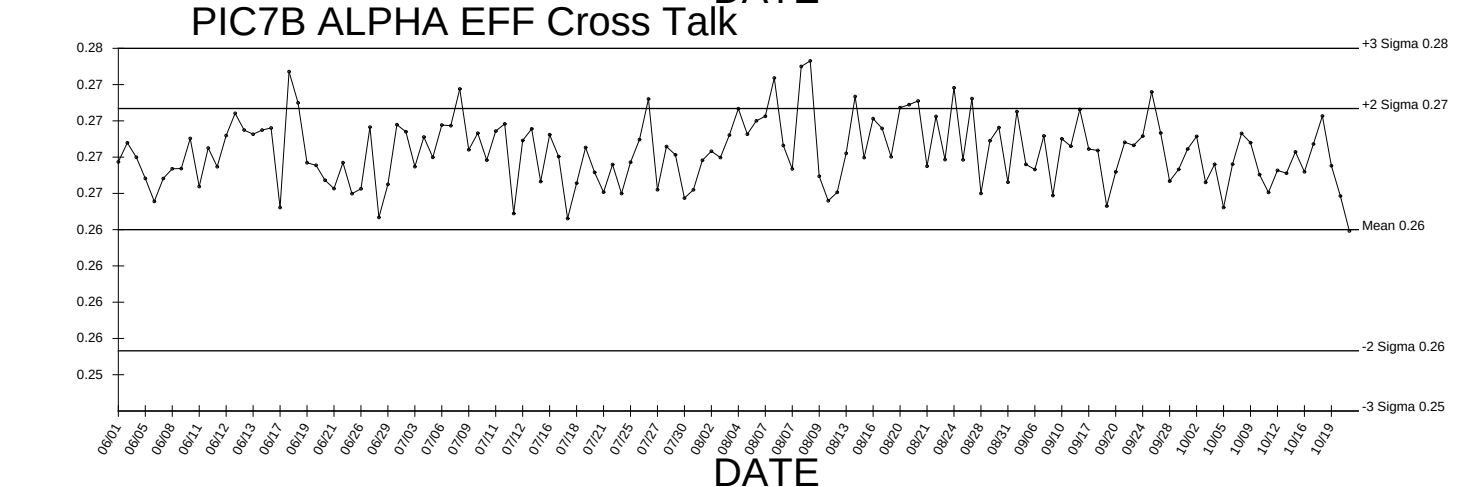
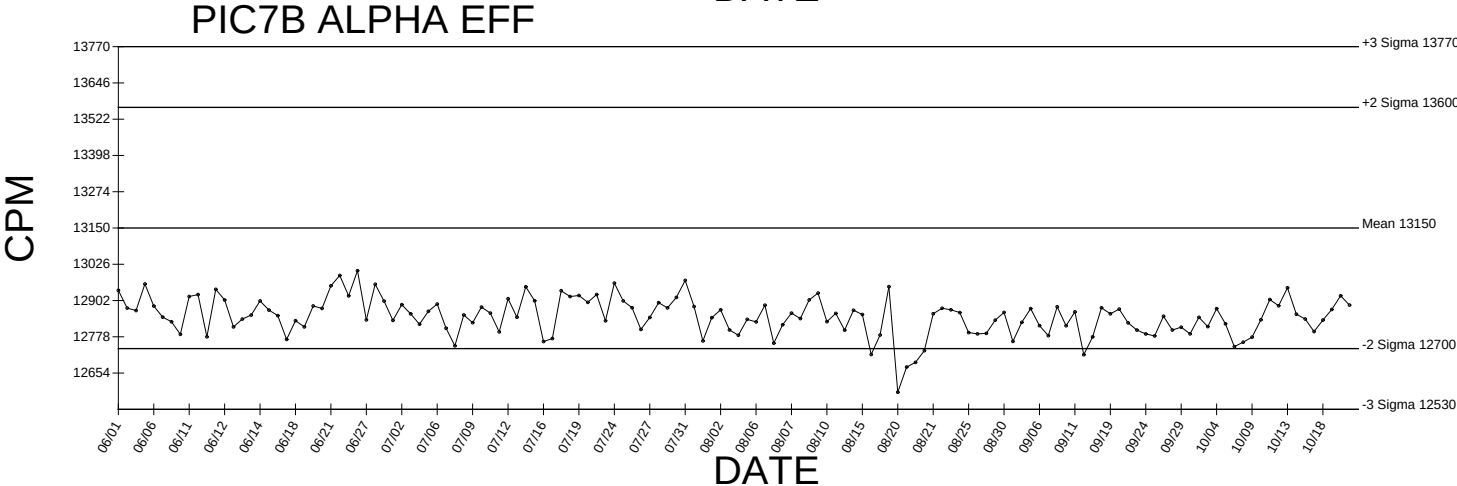
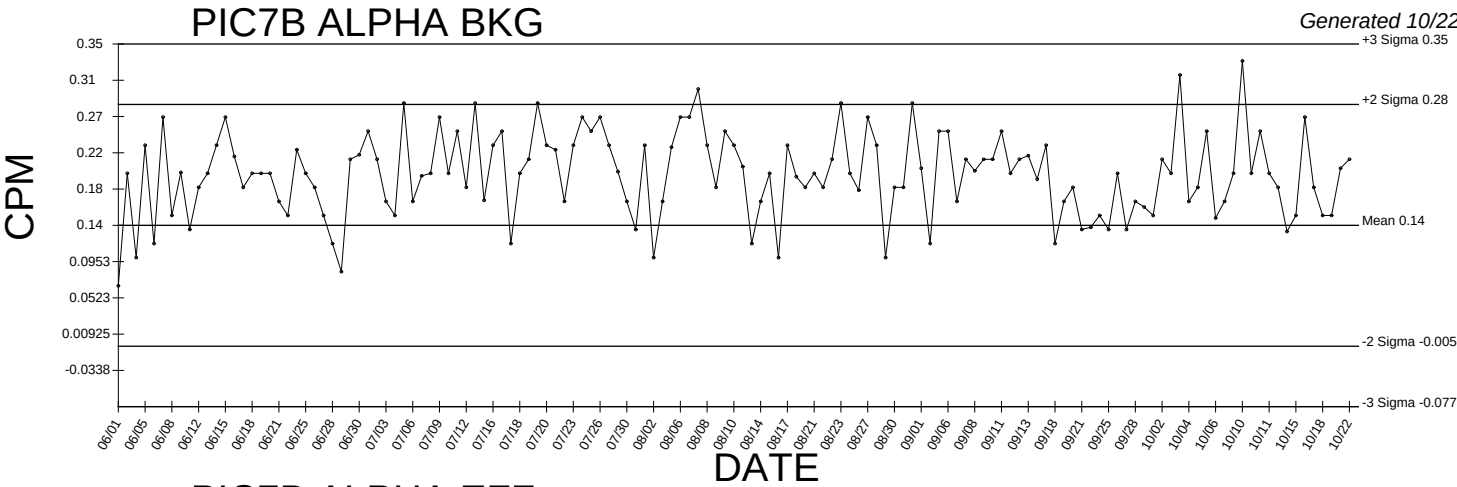
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PIC7A BETA EFF Cross Talk



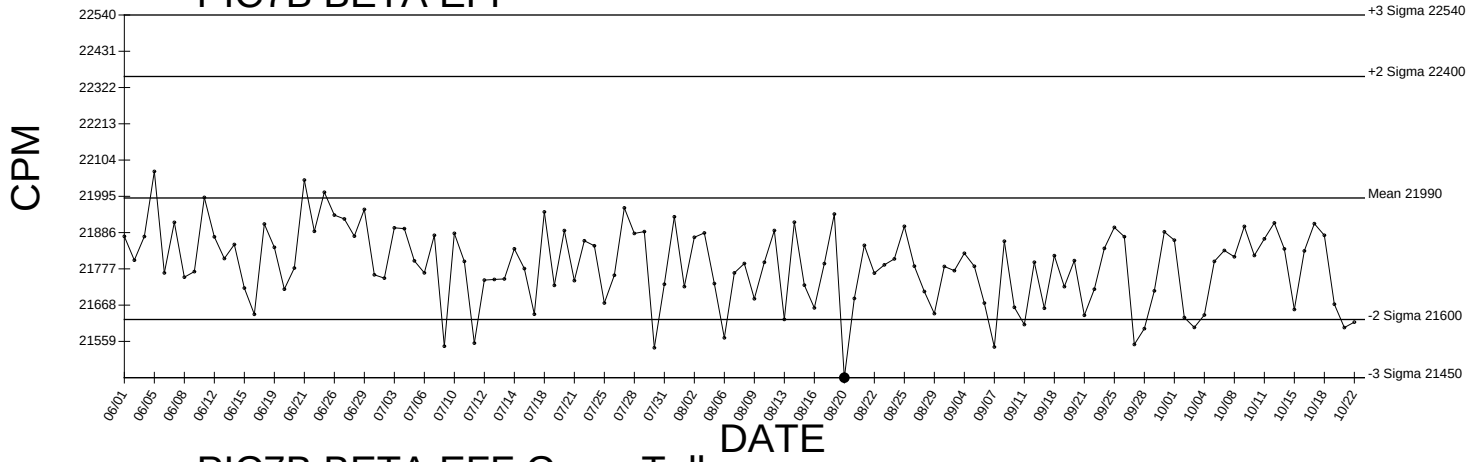
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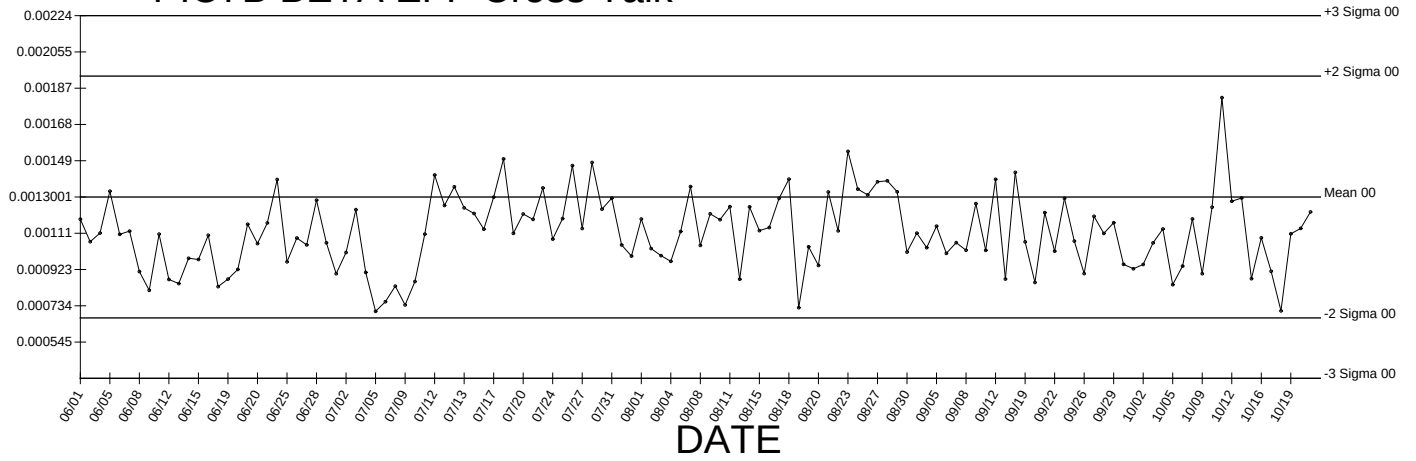
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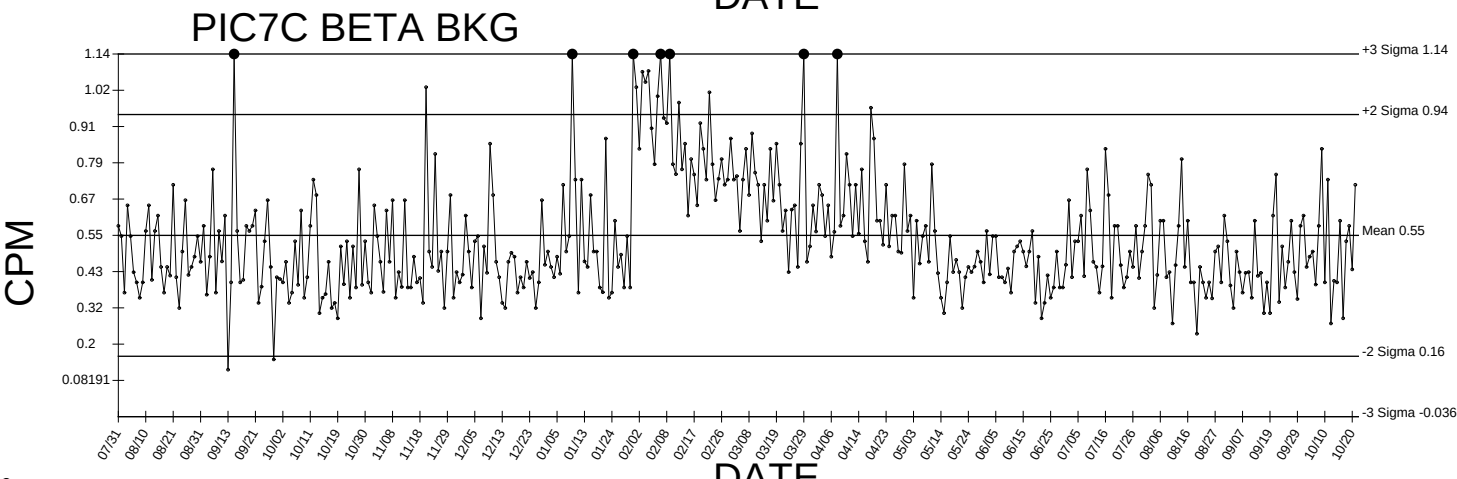
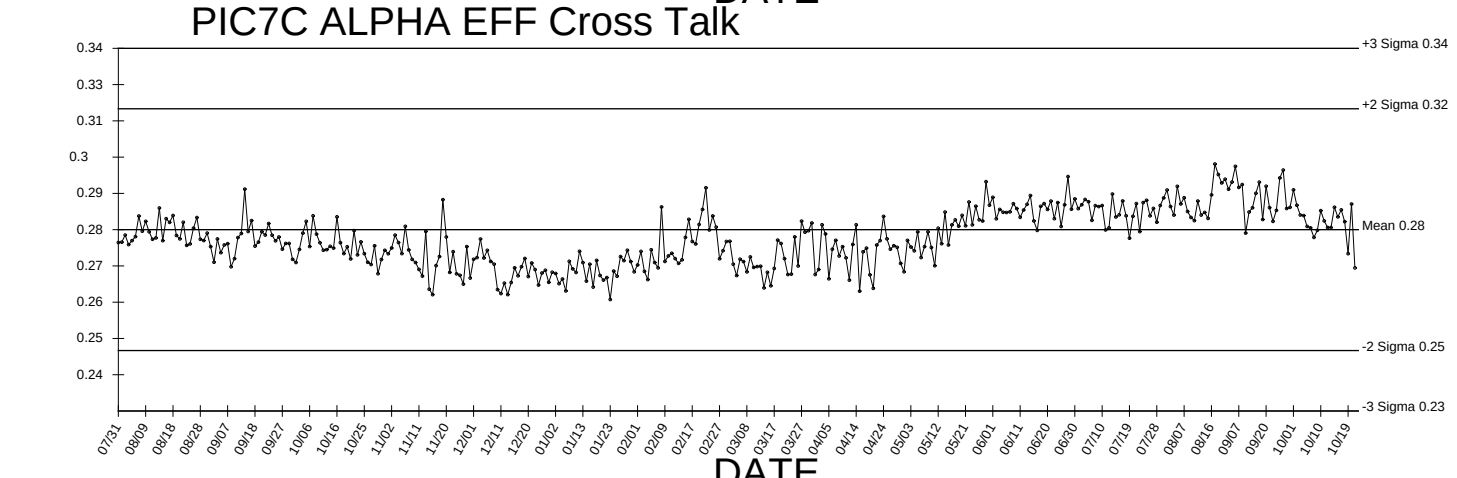
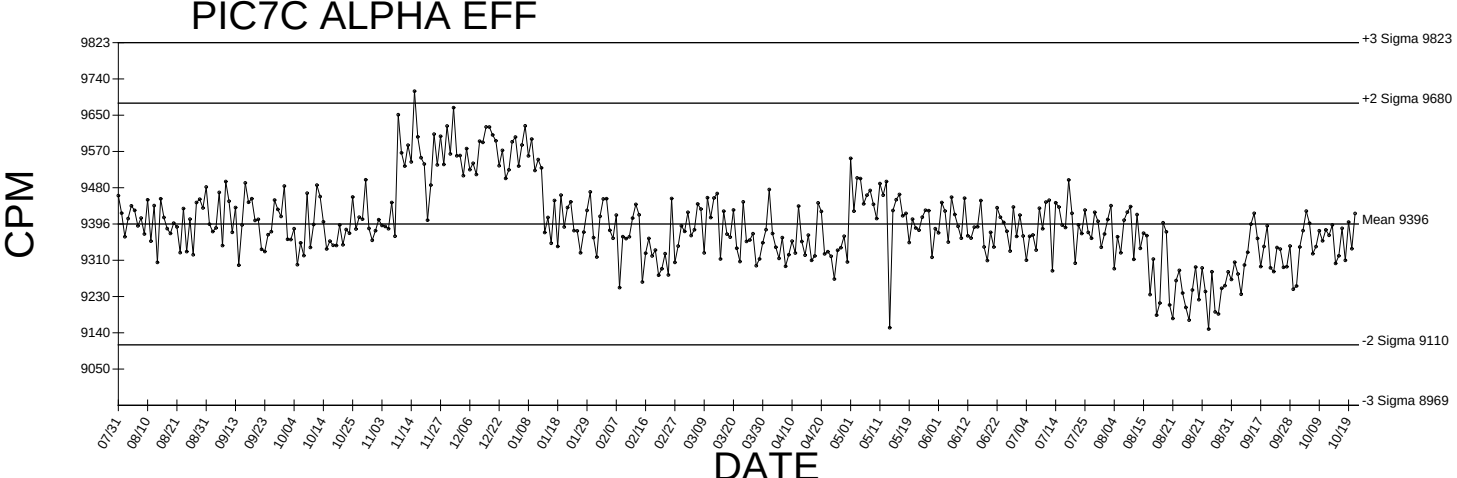
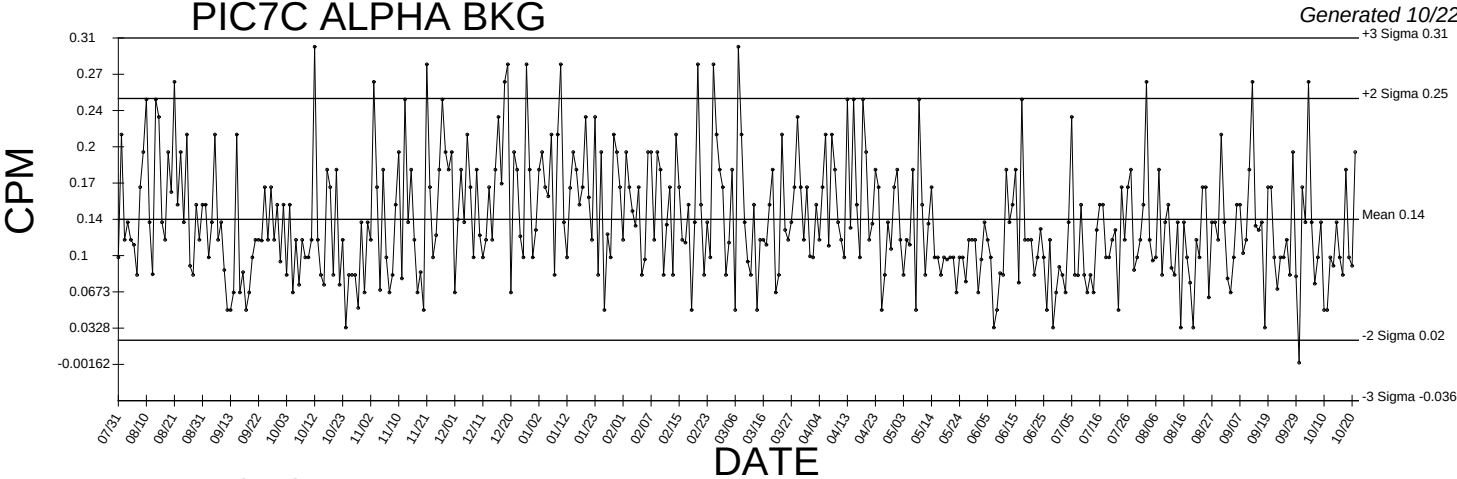
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PIC7B BETA EFF Cross Talk



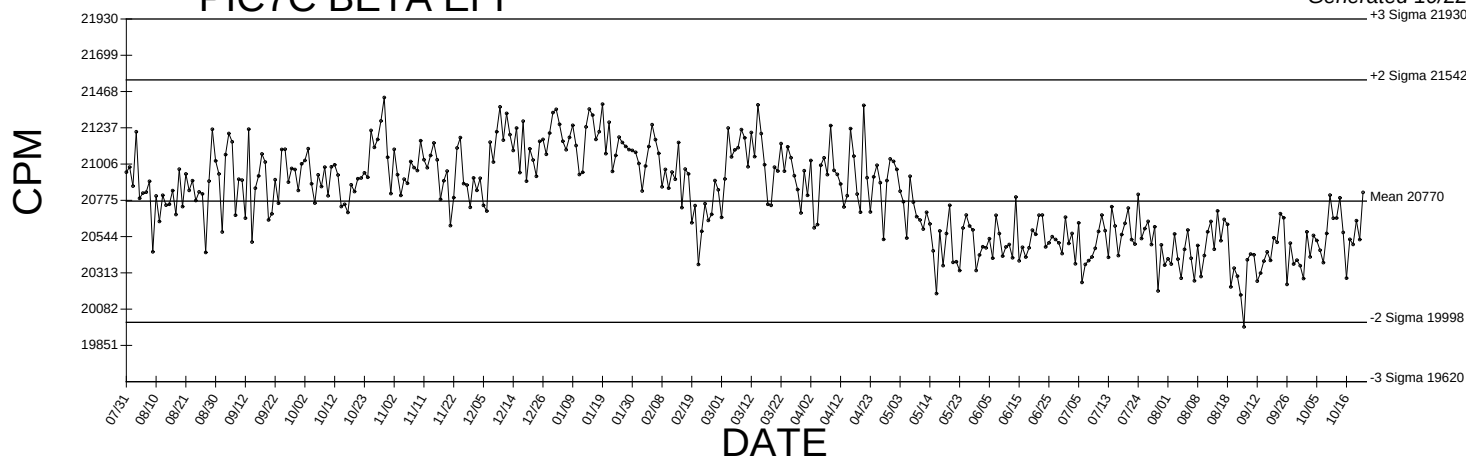
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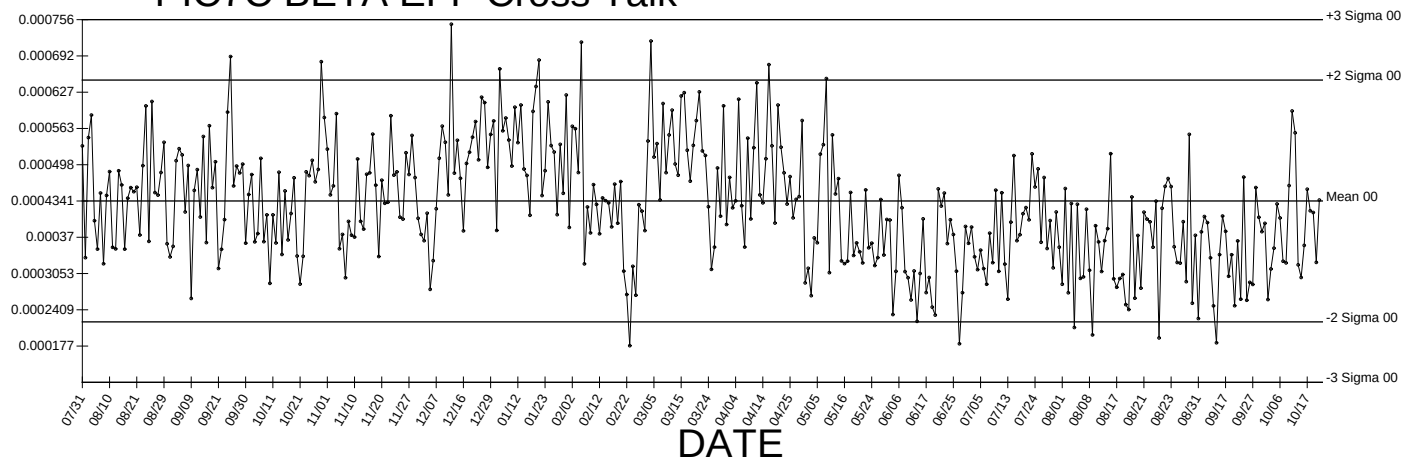
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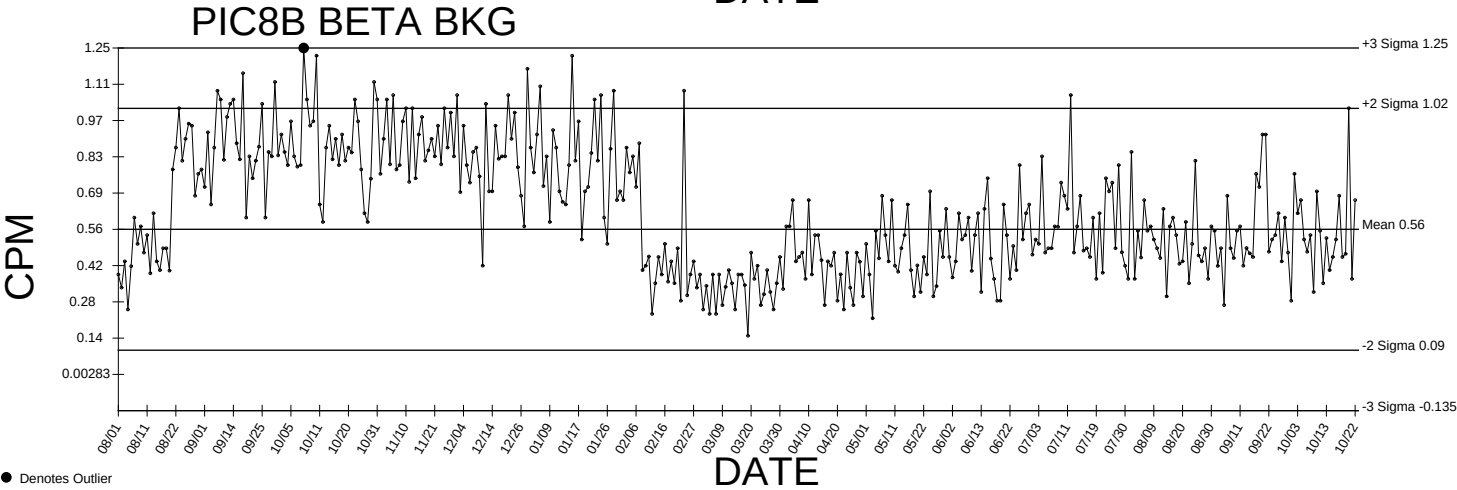
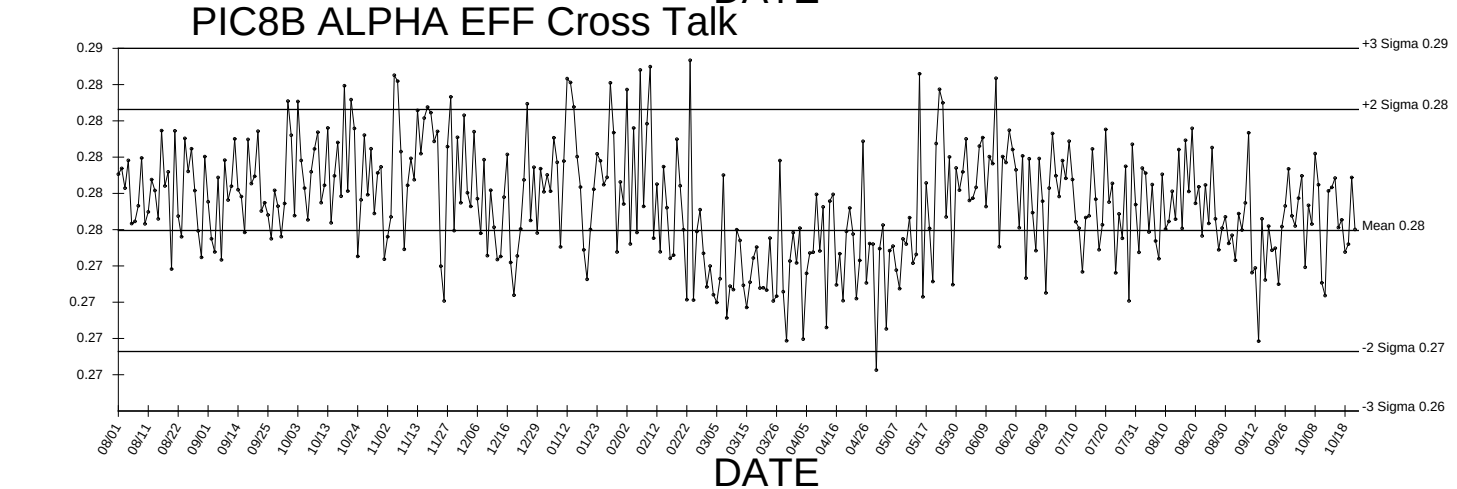
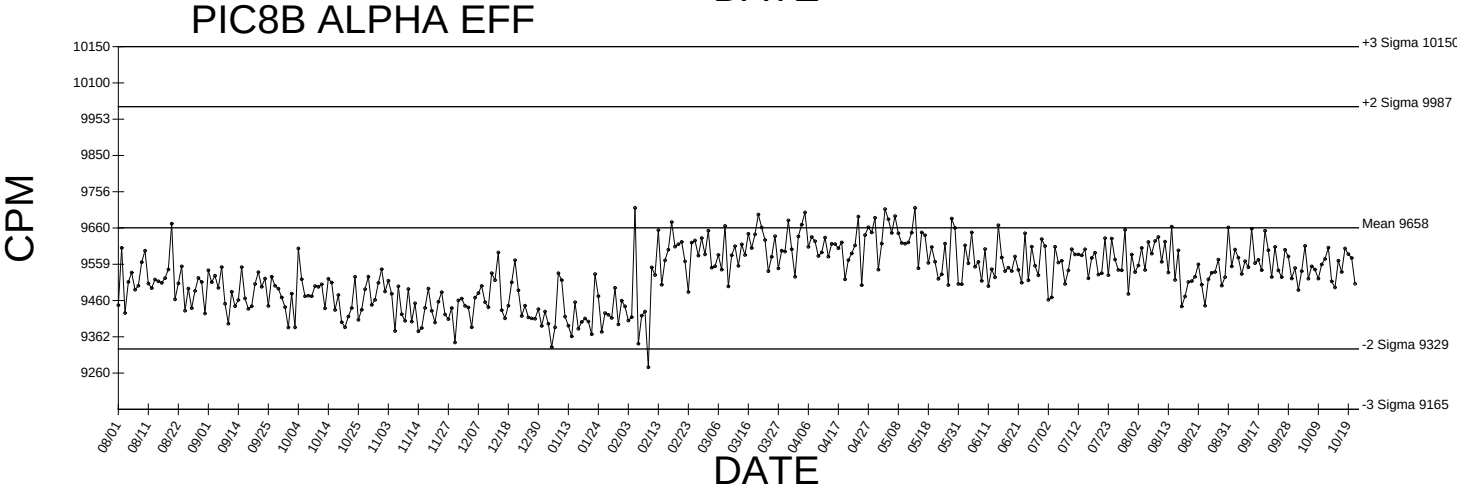
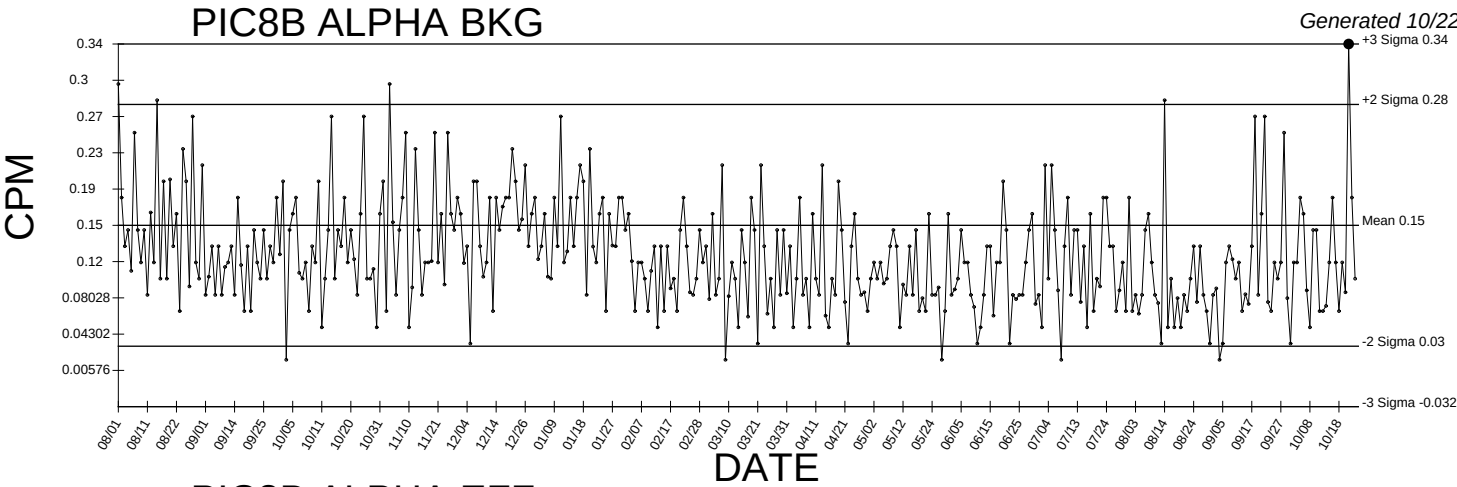
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+3 Sigma 21930



PIC7C BETA EFF Cross Talk



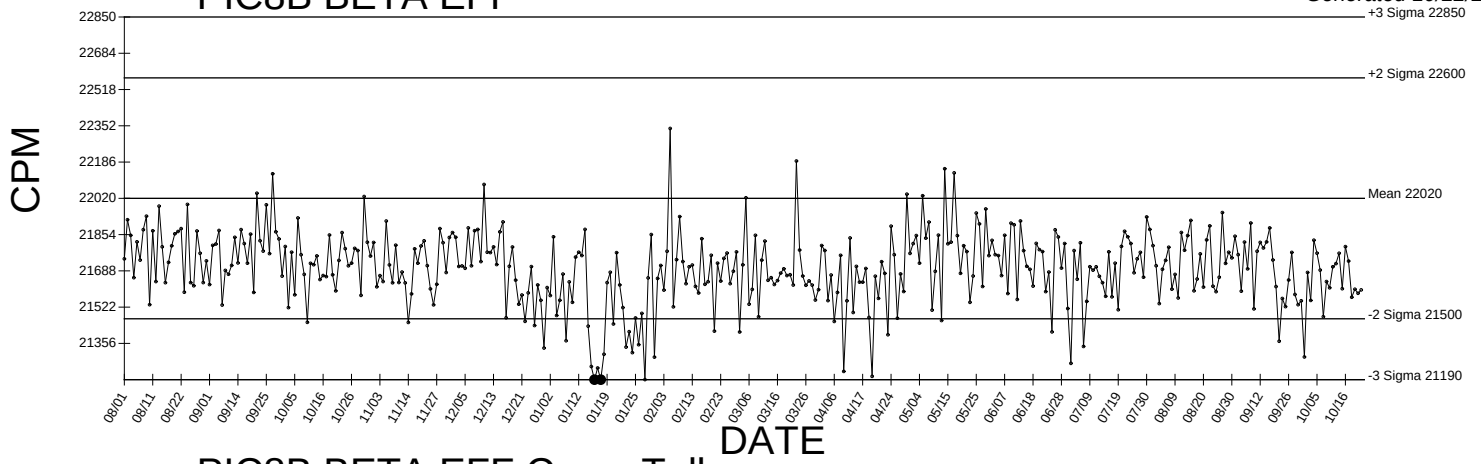
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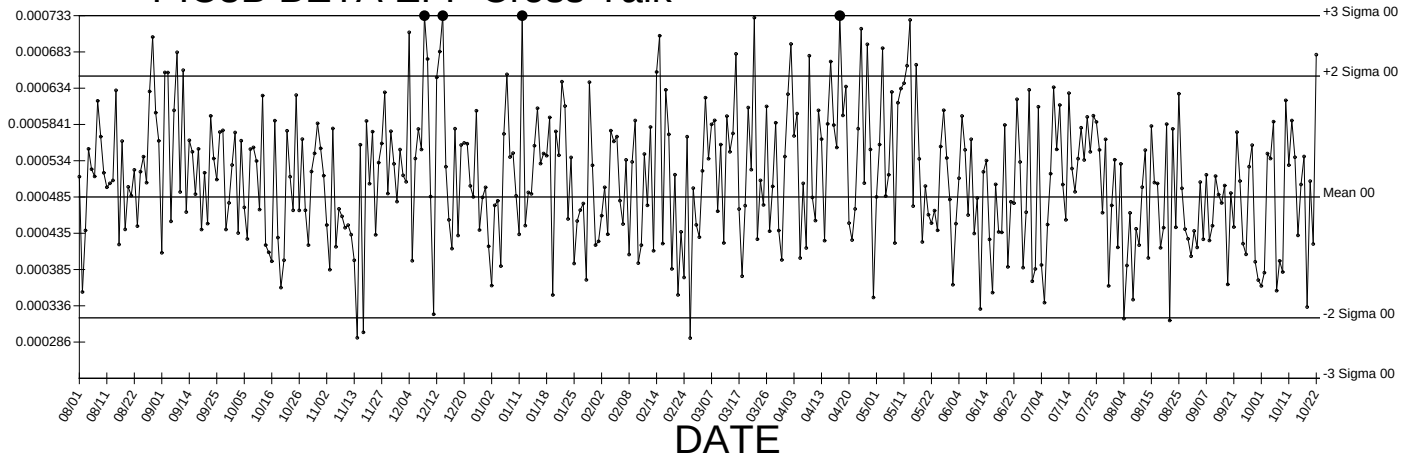
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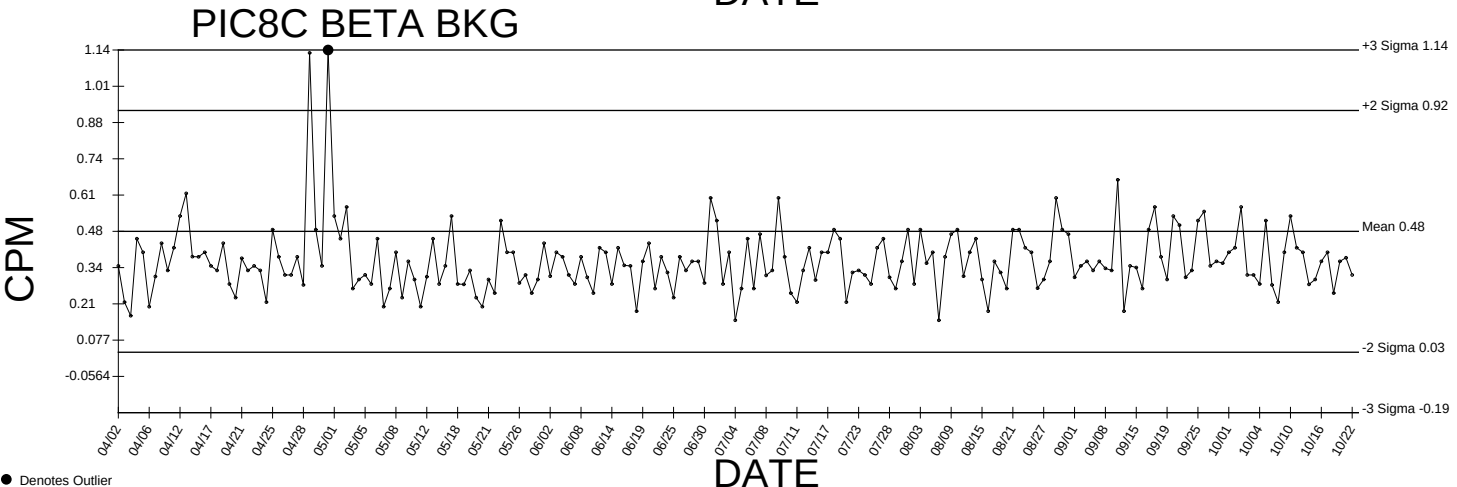
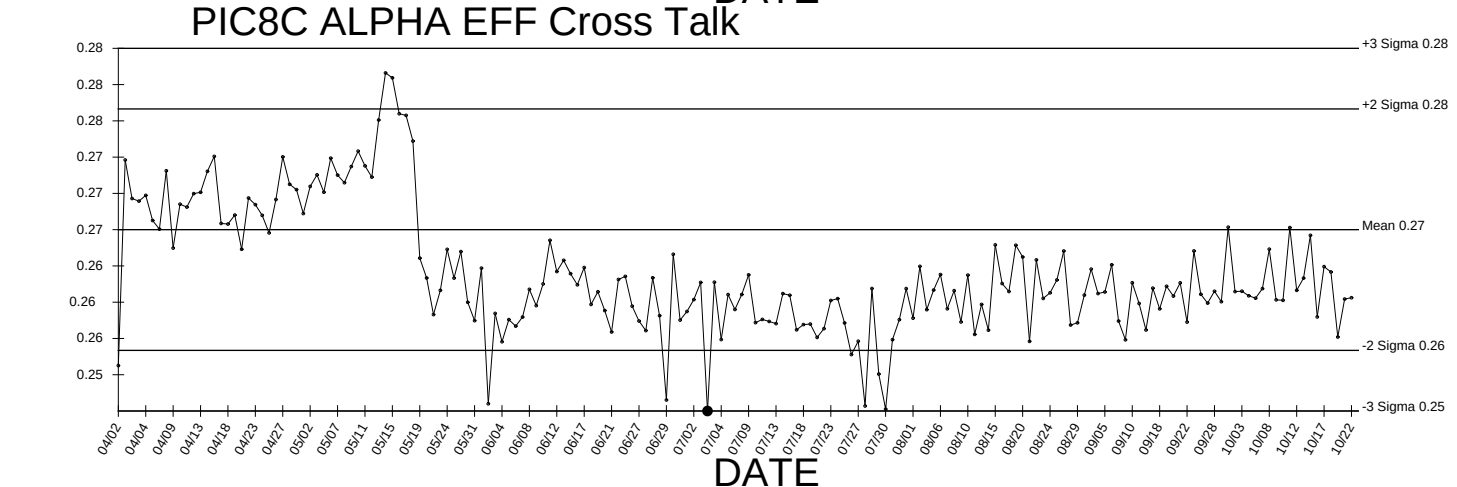
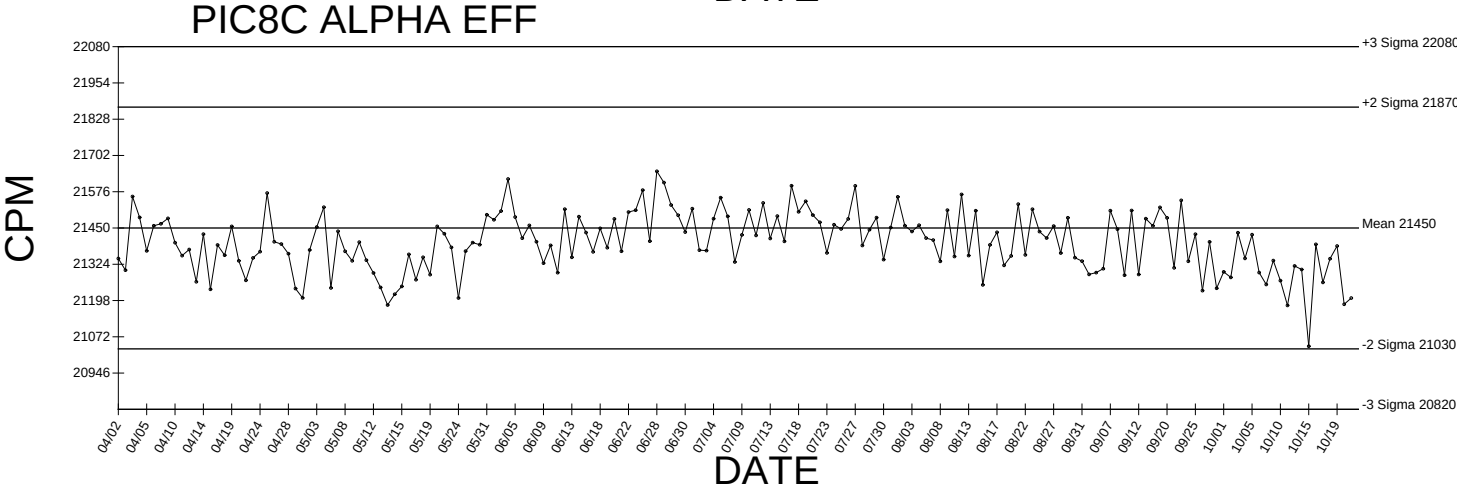
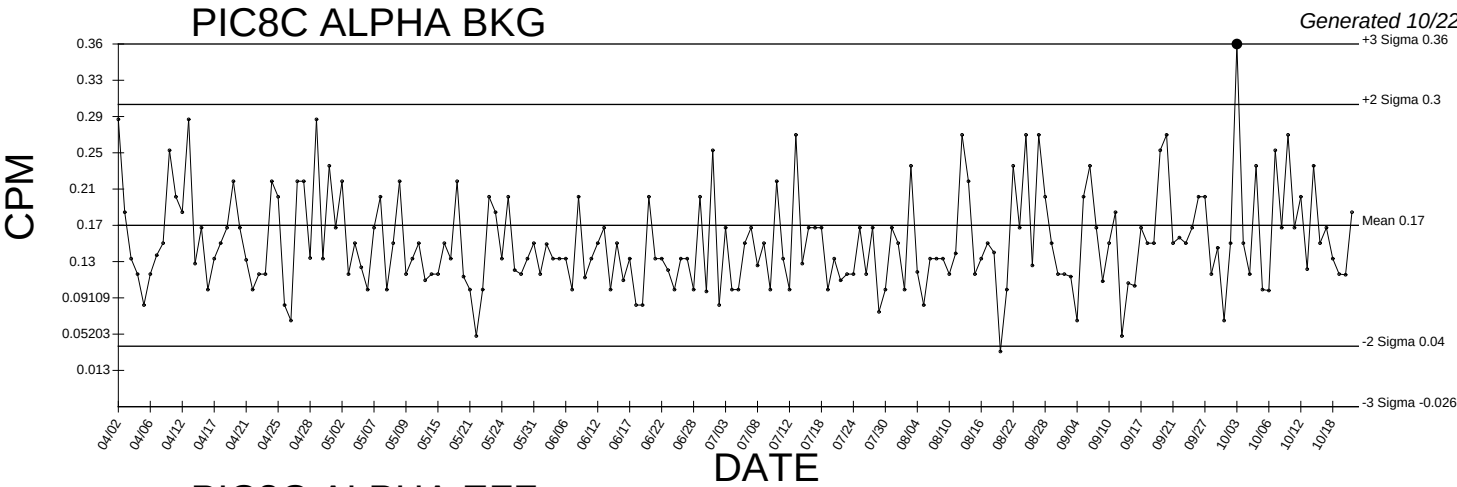
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PIC8B BETA EFF Cross Talk



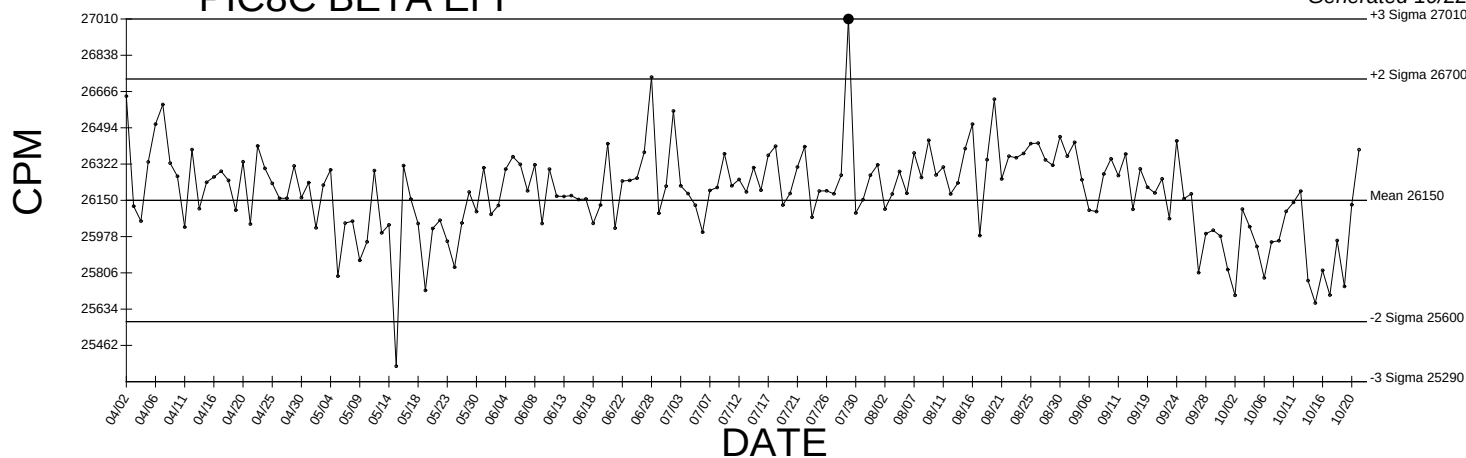
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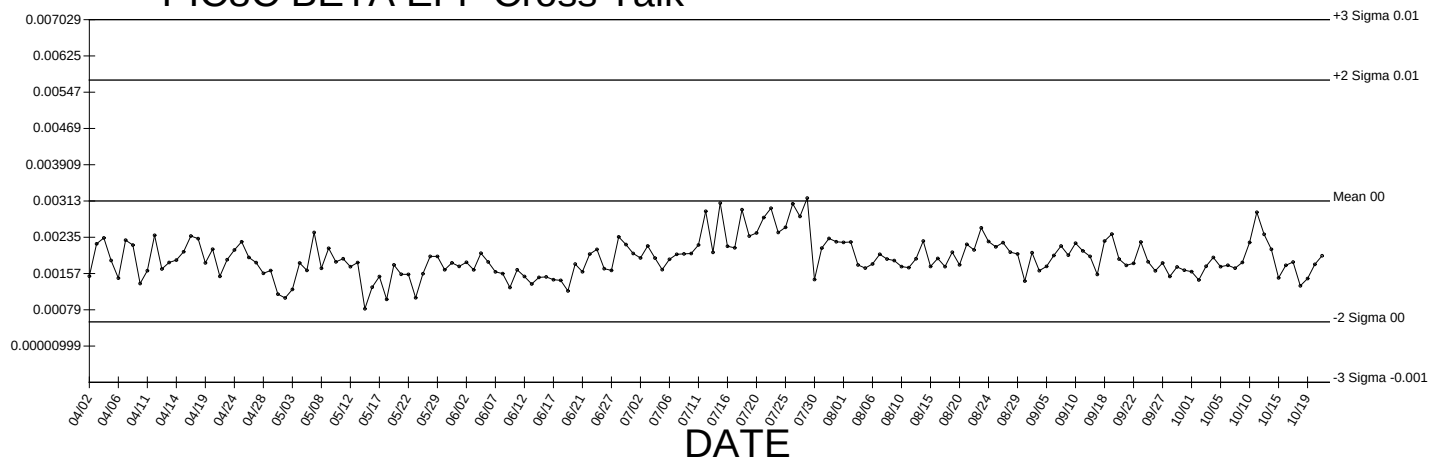
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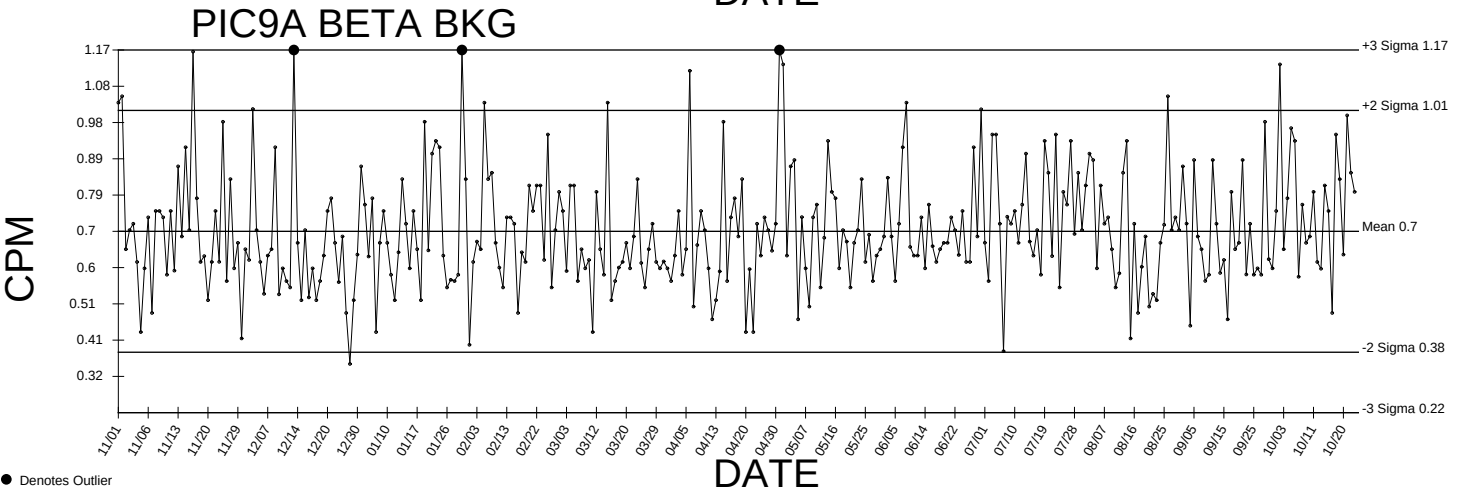
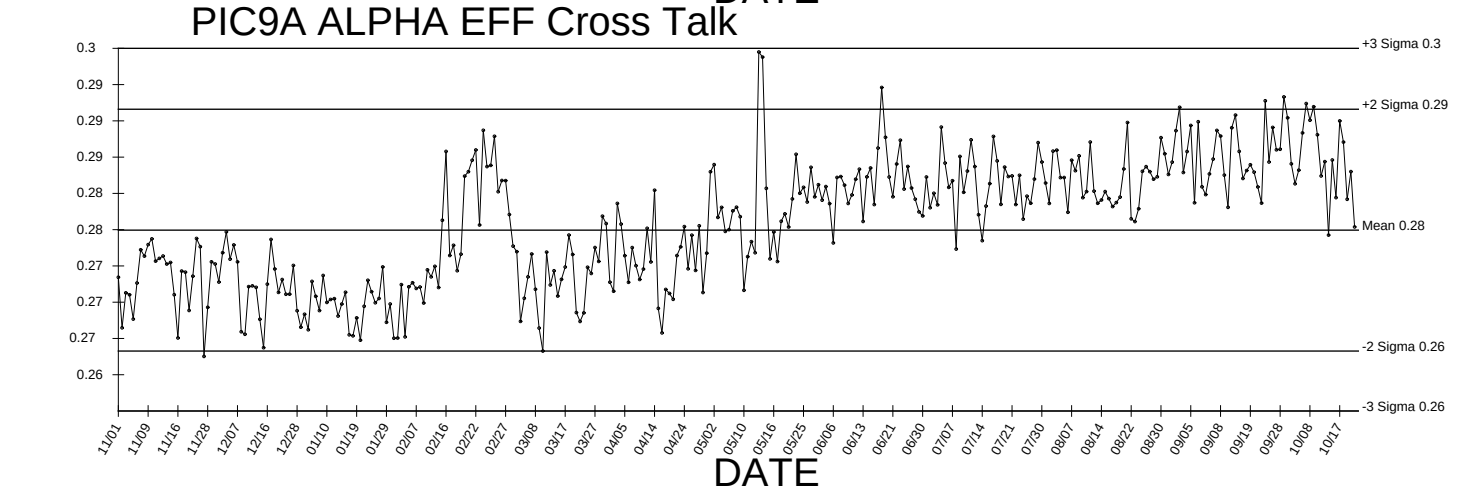
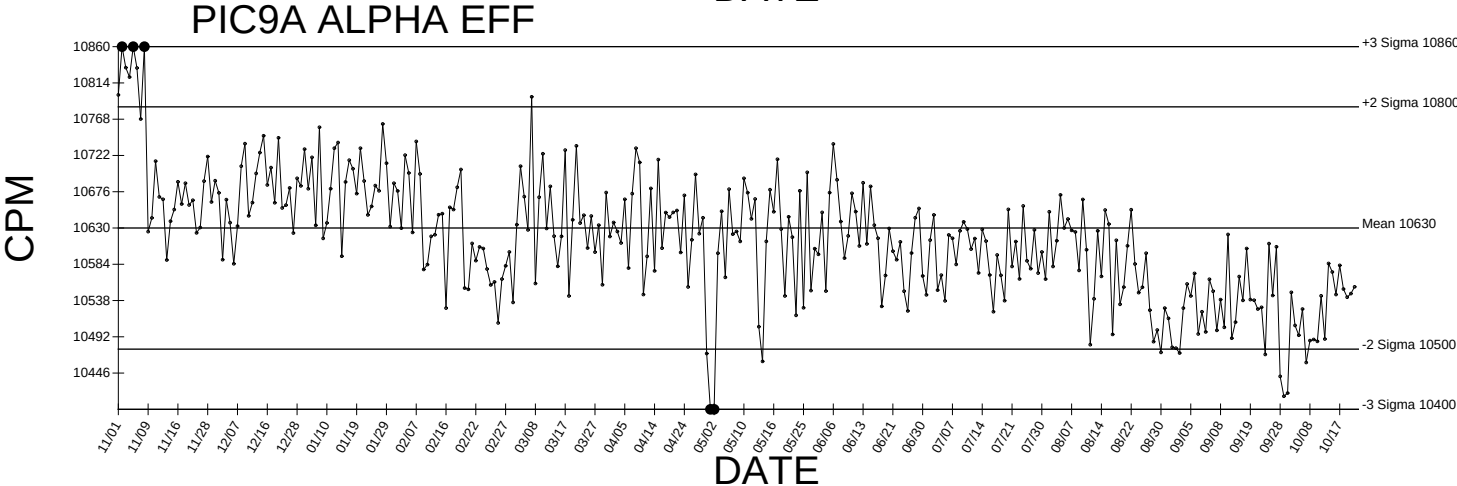
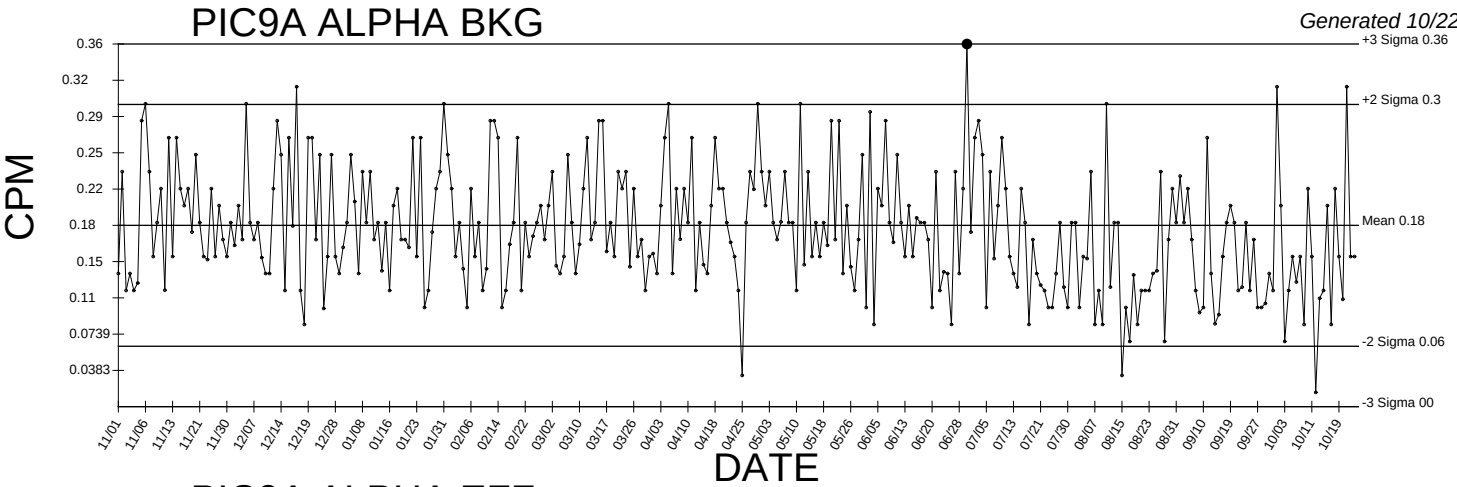
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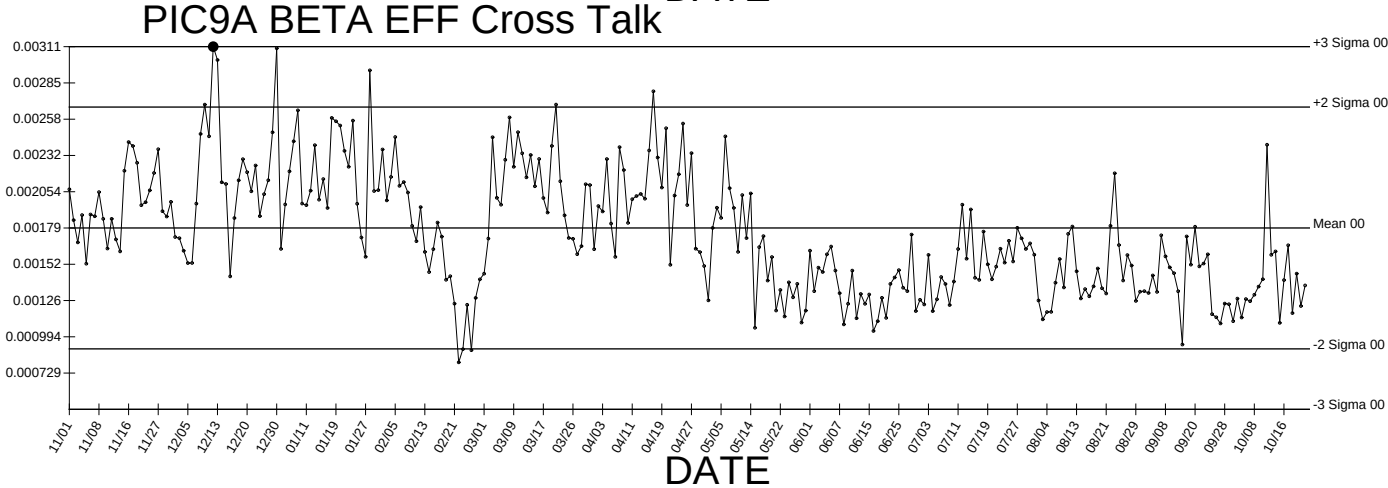
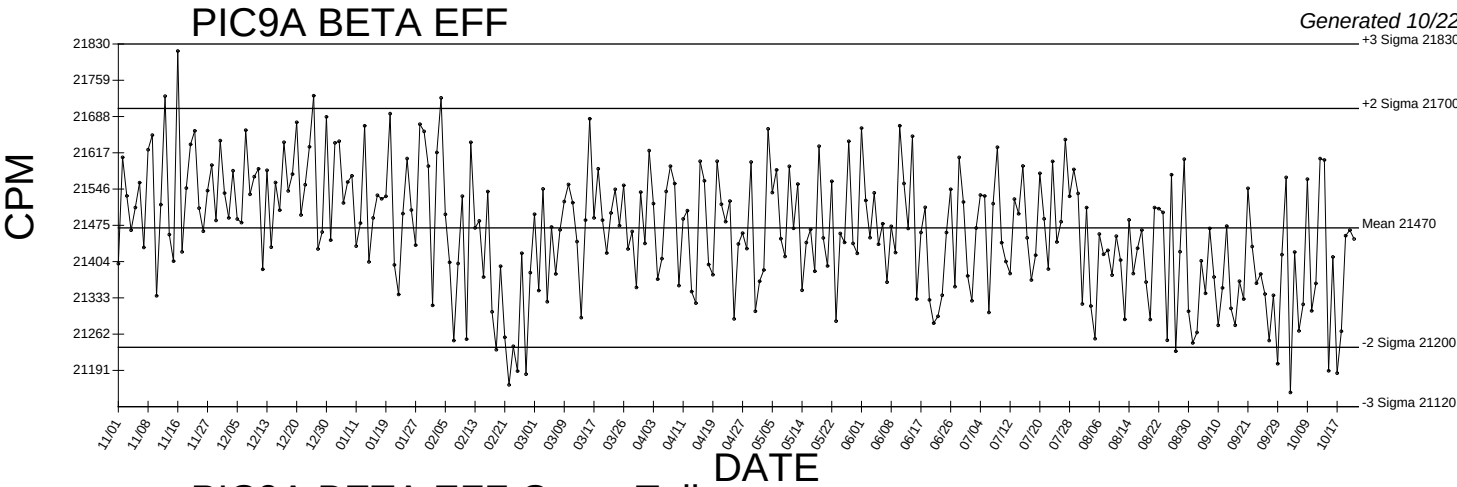
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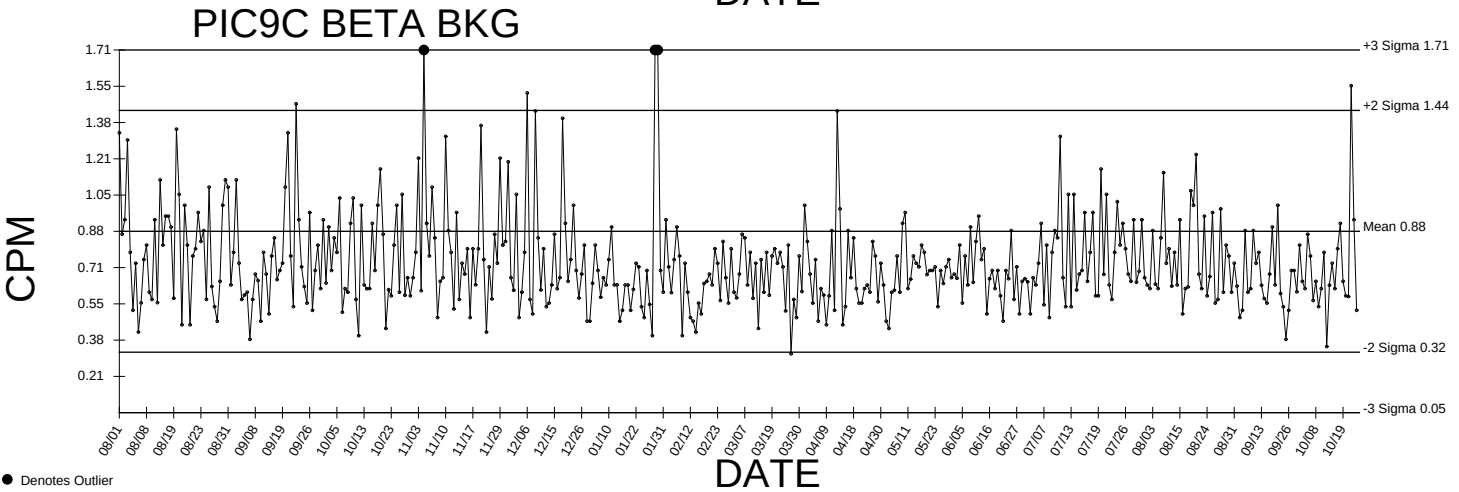
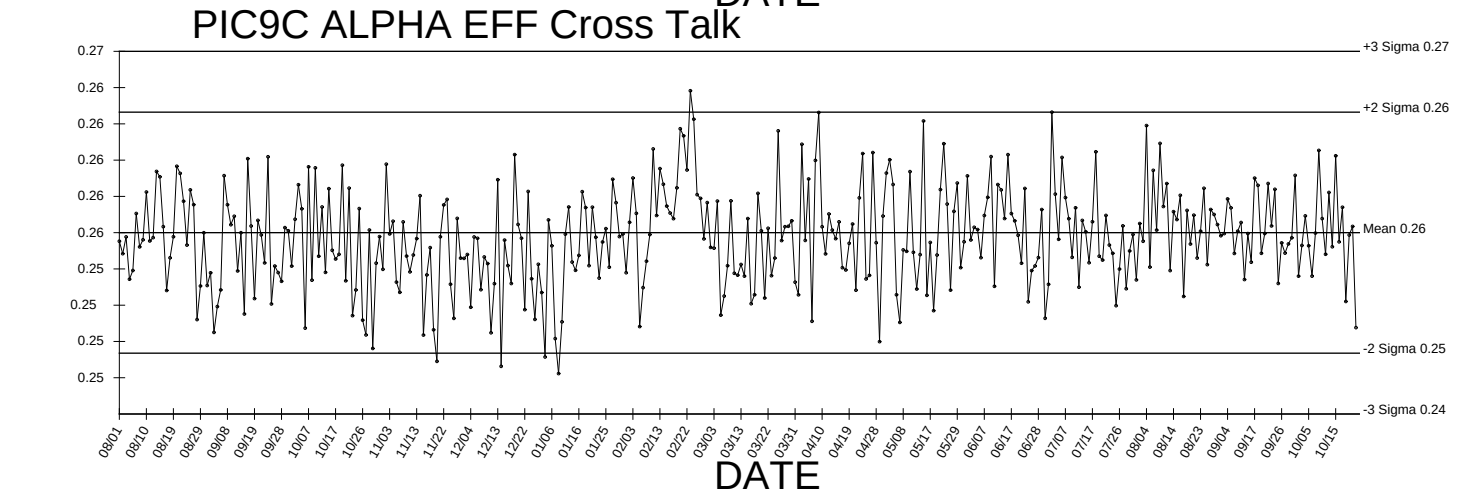
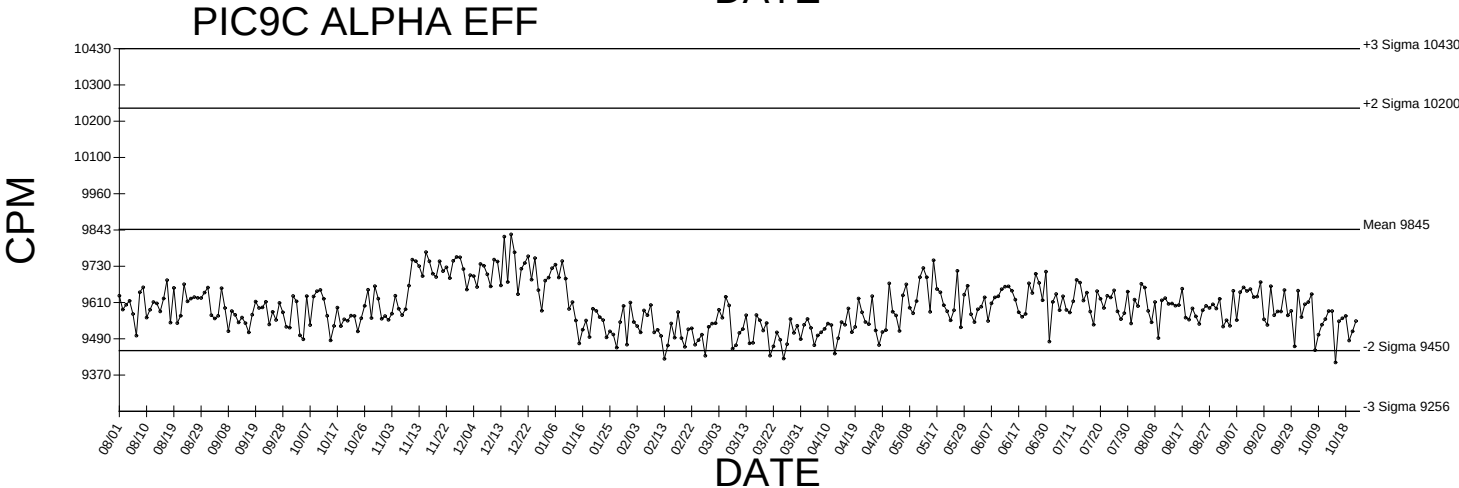
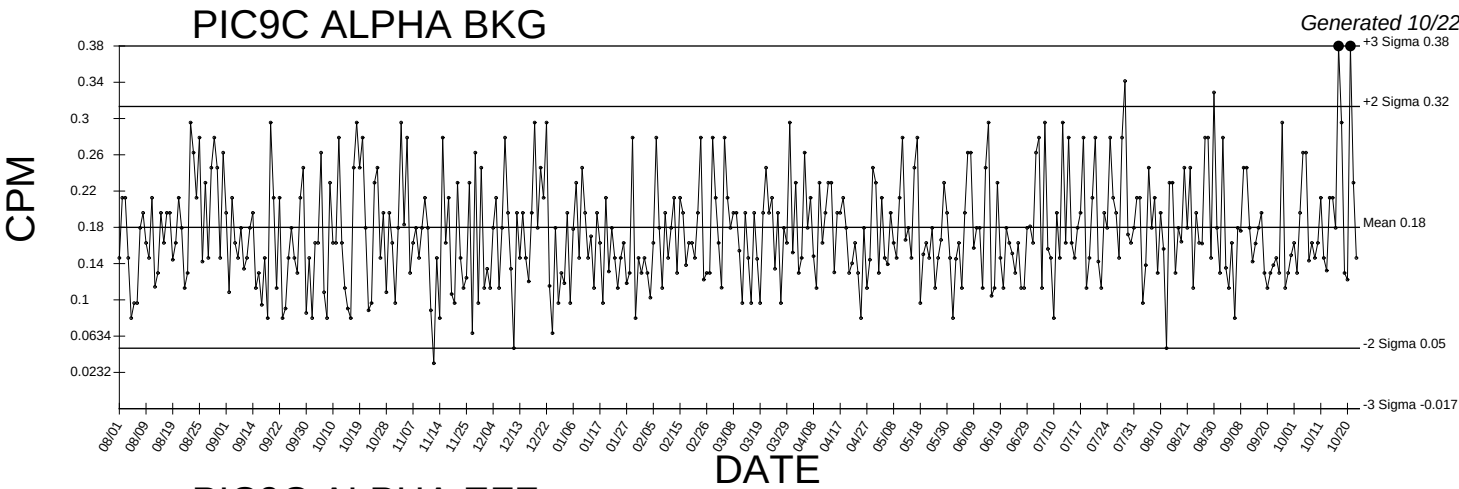
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● Denotes Outlier



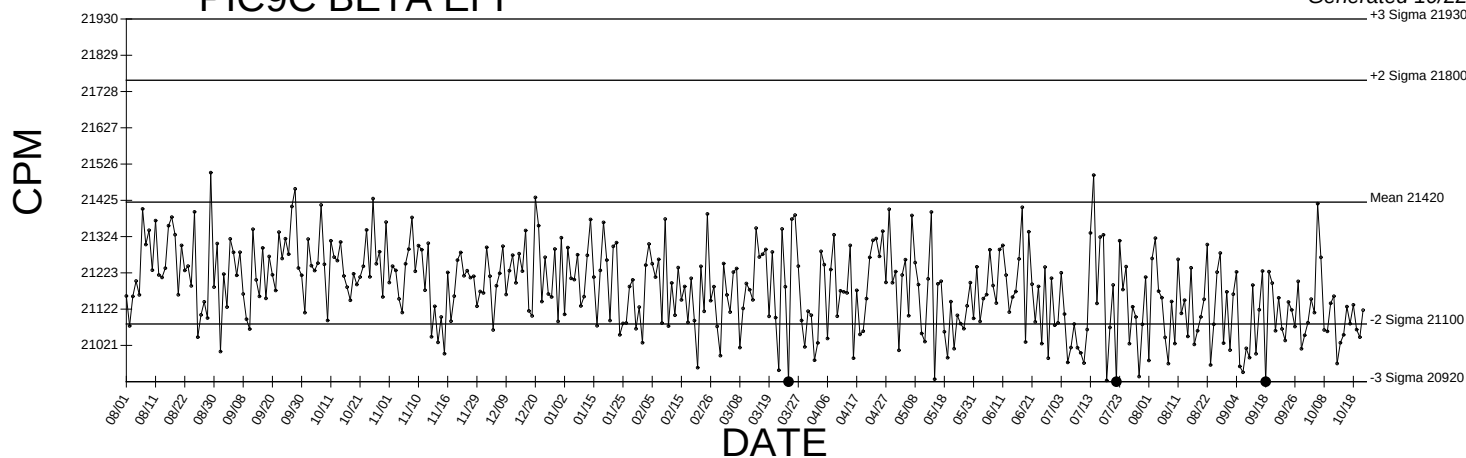
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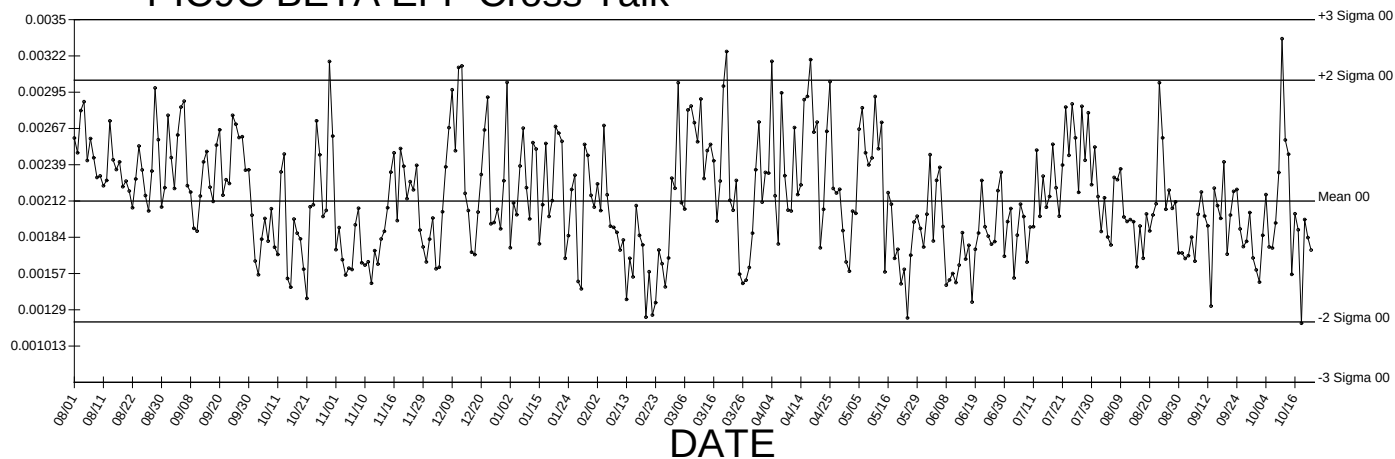
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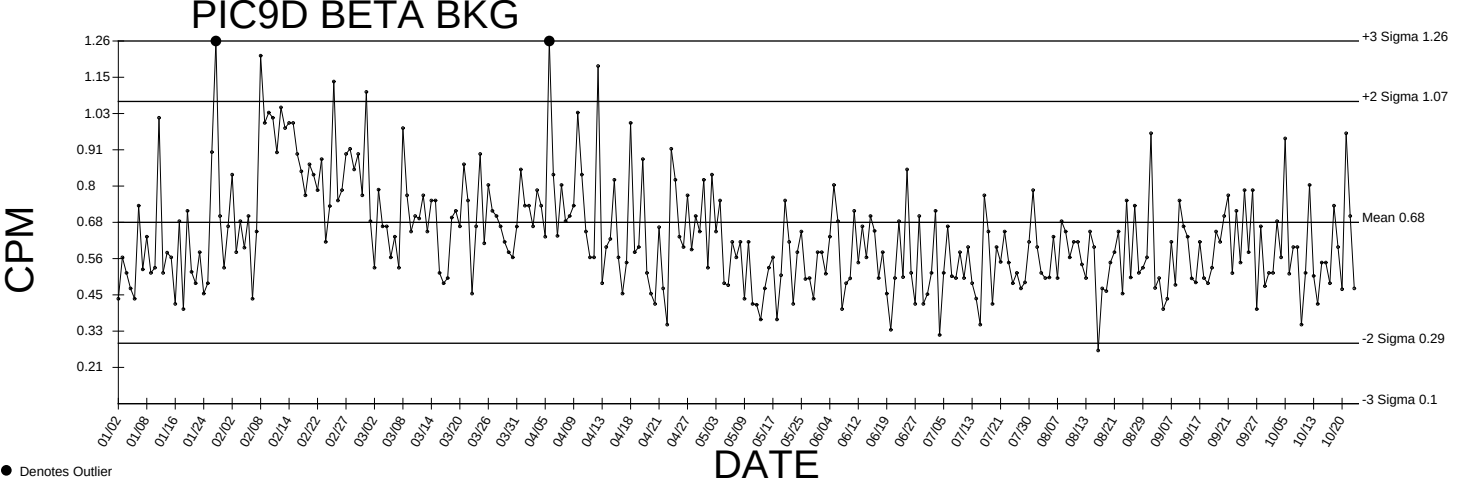
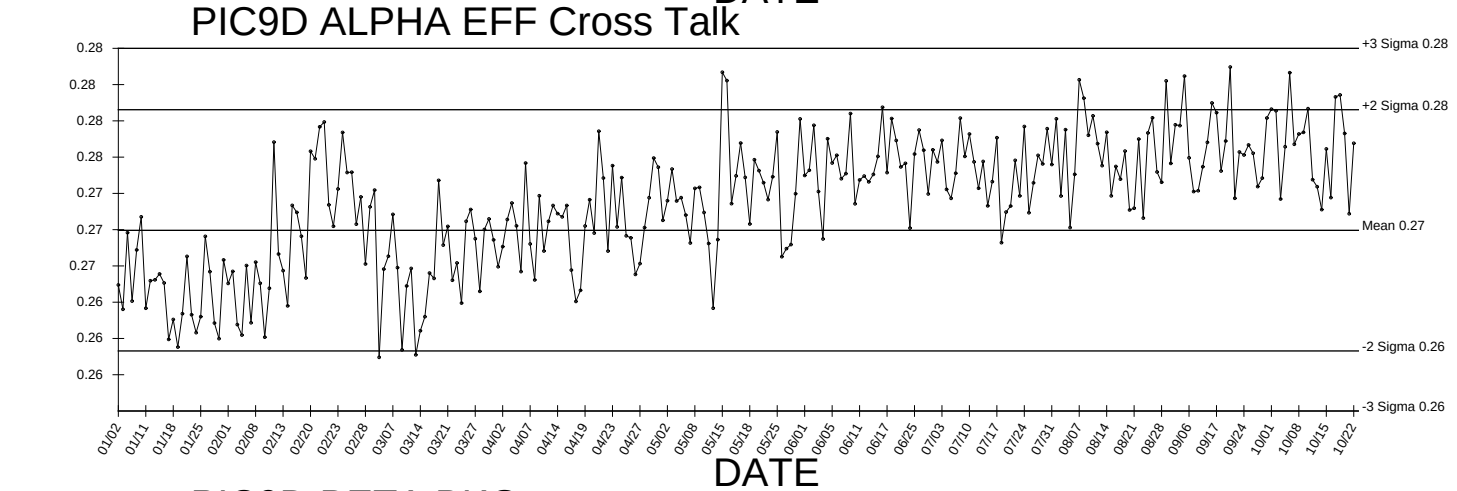
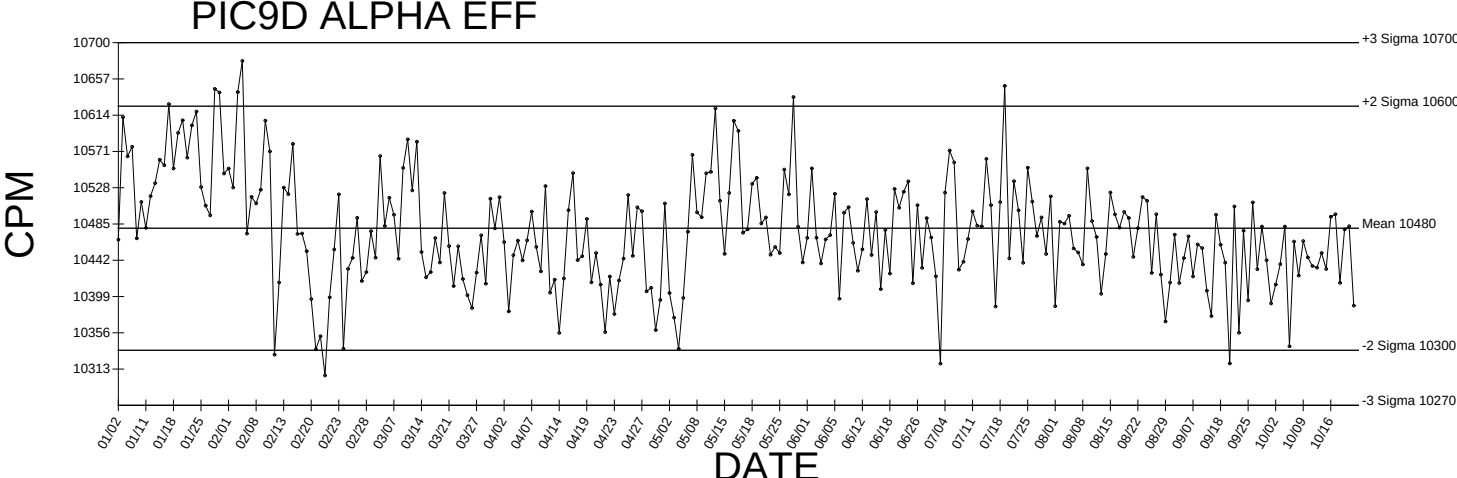
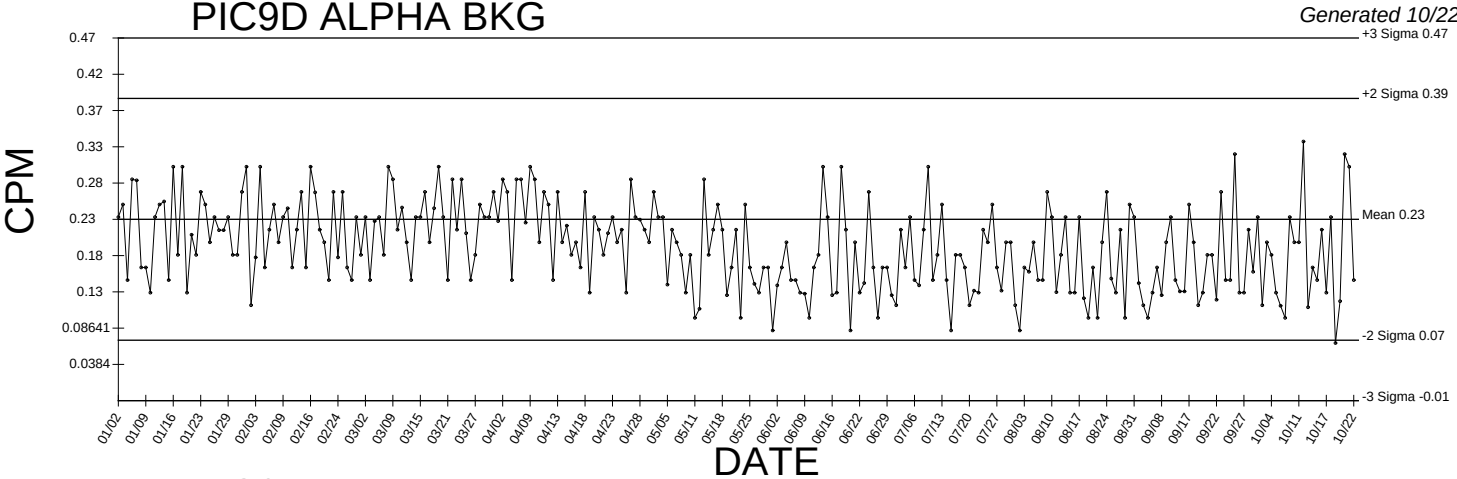
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PIC9C BETA EFF Cross Talk

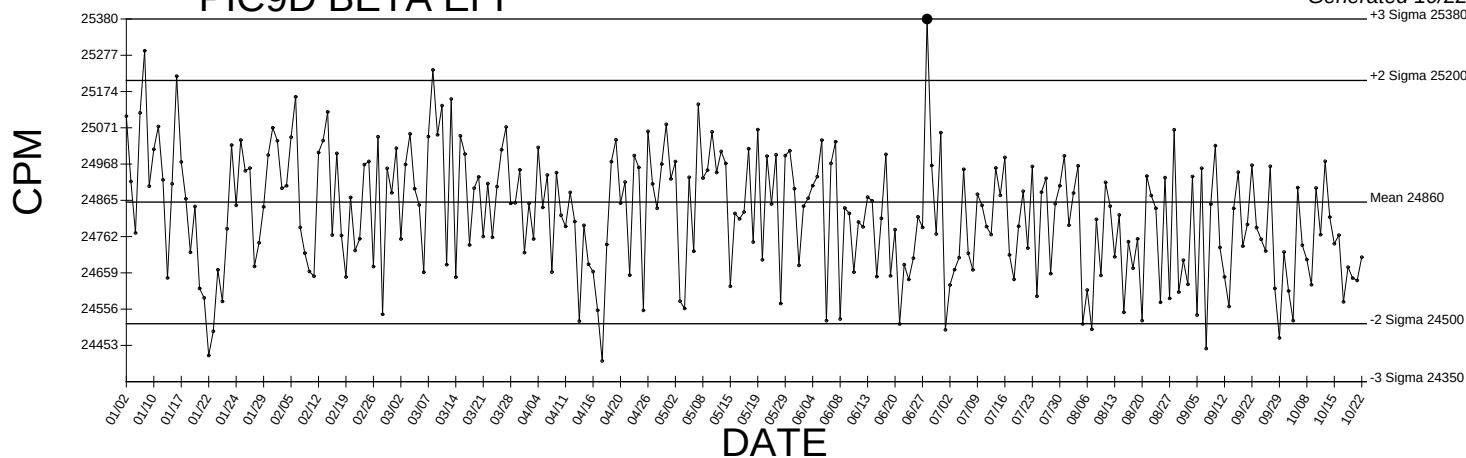


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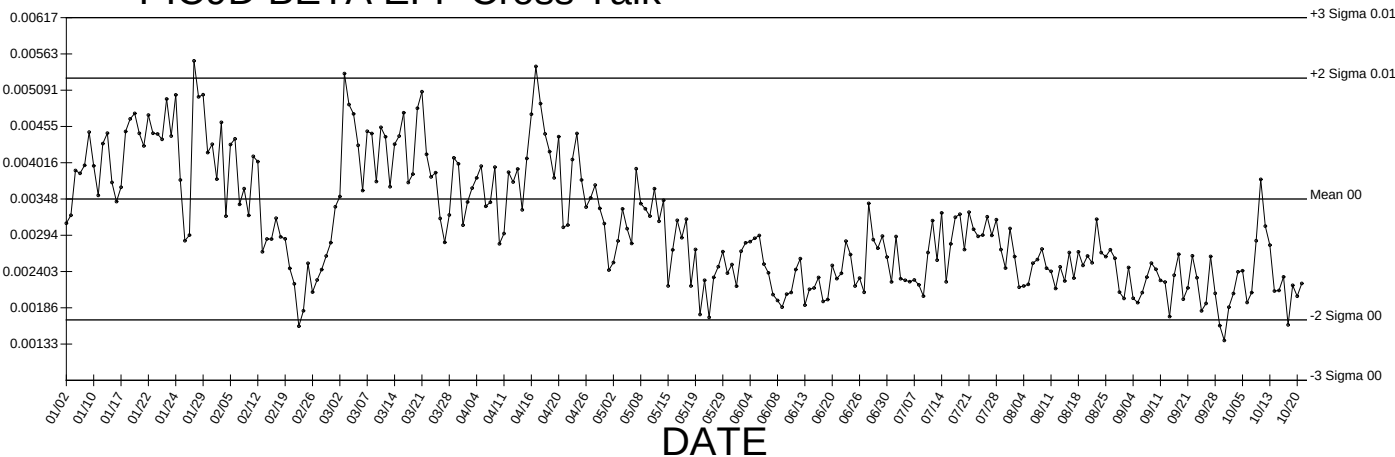


PIC9D BETA EFF

Generated 10/22/2018



PIC9D BETA EFF Cross Talk



● Denotes Outlier

RAD Standards Traceability



National Institute of Standards & Technology

Certificate

Standard Reference Material 4251C Barium-133 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation:

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
October 1994

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have an acid concentration and a carrier concentration comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4251C
(Certified values are shown in bold type)

(Certified values are shown in bold type)

Source identification number	NIST SRM 4251C		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.015 ± 0.002) g·mL ⁻¹ at 22.1 °C [b]*		
Solution mass	(5.054 ± 0.001) g [b]		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O	54	0.96
	HCl	1.0	0.04
	BaCl ₂	6×10^{-4}	1.2×10^{-4}
	¹³³ BaCl ₂	4×10^{-7}	8×10^{-8}
Radiological Properties:			
Radionuclide	Barium-133		
Reference time	1200 EST, 1 September 1993		
Massic activity of the solution [c] (Activity per unit mass of solution)	4.876×10^5 Bq·g ⁻¹		
Relative expanded uncertainty (k=2)	0.52% [d]		
Photon-emitting impurities	None detected [e]		
Half-lives used	Barium-133: (10.52 ± 0.13) a [f]		
	Radium-226: (1600 ± 7) a [f]		
Measuring instrument	Pressurized ⁴ πγ ionization chamber. A calibrated using a barium-133 solution whose activity was determined by 4π(β+X)-γ-anticoincidence counting		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [g]	Relative Sensitivity Factor, $ \partial y/\partial x_i \cdot (x_i/y)$ [h]	Relative Uncertainty Of Output Quantity, $u_c(y)/y$, (%) [i]
PIC A net response per gram of SRM 4251C, measured relative to RRS20 [j]	Standard deviation of the mean for 1000 repeated measurements (A)	0.008	1.0	0.01
PIC A background response, measured relative to RRS20	Standard deviation of the mean for >150 repeated measurements (A)	0.25	0.001 [k]	0.00
PIC A net response for RRS200, measured relative to RRS20	Standard deviation of the mean for >100 repeated measurements (A)	0.06	1.0	0.06
PIC A net response per Bq of barium-133 in solution, measured relative to RRS200.	Standard deviation of the mean for 240 repeated measurements (A)	0.02	1.0	0.02
Gravimetric measurements	Estimated (B)	0.01	1.0	0.01
Half life of barium-133 Half life of radium-226	Standard uncertainty of the half life (A)	1.24 [m] 0.44 [m]	0.004 [n] 0.004 [n]	0.00 0.00
Activity used to calibrate PIC A net response per Bq of barium-133 in solution	Standard uncertainty of the activity determined by $4\pi(\epsilon+X)$ - γ -anticoincidence counting. (B)	0.22	1.0	0.22
Live-time [p]	Estimated (B)	0.10	1.0	0.10
PIC A charge collection	Estimated (B)	0.05	1.0	0.05
Source Positioning	Estimated (B)	0.05	1.0	0.05
Photon-emitting impurities	Limit of detection for Cs-134 (B) [q]	100	0.00002	0.00
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.16
Coverage Factor, k				$\times 2$
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.32

* Notes and references are on pages 5 and 6.

NOTES

- (a) The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): 100 1.5 0.2
- (b) The stated uncertainty is two times the standard uncertainty.
- (c) **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [3].
- (d) The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the **expanded uncertainty** of y .

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

- (e) Estimated limits of detection for photon-emitting impurities are:
 $600 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 12 and 75 keV,
 $150 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 84 and 379 keV, and
 $3 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 387 and 2700 keV, provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of barium-133.
- (f) The stated uncertainty is the standard uncertainty. See reference [5].
- (g) Relative standard uncertainty of the input quantity x_i .
- (h) The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y / \partial x_i| \cdot (x_i / y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y / \partial x_i| \cdot (x_i / y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- (i) Relative component of combined standard uncertainty of output quantity y , rounded to two decimal places. The relative component of combined standard uncertainty of y is given by $u_i(y) / y = |\partial y / \partial x_i| \cdot u(x_i) / y = |\partial y / \partial x_i| \cdot (x_i / y) \cdot u(x_i) / x_i$. The numerical values of $u(x_i) / x_i$, $|\partial y / \partial x_i| \cdot (x_i / y)$, and $u_i(y) / y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

- [j] The response of pressurized ionization chamber A (PIC A) is determined from measurement of the time required to collect a given amount of charge on a stable fixed capacitor. All of the response measurements in the NIST pressurized ionization chambers are made relative to the response of one or more artifact standards. These artifact standards consist of microgram quantities of aged radium-226 in small welded stainless-steel capsules. These capsules are encapsulated in plastic rods whose dimensions are similar to those of the standard NIST ampoule. The artifact standards are called **Radium Reference Sources** and are designated as RRSx, where x is the nominal mass (in micrograms) of radium-226 in the capsule.
- [k] $|\partial y / \partial x_i| \cdot (x_i / y) = (\text{average background response}) / (\text{average net sample response})$
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y / \partial x_i| \cdot (x_i / y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i) / x_i = 100\%$. $|\partial y / \partial x_i| \cdot (x_i / y) = \{(\text{response per Bq of impurity}) / (\text{response per Bq of Ba-133})\} \cdot \{(\text{Bq of impurity}) / (\text{Bq of Ba-133})\}$. Thus $u(y) / y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] Evaluated Nuclear Structure Data File (ENSDF), April 1994.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	0487
Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL
Reference Date:	09/01/1993
Ampoule Mass (g):	5.054 g
Uncertainty:	+/- .26 %
LogBook No:	RC S 035 002

A Solution Material Info		
Isotope:	Barium-133	
Prepared By:	Angela Johnson	
Prep Date:	10/31/2002	
Verification Date:	10/10/2018	
Expiration Date:	10/10/2019	
Primary Code:	0487-A	
Dilution(mL):	100 mL	
Mass of Parent(g):	4.7696 g	
Density(g/mL):	0.9984	Balance ID:

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (100 \text{ mL}) = 1395394.1760 \text{ dpm/mL}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (0.9984 \text{ g/mL}) / (100 \text{ mL}) = 1397609.3930 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
12/18/2015	Gregory Ramsay	15.0062	1000	0487-B	20972.806 dpm/mL	11/18/2016	11/18/2017
01/17/2017	Bethany Fiem	15.1795	1000	0487-C	21215.0117 dpm/mL	01/17/2017	01/17/2018
11/08/2017	Bethany Fiem	15.5573	1000	0487-D	21708.5658 dpm/mL	11/08/2017	11/08/2018

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ba-133 Standard 0487-D

Assignment	BLUE
Analyst	RPZ
Verification Prep Date	

Standard Information	
Isotope	Ba-133
Source Number	
Source Value	0.500E+03 D
Recovery Date	
Ref Act (Bq/mL)	
Amount of Std. Unit	
Standard Prep Date	

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1				
2				
3				

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	5668.77	0.818570	6930.75	4490.11
2	3622.28	0.818570	4426.63	4628.58
3	3620.44	0.818570	4424.90	4431.30

Mean Value = 4460.14
 Stdev = 1.02933E+06
 Certificate Value* = 4467.7
 Two sigma = 34.765
 10 % of Mean = 446.014
 Rule A (Pass/Fail) Pass
 % Recovery 109.747
 Rule B (Pass/Fail) Pass
 Expiration Date 11-8-2018

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value

* Certificate Value is decay corrected to Count Date.

The analyst prepared three standard verification sources for Ba-133 source 0487-D by transferring 1 mL portions of the standard into 15 mL acid-washed vials. 10 mL of Econcent Ultra liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A blank vial was prepared in a similar fashion using 10 mL of Econcent Ultra liquid scintillation cocktail. The standard verification vials and blank vial were dark-adapted for at least two hours and counted on LSCELE for Ba-133 source standard verification. The Ba-133 efficiency calibration which was used for verification calculations was performed on 11-26-17 using Ba-133 source 1501-A.

Standard results for each verification source was calculated as follows

$$\text{Source dpm/mL} = (A - B) / (C \times D)$$

where

A = Net source cpm

B = BKG cpm

C = System efficiency (cpm/dpm), and

D = Volume used for standard verification

HA01-M-001



Certificate

6000117
3.11.17Standard Reference Material[®] 4339b

1810

Radium-228 Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive radium-228 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. A unit of SRM 4339b consists of approximately 5 mL of a solution, whose composition is specified in Tables 1 and 2, contained in a flame-sealed borosilicate-glass ampoule [1].

The certified radium-228 massic activity value, at a Reference Time of 1200 EST, 07 October 2010, is:

$$(195 \pm 14) \text{ Bq}\cdot\text{g}^{-1}$$

A NIST certified value, as used within the context of this certificate, is a value for which NIST has the highest confidence in its uncertainty assessment. It is a "measurement result" [2] obtained directly or indirectly from a "primary reference measurement procedure" [3]. The certified value is traceable to the derived SI unit, Becquerel (Bq).

Additional physical, chemical, and radiological properties for this SRM, as well as details on the standardization method, are given in Tables 1 and 2. Uncertainties for the certified quantities are expanded ($k=2$). The uncertainties are calculated according to the ISO and NIST Guides [4,5]. Table 3 contains a specification of the components that comprise the uncertainty analyses.

Expiration of Certification: The certification of SRM 4339b is valid indefinitely, within the measurement uncertainty specified, provided that the SRM is handled and stored properly and that no evaporation or change in composition has occurred. The solution matrix, in an unopened ampoule, is homogeneous and stable within its half-life-dependent useful lifetime provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Handling and Storage"). Periodic recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Radiological and Chemical Hazard: Consult the Safety Data Sheet (SDS), enclosed with the SRM shipment, for radiological and chemical hazard information.

This SRM was prepared in the Physical Measurement Laboratory, Radiation and Biomolecular Physics Division, Radioactivity Group, M.P. Unterwiesing, Group Leader. The overall technical direction and physical measurement leading to certification and photon-emitting impurity analyses were provided by L. Pibida of the NIST Radioactivity Group, with production assistance by J. LaRosa, R. Collé, and L. Laureano-Pérez. Alpha-emitting impurity analyses were provided by J. LaRosa.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Lisa R. Katon, Chief
Radiation and Biomolecular Physics Division

Gaithersburg, Maryland 20899
Certificate Issue Date: 14 November 2012
SRM 4339b

Robert L. Walters, Jr., Director
Office of Reference Materials

Page 1 of 4

Table 1. Certified Massic Activity of SRM 4339b

Radionuclide	Radium-228 ^{1a)}
Reference time	1200 EST, 07 October 2010
Massic activity of the solution	195 Bq g ⁻¹
Relative expanded uncertainty ($k \approx 2$)	7.2 % ^{1b)}

^{1a)} The final ²²⁸Ra purification from the ²³²Th mother solution was performed on 02 September 2010 (0920 EST).

^{1b)} The uncertainties on certified values are expanded uncertainties, $U = k u_c$. The quantity u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides [4,5]. The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ and was chosen to obtain what is assumed to be an approximate 95 % level of confidence.

Table 2. Uncertified Information of SRM 4339b

Source description	Liquid in a flame-sealed 5 mL borosilicate-glass ampoule [1]
Solution composition	1.3 mol L ⁻¹ HNO ₃ with 19.8 μg g ⁻¹ Ba ²⁺
Solution density	(1.014 ± 0.002) g mL ⁻¹ at 20.8 °C ^{1a)}
Solution mass	(5.180 ± 0.003) g ^{1b)}
Photon-emitting impurities	²²⁶ Ra: < 0.5 Bq g ^{-1b)}
Alpha-emitting impurities	²³² Th: < 0.08 Bq g ^{-1b)}
Half-lives used	²²⁶ Ra: (5.75 ± 0.04) a [6] ²²⁶ Ac: (6.15 ± 0.02) h [7] ²²⁶ Ra: (1600 ± 7) a [8] ²³² Th: (14.02 ± 0.06) × 10 ⁹ a [9]
Calibration methods (and instruments)	The certified massic activity for ²²⁶ Ra was obtained by high-resolution gamma-ray spectrometry of three master solution ampoules (eleven separate determinations), as measured on three to five different spectrometers and geometries on each ampoule, and used assumed nuclear data for probabilities per decay for 16 gamma-ray transitions. Confirmatory measurements were performed by 2πα spectrometry of ingrown ²²⁶ Ra with a planar, ion-implanted Si detector.

^{1a)} The stated uncertainty is two times the standard uncertainty. See reference 5.

^{1b)} Based on gamma-ray spectrometry of forced-fitted peak at 186.2 keV and assuming a probability per decay of 0.0355 [6].

^{1c)} The maximum ²³²Th activity concentration in ²²⁶Ra.

^{1d)} The stated uncertainty is the standard uncertainty. See reference 5.

Table 3. Uncertainty Evaluation for the Massic Activity of SRM 4339b

Uncertainty component		Assessment Type ^(a)	Relative standard uncertainty contribution on massic activity of ²²⁶ Ra (%)
1	Gamma-ray spectrometry precision; relative standard deviation of the grand mean on the average massic gamma-ray emission rates for 16 measured ²²⁶ Ac gamma-ray transitions. Each mean in the grand mean is based on 11 determinations with three sources in three to five different detectors. The uncertainty in the determination of the massic gamma-ray emission rate for any one transition in a given determination ranged from typically 0.5 % to 1.5 %. The relative standard deviation of the mean for the average of the 16 lines, for any one determination, was typically 1 %; whereas the relative standard deviation of the grand mean for the average of the 16 lines across all 11 determinations is 0.34 % ^(b) . Data passes normality test.	A	11.84
2	Uncertainty due to assumed gamma-ray probabilities per decay for the measured ²²⁶ Ac transitions [7]. The uncertainty on each transition has a shared (correlated) component of 2.5 % (see comments in [7]).	B	3.5
3	Detection efficiencies not embodied within component 1	B	0.4
4	Mass determinations for dilution factors and counting source preparations	B	0.1
5	Decay corrections for ²²⁶ Ra half-life uncertainty of 0.7 % [6]	B	0.003
6	Effect of ²²⁶ Ra and ²²⁶ Ac half-life uncertainties on secular equilibrium ratio	B	0.02
Relative combined standard uncertainty			3.6
Relative expanded uncertainty (k = 2)			7.2

^(a) Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^(b) Average massic gamma-ray emission rates of 11 geometries (R_g) for 16 measured ²²⁶Ac gamma-ray transitions with their respective energy (E_γ); assumed gamma-ray probabilities per decay (I_γ) and standard deviation of the mean (S_m).

E_γ (keV)	Assumed I_γ (%) [1]	Mean R_g (s ⁻¹ g ⁻¹) ^(a)	S_m (%) ^(b)
129.065	2.50	1347	0.38
153.967	0.754	421.6	0.40
219.249	3.97	2264	0.55
270.245	3.55	2014	0.33
328.084	3.04	1822	0.43
378.52	12.4	6712	0.43
409.46	2.02	1185	0.29
463.062	4.45	2645	0.33
755.313	1.03	593.3	0.46
772.291	1.52	599.2	0.53
794.942	4.31	2588	0.35
835.704	1.7	945.3	0.42
911.396	26.2	15609	0.29
964.786	4.99	3067	0.35
968.96	15.9	9582	0.30
1588.2	3.06	1889	0.28

(a) Grand mean for $n = 11$ determinations with three sources in three to five different detectors.

(b) Relative standard deviation of the grand mean on R_g for $n = 11$.

INSTRUCTIONS FOR HANDLING AND STORAGE

Handling: If the ampoule is transported, it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of both the radioactivity and the strong acid. The ampoule should be opened only by persons qualified to handle both radioactive material and alkaline and/or acidic solutions. Appropriate shielding and/or distance should be used to minimize personnel exposure. Refer to SDS for further information.

Storage: SRM 4339b should be stored and used at a temperature between 5 °C and 65 °C. The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material.

REFERENCES

- [1] NIST Physical Measurement Laboratory; *Storage and Handling of Radioactive Standard Reference Materials, Ampoule Specifications and Opening Procedure*, available at <http://www.nist.gov/pml/div682/gsp04/srm.cfm> (accessed Nov 2012). Note: This SRM is contained in a generic borosilicate-glass ampoule and not in the standard NIST ampoule.
- [2] JCGM 200:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM) (2008 version with Minor Corrections)*, 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 19 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [3] JCGM 200:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM) (2008 version with Minor Corrections)*, 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 18 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [4] JCGM 100:2008: *Guide to the Expression of Uncertainty in Measurement*; (ISO GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Nov 2012).
- [5] Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/> (accessed Nov 2012).
- [6] Luca, A.; June 2009, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [7] Pearce, A.; January 2010, ^{228}Ac . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ac-228_tables.pdf (accessed Nov 2012).
- [8] Christé, V. and M.M. Bé; December 2006, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [9] Arino, A.; September 2008, ^{232}Th . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Th-232_tables.pdf (accessed Nov 2012).

Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program; telephone (301) 975-2200; fax (301) 948-3710; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	1810
Prepared By:	Tim Chandler
Carrier Conc:	1.3M HNO ₃
Reference Date:	10/07/2010
Ampoule Mass (g):	5.18 g
Uncertainty:	+/- 3.6 %
LogBook No:	GL-CED-297-103

A Solution Material Info			
Isotope:	Radium-228 SPIKE		
Prepared By:	Bethany Fiem		
Prep Date:	05/23/2018		
Verification Date:	05/23/2018		
Expiration Date:	05/23/2019		
Primary Code:	1810-A		
Dilution(mL):	200 mL		
Mass of Parent(g):	5.1447 g		
Density(g/mL):	1.0178	Balance ID:	B733529066

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (200 \text{ mL}) = 300.9650 \text{ dpm/mL}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (1.0178 \text{ g/mL}) / (200 \text{ mL}) = 295.7015 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-228 Standard

Jar

1810-A

4/1/12

5/1/12

5/23/2010

Isotope	Result
Ra-228	pCi/L
Ra-228 N1	29340
Ra-228 N2	28310
Ra-228 N3	29320

Mean Value (Counting) =
Stdev =

107.165

Rule B (Pass/Fail)

* Exception: taken due to the high uncertainty of the certified value

Certificate Value =
Two sigma =
10 % of Mean =
Rule A (Pass/Fail)

27714.0
547.0656436
2905.666667
Pass

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

27714.0
547.0656436
2905.666667
Pass

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1811253

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
461244001	SAMPLE	JXC9	PIC5D	OCT-22-18 11:27:10	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204133162	MB	JXC9	PIC8C	OCT-22-18 11:36:24	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204133163	DUP	JXC9	PIC9A	OCT-22-18 11:36:36	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204133165	MSD	JXC9	PIC9C	OCT-22-18 11:36:49	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204133166	LCS	JXC9	PIC9D	OCT-22-18 11:36:54	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244002	SAMPLE	JXC9	PIC6B	OCT-22-18 11:36:58	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244003	SAMPLE	JXC9	PIC6C	OCT-22-18 11:37:07	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244004	SAMPLE	JXC9	PIC7A	OCT-22-18 11:37:15	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244005	SAMPLE	JXC9	PIC7B	OCT-22-18 11:37:20	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244006	SAMPLE	JXC9	PIC7C	OCT-22-18 11:37:25	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461244007	SAMPLE	JXC9	PIC8B	OCT-22-18 11:37:30	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204133164	MS	JXC9	LB4100A1	OCT-22-18 13:19:35	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1810204 Check-list

This check-list was completed on 16-OCT-18 by Elizabeth Krouse

This batch was reviewed by Elizabeth Krouse on 16-OCT-18 and Gregory Ramsay on 16-OCT-18.

Batch ID:
1810204

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?		No	
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?		No	
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Literature

Radium-226 in Liquid

Research ID: 1810204 Due Dates for Lab: 23-03-2018 Hold: 30-MAR-2018 Package: 04-NOV-2018 S/P/C: 24-03-1-2018
 Analyst: Peter W. Gilbert Lab SOP: GL-RAD-A-006 REV 15
 Instrument: GPC 1815023 Method: EPA 903.1 Modified

Account	Dr	Cr	Balance	Dr	Cr	Balance
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1. Name	2. Address	3. City	4. State	5. Zip
6. Phone	7. E-mail	8. Fax	9. Birthdate	10. Gender
11. Marital Status	12. Number of Children	13. Education	14. Occupation	15. Annual Income
16. Number of Vehicles	17. Number of Pets	18. Number of Hobbies	19. Number of Travel Days	20. Number of Vacations
21. Number of Books Read	22. Number of Movies Watched	23. Number of TV Shows Watched	24. Number of Restaurants Visited	25. Number of Museums Visited
26. Number of Parks Visited	27. Number of Beaches Visited	28. Number of Mountains Visited	29. Number of Lakes Visited	30. Number of Rivers Visited
31. Number of Forests Visited	32. Number of Deserts Visited	33. Number of Oceans Visited	34. Number of Islands Visited	35. Number of Continents Visited
36. Number of Countries Visited	37. Number of States Visited	38. Number of Counties Visited	39. Number of Cities Visited	40. Number of Towns Visited
41. Number of Villages Visited	42. Number of Hamlets Visited	43. Number of Castles Visited	44. Number of Monasteries Visited	45. Number of Churches Visited
46. Number of Synagogues Visited	47. Number of Mosques Visited	48. Number of Temples Visited	49. Number of Pagodas Visited	50. Number of Stupas Visited
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86. Number of Stupas Visited	87. Number of Pagodas Visited	88. Number of Stupas Visited	89. Number of Pagodas Visited	90. Number of Stupas Visited
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Since you wish the CAP, you inform us

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RA1810204.xls

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1810204
Analyst : PETE049
Prep Date : 10/10/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Half-life of Ra-226 : 1600 years
Ra-226 Abundance : 1.00
Half-life of Rn-222 : 3.8235 days
Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
		Sample Aliquot	Sample Aliquot		Cell	Counting	Gross	Gross	Background	Background	Count	Cell
Pos.	Sample ID	L	StDev. L	Sample Date/Time	Number	Time (min.)	Counts	CPM	Counts	CPM	Time (min.)	Efficiency (cpm/dpm)
1	460242001.1	0.1000	1.1370E-05	10/1/2017 12:00	105	30	1305	43.500	2	0.067	30	2.0440
2	460242002.1	0.1000	1.1370E-05	10/1/2017 12:00	202	30	1999	66.633	6	0.200	30	1.8580
3	460242003.1	0.0500	7.8337E-06	10/1/2017 12:00	301	30	745	24.833	2	0.067	30	1.8290
4	460242004.1	0.0500	7.8337E-06	10/1/2017 12:00	407	30	56	1.867	2	0.067	30	1.7420
5	460242005.1	0.0500	7.8337E-06	10/1/2017 12:00	505	30	13	0.433	1	0.033	30	1.5140
6	461244001.1	0.5000	2.0256E-05	10/4/2018 12:00	606	30	13	0.433	3	0.100	30	1.9430
7	461244002.1	0.5000	2.0256E-05	10/4/2018 10:20	701	30	20	0.667	5	0.167	30	1.9520
8	461244003.1	0.5000	2.0256E-05	10/4/2018 10:20	806	30	28	0.933	8	0.267	30	1.9730
9	461244004.1	0.5000	2.0256E-05	10/4/2018 12:40	101	30	28	0.933	7	0.233	30	1.5100
10	461244005.1	0.5000	2.0256E-05	10/4/2018 11:45	207	30	16	0.533	2	0.067	30	1.9750
11	461244006.1	0.5000	2.0256E-05	10/4/2018 13:40	306	30	29	0.967	1	0.033	30	1.7820
12	461244007.1	0.5000	2.0256E-05	10/4/2018 14:25	408	30	45	1.500	1	0.033	30	1.8510
13	1204130926.1	0.5000	2.0256E-05	10/10/2018 0:00	507	30	11	0.367	4	0.133	30	1.9970
14	1204130927.1	0.5000	2.0256E-05	10/4/2018 10:20	601	30	19	0.633	7	0.233	30	1.9080
15	1204130928.1	0.1000	1.1370E-05	10/4/2018 10:20	704	30	901	30.033	5	0.167	30	2.0850
16	1204132247.1	0.1000	1.1370E-05	10/4/2018 10:20	805	30	1047	34.900	1	0.033	30	1.9810
17	1204130929.1	0.5000	2.0256E-05	10/10/2018 0:00	107	30	859	28.633	6	0.200	30	1.5510

RA1810204.xls

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-026
Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
9.300%	5/1/2018	4/30/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
9.300%	8/1/2018	7/31/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
8.200%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
6.600%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
4.000%	6/1/2018	5/31/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
2.400%	7/1/2018	6/30/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
1.900%	11/1/2017	10/31/2018	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
6.000%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:06	10/16/2018 9:40	0.650	0.973	1.002	1.000
5.300%	5/1/2018	4/30/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
2.100%	8/1/2018	7/31/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
3.900%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
7.000%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
5.300%	6/1/2018	5/31/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
8.500%	7/1/2018	6/30/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
2.200%	11/1/2017	10/31/2018	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
3.100%	3/1/2018	2/28/2019	10/10/2018 11:00	10/16/2018 6:29	10/16/2018 10:15	0.651	0.972	1.002	1.000
9.300%	5/1/2018	4/30/2019	10/10/2018 11:00	10/16/2018 7:00	10/16/2018 11:00	0.653	0.970	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1715-D
Spike Exp Date : 12/19/2018
Spike Activity (dpm/ml): 288.43
Spike Volume Added: 0.10

LCS S/N : 1715-D
LCS Exp Date : 12/19/2018
LCS Activity (dpm/ml): 288.43
LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.5420	0.3827	1	1.1143	151.5594	9.71%	43.4333	1.2051	8.2420	36.1908		SAMPLE				
2	1.0328	0.7292	1	1.8422	255.0239	9.57%	66.4333	1.4926	11.2302	60.3508		SAMPLE				
3	1.2115	0.8553	1	2.4906	193.1632	8.99%	24.7667	0.9110	13.9268	43.9913		SAMPLE				
4	1.2720	0.8980	1	2.6150	14.7399	15.57%	1.8000	0.2539	4.0745	4.9764		SAMPLE				
5	1.0349	0.7306	1	2.4035	3.7688	31.44%	0.4000	0.1247	2.3033	2.3850		SAMPLE				
6	0.1396	0.0986	1	0.2705	0.2446	40.07%	0.3333	0.1333	0.1918	0.1953		SAMPLE				
7	0.1794	0.1267	1	0.3264	0.3652	33.39%	0.5000	0.1667	0.2386	0.2448		SAMPLE				
8	0.2245	0.1585	1	0.3893	0.4818	30.59%	0.6667	0.2000	0.2833	0.2972		SAMPLE				
9	0.2744	0.1937	1	0.4819	0.6610	28.67%	0.7000	0.1972	0.3650	0.3834		SAMPLE				
10	0.1121	0.0792	1	0.2305	0.3369	30.38%	0.4667	0.1414	0.2001	0.2064		SAMPLE				
11	0.0879	0.0620	1	0.2041	0.7468	19.95%	0.9333	0.1826	0.2863	0.3112		SAMPLE				
12	0.0846	0.0597	1	0.1965	1.1298	16.93%	1.4667	0.2261	0.3413	0.4088		SAMPLE				
13	0.1568	0.1107	1	0.2929	0.1666	55.58%	0.2333	0.1291	0.1807	0.1831		MB				
14	0.2172	0.1533	1	0.3814	0.2989	43.33%	0.4000	0.1700	0.2489	0.2575	461244002.1	DUP	20.0%			
15	0.8398	0.5929	1	1.5277	102.1205	4.02%	29.8667	1.0033	6.7240	16.7900	461244002.1	MS			129.9230	78.3%
16	0.3953	0.2791	1	0.9180	125.4753	4.38%	34.8667	1.0791	7.6114	21.0740	461244002.1	MSD	20.5%		129.9230	96.3%
17	0.2472	0.1746	1	0.4410	26.1298	9.92%	28.4333	0.9804	1.7658	6.3270		LCS			25.9844	100.6%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 16-OCT-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	04:10	1	1.29E+05	128576	-0.76		
LUCAS2	EFF	04:10	1	1.35E+05	135025	2.91		
LUCAS3	EFF	04:10	1	1.42E+05	141570	0.3		
LUCAS4	EFF	04:10	1	1.31E+05	131384	-0.27		
LUCAS5	EFF	04:10	1	1.36E+05	136081	1.58		
LUCAS6	EFF	04:10	1	1.32E+05	132396	-2.38		
LUCAS7	EFF	04:10	1	1.42E+05	142238	1.43		
LUCAS8	EFF	04:10	1	1.37E+05	137328	-0.6		

Reviewed by:

Elizabeth Krouse

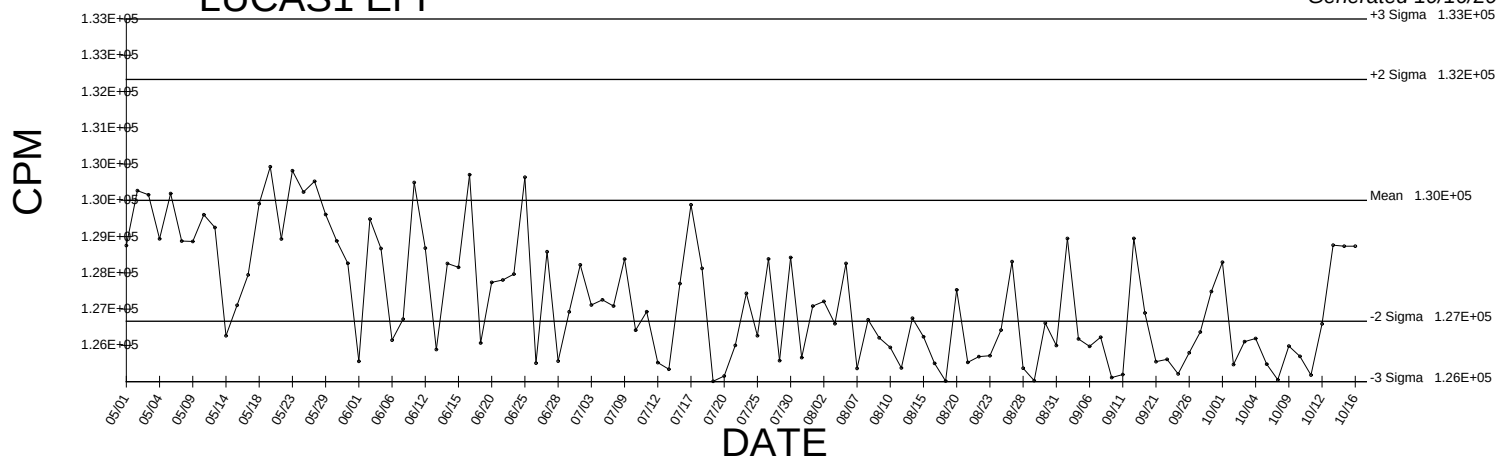
Date: 16-OCT-18

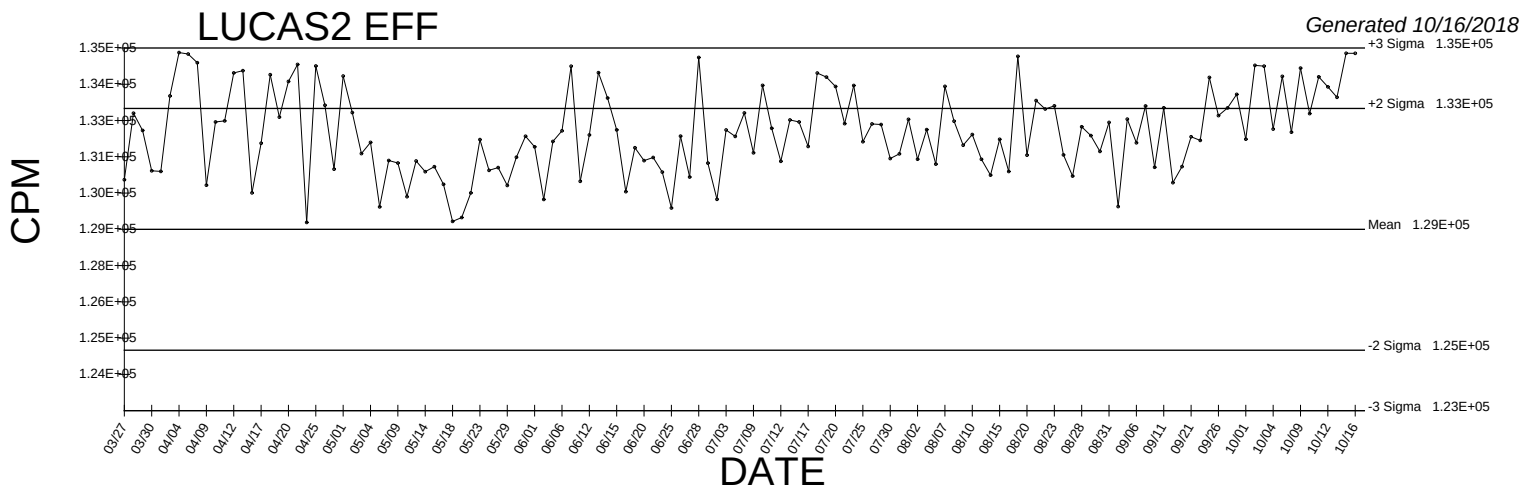
GEL Laboratories LLC

Efficiency Data

LUCAS1 EFF

Generated 10/16/2018

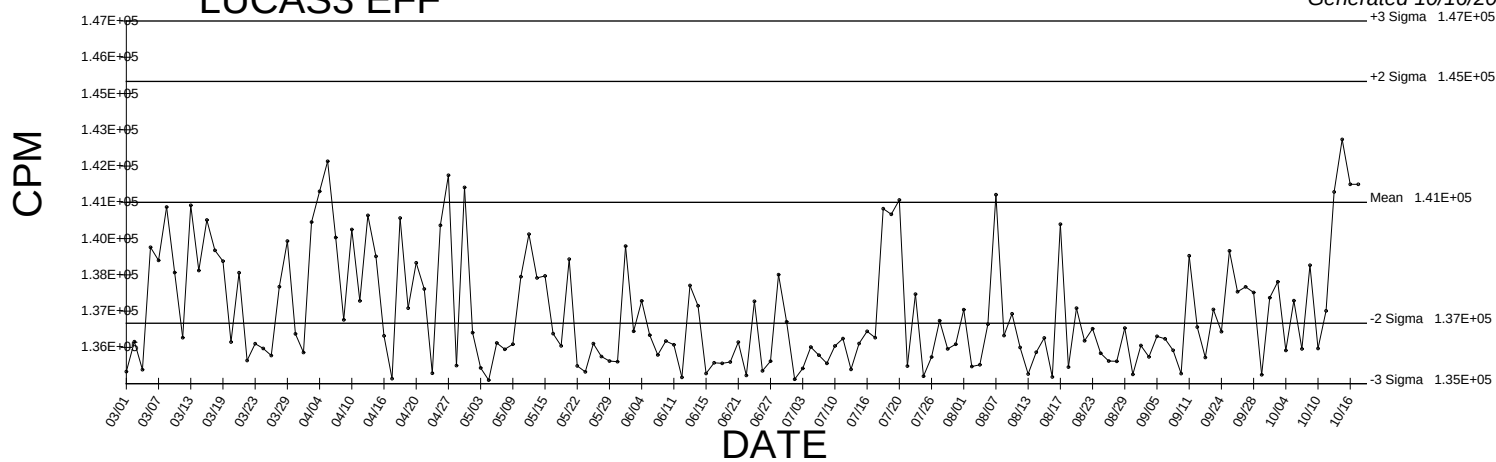




● Denotes Outlier

LUCAS3 EFF

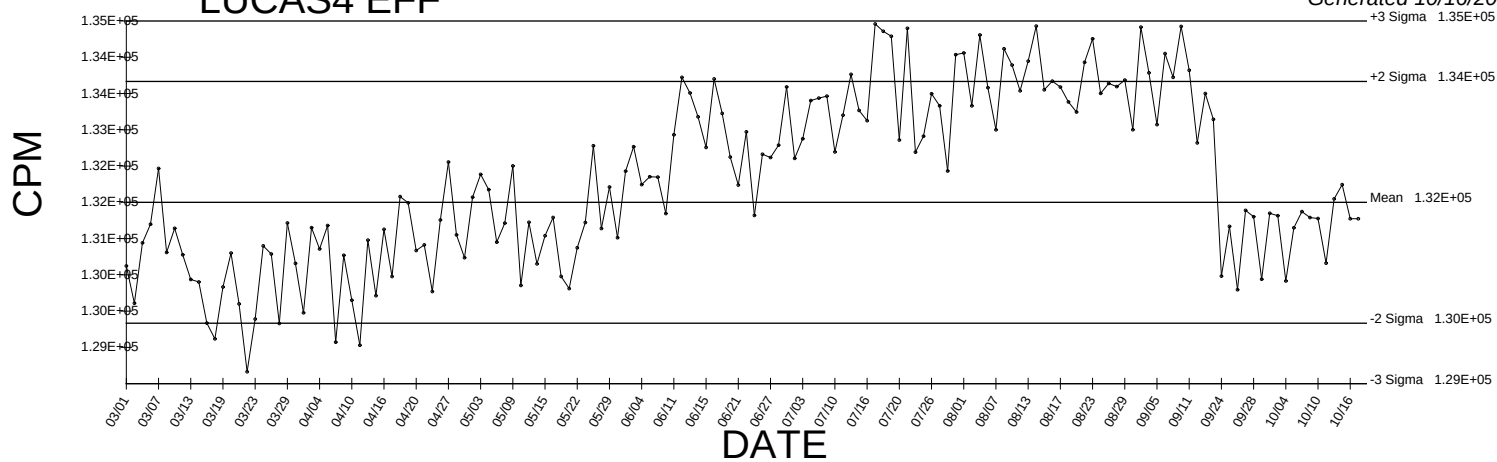
Generated 10/16/2018



● Denotes Outlier

LUCAS4 EFF

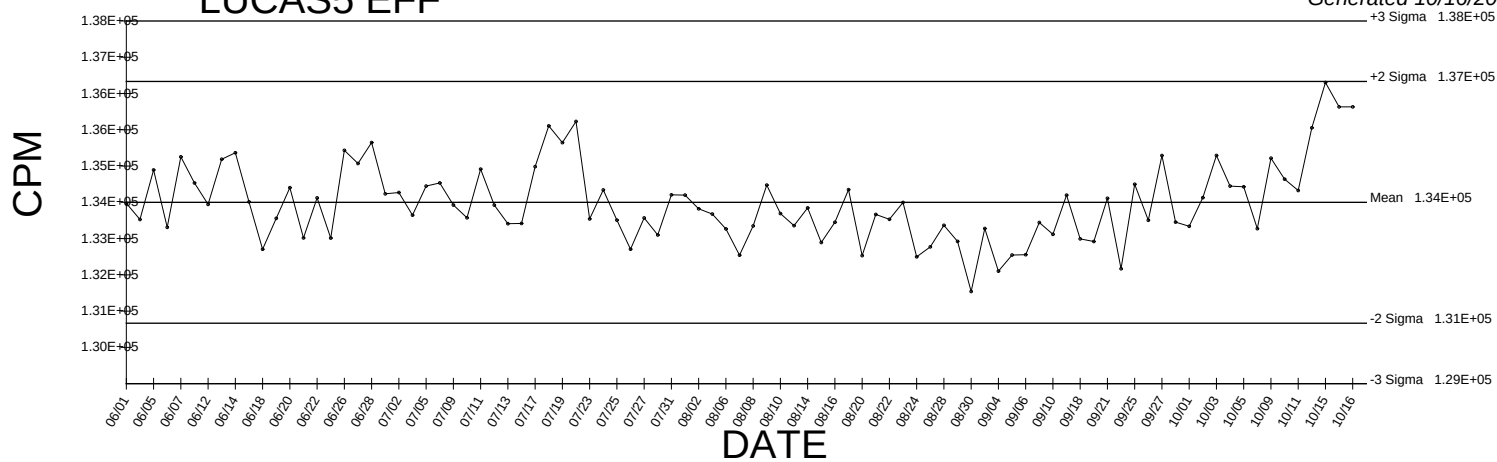
Generated 10/16/2018



● Denotes Outlier

LUCAS5 EFF

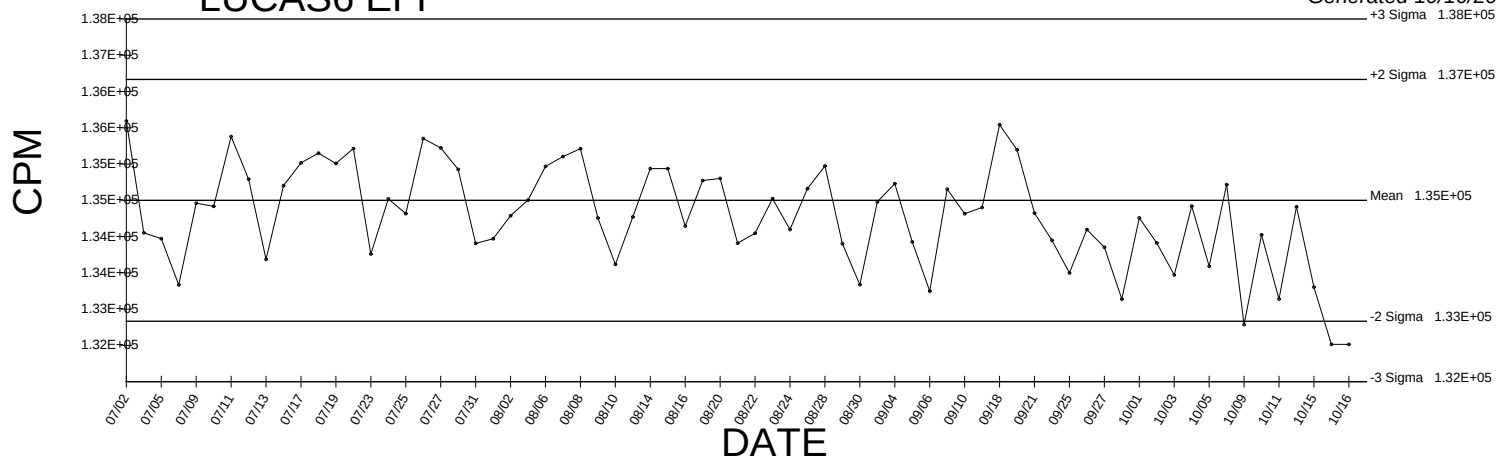
Generated 10/16/2018



● Denotes Outlier

LUCAS6 EFF

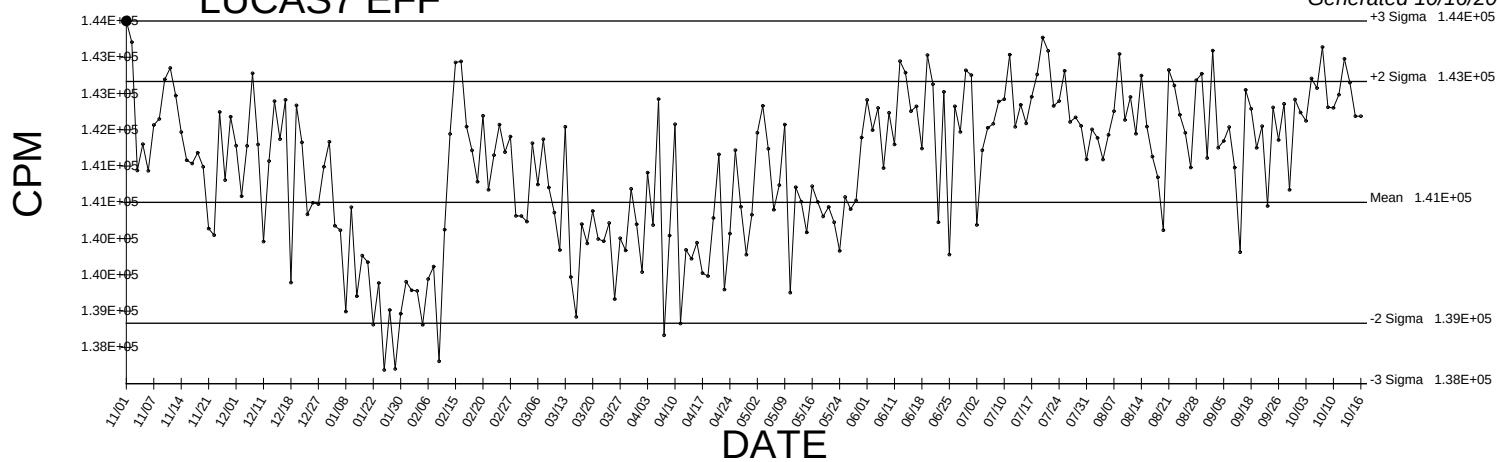
Generated 10/16/2018



● Denotes Outlier

LUCAS7 EFF

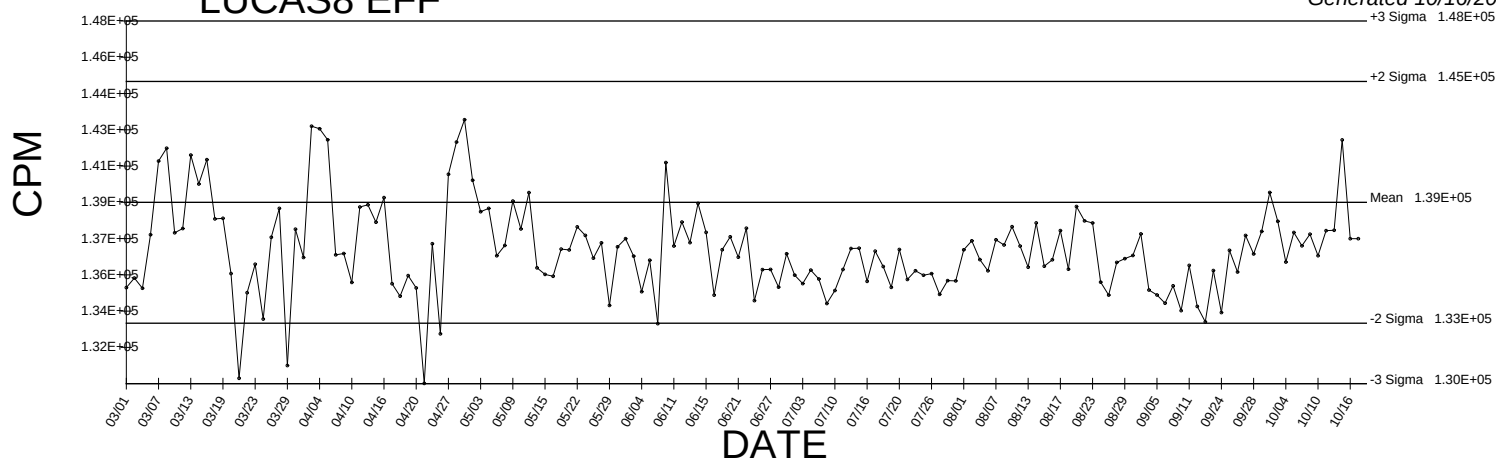
Generated 10/16/2018



● Denotes Outlier

LUCAS8 EFF

Generated 10/16/2018



● Denotes Outlier

RAD Standards Traceability



Eckert & Ziegler

Analytics

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Atlanta, Georgia 30318
Tel: 404-352-8677
Fax: 404-352-2817
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

1215

98307

Ra-226 5 mL Liquid in Flame Sealed Vial

Customer: GEL Laboratories, LLC

P.O. No.: GEL 1409800, Item 7

Product Code: 8825

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked by germanium gamma ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.19, Revision 2, July 2007, and compliance with ANSI N42.22-1989, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Delfray Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty ^a , %			Reference Date (12:00 PM EST)
			σ_A	σ_k	U	
Ra-226	5.844E+05	3.575E+04	1.0	2.1	4.7	09/09/2014

^aUncertainty: U = Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities (other than decay products) < 0.1%.

5.02193 g 0.1M HCl solution with approximately 30 $\mu\text{g/g}$ Ba carrier.

Source Prepared by:

R. Ormsby
R. Ormsby, Radiochemist

QC Approved:

L. Trivelpiece
L. Trivelpiece, Nuclear Metrologist

Date: 9 Sep 14

[Signature]





Standard Traceability Log Rad

Source Material Info	
Parent Code:	1715
Prepared By:	Gregory Ramsay
Carrier Conc:	0.1M HCl
Reference Date:	09/09/2014
Ampoule Mass (g):	5.02193 g
Uncertainty:	+/- 2.35 %
LogBook No:	GL-CED-297-008

A Solution Material Info			
Isotope:	Radium-226		
Prepared By:	Gregory Ramsay		
Prep Date:	07/06/2016		
Verification Date:	02/08/2017		
Expiration Date:	02/08/2018		
Primary Code:	1715-A		
Dilution(mL):	100 mL		
Mass of Parent(g):	4.9865 g		
Density(g/mL):	0.9967	Balance ID:	C31514

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21900.3937 \text{ dpm/mL}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (0.9967 \text{ g/mL}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21972.4854 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
07/06/2016	Gregory Ramsay	2.6261	200	1715-B	288.51 dpm/ml	01/25/2017	11/10/2018
02/08/2017	Gregory Ramsay	21.96	250	1715-C	1930.063 dpm/ml	02/08/2017	02/08/2018
12/19/2017	Gregory Ramsay	2.63	200	1715-D	288.938 dpm/ml	12/19/2017	12/19/2018

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-226 Standard 1715-D

Page 2

Instrument	Yellow
Analyst	CSR
Verification Prep Date	12/18/2013

Standard Information	
Isotope	Ra-226
Serial Number	1715-D
Isotope Half-life	1600E+03 Y
Reference Date	01/01/2006
Ref Act (dpm/mL)	286.47
Amount of Std (mL)	1.0
Standard Prep Date	12/18/2013

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	12/18/2013	1715-D	1715-D	1715-D
2	12/18/2013	1715-D	1715-D	1715-D
3	12/18/2013	1715-D	1715-D	1715-D

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	59.40	0.422157	286.47	140.71
2	59.70	0.422157	286.47	141.42
3	62.30	0.422157	286.47	147.58

Mean Value =	286.47
Stddev =	1.95642063
Certificate Value* =	286.5
Two sigma =	15.111
10 % of Mean =	28.647
Rule A (Pass/Fail)	Pass
% Recovery	59.23%
Rule B (Pass/Fail)	Pass
Expiration Date	12/18/2013

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
 Rule B = The determined mean value shall be within 5% of the certificate value.

* Certificate Value is decay corrected to Count Date.

The analysis prepared three standard verification sources for Ra-226 source 1715-D by transferring 0.5 mL portions of the standard into glass liquid scintillation vials 10 mL of Ecosint Ultra liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A blank vial was prepared in a similar fashion using 10 mL of Ecosint Ultra liquid scintillation cocktail. The standard verification vials and background source were dark adapted for at least two hours and counted on LSC Yellow for Ra-226 source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 12/20/2013 using Ra-226 source 0299-1.

Standard results for each verification source was calculated as follows

$$\text{Source dpm/mL} = (A - B) / (C/D)$$

where:

- A = Ver source cpm
- B = Bkg cpm
- C = System efficiency (cpm/dpm), and
- D = volume used for standard verification

RAD-M-031

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1810204

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
460242001	SAMPLE	PCW	LUCAS1	OCT-16-18 09:40:00	DONE	Lucas Cell	01-MAY-18 00:00
460242002	SAMPLE	PCW	LUCAS2	OCT-16-18 09:40:00	DONE	Lucas Cell	01-AUG-18 00:00
460242003	SAMPLE	PCW	LUCAS3	OCT-16-18 09:40:00	DONE	Lucas Cell	01-MAR-18 00:00
460242004	SAMPLE	PCW	LUCAS4	OCT-16-18 09:40:00	DONE	Lucas Cell	01-MAR-18 00:00
460242005	SAMPLE	PCW	LUCAS5	OCT-16-18 09:40:00	DONE	Lucas Cell	01-JUN-18 00:00
461244001	SAMPLE	PCW	LUCAS6	OCT-16-18 09:40:00	DONE	Lucas Cell	01-JUL-18 00:00
461244002	SAMPLE	PCW	LUCAS7	OCT-16-18 09:40:00	DONE	Lucas Cell	01-NOV-17 00:00
461244003	SAMPLE	PCW	LUCAS8	OCT-16-18 09:40:00	DONE	Lucas Cell	01-MAR-18 00:00
461244004	SAMPLE	PCW	LUCAS1	OCT-16-18 10:15:00	DONE	Lucas Cell	01-MAY-18 00:00
461244005	SAMPLE	PCW	LUCAS2	OCT-16-18 10:15:00	DONE	Lucas Cell	01-AUG-18 00:00
461244006	SAMPLE	PCW	LUCAS3	OCT-16-18 10:15:00	DONE	Lucas Cell	01-MAR-18 00:00
461244007	SAMPLE	PCW	LUCAS4	OCT-16-18 10:15:00	DONE	Lucas Cell	01-MAR-18 00:00
1204130926	MB	PCW	LUCAS5	OCT-16-18 10:15:00	DONE	Lucas Cell	01-JUN-18 00:00
1204130927	DUP	PCW	LUCAS6	OCT-16-18 10:15:00	DONE	Lucas Cell	01-JUL-18 00:00
1204130928	MS	PCW	LUCAS7	OCT-16-18 10:15:00	DONE	Lucas Cell	01-NOV-17 00:00
1204132247	MSD	PCW	LUCAS8	OCT-16-18 10:15:00	DONE	Lucas Cell	01-MAR-18 00:00
1204130929	LCS	PCW	LUCAS1	OCT-16-18 11:00:00	DONE	Lucas Cell	01-MAY-18 00:00

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Mercer
Groundwater and Water Samples
Collected on 10/29/18

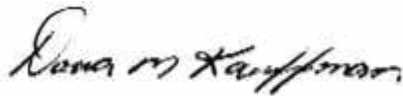
SDG# GEJ59

GROUP	SAMPLE NUMBERS
2003763	9874902-9874908

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-18-27
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 11/20/2018

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ59
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Mercer

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9874902	MW-1	10/29/2018 11:30	10/30/2018 16:45
9874903	MW-2	10/29/2018 11:10	10/30/2018 16:45
9874904	MW-3	10/29/2018 15:00	10/30/2018 16:45
9874905	MW-4	10/29/2018 13:00	10/30/2018 16:45
9874906	MW-5	10/29/2018 13:10	10/30/2018 16:45
9874907	MW-6	10/29/2018 15:00	10/30/2018 16:45
9874908	FB-20181029	10/29/2018 11:00	10/30/2018 16:45

Sample pH Log

SDG: GEJ59

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9874902	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:15:37PM	1532
9874902	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:02:55PM	12665
9874902	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:24PM	1532
9874902	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:07:19PM	1532
9874902	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:11:46PM	1532
9874902	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:43:59PM	12665
9874902	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:15:37PM	1532
9874902	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:11:46PM	1532
9874903	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:16:04PM	1532
9874903	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:03:53PM	12665
9874903	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:55PM	1532
9874903	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:12PM	1532
9874903	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:12:11PM	1532
9874903	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:47:54PM	12665
9874903	148A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:29:31PM	12665
9874903	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:16:04PM	1532
9874903	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:12:11PM	1532
9874904	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:16:33PM	1532
9874904	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:04:14PM	12665
9874904	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:07:06PM	1532
9874904	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:36PM	1532
9874904	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:12:37PM	1532
9874904	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:50:16PM	12665
9874904	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:16:33PM	1532
9874904	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:12:37PM	1532
9874905	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:17:19PM	1532
9874905	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:04:39PM	12665
9874905	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:07:39PM	1532
9874905	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:01PM	1532
9874905	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:13:03PM	1532
9874905	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:39:08PM	12665
9874905	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:17:19PM	1532
9874905	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:13:03PM	1532
9874906	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:15:10PM	1532
9874906	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:05:04PM	12665
9874906	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:09:03PM	1532
9874906	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:08:52PM	1532
9874906	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:09:37PM	1532

LLI Sample Number	Bottle Code	Actual pH	Exp. pH	*pH Check Code	Adj. pH	Adjusted Date	Adjusted Time	Preservative Added	Preservative Lot #	LLI Supplied Bottle?	Sulfide Present?	Corrective Substance	CS Lot #	**Chlorine Present?	Corrective Substance	CS Lot #	Record Date	Employee
9874906	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:41:56PM	12665
9874906	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:15:10PM	1532
9874906	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:09:37PM	1532
9874907	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:14:41PM	1532
9874907	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:06:10PM	12665
9874907	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:08:40PM	1532
9874907	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:08:26PM	1532
9874907	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:10:42PM	1532
9874907	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:30:58PM	12665
9874907	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:14:41PM	1532
9874907	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:10:42PM	1532
9874908	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:14:09PM	1532
9874908	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:05:36PM	12665
9874908	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:07:53PM	1532
9874908	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:08:06PM	1532
9874908	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:11:08PM	1532
9874908	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/31/2018 5:37:01PM	12665
9874908	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:14:09PM	1532
9874908	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/30/2018 9:11:08PM	1532

*pH Check Code Key	**Chlorine Present Code Key
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

00259 Mercury

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U5

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U5

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: November 07, 2018 09:39

Project: PSEG Mercer

Account #: 07701
Group Number: 2003763
SDG: GEJ59
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
MW-1 Grab Groundwater	10/29/2018 11:30	9874902
MW-2 Grab Groundwater	10/29/2018 11:10	9874903
MW-3 Grab Groundwater	10/29/2018 15:00	9874904
MW-4 Grab Groundwater	10/29/2018 13:00	9874905
MW-5 Grab Groundwater	10/29/2018 13:10	9874906
MW-6 Grab Groundwater	10/29/2018 15:00	9874907
FB-20181029 Grab Water	10/29/2018 11:00	9874908

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Mercer

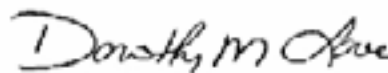
Sampling Date(s): 10/29/18

Laboratory Sample ID(s): 9874902-9874908

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	EPH Method: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	No
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Dorothy M. Love
Director

11/07/2018



Project Name: PSEG Mercer
ELLE Group #: 2003763

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9874902, 9874903, 9874904, 9874905, 9874906, 9874907, 9874908

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium

Batch #: 183051404402 (Sample number(s): 9874902-9874908 UNSPK: 9874907 BKG: 9874907)

The recovery(ies) for the following analyte(s) in the MS and/or MSD exceeded the acceptance window indicating a positive bias: Calcium

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874902
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:30
SDG#: GEJ59-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.186	0.0010	0.0050	1
08014	Boron	7440-42-8	1.17	0.0120	0.0500	1
01750	Calcium	7440-70-2	210	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0305 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0037	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	159	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	280	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,120	160	480	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874902
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:30
SDG#: GEJ59-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.1	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:45	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:02	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:31	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:31	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:31	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:31	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:31	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:31	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:44	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106A	10/31/2018 22:51	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18304520106A	10/31/2018 22:32	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-1 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874902
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:30
SDG#: GEJ59-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106A	10/31/2018 22:51	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202B	10/31/2018 11:31	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 22:15	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 22:15	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874903
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:10
SDG#: GEJ59-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0179	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0358 J	0.0120	0.0500	1
01750	Calcium	7440-70-2	24.2	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	0.00046 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0031	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0036	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.7 J	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	6.4	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	103	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.5	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874903
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:10
SDG#: GEJ59-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.9	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:53	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:05	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:33	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:33	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:33	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:33	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:33	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:33	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:46	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106A	10/31/2018 23:09	Ashlynn M Cornelius	5
01504	Fluoride	EPA 300.0	1	18304520106A	10/31/2018 23:09	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-2 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874903
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:10
SDG#: GEJ59-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106A	10/31/2018 23:09	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:31	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 21:47	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 21:47	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874904
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.248	0.0010	0.0050	1
08014	Boron	7440-42-8	0.267	0.0120	0.0500	1
01750	Calcium	7440-70-2	58.4	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0025 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0340 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0072	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0179	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	257	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	18.2	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	614	80.0	240	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874904
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.2	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:55	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:13	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:46	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:46	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:46	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:46	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:46	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:46	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:32	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106B	11/01/2018 01:35	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18304520106B	11/01/2018 01:17	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-3 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874904
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106B	11/01/2018 01:17	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:31	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 22:24	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 22:24	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874905
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:00
SDG#: GEJ59-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0119	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0241 J	0.0120	0.0500	1
01750	Calcium	7440-70-2	4.52	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0020 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	0.00022 J	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0015 J	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	2.1	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	3.4 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	38.5 J	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.6	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874905
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:00
SDG#: GEJ59-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.7	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:58	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:15	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:48	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:48	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:48	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:48	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:48	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:48	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:48	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106B	11/01/2018 01:53	Ashlynn M Cornelius	5
01504	Fluoride	EPA 300.0	1	18304520106B	11/01/2018 01:53	Ashlynn M Cornelius	5

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-4 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874905
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:00
SDG#: GEJ59-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106B	11/01/2018 01:53	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:32	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101B	10/31/2018 21:56	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101B	10/31/2018 21:56	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874906
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:10
SDG#: GEJ59-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.197	0.0010	0.0050	1
08014	Boron	7440-42-8	0.410	0.0120	0.0500	1
01750	Calcium	7440-70-2	96.3	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0184	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	105	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	104	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	656	80.0	240	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9874906
ELLE Group #: 2003763
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:10
SDG#: GEJ59-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.2	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 20:00	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:18	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:51	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:51	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:51	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:51	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:51	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:51	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:51	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106B	11/05/2018 19:18	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18304520106B	11/01/2018 02:30	Ashlynn M Cornelius	5

* = This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-5 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874906
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 13:10
SDG#: GEJ59-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106B	11/05/2018 19:18	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:32	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 22:33	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 22:33	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874907
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.254	0.0010	0.0050	1
08014	Boron	7440-42-8	0.157	0.0120	0.0500	1
01750	Calcium	7440-70-2	40.5	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0027	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	246	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	6.4	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	465	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.8	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer**GEI Consultants, Inc.**
ELLE Sample #: GW 9874907
ELLE Group #: 2003763
Matrix: Groundwater**Project Name:** PSEG Mercer**Submittal Date/Time:** 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.8	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	2	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	2	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	2	183051404402	11/05/2018 19:29	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:53	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:53	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:53	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:53	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:53	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:53	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:53	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106B	11/01/2018 03:06	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18304520106B	11/01/2018 02:48	Ashlynn M Cornelius	5

*This limit was used in the evaluation of the final result

Analysis Report

Sample Description: MW-6 Grab Groundwater
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874907
ELLE Group #: 2003763
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 15:00
SDG#: GEJ59-06

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106B	11/01/2018 02:48	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:32	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 22:20	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 22:20	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20181029 Grab Water
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874908
ELLE Group #: 2003763
Matrix: Water

Project Name: PSEG Mercer

Submission Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:00
SDG#: GEJ59-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0050	1
08014	Boron	7440-42-8	N.D.	0.0120	0.0500	1
01750	Calcium	7440-70-2	0.0696 J	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
		SW-846 6020B Rev.2, July 2014	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0020	1
		SW-846 7470A	mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1

03277 Lab Filtration - Metals

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.7	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20181029 Grab Water
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874908
ELLE Group #: 2003763
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:00
SDG#: GEJ59-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.2	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183051404402	11/05/2018 20:03	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183051404402	11/04/2018 11:21	Jonathan J Allen	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:59	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:59	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:59	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:59	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183051404702A	11/06/2018 11:59	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183051404702C	11/06/2018 11:59	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183050571302	11/02/2018 18:55	Parker D Lindstrom	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	183051404402	11/02/2018 07:05	Denise L Trimby	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	183051404702	11/02/2018 07:05	Denise L Trimby	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183050571302	11/01/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18304520106B	11/01/2018 04:01	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18304520106B	11/01/2018 04:01	Ashlynn M Cornelius	1

*=This limit was used in the evaluation of the final result

Analysis Report

Sample Description: FB-20181029 Grab Water
1504710 / PSEG Mercer

GEI Consultants, Inc.
ELLE Sample #: GW 9874908
ELLE Group #: 2003763
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 10/30/2018 16:45
Collection Date/Time: 10/29/2018 11:00
SDG#: GEJ59-07FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	1	18304520106B	11/01/2018 04:01	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18304921202A	10/31/2018 11:32	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18304004101A	10/31/2018 22:10	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18304004101A	10/31/2018 22:10	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 11/07/2018 09:39

Group Number: 2003763

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 183050571302	Sample number(s): 9874902-9874908		
Mercury	N.D.	0.000050	0.00020
Batch number: 183051404402	Sample number(s): 9874902-9874908		
Barium	N.D.	0.0010	0.0050
Boron	N.D.	0.0120	0.0500
Calcium	0.0581 J	0.0330	0.500
Chromium	N.D.	0.0053	0.0150
Cobalt	N.D.	0.0015	0.0050
Lithium	N.D.	0.0110	0.0500
Selenium	N.D.	0.0210	0.0500
Thallium	N.D.	0.0140	0.0300
Batch number: 183051404702A	Sample number(s): 9874902-9874908		
Antimony	0.00047 J	0.00041	0.0020
Arsenic	N.D.	0.00068	0.0020
Beryllium	0.00011 J	0.000091	0.00050
Cadmium	N.D.	0.00015	0.0010
Lead	N.D.	0.0011	0.0030
Batch number: 183051404702C	Sample number(s): 9874902-9874908		
Molybdenum	0.00053 J	0.00031	0.0020
Batch number: 18304520106A	Sample number(s): 9874902-9874903		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18304520106B	Sample number(s): 9874904-9874908		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18304921202A	Sample number(s): 9874903-9874908		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18304921202B	Sample number(s): 9874902		
Total Dissolved Solids	N.D.	20.0	60.0

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 11/07/2018 09:39

Group Number: 2003763

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 183050571302 Mercury	Sample number(s): 9874902-9874908 0.00100	0.000900			90		80-120		
Batch number: 183051404402	Sample number(s): 9874902-9874908								
Barium	2.00	1.89			95		80-120		
Boron	2.00	1.84			92		80-120		
Calcium	4.00	3.89			97		80-120		
Chromium	0.200	0.198			99		80-120		
Cobalt	0.500	0.493			99		80-120		
Lithium	1.00	0.986			99		80-120		
Selenium	0.150	0.146			97		80-120		
Thallium	0.150	0.151			100		80-120		
Batch number: 183051404702A	Sample number(s): 9874902-9874908								
Antimony	0.00600	0.00603			100		80-120		
Arsenic	0.0100	0.0109			109		80-120		
Beryllium	0.00400	0.00436			109		80-120		
Cadmium	0.00500	0.00532			106		80-120		
Lead	0.0150	0.0154			102		80-120		
Batch number: 183051404702C Molybdenum	Sample number(s): 9874902-9874908 0.0500	0.0516			103		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18304520106A	Sample number(s): 9874902-9874903								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.730			97		90-110		
Sulfate	7.50	7.56			101		90-110		
Batch number: 18304520106B	Sample number(s): 9874904-9874908								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.730			97		90-110		
Sulfate	7.50	7.56			101		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18304921202A Total Dissolved Solids	Sample number(s): 9874903-9874908 200	208			104		62-127		
Batch number: 18304921202B Total Dissolved Solids	Sample number(s): 9874902 200	208			104		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18304004101A pH	Sample number(s): 9874902-9874904,9874906-9874908 7.00	6.99			100		95-105		
Batch number: 18304004101B	Sample number(s): 9874905								

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

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(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 11/07/2018 09:39

Group Number: 2003763

LCS/LCSD (continued)

Analysis Name	LCS Spike Added Std. Units	LCS Conc Std. Units	LCSD Spike Added Std. Units	LCSD Conc Std. Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
pH	7.00	6.99			100		95-105		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 183050571302 Mercury	Sample number(s): 9874902-9874908 UNSPK: 9874904 N.D.	0.00100	0.000879	0.00100	0.000883	88	88	75-125	0	20
Batch number: 183051404402	Sample number(s): 9874902-9874908 UNSPK: 9874907									
Barium	0.254	2.00	2.33	2.00	2.36	104	105	75-125	1	20
Boron	0.157	2.00	2.06	2.00	2.10	95	97	75-125	2	20
Calcium	40.47	4.00	46.12	4.00	45.66	141 (2)	130 (2)	75-125	1	20
Chromium	N.D.	0.200	0.205	0.200	0.208	102	104	75-125	2	20
Cobalt	N.D.	0.500	0.490	0.500	0.502	98	100	75-125	2	20
Lithium	N.D.	1.00	0.964	1.00	0.975	96	98	75-125	1	20
Selenium	N.D.	0.150	0.147	0.150	0.154	98	103	75-125	5	20
Thallium	N.D.	0.150	0.157	0.150	0.160	105	107	75-125	2	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18304921202A Total Dissolved Solids	Sample number(s): 9874903-9874908 UNSPK: 9874904 614	800	1414			100		62-127		
Batch number: 18304921202B Total Dissolved Solids	Sample number(s): 9874902 UNSPK: 9874904 614	800	1414			100		62-127		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 183050571302 Mercury	Sample number(s): 9874902-9874908 BKG: 9874904 N.D.	N.D.	0 (1)	20
Batch number: 183051404402 Barium	Sample number(s): 9874902-9874908 BKG: 9874907 0.254	0.252	1	20

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 11/07/2018 09:39

Group Number: 2003763

Laboratory Duplicate (continued)

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Boron	0.157	0.151	3 (1)	20
Calcium	40.47	40.37	0	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	N.D.	N.D.	0 (1)	20
Lithium	N.D.	N.D.	0 (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20
	Degrees C	Degrees C		
Batch number: 18304004101A	Sample number(s): 9874902-9874904,9874906-9874908 BKG: 9874903			
Temperature of pH	22.49	22.52	0	5
Batch number: 18304004101B	Sample number(s): 9874905 BKG: 9874905			
Temperature of pH	22.64	23.07	2	5
	mg/l	mg/l		
Batch number: 18304921202A	Sample number(s): 9874903-9874908 BKG: 9874904			
Total Dissolved Solids	614	618	1 (1)	5
Batch number: 18304921202B	Sample number(s): 9874902 BKG: 9874902			
Total Dissolved Solids	1124	1132	1 (1)	5
	Std. Units	Std. Units		
Batch number: 18304004101A	Sample number(s): 9874902-9874904,9874906-9874908 BKG: 9874903			
pH	7.85	7.89	1	4
Batch number: 18304004101B	Sample number(s): 9874905 BKG: 9874905			
pH	6.65	6.63	0	4

*- Outside of specification

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(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.



**Lancaster Laboratories
Environmental**

For Suppliers/Landscapers/Laboratories Environmental use only

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Sample Size: 100

COC # 000000

[illegible]



Client: GEI Consultants, Inc

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>10/30/2018 16:45</u>
Number of Packages:	<u>2</u>	Number of Projects:	<u>1</u>
State/Province of Origin:	<u>NJ</u>		

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace $\geq$ 6mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Cory Jeremiah (10469) at 18:14 on 10/30/2018

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT42-03	1.1	DT	Wet	Y	Bagged	N
2	DT42-03	1.9	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9874902	MW-1	X		1	
9874903	MW-2	X		1	
9874904	MW-3	X		1	
9874905	MW-4	X		1	
9874906	MW-5	X		1	
9874907	MW-6	X		1	
9874908	FB-20181029	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Method Blank

For noncompliant preparation/method blanks, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

MS/MSD

Method defined actions are taken for any failed matrix QC.

Batch#: 183051404402 (Sample number(s): 9874902-9874908, UNSPK: 9874907, BKG: 9874907)

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

ICP Metals

Fraction: Metals in Liquid

The recovery(ies) for the following analyte(s) in the MS and MSD exceeded the acceptance window indicating a positive bias: Calcium

SAMPLE ANALYSIS:

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9874902-9874908: Analysis: 07036)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: Selenium, Thallium

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike
P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874902
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	186			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1170			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	210000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	30.5	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.7			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874903
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.46	B		MS
7440-38-2	Arsenic	3.1			MS
7440-39-3	Barium	17.9			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	35.8	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	24200			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.6			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER

Level (low/med): LOW

Lab Sample ID: 9874904, 9874904BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	7.2			MS
7440-39-3	Barium	248			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	267			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	58400			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.5	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	34.0	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	17.9			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874905
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	11.9			P
7440-41-7	Beryllium	0.22	B		MS
7440-42-8	Boron	24.1	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	4520			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.0	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	1.5	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874906
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	197			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	410			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	96300			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	18.4			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874907, 9874907BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	254			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	157			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	40500			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.7			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9874908
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/30/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	12.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	69.6	B		P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ59

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	183051404402	9874902
Boron		9874903
Calcium		9874904
Chromium		9874905
Cobalt		9874906
Lithium		9874907BKG
Selenium		9874907MS
Thallium		9874907MSD
		9874907DUP
		9874908
		P30504BB
		P30504BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ59

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	183051404702	*73117BKG
Arsenic		9874902
Beryllium		9874903
Cadmium		9874904
Lead		9874905
Molybdenum		9874906
		9874907
		9874908
		P30504BB
		P30504BQ

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ59

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	183050571302	9874902
		9874903
		9874904BKG
		9874904MS
		9874904MSD
		9874904DUP
		9874905
		9874906
		9874907
		9874908
		P30571BB
		P30571BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: P
Run Name: 1830801T71
Calibration Date(s): 11/04/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	594.49	99.1	500.0	493.73	98.7	500.0	481.28	96.3
Boron										
Calcium		30000.0	29539.62	98.5	25000.0	24493.95	98.0	25000.0	24382.05	97.5
Chromium		600.0	592.74	98.8	500.0	496.85	99.4	500.0	492.07	98.4
Cobalt		600.0	589.04	98.2	500.0	482.90	96.6	500.0	487.45	97.5
Lithium		600.0	601.49	100.2	500.0	505.34	101.1	500.0	506.44	101.3
Selenium		600.0	586.26	97.7	500.0	477.91	95.6	500.0	477.07	95.4
Thallium		600.0	606.06	101.0	500.0	488.59	97.7	500.0	497.78	99.6

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: P
Run Name: 1830801T71
Calibration Date(s): 11/04/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	479.31	95.9	500.0	477.49	95.5
Boron										
Calcium					25000.0	24291.95	97.2	25000.0	24198.03	96.8
Chromium					500.0	494.95	99.0	500.0	501.26	100.3
Cobalt					500.0	485.73	97.1	500.0	483.37	96.7
Lithium					500.0	501.40	100.3	500.0	503.98	100.8
Selenium					500.0	490.37	98.1	500.0	501.51	100.3
Thallium					500.0	501.56	100.3	500.0	500.71	100.1

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: P
Run Name: 1830904T71
Calibration Date(s): 11/05/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	598.91	99.8	500.0	489.61	97.9	500.0	504.62	100.9
Boron		600.0	590.66	98.4	500.0	468.35	93.7	500.0	471.11	94.2
Calcium		30000.0	29780.34	99.3	25000.0	24558.64	98.2	25000.0	24523.80	98.1
Chromium		600.0	606.74	101.1	500.0	498.43	99.7	500.0	501.92	100.4
Cobalt		600.0	586.03	97.7	500.0	485.46	97.1	500.0	481.85	96.4
Lithium		600.0	590.38	98.4	500.0	488.35	97.7	500.0	483.65	96.7
Selenium		600.0	572.05	95.3	500.0	458.85	91.8	500.0	475.14	95.0
Thallium		600.0	608.43	101.4	500.0	495.00	99.0	500.0	499.37	99.9

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: P

Run Name: 1830904T71

Calibration Date(s): 11/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	507.37	101.5			
Boron					500.0	473.28	94.7	500.0	475.58	95.1
Calcium					25000.0	24606.77	98.4			
Chromium					500.0	500.43	100.1			
Cobalt					500.0	480.12	96.0			
Lithium					500.0	483.57	96.7			
Selenium					500.0	472.41	94.5			
Thallium					500.0	492.75	98.6			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: MS
Run Name: 1831007E07
Calibration Date(s): 11/06/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	52.54	105.1	25.0	25.72	102.9	25.0	25.66	102.6
Arsenic	75	500.0	520.67	104.1	250.0	254.84	101.9	250.0	250.30	100.1
Beryllium	9	50.0	51.33	102.7	25.0	25.51	102.0	25.0	25.36	101.4
Cadmium	111	50.0	51.74	103.5	25.0	26.13	104.5	25.0	25.93	103.7
Lead	208	50.0	51.32	102.6	25.0	25.63	102.5	25.0	25.59	102.4
Molybdenum	98	50.0	51.77	103.5	25.0	25.09	100.4	25.0	25.44	101.8

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: MS
Run Name: 1831007E07
Calibration Date(s): 11/06/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	25.74	103.0	25.0	25.21	100.8
Arsenic	75				250.0	248.81	99.5	250.0	247.96	99.2
Beryllium	9				25.0	25.39	101.6	25.0	25.55	102.2
Cadmium	111				25.0	25.97	103.9	25.0	25.44	101.8
Lead	208				25.0	25.62	102.5	25.0	25.85	103.4
Molybdenum	98				25.0	25.10	100.4	25.0	25.17	100.7

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.51	100.4	1.0	0.98	98.0	1.0	1.02	102.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.02	102.0	1.0	1.02	102.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.01	101.0	1.0	1.01	101.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.98	98.0	1.0	0.98	98.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.98	98.0	1.0	0.99	99.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.97	97.0	1.0	0.99	99.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.98	98.0	1.0	0.97	97.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ59

Method: P
Run Name: 1830801T71
Calibration Date(s): 11/04/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	5.10	102.0		
Boron						
Calcium		500.0	486.40	97.3		
Chromium		15.0	14.40	96.0		
Cobalt		5.0	4.85	97.0		
Lithium		50.0	52.35	104.7		
Selenium		50.0	48.69	97.4		
Thallium		30.0	33.36	111.2		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ59

Method: P

Run Name: 1830904T71

Calibration Date(s): 11/05/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	5.32	106.4		
Boron		50.0	47.90	95.8		
Calcium		500.0	517.88	103.6		
Chromium		15.0	15.65	104.3		
Cobalt		5.0	5.89	117.8		
Lithium		50.0	50.25	100.5		
Selenium		50.0	52.87	105.7		
Thallium		30.0	30.71	102.4		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ59

Method: MS
Run Name: 1831007E07
Calibration Date(s): 11/06/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	2.29	114.5		
Arsenic	75	2.0	2.08	104.0		
Beryllium	9	0.5	0.58	116.0		
Cadmium	111	1.0	1.01	101.0		
Lead	208	3.0	3.04	101.3		
Molybdenum	98	2.0	2.14	107.0		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ59

Method: CV

Run Name: 1830601M07

Calibration Date(s): 11/02/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.20	100.0	0.21	105.0

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



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QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ59

Method: P

Run Name: 1830801T71

Calibration Date(s): 11/04/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)				
			C	1	C	2	C	3	C	Mass		C	Batch Number
Barium		0.64U		0.64U		0.64U		0.64U			1.000U		183051404402
Boron													
Calcium		33.4U		33.4U		33.4U		33.4U			58.090B		183051404402
Chromium		1.2U		1.2U		1.2U		-1.3B			5.300U		183051404402
Cobalt		0.76U		0.76U		0.76U		0.76U			1.500U		183051404402
Lithium		4.0U		4.0U		4.0U		4.0U			11.000U		183051404402
Selenium		5.6U		9.7B		5.6U		5.6U			21.000U		183051404402
Thallium		7.3U		7.3U		7.3U		7.3U			14.000U		183051404402

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: P
Run Name: 1830801T71
Calibration Date(s): 11/04/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium				0.64	U						
Boron											
Calcium				33.4	U						
Chromium				1.2	U						
Cobalt				0.76	U						
Lithium				4.0	U						
Selenium				5.6	U						
Thallium				7.3	U						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ59

Method: P

Run Name: 1830904T71

Calibration Date(s): 11/05/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)				Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Batch Number
Barium		0.64	U	0.64	U	0.64	U	0.64	U	
Boron		8.4	U	8.4	U	8.4	U	8.4	U	12.000
Calcium		33.4	U	34.1	B	42.5	B	33.4	U	183051404402
Chromium		1.2	U	1.2	U	1.3	B	1.2	U	
Cobalt		0.85	B	0.76	U	0.94	B	0.89	B	
Lithium		4.0	U	4.0	U	4.0	U	4.0	U	
Selenium		5.6	U	5.6	U	5.6	U	5.6	U	
Thallium		7.3	U	7.3	U	7.3	U	7.3	U	

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: P
Run Name: 1830904T71
Calibration Date(s): 11/05/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass	C	Batch Number
Barium											
Boron			8.4	U							
Calcium											
Chromium											
Cobalt											
Lithium											
Selenium											
Thallium											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ59

Method: MS

Run Name: 1831007E07

Calibration Date(s): 11/06/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony	121	0.69	B	0.90	B	0.46	B	0.41	B	121	0.473	B183051404702A
Arsenic	75	0.50	U	0.50	U	0.50	U	0.50	U	75	0.680	U183051404702A
Beryllium	9	0.073	U	0.073	U	0.12	B	0.11	B	9	0.109	B183051404702A
Cadmium	111	0.18	U	0.18	U	0.18	U	0.18	U	111	0.150	U183051404702A
Lead	208	0.14	U	0.16	B	0.14	U	0.14	U	208	1.100	U183051404702A
Molybdenum	98	0.30	U	0.48	B	0.30	U	0.30	U	98	0.527	B183051404702A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: MS
Run Name: 1831007E07
Calibration Date(s): 11/06/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony	121			0.32	B						
Arsenic	75			0.50	U						
Beryllium	9			0.073	U						
Cadmium	111			0.18	U						
Lead	208			0.14	U						
Molybdenum	98			0.30	U						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: CV

Run Name: 1830601M07

Calibration Date(s): 11/02/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Batch Number
Mercury		0.050	U	0.050	U	0.050	U	0.050	U	183050571302

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Mercury				0.050	U	0.050	U	0.050	U		

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)			
			C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury				0.050	U	0.050	U	0.050	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Mercury				0.050	U	0.050	U	0.050	U		

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ59

Method: CV
Run Name: 1830601M07
Calibration Date(s): 11/02/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)				
			C	1	C	2	C	3	C	Mass		C	Batch Number
Mercury					0.050U		0.050U						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ59

Instrument ID: 16315
Run Name: 1830801T71
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		491099	98.2						
Barium	0		1							
Boron										
Calcium	500000		501816	100.4						
Chromium	0		-8							
Cobalt	0		-2							
Iron	200000		198108	99.1						
Lithium	0		53							
Magnesium	500000		483266	96.7						
Selenium	0		22							
Thallium	0		5							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ59

Instrument ID: 16315
Run Name: 1830904T71
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		508096	101.6						
Barium	0		1							
Boron	0		13							
Calcium	500000		517216	103.4						
Chromium	0		-6							
Cobalt	0		-2							
Iron	200000		201937	101.0						
Lithium	0		52							
Magnesium	500000		497447	99.5						
Selenium	0		7							
Thallium	0		8							

Control Limits: All Metals 80%-120%

Instrument ID: 27813
 Run Name: 1831007E07
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		101560	101.6		
Antimony	121	0		1			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		300562	100.2		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		247298	98.9		
Lead	208	0		1			
Magnesium	24	100000		99675	99.7		
Molybdenum	98	2000		2129	106.5		
Phosphorus	31	10000		NA			
Potassium	39	100000		99068	99.1		
Sodium	23	250000		252970	101.2		
Sulfur	34	10000		NA			
Titanium	47	2000		2012	100.6		

Control Limits: All Metals 80%-120%



Lancaster Laboratories
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QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9874904BKG Matrix Spike Lab Sample ID: 9874904MS Matrix Spike Duplicate Lab Sample ID: 9874904MSD

Batch Number(s): 183050571302

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	M
Mercury		0.0500	U	0.8792		0.8827		1.0000	1.0000	UG/L	88		88		0		75 - 125	20	CV

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS: P = ICP Atomic Emission Spectrometer CV = Cold Vapor MS = ICP Mass Spectrometry AF = Cold Vapor Atomic Fluorescence		CONCENTRATION QUALIFIERS: U= Below MDL, B= Below LOQ FLAGS: N = Matrix Spike OOS, * = Duplicate OOS



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QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9874907BKG Matrix Spike Lab Sample ID: 9874907MS Matrix Spike Duplicate Lab Sample ID: 9874907MSD
Batch Number(s): 183051404402

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		M
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	
Barium		254.4200		2333.2200		2362.2300		2000.0000	2000.0000	UG/L	104		105		1		75 - 125	20	P
Boron		156.6900		2055.1400		2097.7500		2000.0000	2000.0000	UG/L	95		97		2		75 - 125	20	P
Calcium		40467.6100		46118.2300		45656.4300		4000.0000	4000.0000	UG/L	141		130		1				P
Chromium		5.3000	U	204.7100		208.1700		200.0000	200.0000	UG/L	102		104		2		75 - 125	20	P
Cobalt		1.5000	U	489.8400		501.6600		500.0000	500.0000	UG/L	98		100		2		75 - 125	20	P
Lithium		11.0000	U	963.5300		975.2500		1000.0000	1000.0000	UG/L	96		98		1		75 - 125	20	P
Selenium		21.0000	U	146.9000		154.1400		150.0000	150.0000	UG/L	98		103		5		75 - 125	20	P
Thallium		14.0000	U	157.1200		160.3000		150.0000	150.0000	UG/L	105		107		2		75 - 125	20	P

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS:

P = ICP Atomic Emission Spectrometer

CV = Cold Vapor

MS = ICP Mass Spectrometry

AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL, B= Below LOQ

FLAGS:

N = Matrix Spike OOS, * = Duplicate OOS



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QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9874904BKG

Duplicate Lab Sample ID: 9874904DUP

Batch Number(s): 183050571302

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Mercury			0.0500	U	0.0500	U			CV

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > 20% OR $|S - D| > LOQ$ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: ** = Duplicate Out of Spec



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QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ59

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9874907BKG

Duplicate Lab Sample ID: 9874907DUP

Batch Number(s): 183051404402

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Barium			254.4200		252.2300		1		P
Boron		50.0	156.6900		151.3900		3		P
Calcium			40467.6100		40365.3400		0		P
Chromium			5.3000	U	5.3000	U			P
Cobalt			1.5000	U	1.5000	U			P
Lithium			11.0000	U	11.0000	U			P
Selenium			21.0000	U	21.0000	U			P
Thallium			14.0000	U	14.0000	U			P

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > 20% OR $|(S) - (D)| > LOQ$ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: * = Duplicate Out of Spec

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ59
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	183051404702	UG/L	6.000	6.027		80 - 120	100	MS	Yes
Arsenic	75	183051404702	UG/L	10.000	10.941		80 - 120	109	MS	Yes
Barium		183051404402	UG/L	2000.000	1891.860		80 - 120	95	P	Yes
Beryllium	9	183051404702	UG/L	4.000	4.359		80 - 120	109	MS	Yes
Boron		183051404402	UG/L	2000.000	1841.210		80 - 120	92	P	Yes
Cadmium	111	183051404702	UG/L	5.000	5.322		80 - 120	106	MS	Yes
Calcium		183051404402	UG/L	4000.000	3887.000		80 - 120	97	P	Yes
Chromium		183051404402	UG/L	200.000	197.940		80 - 120	99	P	Yes
Cobalt		183051404402	UG/L	500.000	492.550		80 - 120	99	P	Yes
Lead	208	183051404702	UG/L	15.000	15.362		80 - 120	102	MS	Yes
Lithium		183051404402	UG/L	1000.000	985.810		80 - 120	99	P	Yes
Mercury		183050571302	UG/L	1.000	0.900		80 - 120	90	CV	Yes
Molybdenum	98	183051404702	UG/L	50.000	51.647		80 - 120	103	MS	Yes
Selenium		183051404402	UG/L	150.000	145.590		80 - 120	97	P	Yes
Thallium		183051404402	UG/L	150.000	150.640		80 - 120	100	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ59

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *73117BKG

Serial Dilution Lab Sample ID: *73117L

Batch Number(s): 183051404702

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I) C		Serial Dilution Result (S) C		% Diff.	Q	M
Antimony	121	0.7271	B	2.0300	U	100		MS
Arsenic	75	0.9608	B	3.4000	U	100		MS
Beryllium	9	0.1278	B	0.4550	U	100		MS
Cadmium	111	0.1510	U	0.7550	U			MS
Lead	208	1.0700	U	5.3500	U			MS
Molybdenum	98	0.5102	B	1.5450	U	100		MS

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL

B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ59

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9874907DUP

Serial Dilution Lab Sample ID: 9874907DL

Batch Number(s): 183051404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		252.2300		250.1500		1		P
Boron		151.3900		183.9500	B	22		P
Calcium		40365.3400		40521.1500		0		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		1.5000	U	7.5000	U			P
Lithium		11.0000	U	55.0000	U			P
Selenium		21.0000	U	105.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 16315
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.64
Boron	249.67		8.4
Calcium	317.93		33.4
Chromium	267.72		1.2
Cobalt	228.62		0.76
Lithium	670.78		4.0
Selenium	196.09		5.6
Thallium	190.86		7.3

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 27813
Date: 09/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.29
Arsenic	75		0.50
Beryllium	9		0.073
Cadmium	111		0.18
Lead	208		0.14
Molybdenum	98		0.30

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 17384
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury	254.00		0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ59
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		5.0	1.0
Boron	249.67		50.0	12.0
Calcium	317.93		500	33.0
Chromium				
Cobalt	228.62		5.0	1.5
Lithium	670.78		50.0	11.0
Selenium				
Thallium				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Method: P
Date: 09/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium				
Boron				
Calcium				
Chromium	267.72		15.0	5.3
Cobalt				
Lithium				
Selenium	196.09		50.0	21.0
Thallium	190.86		30.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ59
Matrix: WATER

Method: MS
Date: 09/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		2.0	0.41
Arsenic	75		2.0	0.68
Beryllium	9		0.50	0.091
Cadmium	111		1.0	0.15
Lead	208		3.0	1.1
Molybdenum	98		2.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ59
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury	254.00		0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

US EPA Tune Check Report

Operator Name US19_USR_INS27814
 Acq/Data Batch D:\Agilent\ICPMH\1\DATA\EPA_Tune.b
 Acq. Date-Time 2018-11-05 17:40:56
 Report Comment ---
 Instrument Name G8403A SG18254097

[No Gas]

Sensitivity

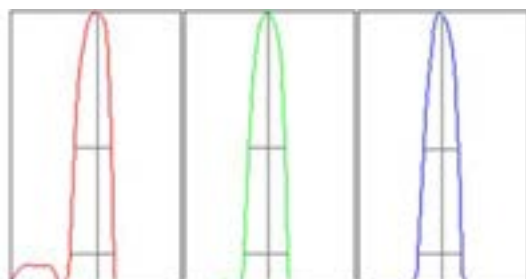
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	1227	12265.29			1.547	5.000
89	10.00	8418	84183.04			0.486	5.000
205	10.00	3773	37729.40			1.248	5.000

Mass	RSD% (Flag)
7	
89	
205	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	1254	1226	1209	1235	1210
89	8485	8389	8382	8426	8410
205	3800	3698	3754	3810	3803

Integration Time [sec] 0.1

Resolution/Axis



Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	1930.59	7.05	6.90 - 7.10	
89	13717.99	89.00	88.90 - 89.10	
205	6389.82	205.00	204.90 - 205.10	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.66	0.774	0.800	
89	0.65	0.772	0.800	
205	0.62	0.771	0.800	

Integration Time [sec] 0.1
 Acquisition Time [sec] 113.7
 Y Axis Linear

US EPA Tune Check Report

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	0.65 L/min	Dilution Gas	0.45 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.10 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	10.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	11.6 V	Deflect	17.0 V
Extract 2	-170.0 V	Cell Entrance	-40 V	Plate Bias	-50 V
Omega Bias	-70 V	Cell Exit	-60 V		

Cell Parameters

Use Gas	No	3rd Gas Flow	---	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OctP Bias	-8.0 V		
H2 Flow	0.0 mL/min	OctP RF	190 V		

QP Parameters

Mass Gain	124	Axis Gain	0.9995	QP Bias	-3.0 V
Mass Offset	124	Axis Offset	0.03		

Hardware Settings

Torch

Torch H	0.2 mm	Torch V	-0.1 mm

EM

Discriminator	3.9 mV	Analog HV	2142 V	Pulse HV	1608 V

Instrument ID: 27813

Start Date: 11/06/2018

Run Name: 1831007E07

End Date: 11/06/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	IN-3-115	AS, CD, MO, SB
SC-1-45	BE		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-3-115	Q	Element BI-3-209	Q	Element	Q	Element	Q	Element	Q
S0	10:35	100		100		100							
S	10:38	103		100		102							
ICV	10:40	97		96		98							
ICB	10:42	94		93		95							
LLC	10:44	89		93		96							
ICSA	10:47	89		87		90							
LRS2	10:49	100		91		96							
LRS3	10:51	97		91		94							
CCS	10:53	93		90		94							
CCS	10:55	93		94		98							
CCV	10:57	96		95		99							
CCB	10:59	90		93		97							
P30504BB	11:01	83		89		93							
P30504BQ	11:04	91		91		95							
*73117BKG	11:06	94		93		97							
ZZZZZZ	11:08												
ZZZZZZ	11:10												
ZZZZZZ	11:12												
ZZZZZZ	11:14												
*73117L	11:16	97		97		101							
ZZZZZZ	11:18												
CCV	11:21	94		93		97							
CCB	11:23	90		95		95							
ZZZZZZ	11:25												
ZZZZZZ	11:27												
ZZZZZZ	11:29												
9874902	11:31	98		98		101							
9874903	11:33	100		98		102							
ZZZZZZ	11:36												
ZZZZZZ	11:38												
ZZZZZZ	11:40												
CCV	11:42	95		97		101							

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Instrument ID: 27813

Start Date: 11/06/2018

Run Name: 1831007E07

End Date: 11/06/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	IN-3-115	AS, CD, MO, SB
SC-1-45	BE		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-3-115	Q	Element BI-3-209	Q	Element	Q	Element	Q	Element	Q
CCB	11:44	94		95		97							
9874904	11:46	91		93		95							
9874905	11:48	93		91		95							
9874906	11:51	93		93		95							
9874907	11:53	93		95		98							
ZZZZZZ	11:55												
ZZZZZZ	11:57												
9874908	11:59	89		91		94							
CCV	12:01	93		98		100							
CCB	12:03	92		95		99							

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Preparation and Run Logs

Metals in Liquid

Method: P

Batch Number: 183051404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9874902	11/02/2018	50.00	50
9874903	11/02/2018	50.00	50
9874904	11/02/2018	50.00	50
9874905	11/02/2018	50.00	50
9874906	11/02/2018	50.00	50
9874908	11/02/2018	50.00	50
9874907BKG	11/02/2018	25.00	25
9874907DUP	11/02/2018	25.00	25
9874907MSD	11/02/2018	25.00	25
9874907MS	11/02/2018	25.00	25
P30504BB	11/02/2018	50.00	50
P30504BQ	11/02/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Method: MS
Batch Number: 183051404702

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9874902	11/02/2018	50.00	50
9874903	11/02/2018	50.00	50
9874904	11/02/2018	50.00	50
9874905	11/02/2018	50.00	50
9874906	11/02/2018	50.00	50
9874907	11/02/2018	50.00	50
9874908	11/02/2018	50.00	50
*73117BKG	11/02/2018	25.00	25
P30504BB	11/02/2018	50.00	50
P30504BQ	11/02/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Method: CV
Batch Number: 183050571302

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9874902	11/01/2018	40.00	40
9874903	11/01/2018	40.00	40
9874905	11/01/2018	40.00	40
9874906	11/01/2018	40.00	40
9874907	11/01/2018	40.00	40
9874908	11/01/2018	40.00	40
9874904BKG	11/01/2018	40.00	40
9874904DUP	11/01/2018	40.00	40
9874904MSD	11/01/2018	40.00	40
9874904MS	11/01/2018	40.00	40
P30571BB	11/01/2018	40.00	40
P30571BQ	11/01/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ59

Method: P

Instrument ID: 16315

Run Name: 1830801T71

Run Start Date: 11/04/2018

Run End Date: 11/04/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	09:57			X				X	X	X		X			X	X													
S	1.00	10:00							X																					
S	1.00	10:02			X						X	X				X	X													
S	1.00	10:05								X																				
ICV	1.00	10:08			X				X	X	X		X			X	X													
ICB	1.00	10:10			X				X	X	X		X			X	X													
LLC	1.00	10:13			X				X	X	X		X			X	X													
ICSA	1.00	10:15			X				X	X	X		X			X	X													
CCV	1.00	10:18			X				X	X	X		X			X	X													
CCB	1.00	10:21			X				X	X	X		X			X	X													
LRS2	1.00	10:24			X				X	X	X		X			X	X													
LRS4	1.00	10:27			X				X	X	X		X			X	X													
LRS3	1.00	10:30			X				X	X	X		X			X	X													
LRS5	1.00	10:33			X				X	X	X		X			X	X													
CCV	1.00	10:36			X				X	X	X		X			X	X													
CCB	1.00	10:38			X				X	X	X		X			X	X													
P30504BB	1.00	10:41			X				X	X	X		X			X	X													
P30504BQ	1.00	10:44			X				X	X	X		X			X	X													
ZZZZZZ	1.00	10:46																												
ZZZZZZ	1.00	10:49																												
ZZZZZZ	1.00	10:52																												
ZZZZZZ	1.00	10:54																												
ZZZZZZ	1.00	10:57																												
ZZZZZZ	5.00	10:59																												
9874902	1.00	11:02			X				X	X	X		X			X	X													
9874903	1.00	11:05			X				X	X	X		X			X	X													
CCV	1.00	11:07			X				X	X	X		X			X	X													
CCB	1.00	11:10			X				X	X	X		X			X	X													
9874904	1.00	11:13			X				X	X	X		X			X	X													
9874905	1.00	11:15			X				X	X	X		X			X	X													
9874906	1.00	11:18			X				X	X	X		X			X	X													
9874908	1.00	11:21			X				X	X	X		X			X	X													
ZZZZZZ	1.00	11:23																												
CCV	1.00	11:26			X				X	X	X		X			X	X													
CCB	1.00	11:28			X				X	X	X		X			X	X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ59

Method: P

Instrument ID: 16315

Run Name: 1830904T71

Run Start Date: 11/05/2018

Run End Date: 11/05/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	18:38			X		X		X	X	X		X			X	X													
S	1.00	18:41							X																					
S	1.00	18:43			X		X				X	X				X	X													
S	1.00	18:46								X																				
ICV	1.00	18:48			X		X		X	X	X		X			X	X													
ICB	1.00	18:51			X		X		X	X	X		X			X	X													
LLC	1.00	18:54			X		X		X	X	X		X			X	X													
ICSA	1.00	18:56			X		X		X	X	X		X			X	X													
CCV	1.00	18:59			X		X		X	X	X		X			X	X													
CCB	1.00	19:01			X		X		X	X	X		X			X	X													
LRS2	1.00	19:04			X		X		X	X	X		X			X	X													
LRS4	1.00	19:07			X		X		X	X	X		X			X	X													
LRS3	1.00	19:10			X		X		X	X	X		X			X	X													
LRS5	1.00	19:13			X		X		X	X	X		X			X	X													
CCV	1.00	19:16			X		X		X	X	X		X			X	X													
CCB	1.00	19:18			X		X		X	X	X		X			X	X													
P30504BB	1.00	19:21					X																							
P30504BB	1.00	19:24																												
P30504BQ	1.00	19:26					X																							
9874907BKG	1.00	19:29			X		X		X	X	X		X			X	X													
9874907DA	1.00	19:32																												
9874907DUP	1.00	19:34			X		X		X	X	X		X			X	X													
9874907MS	1.00	19:37			X		X		X	X	X		X			X	X													
9874907MSD	1.00	19:40			X		X		X	X	X		X			X	X													
9874907DL	5.00	19:42			X		X		X	X	X		X			X	X													
9874902	1.00	19:45					X																							
CCV	1.00	19:47			X		X		X	X	X		X			X	X													
CCB	1.00	19:50			X		X		X	X	X		X			X	X													
9874903	1.00	19:53					X																							
9874904	1.00	19:55					X																							
9874905	1.00	19:58					X																							
9874906	1.00	20:00					X																							
9874908	1.00	20:03					X																							
CCV	1.00	20:06					X																							
CCB	1.00	20:08					X																							

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Method: MS

Instrument ID: 27813

Run Name: 1831007E07

Run Start Date: 11/06/2018

Run End Date: 11/06/2018

[illegible]

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ59

Method: MS

Instrument ID: 27813

Run Name: 1831007E07

Run Start Date: 11/06/2018

Run End Date: 11/06/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
ZZZZZZ	1.00	11:57																												
9874908	1.00	11:59	X	X		X		X				X			X															
CCV	1.00	12:01	X	X		X		X				X			X															
CCB	1.00	12:03	X	X		X		X				X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ59

Method: CV
Instrument ID: 17384
Run Name: 1830601M07

Run Start Date: 11/02/2018
Run End Date: 11/02/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	13:47												X																
S0.2	1.00	13:49												X																
S0.5	1.00	13:51												X																
S1.0	1.00	13:53												X																
S2.5	1.00	13:55												X																
S5.0	1.00	13:57												X																
ICV	1.00	13:59												X																
ICB	1.00	14:01												X																
CRA	1.00	14:03												X																
CCV	1.00	14:05												X																
CCB	1.00	14:07												X																
ZZZZZZ	1.00	14:09																												
ZZZZZZ	1.00	14:11																												
ZZZZZZ	1.00	14:13																												
ZZZZZZ	1.00	14:15																												
ZZZZZZ	1.00	14:17																												
ZZZZZZ	1.00	14:19																												
ZZZZZZ	1.00	14:21																												
ZZZZZZ	1.00	14:23																												
ZZZZZZ	1.00	14:25																												
ZZZZZZ	1.00	14:27																												
CCV	1.00	14:29												X																
CCB	1.00	14:31												X																
ZZZZZZ	1.00	14:33																												
ZZZZZZ	1.00	14:35																												
ZZZZZZ	1.00	14:37																												
ZZZZZZ	1.00	14:39																												
ZZZZZZ	1.00	14:41																												
ZZZZZZ	1.00	14:43																												
ZZZZZZ	1.00	14:45																												
ZZZZZZ	2.00	14:47																												
ZZZZZZ	1.00	14:50																												
ZZZZZZ	1.00	14:52																												
CCV	1.00	14:54												X																
CCB	1.00	14:56												X																
ZZZZZZ	1.00	14:58																												
ZZZZZZ	1.00	15:00																												
ZZZZZZ	1.00	15:02																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ59

Method: CV
Instrument ID: 17384
Run Name: 1830601M07

Run Start Date: 11/02/2018
Run End Date: 11/02/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	15:04																												
ZZZZZZ	1.00	15:06																												
ZZZZZZ	1.00	15:08																												
ZZZZZZ	1.00	15:10																												
ZZZZZZ	1.00	15:12																												
ZZZZZZ	1.00	15:14																												
ZZZZZZ	1.00	15:16																												
CCV	1.00	15:18													X															
CCB	1.00	15:20													X															
ZZZZZZ	1.00	15:22																												
ZZZZZZ	1.00	15:24																												
ZZZZZZ	1.00	15:26																												
ZZZZZZ	1.00	15:28																												
ZZZZZZ	1.00	15:30																												
ZZZZZZ	1.00	15:32																												
ZZZZZZ	1.00	15:34																												
ZZZZZZ	1.00	15:36																												
ZZZZZZ	1.00	15:38																												
ZZZZZZ	1.00	15:40																												
CCV	1.00	15:42													X															
CCB	1.00	15:44													X															
ZZZZZZ	1.00	15:46																												
ZZZZZZ	1.00	15:48																												
ZZZZZZ	1.00	15:50																												
ZZZZZZ	1.00	15:53																												
ZZZZZZ	1.00	15:55																												
ZZZZZZ	1.00	15:57																												
ZZZZZZ	1.00	15:59																												
ZZZZZZ	1.00	16:01																												
ZZZZZZ	1.00	16:03																												
ZZZZZZ	1.00	16:05																												
CCV	1.00	16:07													X															
CCB	1.00	16:09													X															
ZZZZZZ	1.00	16:11																												
ZZZZZZ	1.00	16:13																												
ZZZZZZ	1.00	16:15																												
ZZZZZZ	1.00	16:17																												
ZZZZZZ	1.00	16:19																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ59

Method: CV

Instrument ID: 17384

Run Name: 1830601M07

Run Start Date: 11/02/2018

Run End Date: 11/02/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	16:21																												
ZZZZZZ	1.00	16:23																												
ZZZZZZ	1.00	16:25																												
ZZZZZZ	1.00	16:27																												
ZZZZZZ	1.00	16:29																												
CCV	1.00	16:32													X															
CCB	1.00	16:34													X															
ZZZZZZ	1.00	16:36																												
ZZZZZZ	1.00	16:38																												
ZZZZZZ	1.00	16:40																												
ZZZZZZ	1.00	16:42																												
ZZZZZZ	1.00	16:44																												
ZZZZZZ	1.00	16:46																												
ZZZZZZ	1.00	16:48																												
ZZZZZZ	1.00	16:50																												
ZZZZZZ	1.00	16:52																												
ZZZZZZ	1.00	16:54																												
CCV	1.00	16:56													X															
CCB	1.00	16:58													X															
ZZZZZZ	1.00	17:01																												
ZZZZZZ	1.00	17:03																												
ZZZZZZ	1.00	17:05																												
ZZZZZZ	1.00	17:07																												
ZZZZZZ	1.00	17:09																												
ZZZZZZ	1.00	17:11																												
ZZZZZZ	1.00	17:13																												
ZZZZZZ	1.00	17:15																												
ZZZZZZ	1.00	17:17																												
ZZZZZZ	1.00	17:19																												
CCV	1.00	17:21													X															
CCB	1.00	17:23													X															
ZZZZZZ	1.00	17:25																												
ZZZZZZ	1.00	17:27																												
ZZZZZZ	1.00	17:29																												
ZZZZZZ	1.00	17:31																												
ZZZZZZ	1.00	17:33																												
ZZZZZZ	1.00	17:35																												
ZZZZZZ	1.00	17:37																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ59

Method: CV
Instrument ID: 17384
Run Name: 1830601M07

Run Start Date: 11/02/2018
Run End Date: 11/02/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	17:39																												
ZZZZZZ	1.00	17:41																												
ZZZZZZ	1.00	17:43																												
CCV	1.00	17:45												X																
CCB	1.00	17:47												X																
ZZZZZZ	1.00	17:49																												
ZZZZZZ	1.00	17:51																												
ZZZZZZ	1.00	17:53																												
ZZZZZZ	1.00	17:55																												
ZZZZZZ	1.00	17:57																												
ZZZZZZ	1.00	17:59																												
ZZZZZZ	1.00	18:02																												
ZZZZZZ	1.00	18:04																												
ZZZZZZ	1.00	18:06																												
ZZZZZZ	1.00	18:08																												
CCV	1.00	18:10												X																
CCB	1.00	18:12												X																
ZZZZZZ	1.00	18:14																												
ZZZZZZ	1.00	18:16																												
ZZZZZZ	1.00	18:18																												
ZZZZZZ	1.00	18:20																												
ZZZZZZ	1.00	18:22																												
ZZZZZZ	1.00	18:24																												
ZZZZZZ	1.00	18:26																												
P30571BB	1.00	18:28												X																
P30571BQ	1.00	18:30												X																
9874904BKG	1.00	18:32												X																
CCV	1.00	18:34												X																
CCB	1.00	18:36												X																
9874904DUP	1.00	18:38												X																
9874904MS	1.00	18:40												X																
9874904MSD	1.00	18:42												X																
9874902	1.00	18:44												X																
9874903	1.00	18:46												X																
9874905	1.00	18:48												X																
9874906	1.00	18:51												X																
9874907	1.00	18:53												X																
9874908	1.00	18:55												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ59

Method: CV

Instrument ID: 17384

Run Name: 1830601M07

Run Start Date: 11/02/2018

Run End Date: 11/02/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
ZZZZZZ	1.00	18:57																												
CCV	1.00	18:59													X															
CCB	1.00	19:01													X															
CRA	1.00	19:03													X															
CCV	1.00	19:05													X															
CCB	1.00	19:07													X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9874902	MW-1	X		
9874903	MW-2	X		
9874904	MW-3	X		
9874905	MW-4	X		
9874906	MW-5	X		
9874907	MW-6	X		
9874908	FB-20181029	X		Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9874902	DF50	DF5	DF50
9874903	DF5	DF5	DF5
9874904	DF50	DF5	DF5
9874905	DF5	DF5	DF5
9874906	DF50	DF5	DF50
9874907	DF50	DF5	DF5
9874908	DF1	DF1	DF1

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18304520106A	9874902	10/31/2018 22:32:00		X	
	9874902	10/31/2018 22:51:00	X		X
	9874903	10/31/2018 23:09:00	X	X	X
	P30420FB	10/31/2018 17:22:00	X	X	X
	P30420FQ	10/31/2018 17:04:00	X	X	X
18304520106B	9874904	11/01/2018 01:17:00		X	X
	9874904	11/01/2018 01:35:00	X		
	9874905	11/01/2018 01:53:00	X	X	X
	9874906	11/01/2018 02:30:00		X	
	9874906	11/05/2018 19:18:00	X		X
	9874907	11/01/2018 02:48:00		X	X
	9874907	11/01/2018 03:06:00	X		
	9874908	11/01/2018 04:01:00	X	X	X

Fraction: Instrumental Wet Chemistry

18304520106A / P30420FB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	10/31/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	10/31/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	10/31/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P30420FQ	Batch: 18304520106A (Sample number(s): 9874902-9874903)								
	Batch: 18304520106B (Sample number(s): 9874904-9874908)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	2.99	NA	100	NA	90-110	NA	NA
Fluoride	IC	0.750	0.730	NA	97	NA	90-110	NA	NA
Sulfate	IC	7.50	7.56	NA	101	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ59

Instrument ID: 17694
Calibration Date: 10/16/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.412143	0.803750	2.060875	4.169802	6.257034	0.9999	0.9999
Sulfate	0.280005	0.561948	1.465270	2.996852	4.544105	1.0000	1.0000

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18304520106B
Run Start Dates: 11/05/2018
Run Names: 1830901D09

Sample	Chloride			Sulfate		
	True	Result	%Rec	True	Result	%Rec
ICV	3	3.2355	108	7.5	7.9089	105
ICB	0	ND	NA	0	ND	NA
CCV2	3	3.1634	105	7.5	7.7933	104
CCB	0	ND	NA	0	ND	NA
CCV2	3	3.1386	105	7.5	7.8363	104
CCB	0	ND	NA	0	ND	NA

* = Out of Specifications

Instrument ID: 10913
Calibration Date: 10/19/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.497489	0.996617	2.345320	4.756166	7.018871	0.9997	0.9998
Fluoride	0.121234	0.385025	0.973416	2.065283	3.275179	0.9995	0.9997
Sulfate	0.322734	0.652928	1.727408	3.663232	5.670423	0.9993	0.9996

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18304520106A, 18304520106B
Run Start Dates: 10/31/2018
Run Names: 1830401D06

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9792	99	7.5	7.5877	101	0.75	0.8152	109
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7720	92	7.5	7.2094	96	0.75	0.6752	90
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7780	93	7.5	7.1491	95	0.75	0.7103	95
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7838	93	7.5	7.2575	97	0.75	0.6907	92
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7854	93	7.5	7.1891	96	0.75	0.6971	93
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7753	93	7.5	7.2999	97	0.75	0.6853	91
CCB	0	ND	NA	0	ND	NA	0	ND	NA

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9874902	MW-1	X		1	
9874903	MW-2	X		1	
9874904	MW-3	X		1	
9874905	MW-4	X		1	
9874906	MW-5	X		1	
9874907	MW-6	X		1	
9874908	FB-20181029	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

All QC is within specification.

SAMPLE ANALYSIS:

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Water Quality

Fraction: Wet Chemistry

BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry



Lancaster Laboratories
Environmental

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18304921202A	B304872B	10/31/2018 11:32
		L304872Q	10/31/2018 11:32
		9874903	10/31/2018 11:31
		9874904 UNSPK/BKG	10/31/2018 11:31
		9874904 MS,DUP	10/31/2018 13:15
		9874905	10/31/2018 11:32
		9874906	10/31/2018 11:32
		9874907	10/31/2018 11:32
		9874908	10/31/2018 11:32
Total Dissolved Solids	18304921202B	9874902 BKG	10/31/2018 11:31
		9874902 DUP	10/31/2018 13:15

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ59

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18304004101A	9874902	10/31/2018 22:15:00	X	X
	9874903 BKG	10/31/2018 21:47:00	X	X
	9874903 DUP	10/31/2018 21:52:00	X	X
	9874904	10/31/2018 22:24:00	X	X
	9874906	10/31/2018 22:33:00	X	X
	9874907	10/31/2018 22:20:00	X	X
	9874908	10/31/2018 22:10:00	X	X
	P004101Q	10/31/2018 21:43:00	X	
18304004101B	9874905 BKG	10/31/2018 21:56:00	X	X
	9874905 DUP	10/31/2018 22:01:00	X	X

Fraction: Wet Chemistry

18304921202A / B304872B						
Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/31/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9874904 MS: 9874904	Batch: 18304921202A (Sample number(s): 9874903-9874908)									
	Batch: 18304921202B (Sample number(s): 9874902)									
Parameter	ME	Spike Added mg/l	Unspiked Conc mg/l	MS Conc mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	800	614.	1414.	NA	100	NA	62-127	NA	NA

Comments:

(2) The unspiked sample result is greater than four times the spike added.

* = Out of Specification

Results are being reported on an as received basis.

Water Quality

Fraction: Wet Chemistry

BKG: 9874903 DUP: 9874903	Batch: 18304004101A (Sample number(s): 9874902-9874904, 9874906-9874908)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	7.85	7.89	1	4

BKG: 9874903 DUP: 9874903	Batch: 18304004101A (Sample number(s): 9874902-9874904, 9874906-9874908)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	22.49	22.52	0	5

BKG: 9874905 DUP: 9874905	Batch: 18304004101B (Sample number(s): 9874905)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	6.65	6.63	0	4

BKG: 9874905 DUP: 9874905	Batch: 18304004101B (Sample number(s): 9874905)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	22.64	23.07	2	5

BKG: 9874904 DUP: 9874904	Batch: 18304921202A (Sample number(s): 9874903-9874908)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	614.	618.	1 (1)	5

BKG: 9874902 DUP: 9874902	Batch: 18304921202B (Sample number(s): 9874902)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	1124.	1132.	1 (1)	5

Comments:

(1) The sample and/or duplicate result is less than five times the LOQ.

* = Out of Specification

Results are being reported on an as received basis.

SDG: GEJ59
Matrix: LIQUID

Water Quality

Fraction: Wet Chemistry

LCS: P004101Q	Batch: 18304004101A (Sample number(s): 9874902-9874904, 9874906-9874908)								
	Batch: 18304004101B (Sample number(s): 9874905)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	6.99	NA	100	NA	95-105	NA	NA

LCS: L304872Q	Batch: 18304921202A (Sample number(s): 9874903-9874908)								
	Batch: 18304921202B (Sample number(s): 9874902)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	208	NA	104	NA	62-127	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

November 26, 2018

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994

Re: NJ Radiochemistry Analyses
Work Order: 463203

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on November 01, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Julie Robinson
Project Manager

Chain of Custody: 2003764
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 463203**

November 26, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on November 01, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
463203001	MW-1
463203002	MW-2
463203003	MW-3
463203004	MW-4
463203005	MW-5
463203006	MW-6
463203007	FB-20181029

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

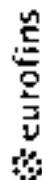
The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.



Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Acc. # ... Date # 2003764 Sample #

[illegible]

Eurofins Laboratories Environmental, LLC • 2425 New Market Pike, -JRCASPR, PA 15501 • 717-656-2300

GEL**SAMPLE RECEIPT & REVIEW FORM**

Client: <u>UNO</u>		SDCA/RCU/CRW/ork Office: <u>402703</u>	
Received By: <u>ZKW</u>		Date Received: <u>11/1/18</u>	
Carrier and Tracking Number		Time Applied Field's Express FedEx Ground UPS Field Services Courier Other <u>60365 4172-155 39457</u>	
Suspected Hazard Information		☒	*If Not Counts - (Shipment samples not marked "radioactive", contact the Maritime Safety Group for further investigation)
Shipped as a DOT Hazardous?		☒	Hazard Class Shipped: <u>None</u>
COC/Samples marked or classified as radioactive?		☒	Maximum Net Weight Observed * (Observed Counts - Area Background Count) ... <u>CTM (indRTR)</u> Classified as: Rad 1 Rad 2 Rad 3
Is package, COC, and/or Samples marked HAZ?		☒	If yes, select Hazards below, and contact the GEL Safety Group. IBC's Flammable Corrosive RCRA Aerosols Biohazard Other
Sample Receipt Criteria		☒	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒	Circle Applicable: Seals broken Damaged container Leaking container Other (describe):
2	Chain of custody documents included with shipment?	☒	
3	Samples requiring cold preservation within 10 ± 6 deg. C (*)	☒	Preservation Method: <u>Ice</u> Ice Packs Dry Ice None Other All temperatures are recorded in Celsius TEMP: <u>1</u>
4	Docs check performed and passed on JB temperature gun?	☒	Temperature Device Serial #: <u>IR3-18</u> Secondary Temperature Device Serial # (if Applicable):
5	Sample containers intact and sealed?	☒	Circle Applicable: Seals broken Damaged container Leaking container Other (describe):
6	Samples requiring chemical preservation at proper pH?	☒	Sample IDs and Containers Affected: If Preservation added: List:
7	Do any samples require Volatile Analysis?	☒	If Yes, Are Endocaps or Soil Xs present? Yes ___ No ___ (If yes, take to VOA Freeport) Do VOA vials contain and preservation? Yes ___ No ___ N/A ___ (if unknown, select No) VOA vials free of headspace? Yes ___ No ___ N/A ___ Sample IDs and containers affected:
8	Samples received within holding time?	☒	IDs and vials affected:
9	Sample IDs on COC match IDs on bottles?	☒	Sample IDs and containers affected:
10	Date & time on COC match date & time on bottles?	☒	Sample IDs affected:
11	Number of containers received match number indicated on COC?	☒	Sample IDs affected:
12	Are sample containers identifiable as GEL generated?	☒	
13	COC form is properly signed on relinquished/received volumes?	☒	
Comments (Use Confirmation Form if needed)			

PST (or PMA) review Initials: KWDate: 11/06/18Page: 1 of 1

GL-CN-SR-001 Rev 5

Laboratory Certifications

List of current GEL Certifications as of 26 November 2018

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-27
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LANC)
SDG #: 463203**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1819110

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
463203001	MW-1
463203002	MW-2
463203003	MW-3
463203004	MW-4
463203005	MW-5
463203006	MW-6
463203007	FB-20181029
1204151331	Method Blank (MB)
1204151332	463203004(MW-4) Sample Duplicate (DUP)
1204151333	463203004(MW-4) Matrix Spike (MS)
1204151334	463203004(MW-4) Matrix Spike Duplicate (MSD)
1204151335	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204151333 (MW-4MS) and 1204151334 (MW-4MSD), aliquots were reduced to conserve sample volume.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1818524

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
463203001	MW-1

463203002	MW-2
463203003	MW-3
463203004	MW-4
463203005	MW-5
463203006	MW-6
463203007	FB-20181029
1204150011	Method Blank (MB)
1204150012	463221005(NonSDG) Sample Duplicate (DUP)
1204150013	463221005(NonSDG) Matrix Spike (MS)
1204150014	463221005(NonSDG) Matrix Spike Duplicate (MSD)
1204150015	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Samples 1204150011 (MB) and 1204150015 (LCS) were degassed and recounted to verify sample results. The second counts are reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204150013 (Non SDG 463221005MS) and 1204150014 (Non SDG 463221005MSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 463203 GEL Work Order: 463203

The Qualifiers in this report are defined as follows:

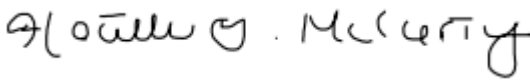
- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:



Name: Heather McCarty

Date: 24 NOV 2018

Title: Analyst II

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994
Contact: Ms. Hannah Cottman
Project: NJ Radiochemistry Analyses

Report Date: November 24, 2018

Client Sample ID: MW-1
Sample ID: 463203001
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	1.26	+/-1.27	2.11	+/-1.32	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.196	+/-0.317	0.565	+/-0.320	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	76	(15%-125%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 24, 2018

Client Sample ID: MW-2
Sample ID: 463203002
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	1.11	+/-1.04	1.71	+/-1.08	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	-0.0999	+/-0.235	0.538	+/-0.235	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	90.4	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration

Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 24, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3
Sample ID: 463203003
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.346	+/-0.670	1.19	+/-0.677	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.15	+/-0.454	0.392	+/-0.487	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	92	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 24, 2018

Client Sample ID: MW-4
Sample ID: 463203004
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.287	+/-0.683	1.23	+/-0.687	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.0912	+/-0.198	0.374	+/-0.198	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	94.2	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 24, 2018

Client Sample ID: MW-5
Sample ID: 463203005
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.095	+/-0.797	1.50	+/-0.798	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.261	+/-0.261	0.418	+/-0.264	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	80.8	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 24, 2018

Client Sample ID: MW-6
Sample ID: 463203006
Matrix: Water
Collect Date: 29-OCT-18
Receive Date: 01-NOV-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	1.03	+/-0.983	1.61	+/-1.02	3.00	pCi/L			JXC9	11/19/18	1045	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.580	+/-0.267	0.222	+/-0.280	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	85.5	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: November 24, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: FB-20181029

Sample ID: 463203007

Matrix: Water

Collect Date: 29-OCT-18

Receive Date: 01-NOV-18

Collector: Client

Project: LANC00115

Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.350	+/-0.771	1.38	+/-0.777	3.00	pCi/L			JXC9	11/19/18	1046	1819110	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.166	+/-0.234	0.408	+/-0.236	1.00	pCi/L			PCW	11/12/18	0855	1818524	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1819110	94.9	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

Quality Control Summary

GEL LABORATORIES LLC

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QC Summary

Report Date: November 24, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 463203

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1819110										
QC1204151332	463203004	DUP									
Radium-228		U	0.287	U	0.518	pCi/L	0		N/A	JXC9	11/19/1810:44
		Uncert:	+/-0.683		+/-0.636						
		TPU:	+/-0.687		+/-0.651						
QC1204151335	LCS										
Radium-228		17.0			16.7	pCi/L	98	(75%-125%)	JXC9	11/19/1810:45	
		Uncert:			+/-2.06						
		TPU:			+/-4.98						
QC1204151331	MB										
Radium-228				U	0.787	pCi/L			JXC9	11/19/1810:44	
		Uncert:			+/-0.754						
		TPU:			+/-0.783						
QC1204151333	463203004	MS									
Radium-228		51.3	U	0.287	44.5	pCi/L	86.7	(75%-125%)	JXC9	11/19/1810:45	
		Uncert:			+/-5.30						
		TPU:			+/-13.2						
QC1204151334	463203004	MSD									
Radium-228		51.3	U	0.287	40.9	pCi/L	8.37	79.8	(0%-20%)	JXC9	11/19/1810:45
		Uncert:			+/-5.39						
		TPU:			+/-12.3						
Rad Ra-226											
Batch	1818524										
QC1204150012	463221005	DUP									
Radium-226			2.26		2.00	pCi/L	12.1	(0%-20%)	PCW	11/12/1810:00	
		Uncert:	+/-0.548		+/-0.618						
		TPU:	+/-0.665		+/-0.700						
QC1204150015	LCS										
Radium-226		26.0			21.9	pCi/L	84.5	(75%-125%)	PCW	11/15/1808:15	
		Uncert:			+/-2.05						
		TPU:			+/-3.93						
QC1204150011	MB										
Radium-226				U	0.304	pCi/L			PCW	11/15/1808:15	
		Uncert:			+/-0.314						
		TPU:			+/-0.318						
QC1204150013	463221005	MS									
Radium-226		130	2.26		116	pCi/L	87.8	(75%-125%)	PCW	11/12/1810:00	
		Uncert:	+/-0.548		+/-8.31						
		TPU:	+/-0.665		+/-28.0						
QC1204150014	463221005	MSD									
Radium-226		130	2.26		109	pCi/L	6.35	82.3	(0%-20%)	PCW	11/12/1810:00
		Uncert:	+/-0.548		+/-8.17						

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QC Summary

Workorder: 463203

Page 2 of 2

Parmname	NOM	Sample Qual	QC	Units	RPD %	REC %	Range	Anlst	Date	Time
Rad Ra-226										
Batch	1818524									
		TPU:	+/-0.665				+/-22.8			

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
 - < Result is less than value reported
 - > Result is greater than value reported
 - BD Results are either below the MDC or tracer recovery is low
 - FA Failed analysis.
 - H Analytical holding time was exceeded
 - J Value is estimated
 - K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
 - L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
 - M M if above MDC and less than LLD
 - M REMF Result > MDC/CL and < RDL
 - N/A RPD or %Recovery limits do not apply.
 - N1 See case narrative
 - ND Analyte concentration is not detected above the detection limit
 - NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
 - R Sample results are rejected
 - U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
 - UI Gamma Spectroscopy--Uncertain identification
 - UJ Gamma Spectroscopy--Uncertain identification
 - UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
 - X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Y Other specific qualifiers were required to properly define the results. Consult case narrative.
 - ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
 - h Preparation or preservation holding time was exceeded
- N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
- ** Indicates analyte is a surrogate/tracer compound.
- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1819110 Check-list

This check-list was completed on 19-NOV-18 by Kenshalla Oston

This batch was reviewed by Kenshalla Oston on 19-NOV-18 and Angela Johnson on 20-NOV-18.

Batch ID:
1819110

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-009

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID: 1819110

Analyst: Jasmine Conley (JXC9)

Method: EPA 904.0/SW846 9320 Modified

Lab SOP: GL-RAD-A-063 REV# 2

Instrument: GFC-51204863

Due Dates for Lab: 26-NOV-2018

Package: 28-NOV-2018

SDG: 30-NOV-2018

Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units
LCS	1204151335	Radium-228 SPIKE	1810-A	.1	mL
MS	1204151333	Radium-228 SPIKE	1810-A	.1	mL
MSD	1204151334	Radium-228 SPIKE	1810-A	.1	mL

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	463203001	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
2	463203002	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
3	463203003	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
4	463203004	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
5	463203005	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
6	463203006	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
7	463203007	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
8	463826001	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
9	463826002	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
10	463826003	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
11	1204151331 MB	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
12	1204151332 DUP (463203004)	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04
13	1204151333 MS (463203004)	14-NOV-2018	3	100	11/15/18 12:54	11/19/18 09:04
14	1204151334 MSD (463203004)	14-NOV-2018	3	100	11/15/18 12:54	11/19/18 09:04
15	1204151335 LCS	14-NOV-2018	3	300	11/15/18 12:54	11/19/18 09:04

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 14-NOV-2018 00:00
REGNT 2662327.1	cerium 500 mg/L in 2%HCl	.2 mL	
REGNT 2672182	RGF-1.5 Ammonium Sulfate	10 mL	
REGNT 2766682.3	RGF-Nitric Acid	5 mL	
REGNT 2832194.1	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 2832313.1	Hydrofluoric Acid Poly Bottle	3 mL	
REGNT 2838193	RGF-50% Potassium Carbonate	2 mL	
REGNT 2840709	RGF-16mg/mL Barium Chloride	1 mL	
REGNT 2843889	RGF-1M Citric Acid	5 mL	
REGNT 2849126	RGF-7M Nitric Acid	25 mL	
REGNT 2851710	2M HCl	20 mL	
WORK 0487-D	Barium-133 TRACER	.1 mL	

RA1819110.xls

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.4.2

Tracer S/N : 0487-D
Tracer Exp Date : 10/10/2019
Tracer Volume Added: 0.10

Batch : 1819110
Analyst : JAS02031
Prep Date : 11/14/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 3 pCi/L
Ra-228 Abundance : 1.00
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.15 hours

Geometry: CeF on 25mm Filter

Sample Characteristics					Tracer Calculations					
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Tracer Ref. Activity (CPM)	Tracer Ref. Count Uncertainty (%)	Tracer Samp. Activity (CPM)	Tracer Samp. Count Uncertainty (%)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)
1	463203001.1	0.3000	1.8459E-05	10/29/2018 11:30	172.1	7.62%	130.8	8.74%	0.1	0.000200
2	463203002.1	0.3000	1.8459E-05	10/29/2018 11:10	172.1	7.62%	155.5	8.02%	0.1	0.000200
3	463203003.1	0.3000	1.8459E-05	10/29/2018 15:00	172.1	7.62%	158.4	7.95%	0.1	0.000200
4	463203004.1	0.3000	1.8459E-05	10/29/2018 13:00	172.1	7.62%	162.1	7.86%	0.1	0.000200
5	463203005.1	0.3000	1.8459E-05	10/29/2018 13:10	172.1	7.62%	139.0	8.48%	0.1	0.000200
6	463203006.1	0.3000	1.8459E-05	10/29/2018 15:00	172.1	7.62%	147.0	8.25%	0.1	0.000200
7	463203007.1	0.3000	1.8459E-05	10/29/2018 11:00	172.1	7.62%	163.2	7.83%	0.1	0.000200
8	463826001.1	0.3000	1.8459E-05	11/6/2018 9:50	172.1	7.62%	120.2	9.12%	0.1	0.000200
9	463826002.1	0.3000	1.8459E-05	11/6/2018 11:25	172.1	7.62%	161.8	7.86%	0.1	0.000200
10	463826003.1	0.3000	1.8459E-05	11/6/2018 13:52	172.1	7.62%	148.3	8.21%	0.1	0.000200
11	1204151331.1	0.3000	1.8459E-05	11/14/2018 0:00	172.1	7.62%	159.6	7.92%	0.1	0.000200
12	1204151332.1	0.3000	1.8459E-05	10/29/2018 13:00	172.1	7.62%	163.9	7.81%	0.1	0.000200
13	1204151333.1	0.1000	1.1370E-05	10/29/2018 13:00	172.1	7.62%	165.2	7.78%	0.1	0.000200
14	1204151334.1	0.1000	1.1370E-05	10/29/2018 13:00	172.1	7.62%	169.3	7.68%	0.1	0.000200
15	1204151335.1	0.3000	1.8459E-05	11/14/2018 0:00	172.1	7.62%	155.6	8.02%	0.1	0.000200

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
Instrument SOP: GL-RAD-I-016

Count raw Data														
Pos.	Detector ID	Counting Time (min.)	Gross Counts		Beta cpm	Count Start Date/Time	Ac-228 Ingrowth Date/Time	Ac-228 Decay Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Ingrowth	Ac-228 Count Correction	Calculated Sample Recovery %	Sample Recovery Error %
			Alpha	Beta										
1	1B	60	10	91	1.517	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.827	1.000	1.057	76.0%	5.80%
2	1D	60	10	86	1.433	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	90.4%	5.54%
3	2A	60	8	36	0.600	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	92.0%	5.51%
4	2B	60	7	39	0.650	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	94.2%	5.48%
5	2C	60	9	38	0.633	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	80.8%	5.71%
6	2D	60	6	64	1.067	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	85.5%	5.62%
7	3B	60	8	48	0.800	11/19/2018 10:46	11/15/2018 12:54	11/19/2018 9:04	0.993	0.826	1.000	1.057	94.9%	5.47%
8	3C	60	19	64	1.067	11/19/2018 10:46	11/15/2018 12:54	11/19/2018 9:04	0.996	0.825	1.000	1.057	69.9%	5.95%
9	3D	60	7	40	0.667	11/19/2018 10:46	11/15/2018 12:54	11/19/2018 9:04	0.996	0.825	1.000	1.057	94.0%	5.48%
10	4A	60	4	49	0.817	11/19/2018 10:46	11/15/2018 12:54	11/19/2018 9:04	0.996	0.825	1.000	1.057	86.2%	5.61%
11	4B	60	1	47	0.783	11/19/2018 10:44	11/15/2018 12:54	11/19/2018 9:04	0.998	0.828	1.000	1.057	92.7%	5.50%
12	4C	60	6	37	0.617	11/19/2018 10:44	11/15/2018 12:54	11/19/2018 9:04	0.993	0.827	1.000	1.057	95.3%	5.46%
13	5A	60	15	327	5.450	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.827	1.000	1.057	96.0%	5.45%
14	5C	60	13	345	5.750	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.993	0.827	1.000	1.057	98.4%	5.42%
15	5D	60	17	383	6.383	11/19/2018 10:45	11/15/2018 12:54	11/19/2018 9:04	0.998	0.827	1.000	1.057	90.4%	5.54%

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	PIC	6/1/2017	5/31/2019	0.6519	0.00711	1.194	11/16/2018 18:13	500
2	PIC	6/1/2017	5/31/2019	0.6504	0.00692	1.096	11/16/2018 18:13	500
3	PIC	6/1/2017	5/31/2019	0.6444	0.01914	0.494	11/16/2018 18:13	500
4	PIC	6/1/2017	5/31/2019	0.6448	0.02111	0.560	11/16/2018 18:14	500
5	PIC	6/1/2017	5/31/2019	0.6389	0.01274	0.608	11/16/2018 18:14	500
6	PIC	6/1/2017	5/31/2019	0.6283	0.00745	0.782	11/17/2018 16:00	500
7	PIC	6/1/2017	5/31/2019	0.6291	0.01614	0.692	11/16/2018 18:14	500
8	PIC	6/1/2017	5/31/2019	0.6374	0.00988	0.856	11/16/2018 18:14	500
9	PIC	6/1/2017	5/31/2019	0.6255	0.02297	0.520	11/16/2018 18:14	500
10	PIC	6/1/2017	5/31/2019	0.6420	0.01123	0.628	11/17/2018 16:00	500
11	PIC	6/1/2017	5/31/2019	0.6410	0.01519	0.540	11/16/2018 18:14	500
12	PIC	6/1/2017	5/31/2019	0.6608	0.00889	0.448	11/16/2018 18:14	500
13	PIC	6/1/2017	5/31/2019	0.6766	0.00851	0.464	11/16/2018 18:14	500
14	PIC	6/1/2017	5/31/2019	0.6704	0.00657	1.094	11/16/2018 18:14	500
15	PIC	6/1/2017	5/31/2019	0.6669	0.00925	1.156	11/16/2018 18:15	500

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

* - RPD changed to 0% due to sample & dup activity below MDA

Spike S/N : 1810-A
 Spike Exp Date : 5/23/2019
 Spike Activity (dpm/ml): 113.30
 Spike Volume Added: 0.10

LCS S/N : 1810-A
 LCS Exp Date : 5/23/2019
 LCS Activity (dpm/ml): 113.30
 LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	1.3572	0.9582	3	2.1115	1.2590	51.88%	0.3227	0.1663	1.2720	1.3178		SAMPLE				
2	1.0971	0.7746	3	1.7137	1.1105	48.20%	0.3373	0.1615	1.0420	1.0848		SAMPLE				
3	0.7300	0.5154	3	1.1939	0.3458	99.06%	0.1060	0.1048	0.6703	0.6770		SAMPLE				
4	0.7593	0.5360	3	1.2314	0.2868	121.62%	0.0900	0.1093	0.6830	0.6875		SAMPLE				
5	0.9309	0.6572	3	1.5019	0.0950	428.32%	0.0253	0.1085	0.7975	0.7979		SAMPLE				
6	1.0152	0.7167	3	1.6137	1.0266	49.18%	0.2847	0.1391	0.9830	1.0219		SAMPLE				
7	0.8592	0.6066	3	1.3755	0.3504	112.47%	0.1080	0.1213	0.7715	0.7774		SAMPLE				
8	1.2777	0.9021	3	2.0211	0.9139	66.54%	0.2107	0.1396	1.1871	1.2134		SAMPLE				
9	0.7544	0.5326	3	1.2296	0.4820	75.39%	0.1467	0.1102	0.7100	0.7223		SAMPLE				
10	0.8816	0.6224	3	1.4195	0.6593	64.88%	0.1887	0.1219	0.8351	0.8542		SAMPLE				
11	0.7564	0.5340	3	1.2298	0.7868	49.19%	0.2433	0.1189	0.7535	0.7834		MB				
12	0.6540	0.4617	3	1.0769	0.5177	62.92%	0.1687	0.1057	0.6359	0.6512	463203004.1	DUP	* 0.0%			
13	1.9353	1.3664	3	3.1789	44.4996	8.21%	4.9860	0.3029	5.2990	13.1740	463203004.1	MS			51.2989	86.7%
14	2.9268	2.0663	3	4.5721	40.9262	8.66%	4.6560	0.3131	5.3939	12.3170	463203004.1	MSD	8.4%		51.2989	79.8%
15	1.0922	0.7711	3	1.7018	16.6807	8.44%	5.2273	0.3297	2.0621	4.9808		LCS			17.0126	98.0%

ASSAY 16-Nov-18 12:11:54

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 11/16/2018
Run id. 2195

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	78	1	180.04	601.6	172.06	7.62		12:11:54
2	78	2	180.04	477.9	130.84	8.74	76.04	12:15:08
3	78	3	180.03	551.77	155.47	8.02	90.36	12:18:22
4	78	4	180.03	560.48	158.37	7.95	92.04	12:21:36
5	78	5	180.04	571.56	162.05	7.86	94.18	12:24:50
1	84	1	180.04	502.43	139.01	8.48	80.79	12:28:25
2	84	2	180.06	526.56	147.04	8.25	85.46	12:31:39
3	84	3	180.04	575.13	163.24	7.83	94.87	12:34:53
4	84	4	180.04	446.02	120.21	9.12	69.87	12:38:07
5	84	5	180.03	570.65	161.76	7.86	94.01	12:41:21
1	53	1	180.05	530.17	148.25	8.21	86.16	12:45:04
2	53	2	180.06	564.11	159.55	7.92	92.73	12:48:18
3	53	3	180.02	577.14	163.93	7.81	95.27	12:51:32
4	53	4	180.04	581.02	165.21	7.78	96.02	12:54:46
5	53	5	180.03	593.36	169.34	7.68	98.42	12:58:00
1	70	1	180.04	552.05	155.55	8.02	90.40	01:01:44

END OF ASSAY

1819110.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
463203001	1B	60	10	91	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203002	1D	60	10	86	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203003	2A	60	8	36	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203004	2B	60	7	39	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203005	2C	60	9	38	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203006	2D	60	6	64	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
463203007	3B	60	8	48	11/19/2018 10:46	11/19/2018 11:46	PIC	1819110
463826001	3C	60	19	64	11/19/2018 10:46	11/19/2018 11:46	PIC	1819110
463826002	3D	60	7	40	11/19/2018 10:46	11/19/2018 11:46	PIC	1819110
463826003	4A	60	4	49	11/19/2018 10:46	11/19/2018 11:46	PIC	1819110
1204151331	4B	60	1	47	11/19/2018 10:44	11/19/2018 11:44	PIC	1819110
1204151332	4C	60	6	37	11/19/2018 10:44	11/19/2018 11:44	PIC	1819110
1204151333	5A	60	15	327	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
1204151334	5C	60	13	345	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110
1204151335	5D	60	17	383	11/19/2018 10:45	11/19/2018 11:45	PIC	1819110

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 19-Nov-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

Short Name	Status	Paramname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100A3	Below	Alpha ell	19-Nov 08:19	5	9228	8529	10140	-4.12
LB4100A3	Above	Alpha XTalk	19-Nov 08:19	5	0.277	0.206	0.253	+4.56
LB4100A3	Below	Beta ell	19-Nov 08:54	5	19482	19560	22500	-3.15
LB4100B2	near 2nd	Alpha bkg	19-Nov 08:40	60	0.267	-4.24E-2	0.351	+1.72
LB4100B2	Below	Alpha ell	19-Nov 08:19	5	7980	8083	10940	-3.22
LB4100C1	Above	Beta bkg	19-Nov 08:39	60	2.083	1.035	1.925	+4.07
LB4100C4	Above	Beta bkg	19-Nov 08:39	60	3.933	0.686	2.113	+10.65
LB4100E2	Above	Beta bkg	19-Nov 08:36	60	2.233	0.261	3.241	+0.97
LB4100E3	Above	Beta bkg	19-Nov 08:36	60	2.767	0.473	2.078	+5.57
LB4100F4	near 2nd	Alpha XTalk	19-Nov 08:01	5	0.548	0.260	0.585	+2.31
LB4100G1	Above	Beta bkg	19-Nov 08:38	60	711	0.338	1.748	+3,019.82
LB4100H2	Above	Beta bkg	19-Nov 08:36	60	3.600	-1.72E+0	4.379	+2.23
LB4100J2	Above	Alpha bkg	19-Nov 08:37	60	0.500	-2.63E-2	0.301	+6.64
LB4100J2	Above	Beta bkg	19-Nov 08:37	60	1.617	0.276	1.460	+3.79
LB4100J2	near 2nd	Beta ell	19-Nov 08:19	5	15076	15040	16380	-2.86
LB4100J4	Above	Alpha bkg	19-Nov 08:37	60	0.317	-3.59E-3	0.337	+2.64
LB4100J4	near 2nd	Beta ell	19-Nov 08:19	5	28772	28680	34580	-2.91
PIC1A	Above	Alpha bkg	19-Nov 07:35	60	0.417	-4.72E-2	0.399	+3.24
PIC4D	Below	Alpha XTalk	19-Nov 07:37	5	0.242	0.251	0.277	-5.15
PIC12D	Above	Alpha XTalk	19-Nov 04:48	5	0.418	0.320	0.405	+3.86
PIC12D	near 2nd	Beta ell	19-Nov 07:38	5	38279	38040	40320	-2.44
PIC13D	Above	Beta bkg	19-Nov 08:29	60	2.150	-2.54E-1	1.798	+4.06

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

LB4100B3	Alpha bkg, Alpha ell, Alpha XTalk, Beta bkg, Beta ell, Beta XTalk
LB4100D1	Alpha bkg, Alpha ell, Alpha XTalk, Beta bkg, Beta ell, Beta XTalk
LB4100D2	Alpha bkg, Alpha ell, Alpha XTalk, Beta bkg, Beta ell, Beta XTalk

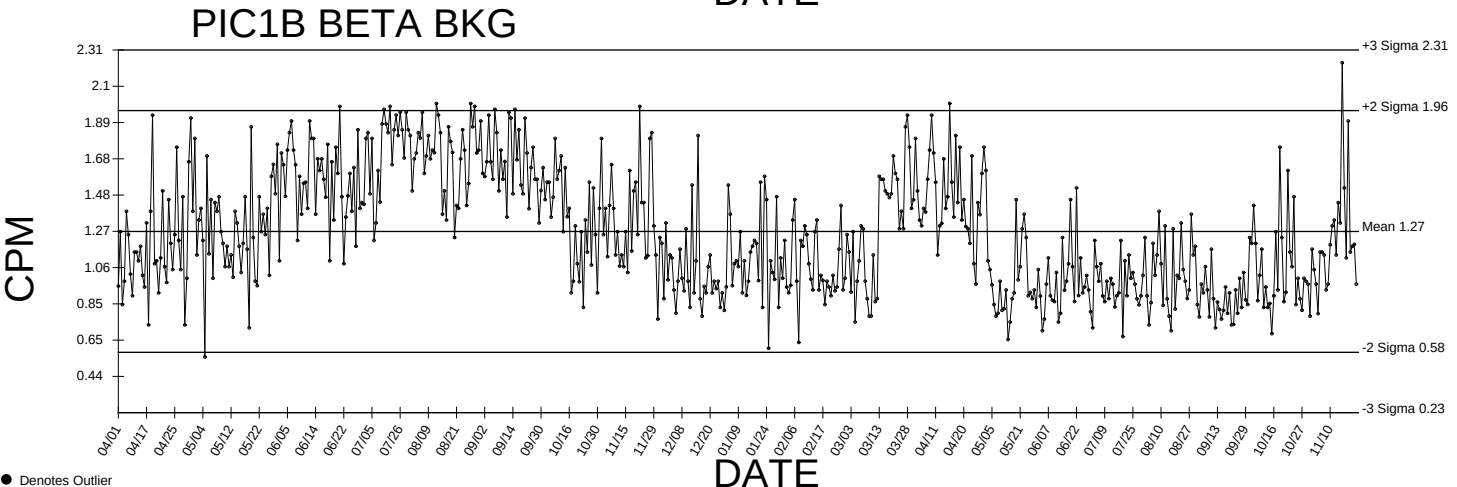
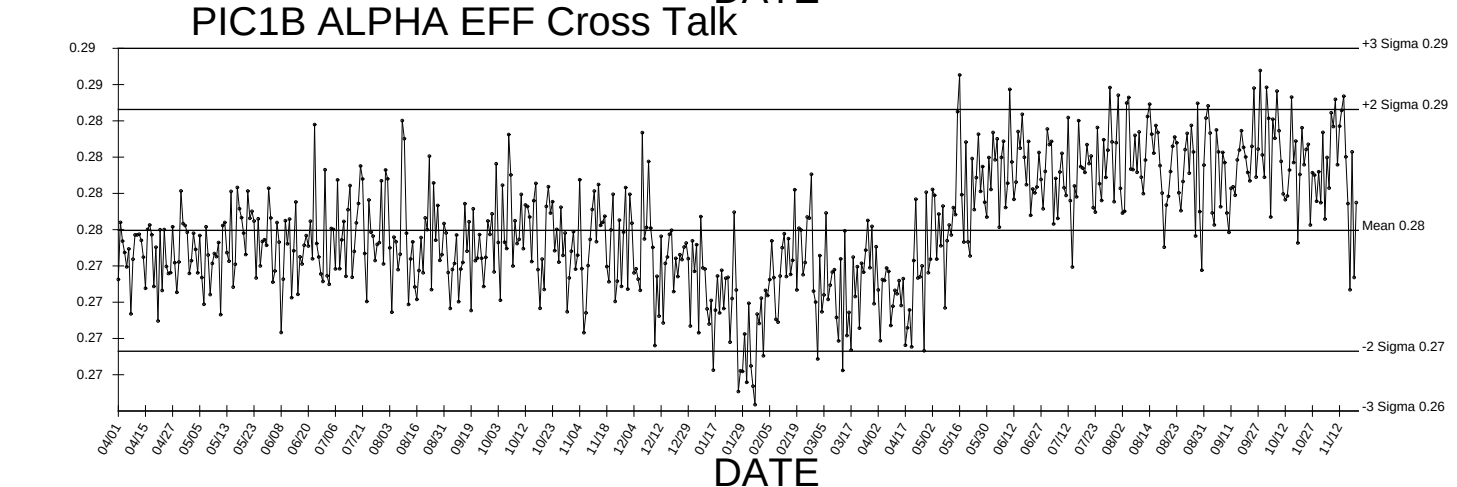
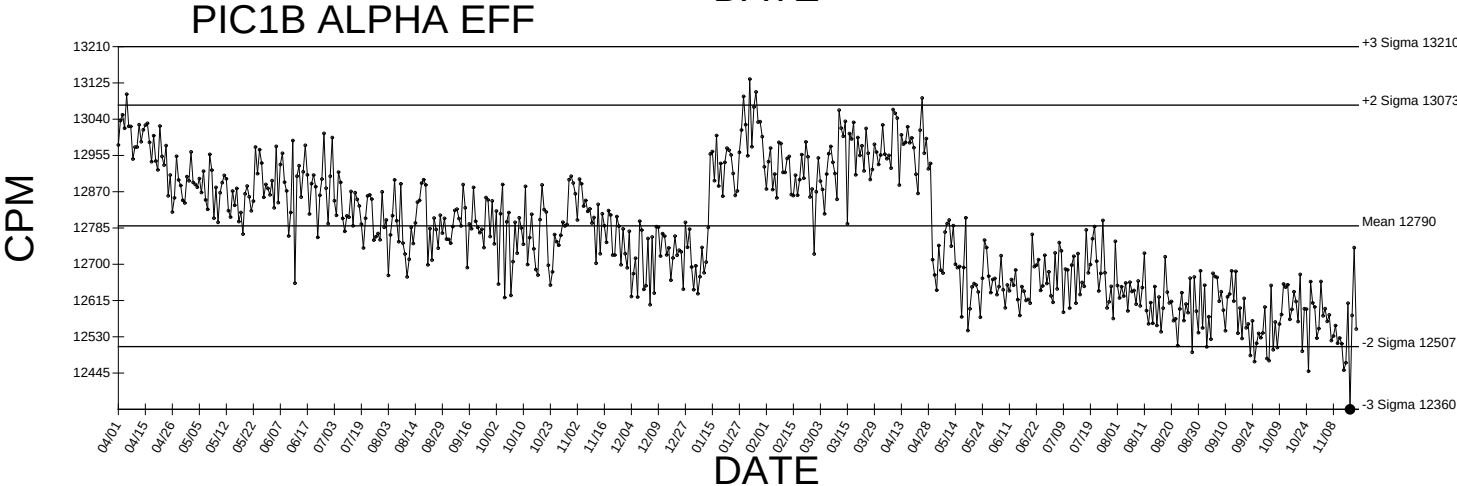
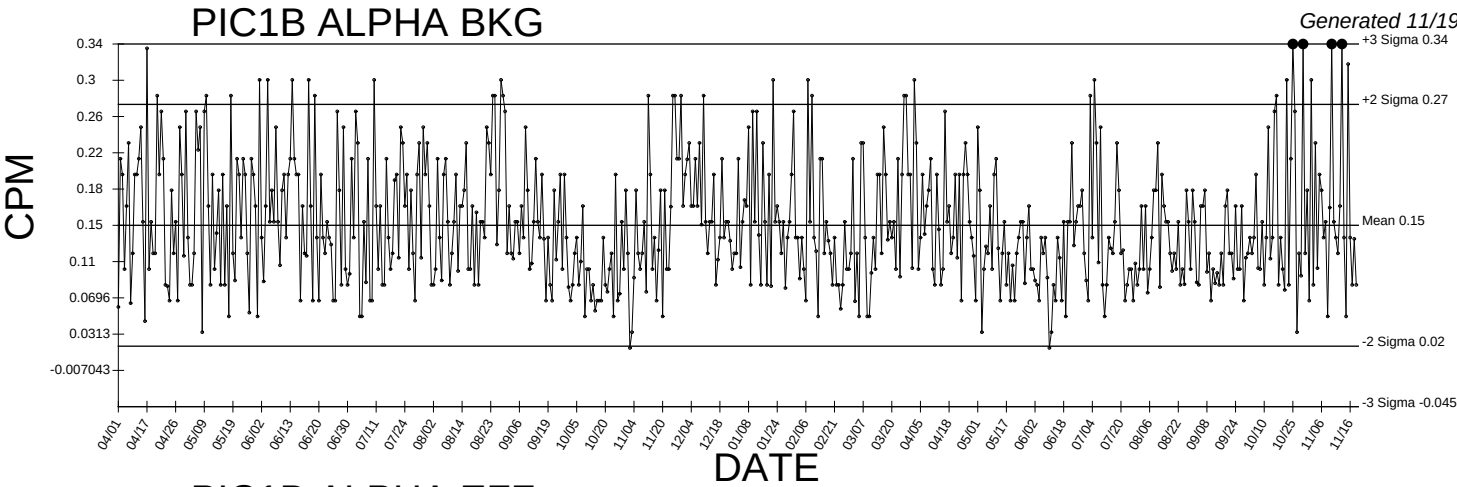
LD4100D3	Alpha pkg, Alpha eff, Alpha xTalk, Beta pkg, Beta eff, Beta xTalk
LD4100D4	Alpha pkg, Alpha eff, Alpha xTalk, Beta pkg, Beta eff, Beta xTalk
PIC3A	Alpha pkg, Alpha eff, Alpha xTalk, Beta pkg, Beta eff, Beta xTalk
PIC6D	Alpha pkg, Alpha eff, Alpha xTalk, Beta pkg, Beta eff, Beta xTalk
PIC13C	Alpha pkg, Alpha eff, Alpha xTalk, Beta pkg, Beta eff, Beta xTalk

Reviewed by _____

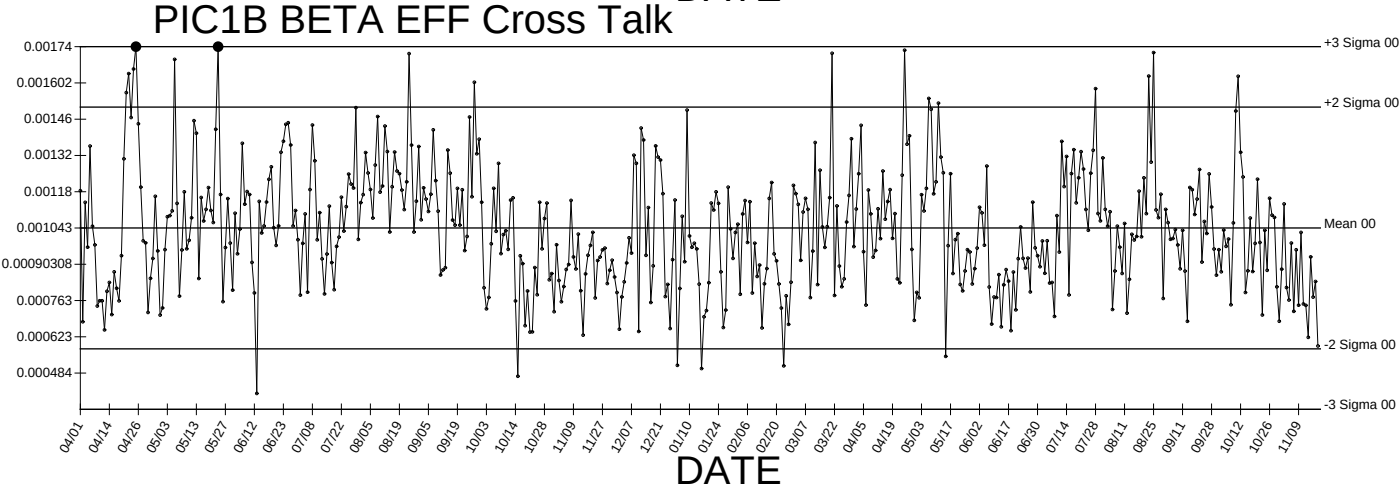
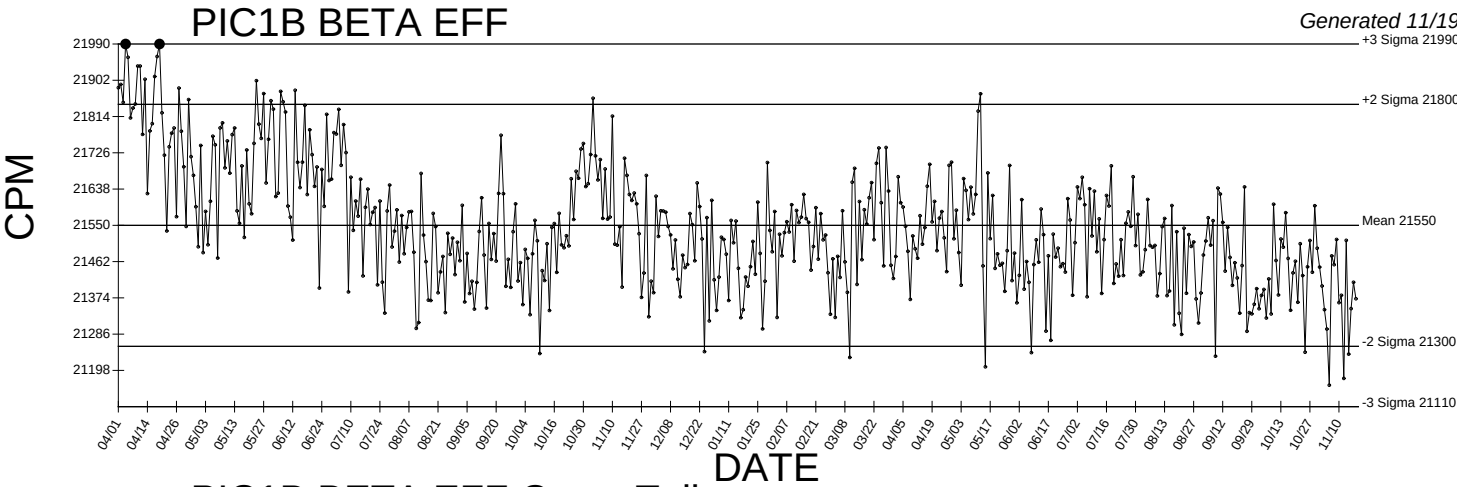
Date 7/1/99

GFI Laboratories LLC

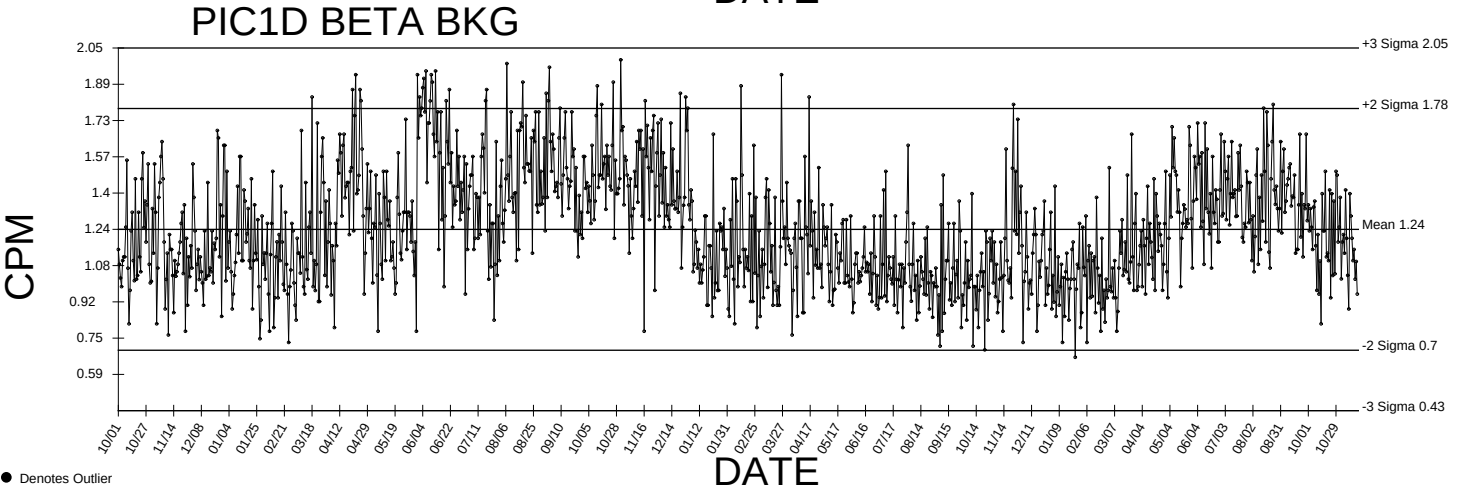
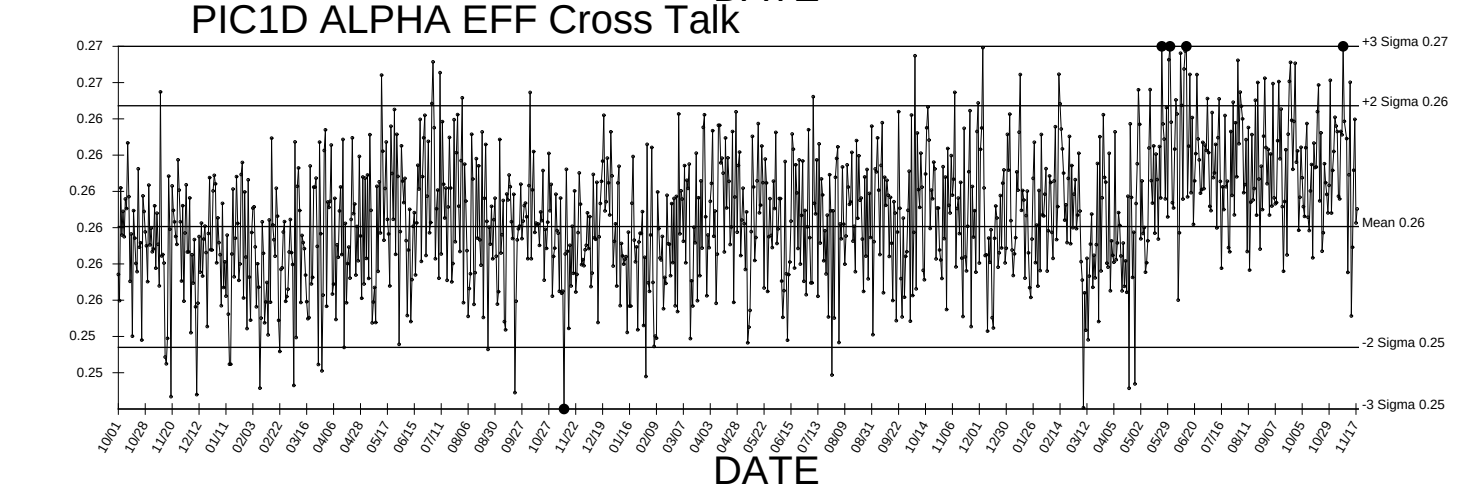
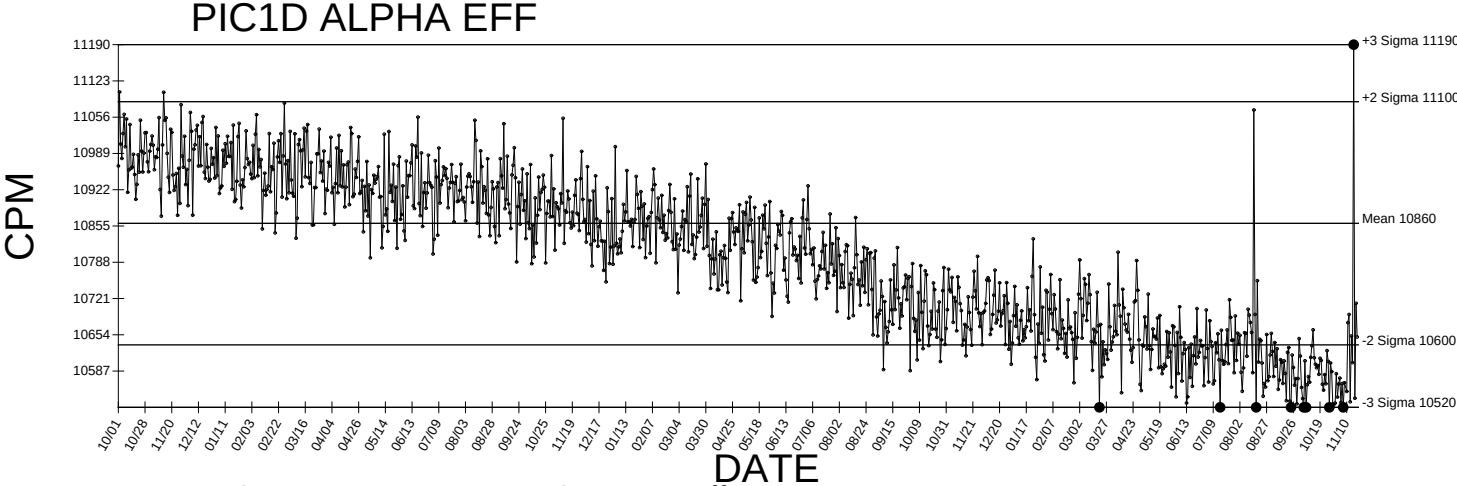
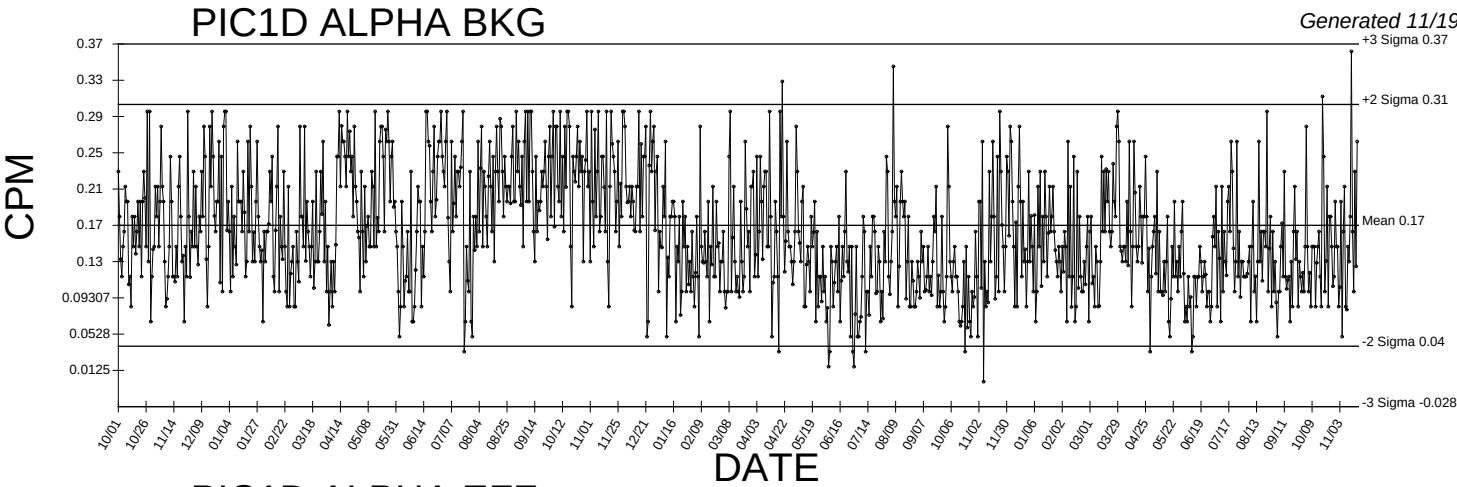
Background and Efficiency Data



● Denotes Outlier



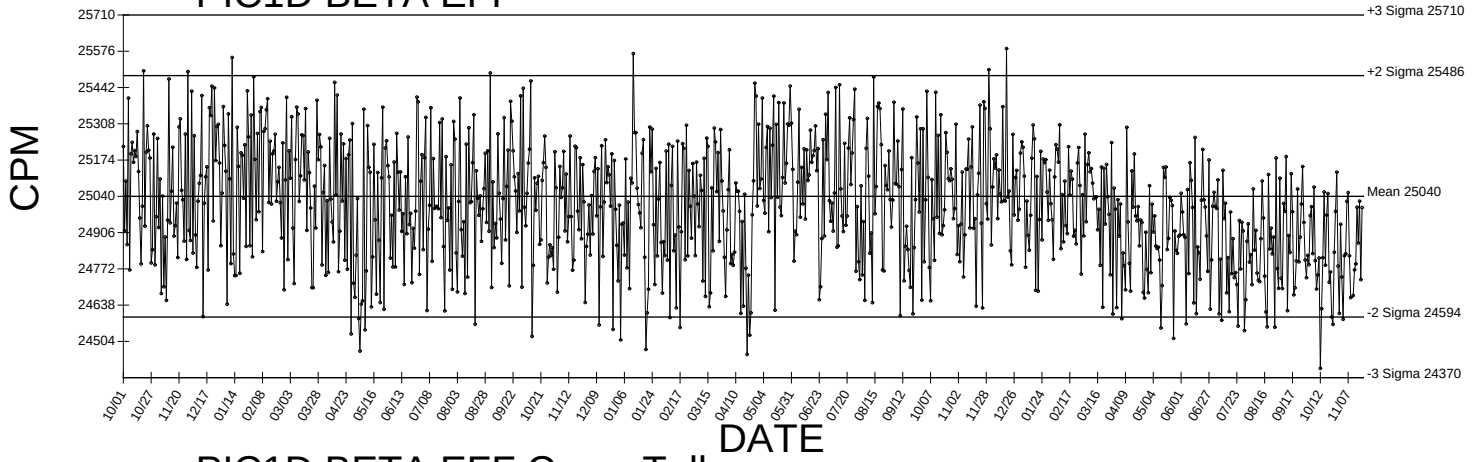
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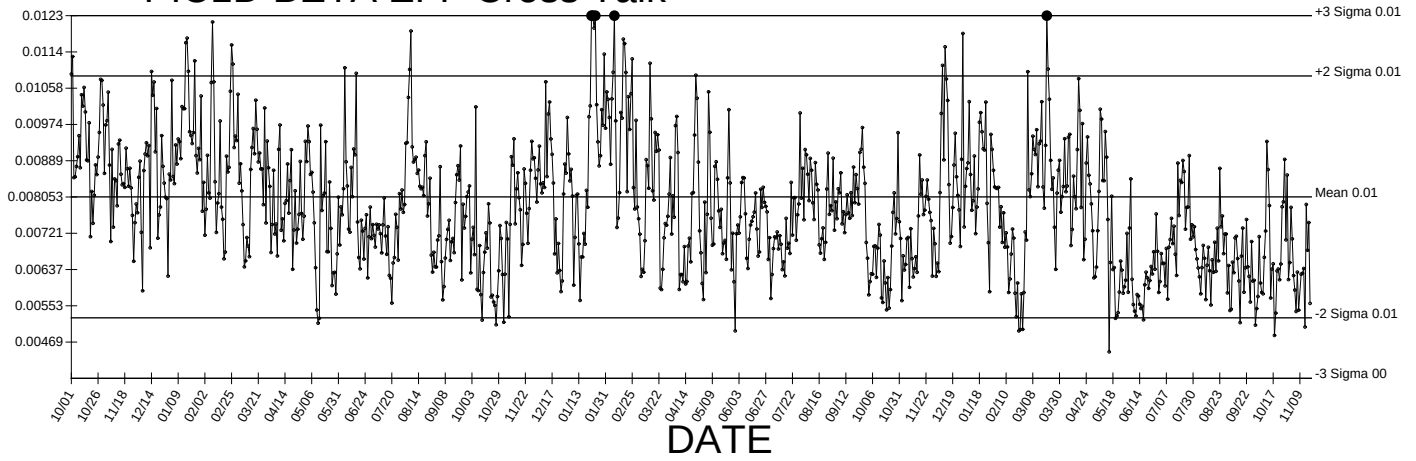
● Denotes Outlier

PIC1D BETA EFF

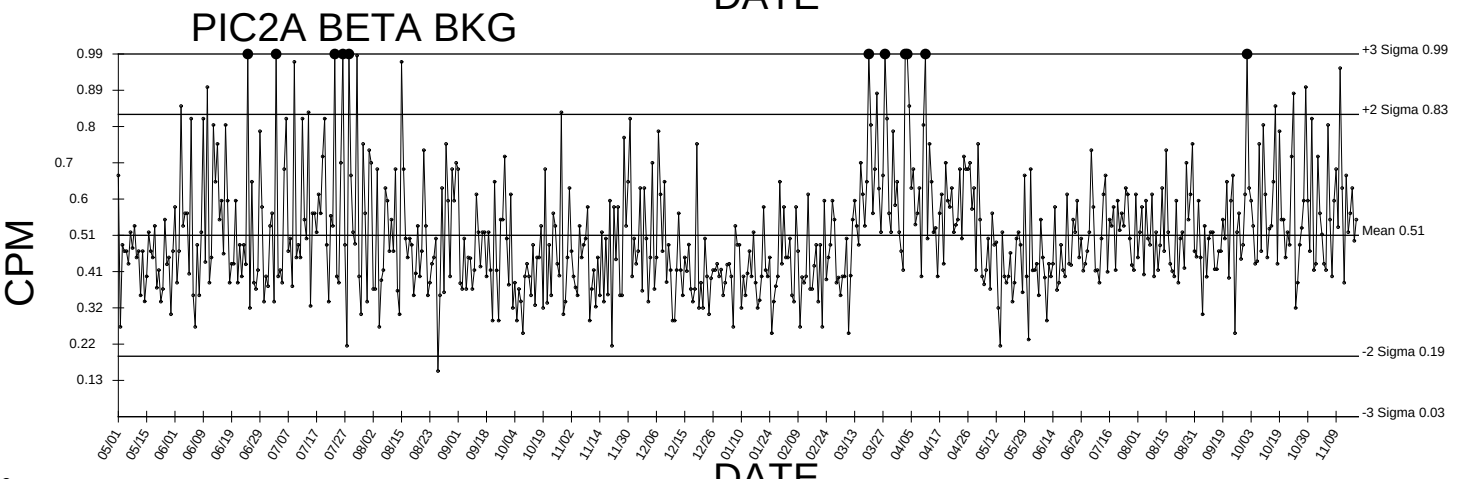
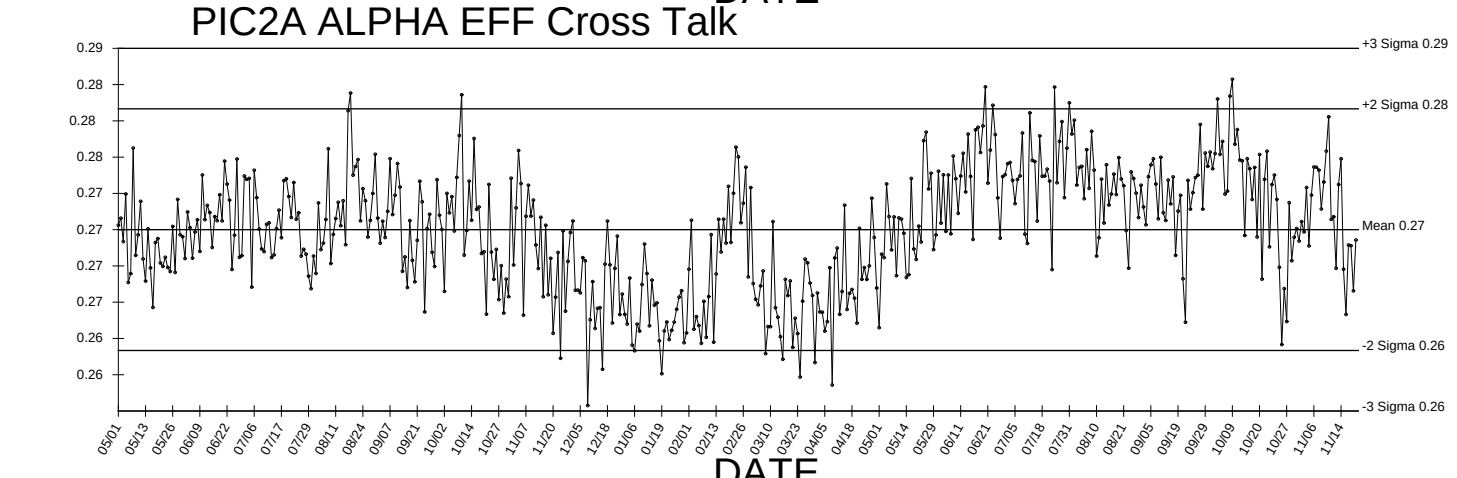
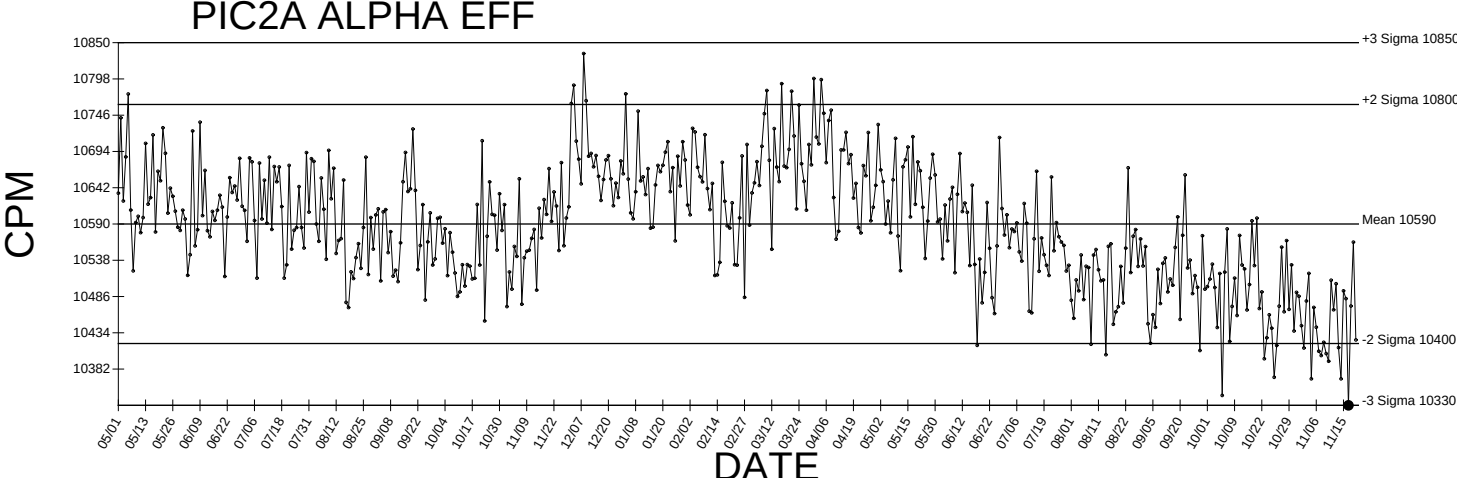
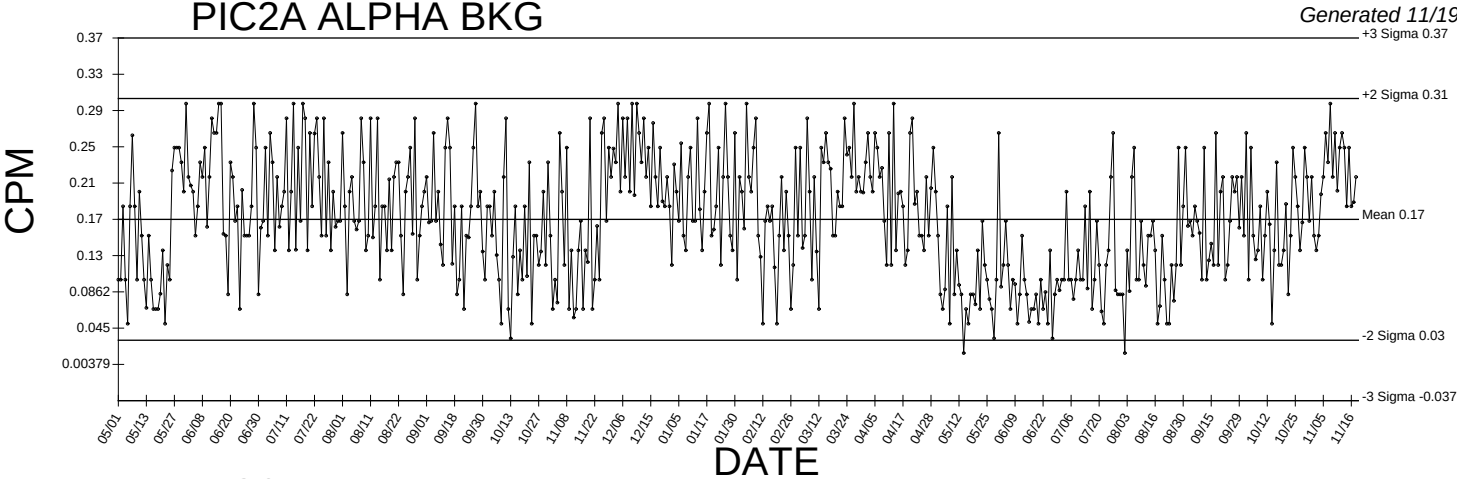
Generated 11/19/2018
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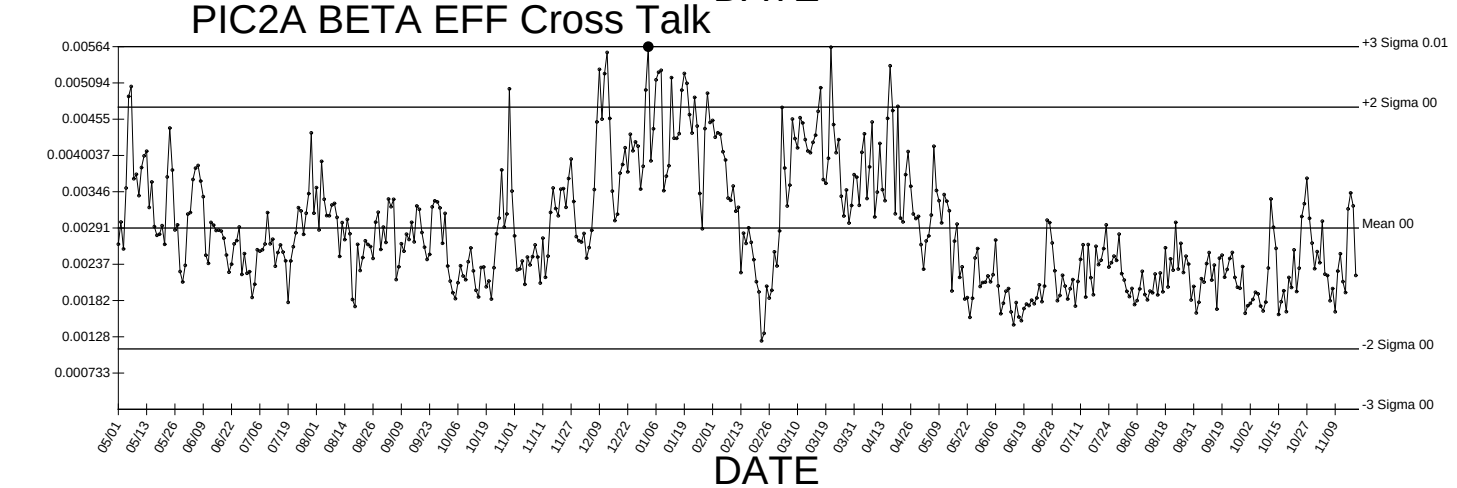
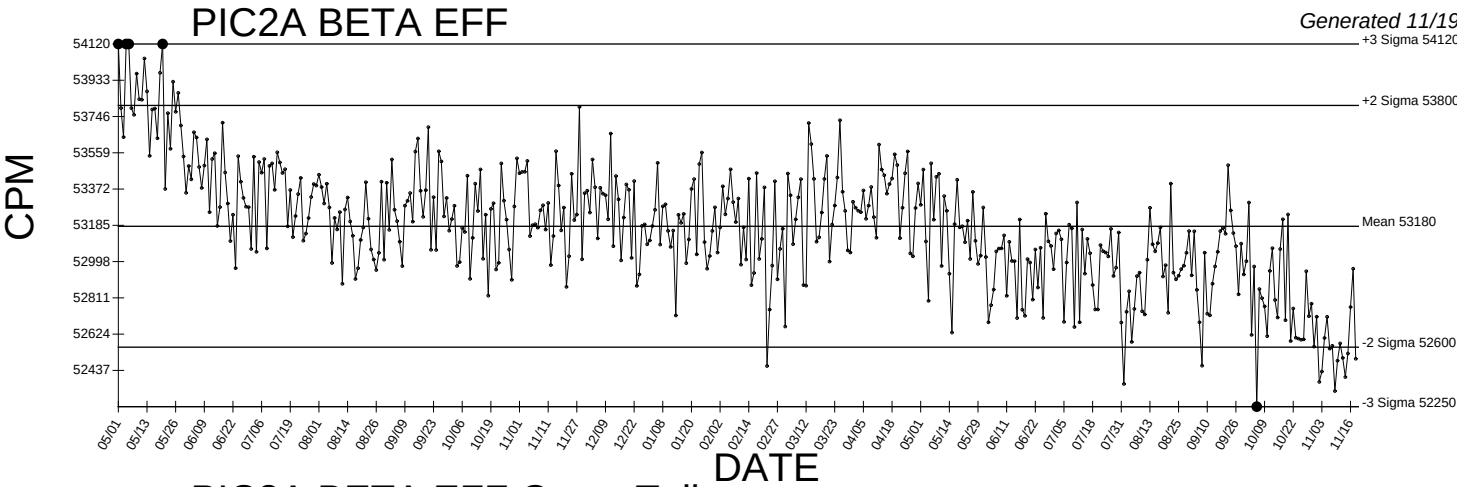


PIC1D BETA EFF Cross Talk

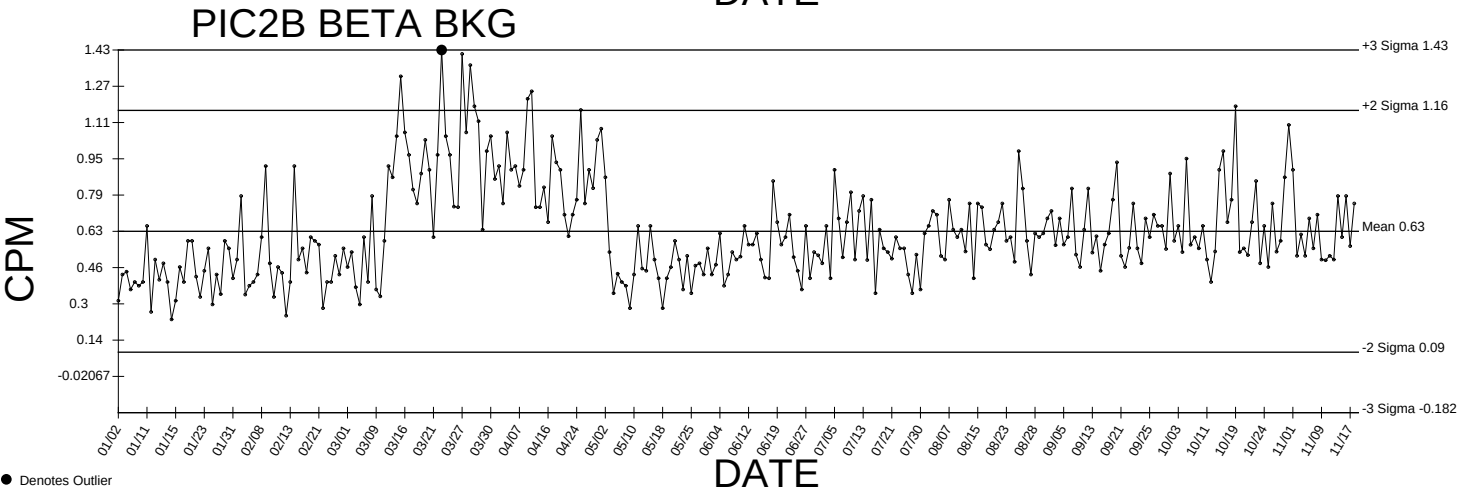
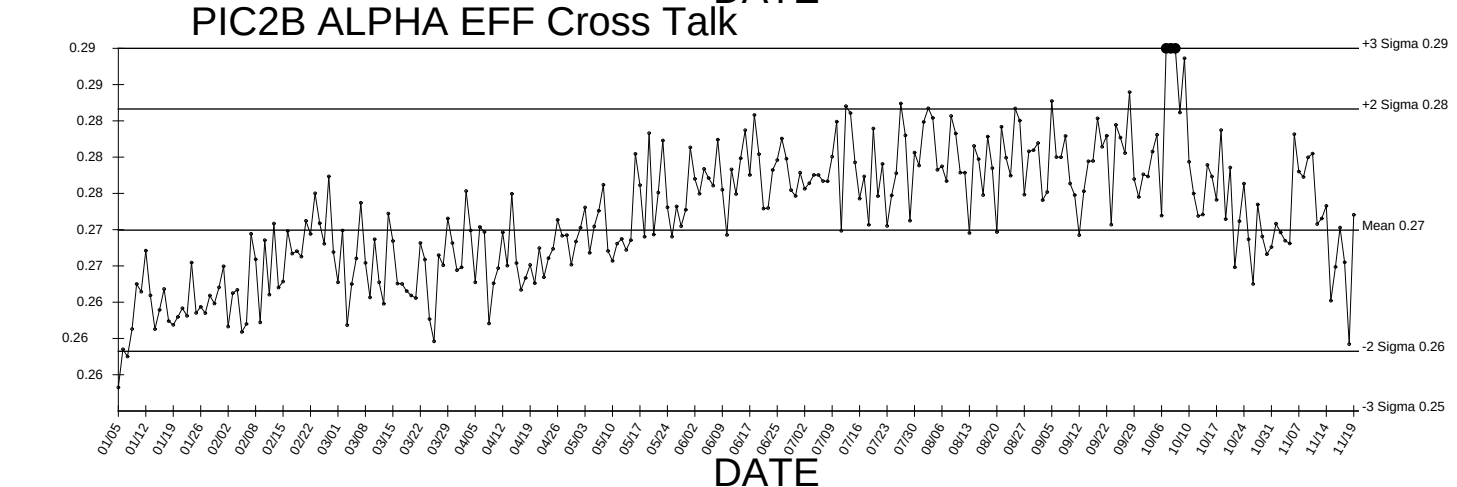
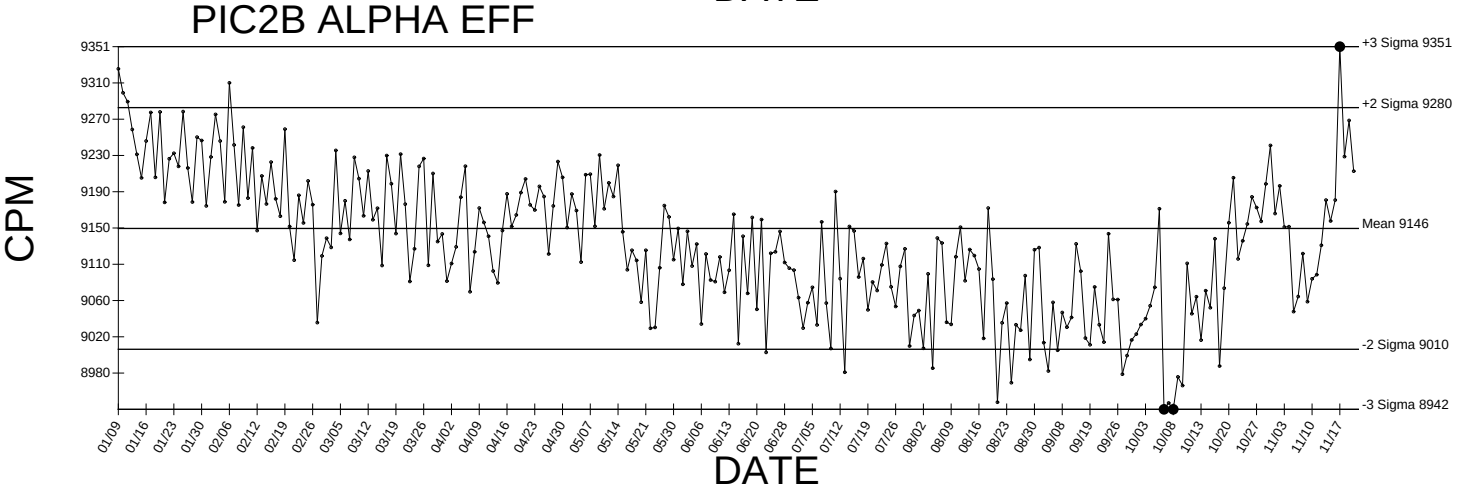
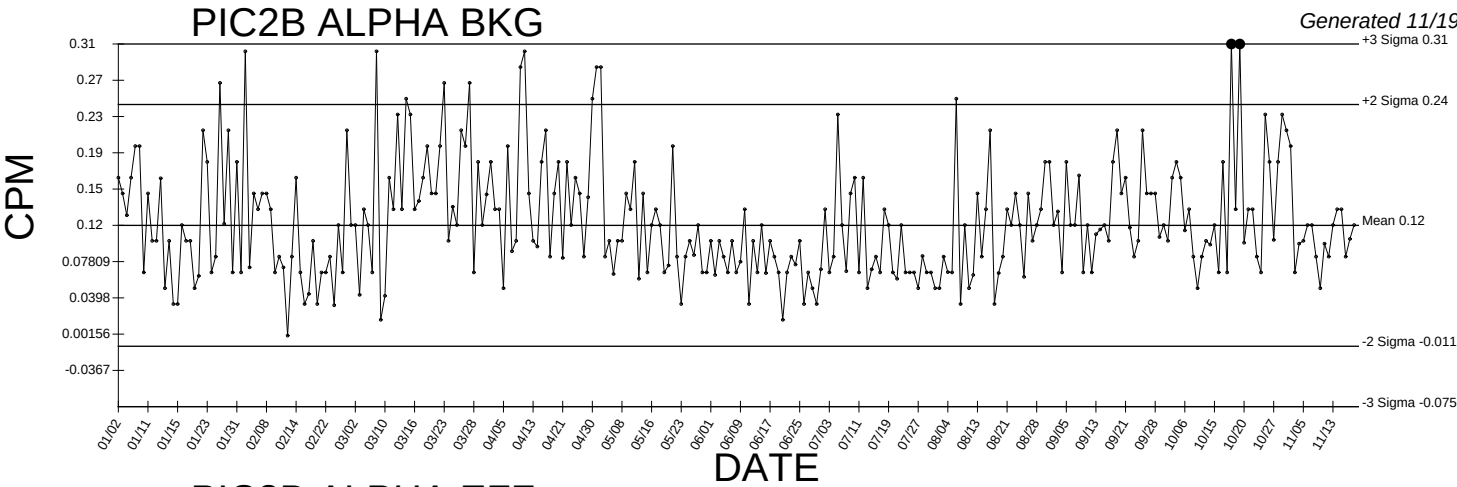


● Denotes Outlier

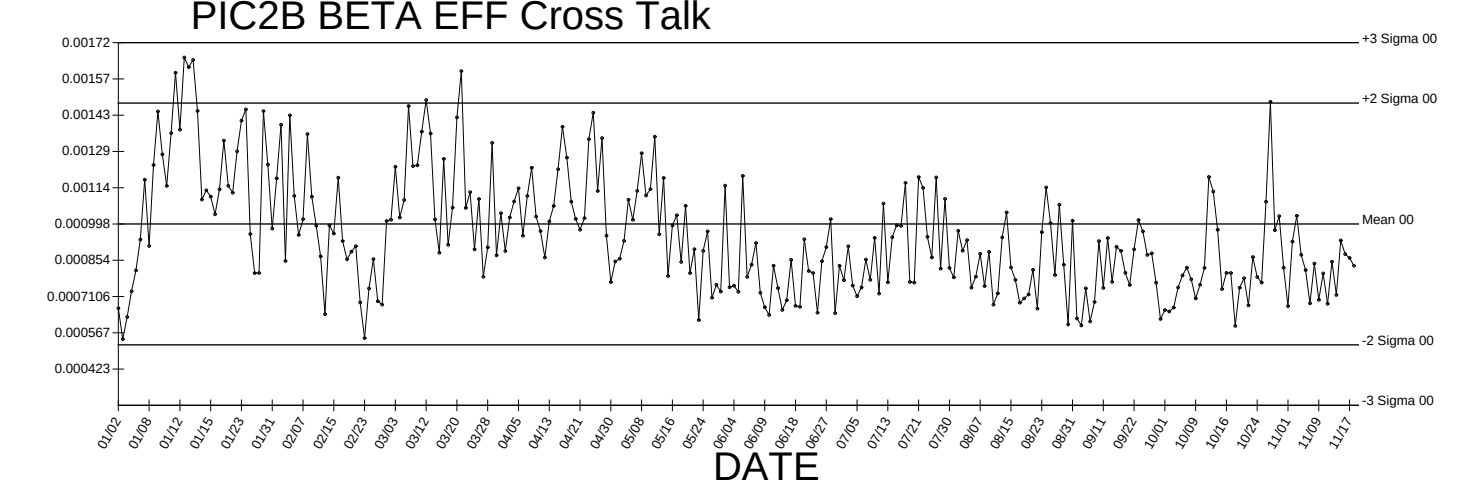
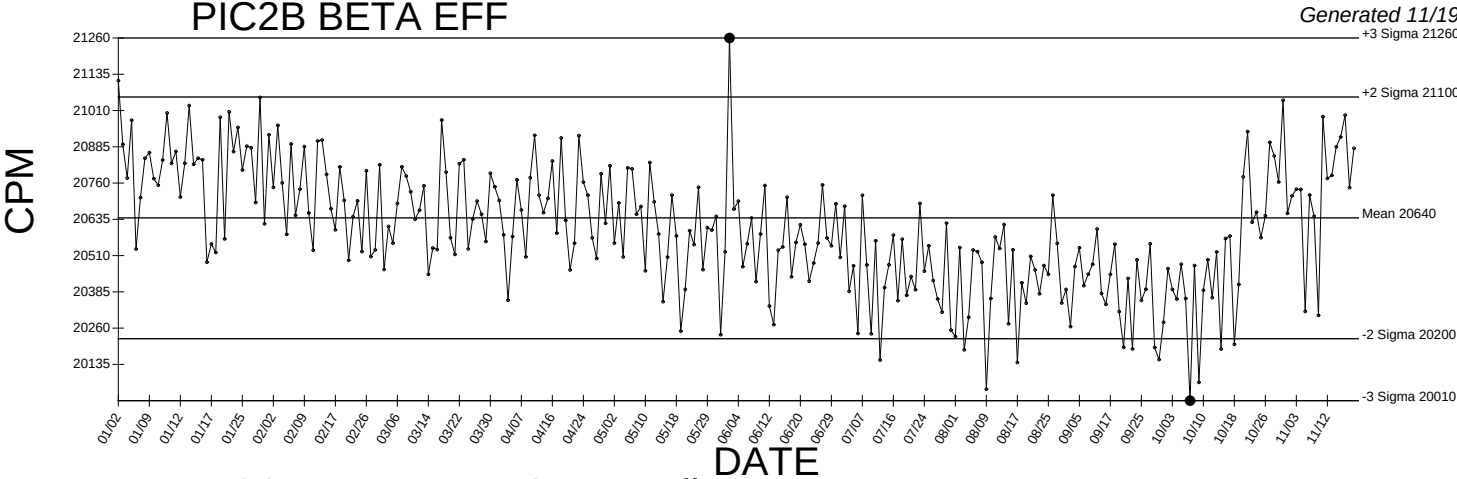




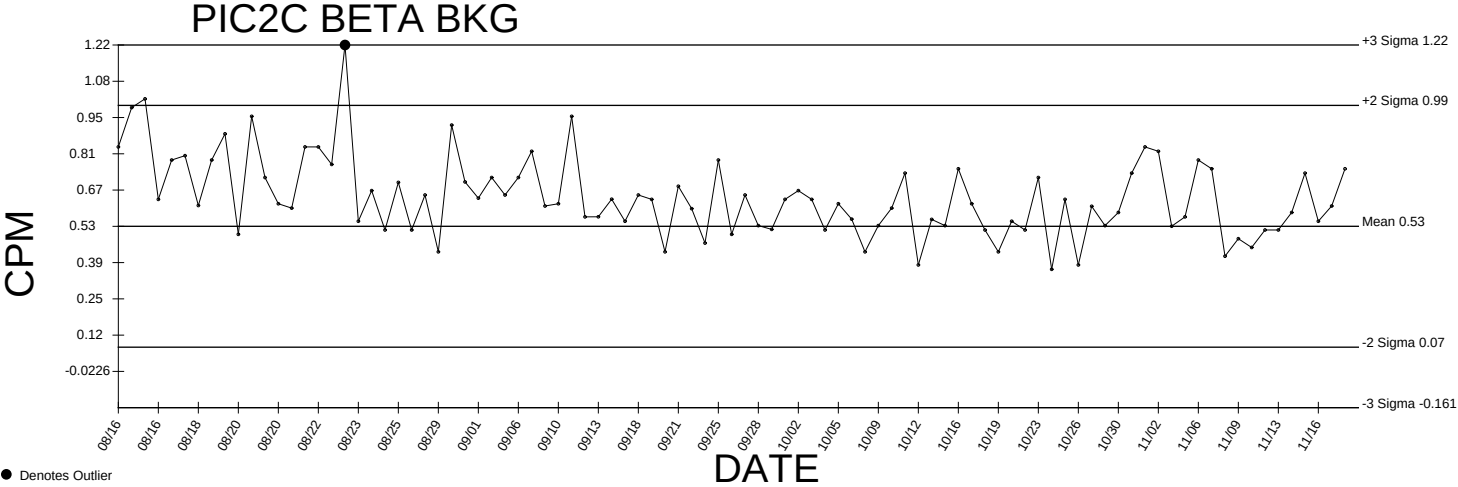
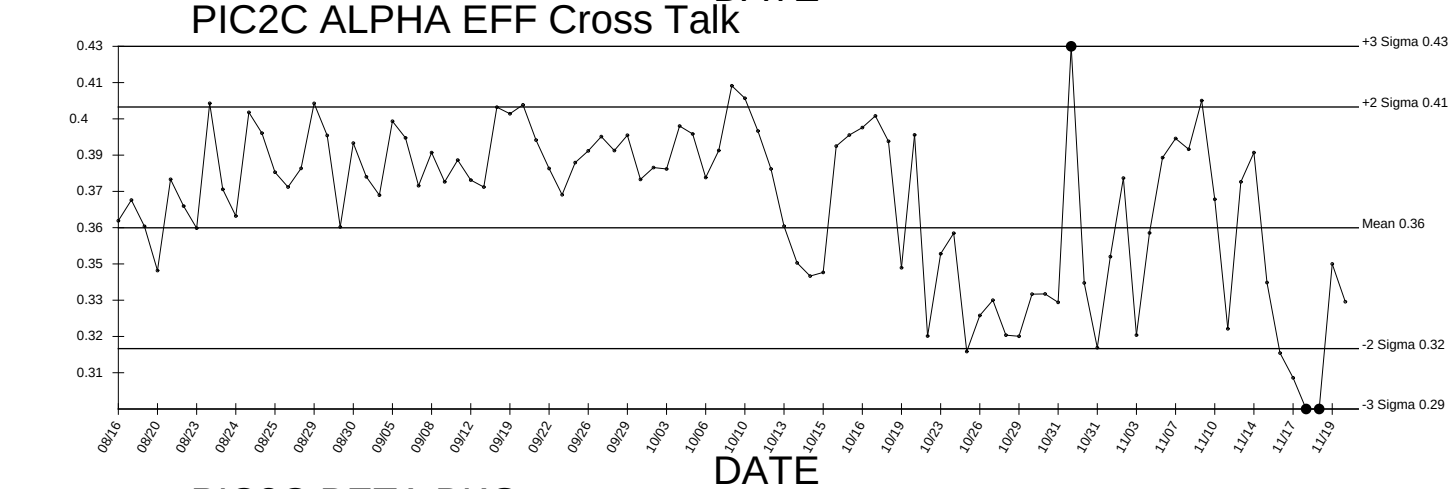
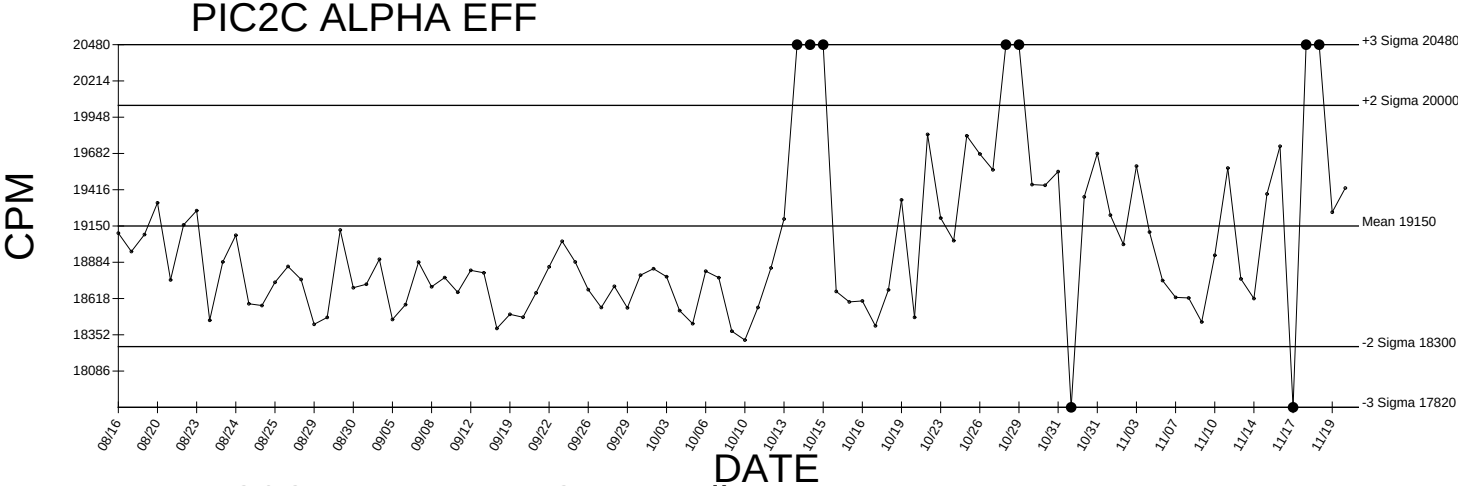
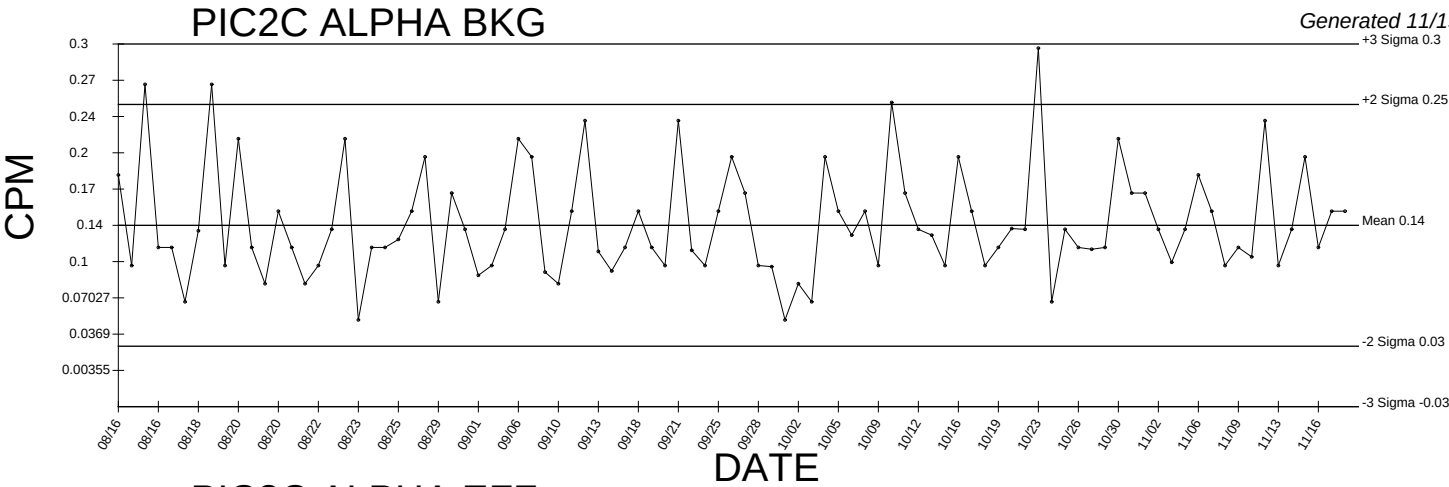
● Denotes Outlier



● Denotes Outlier



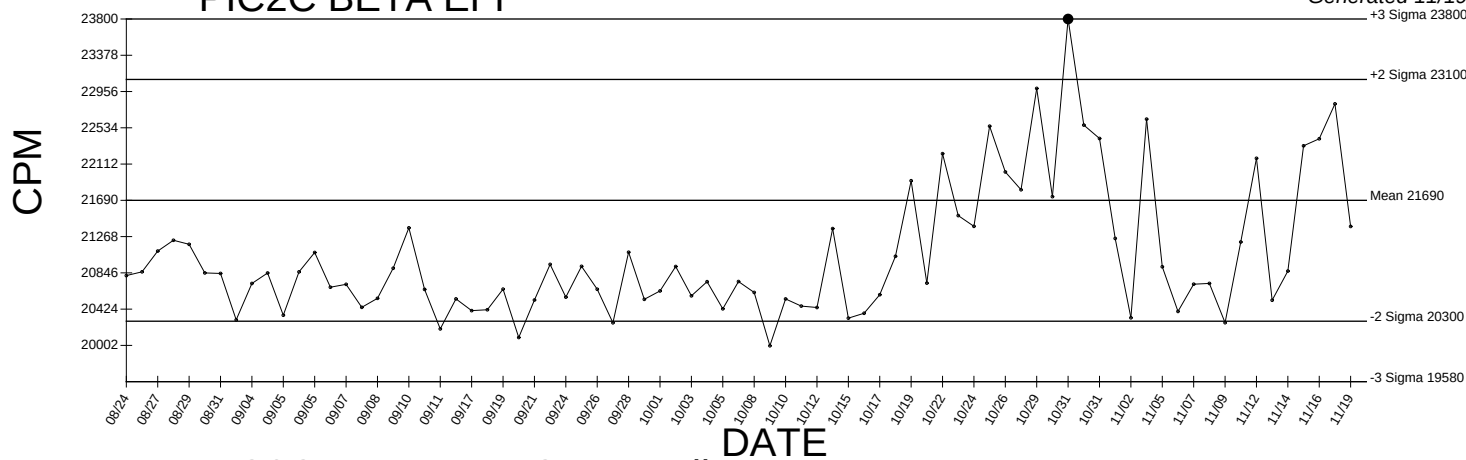
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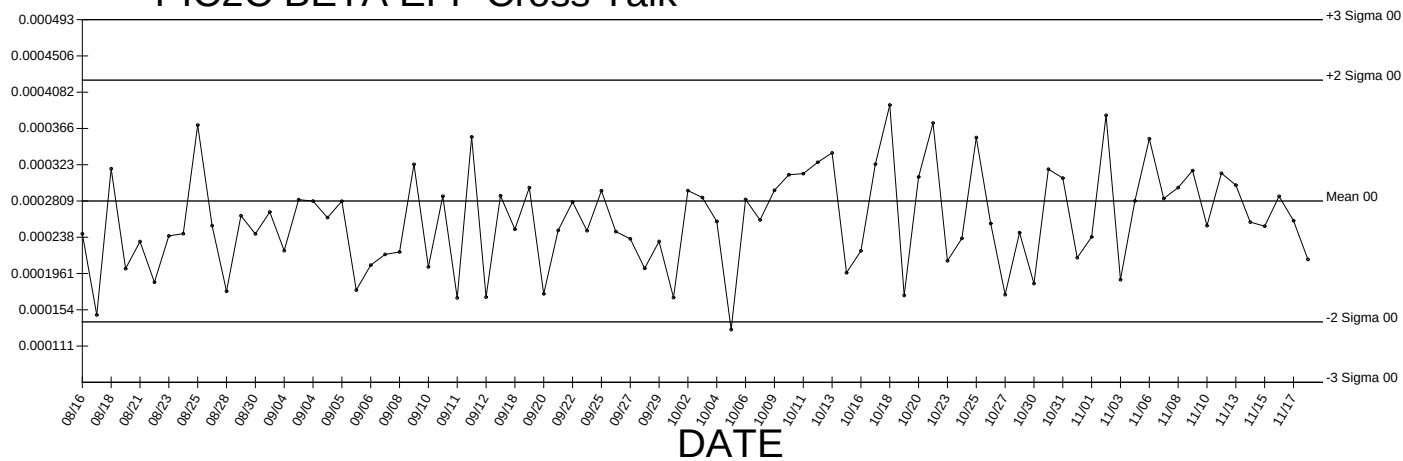
● Denotes Outlier

PIC2C BETA EFF

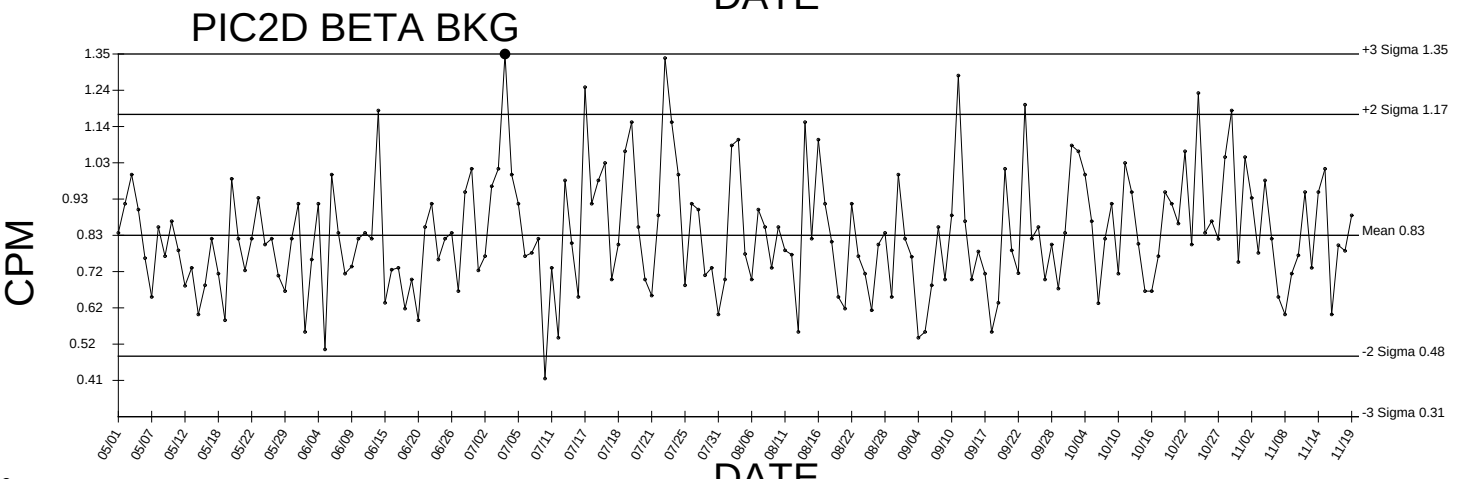
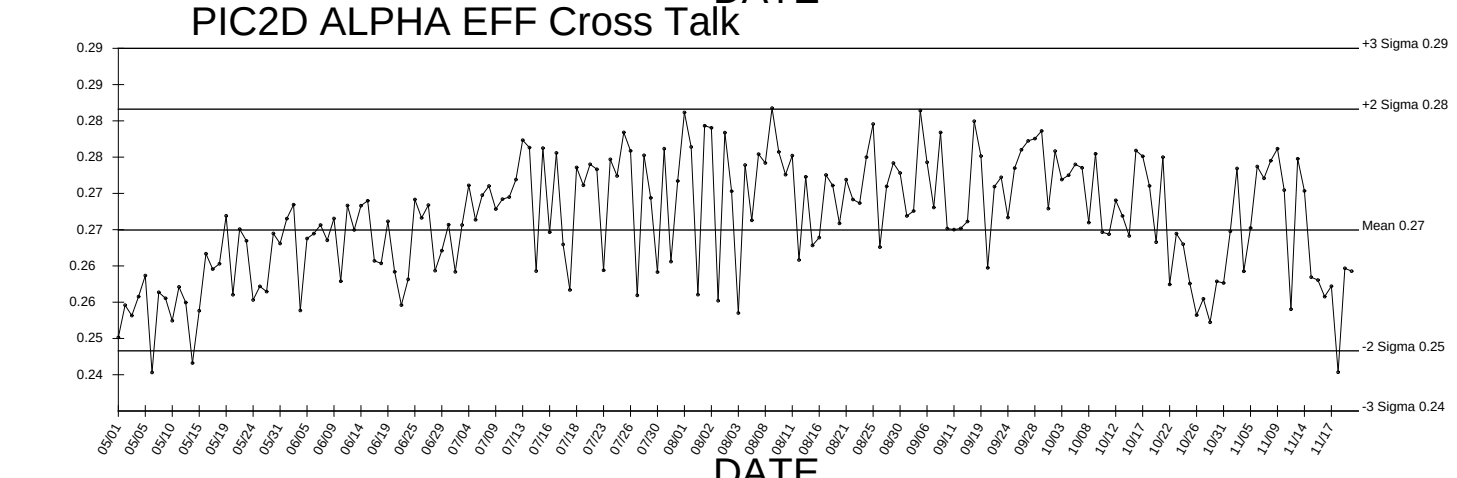
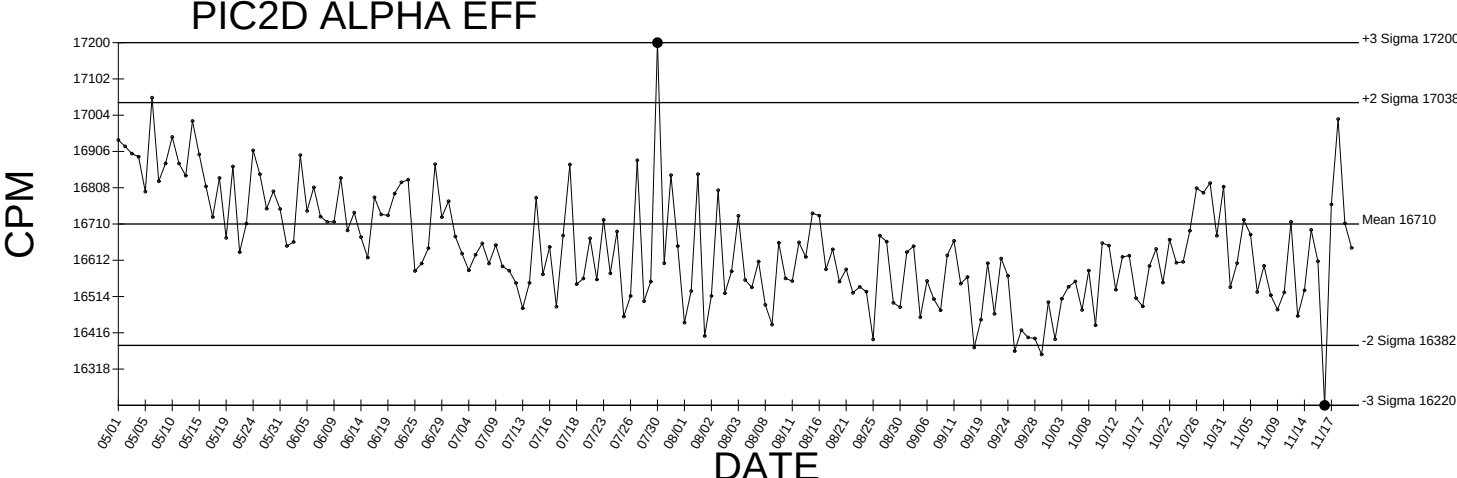
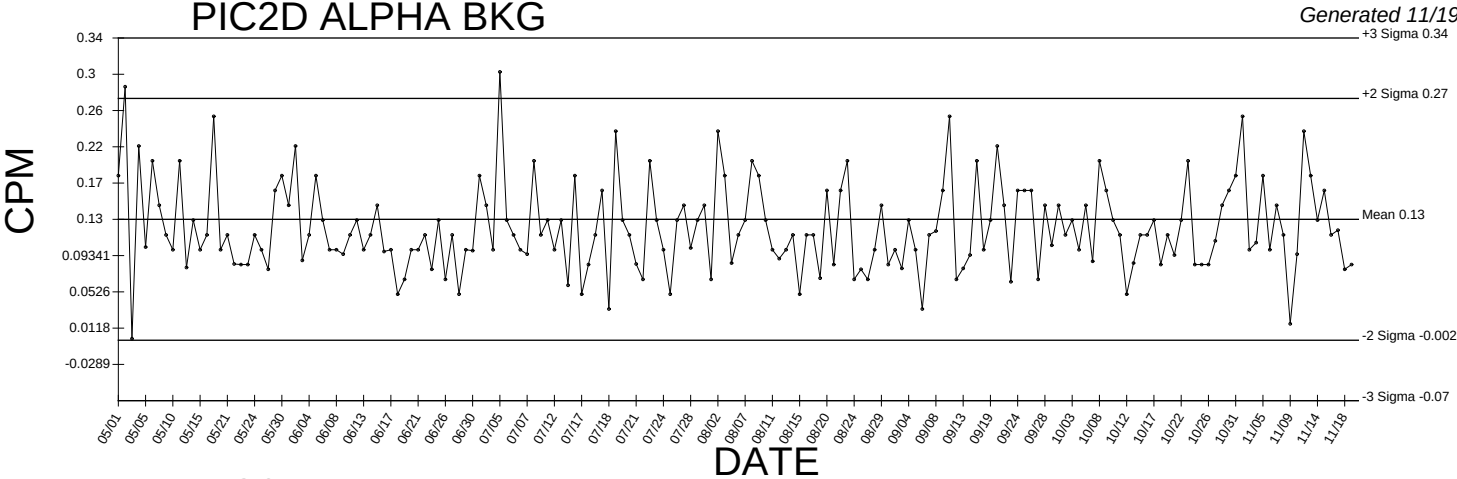
Generated 11/19/2018



PIC2C BETA EFF Cross Talk



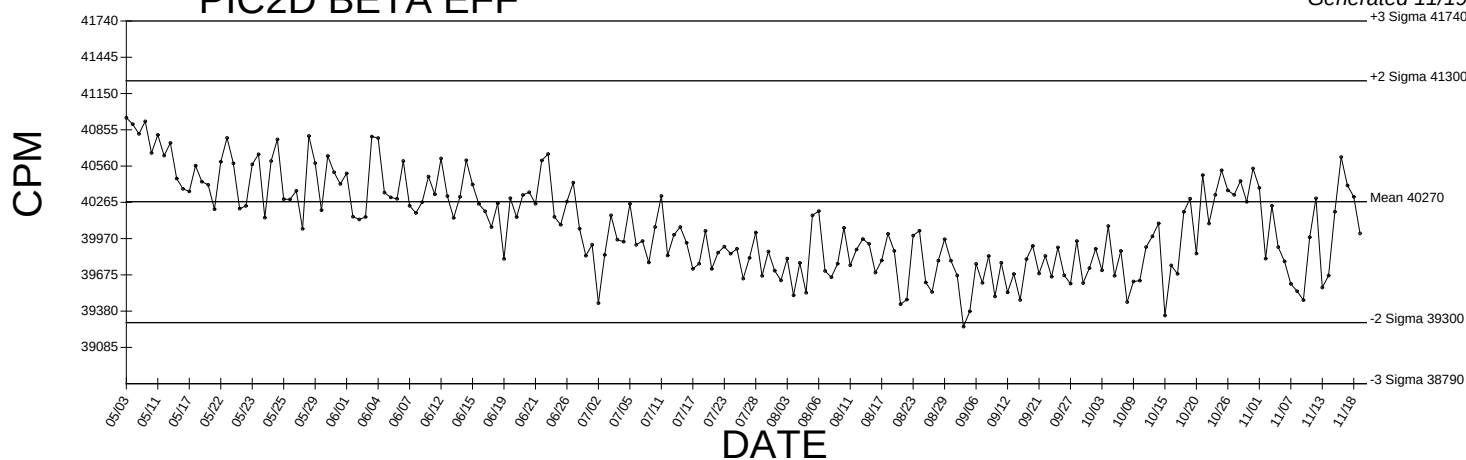
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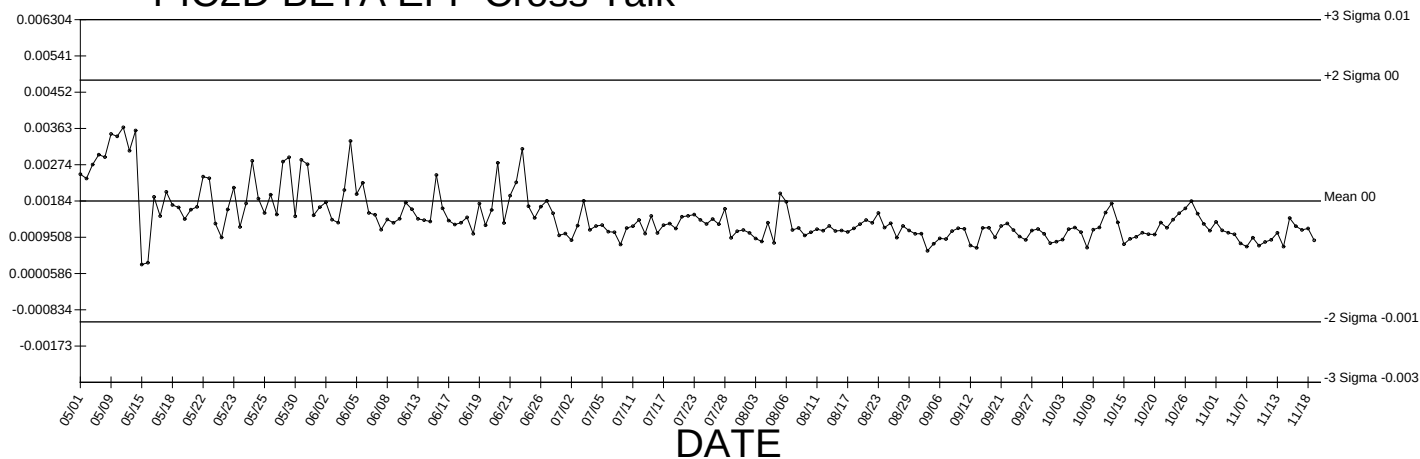
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PIC2D BETA EFF

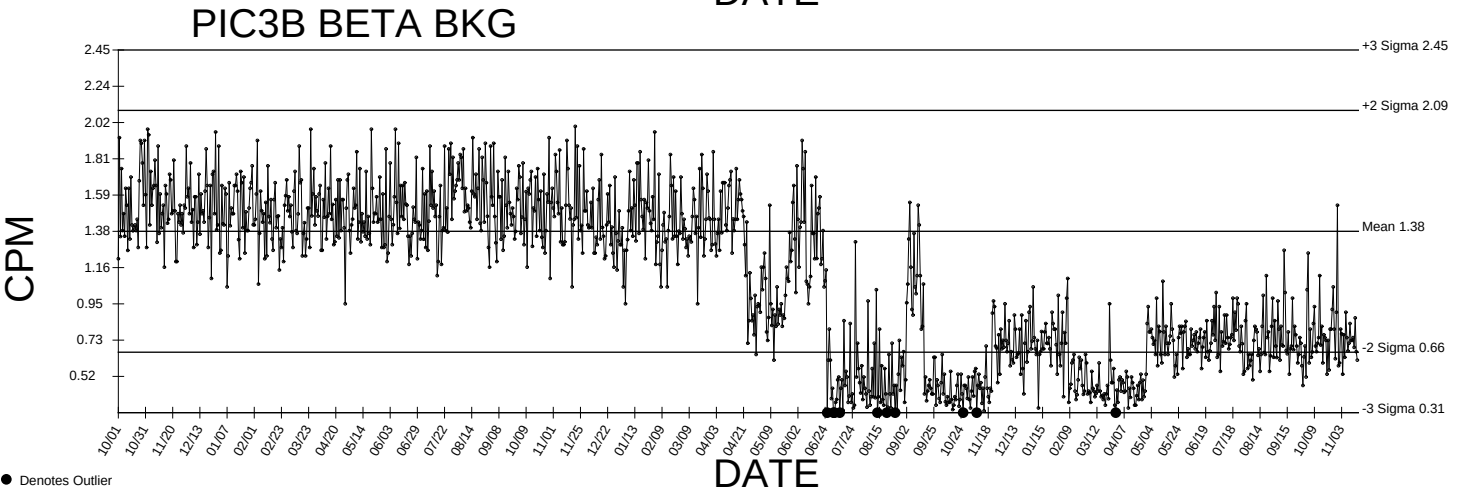
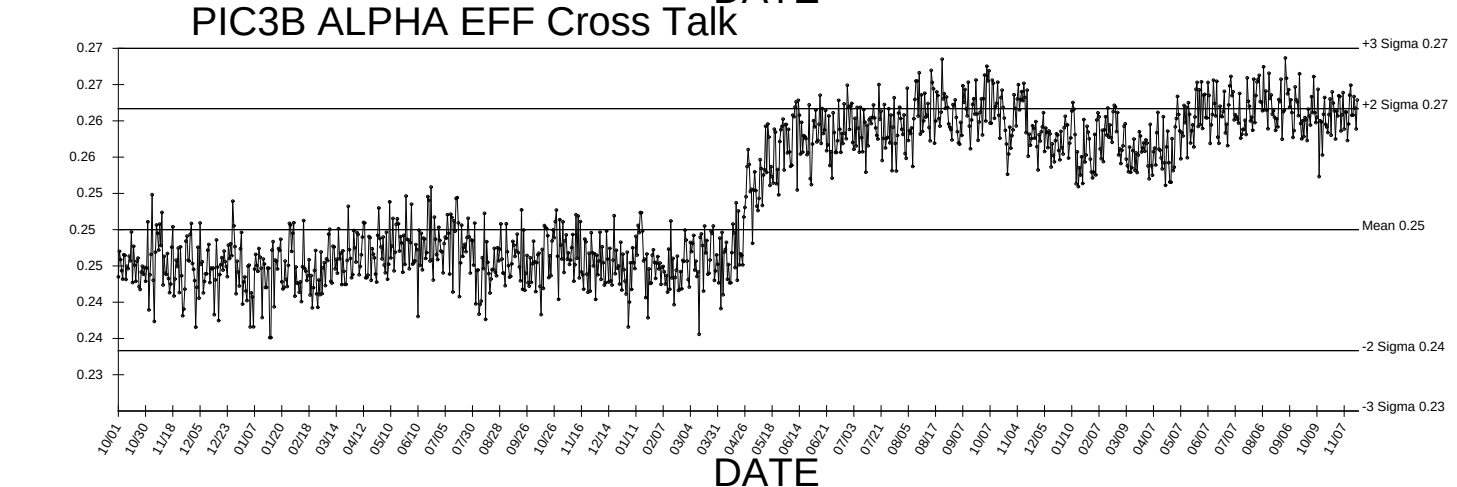
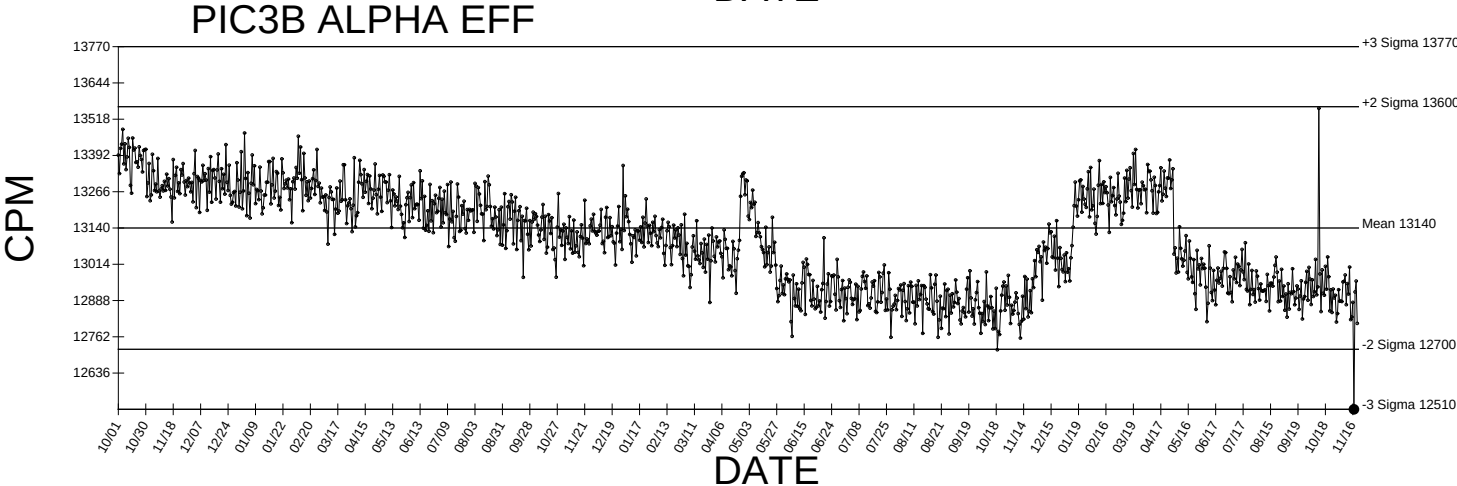
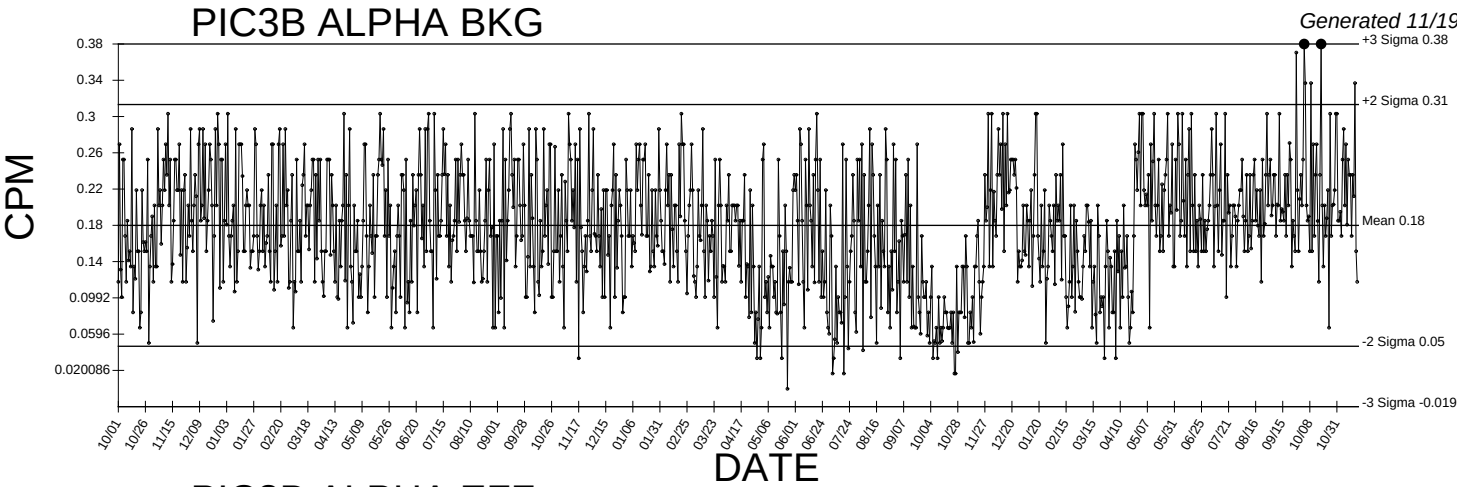
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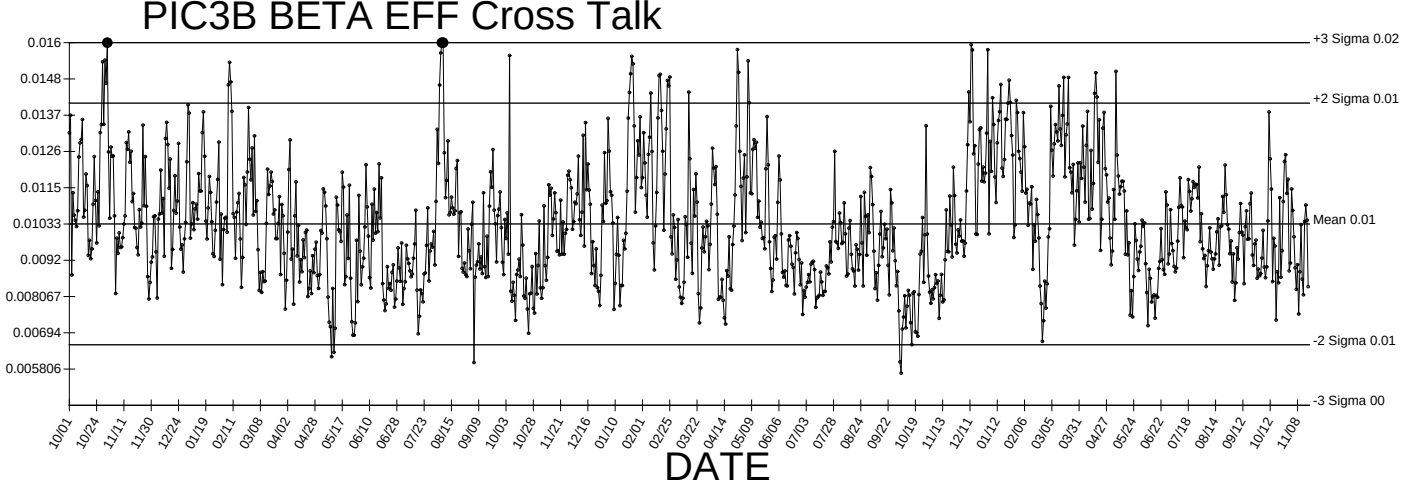
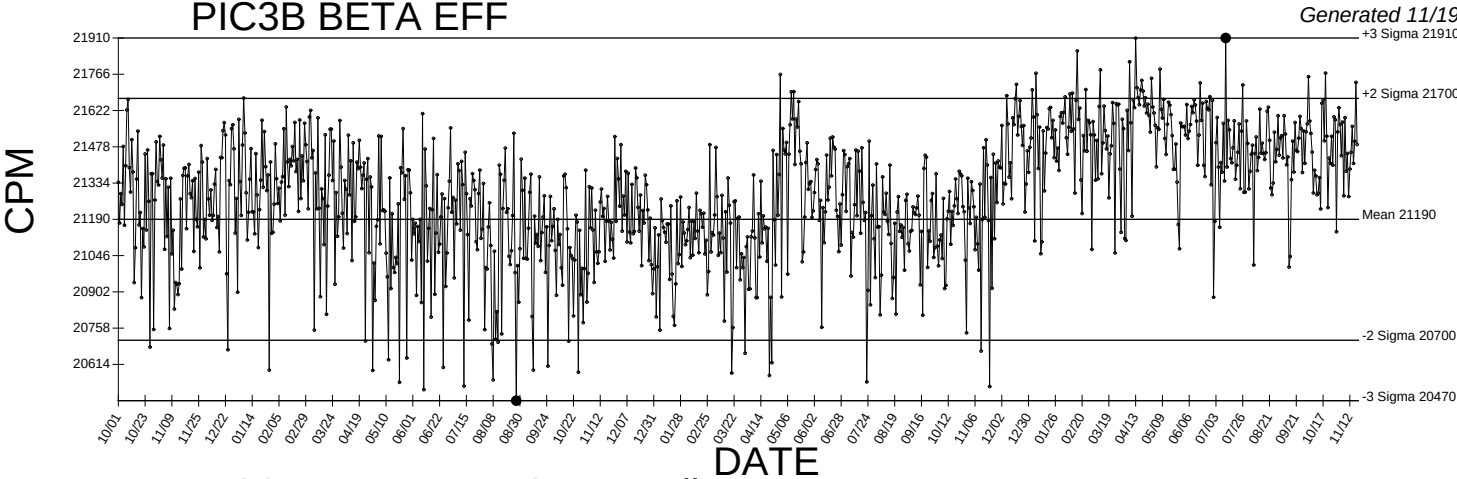
PIC2D BETA EFF Cross Talk



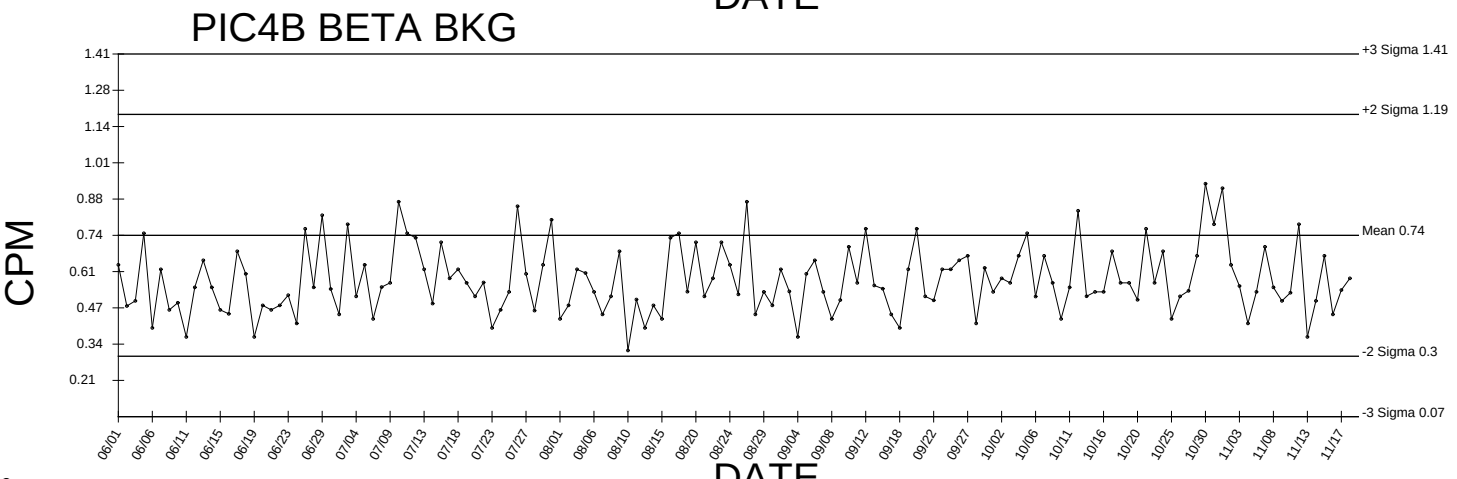
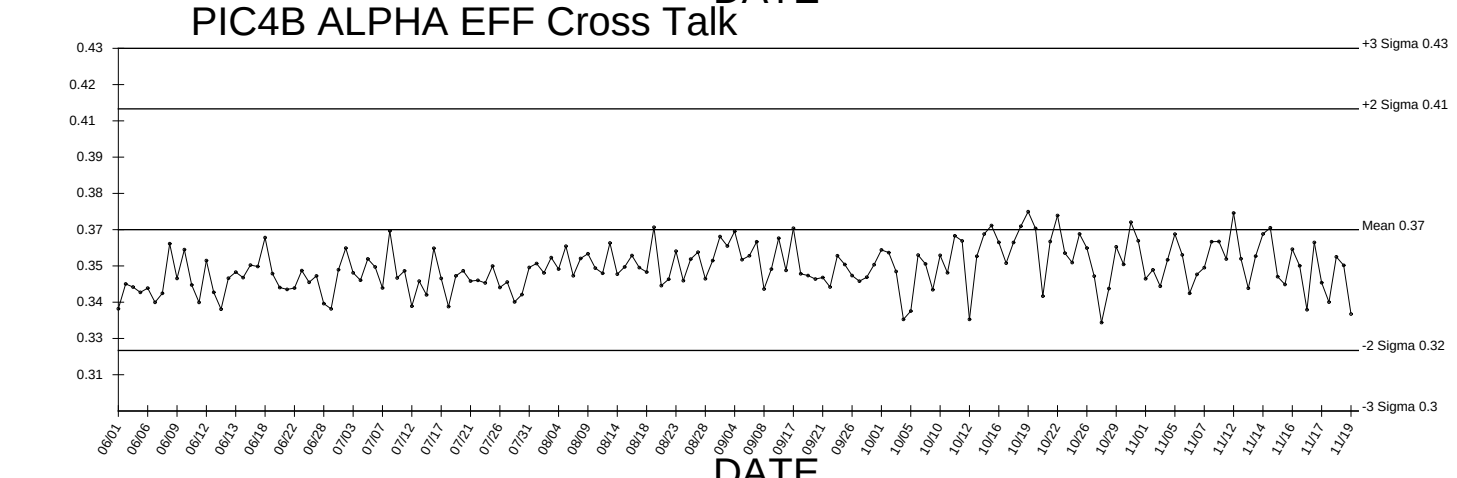
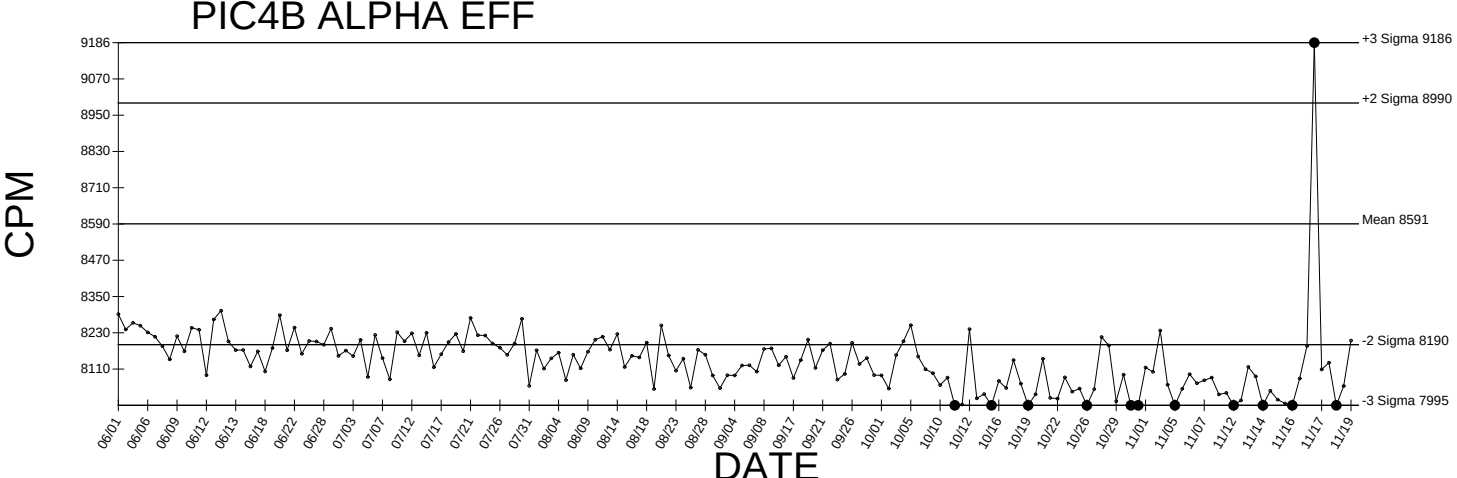
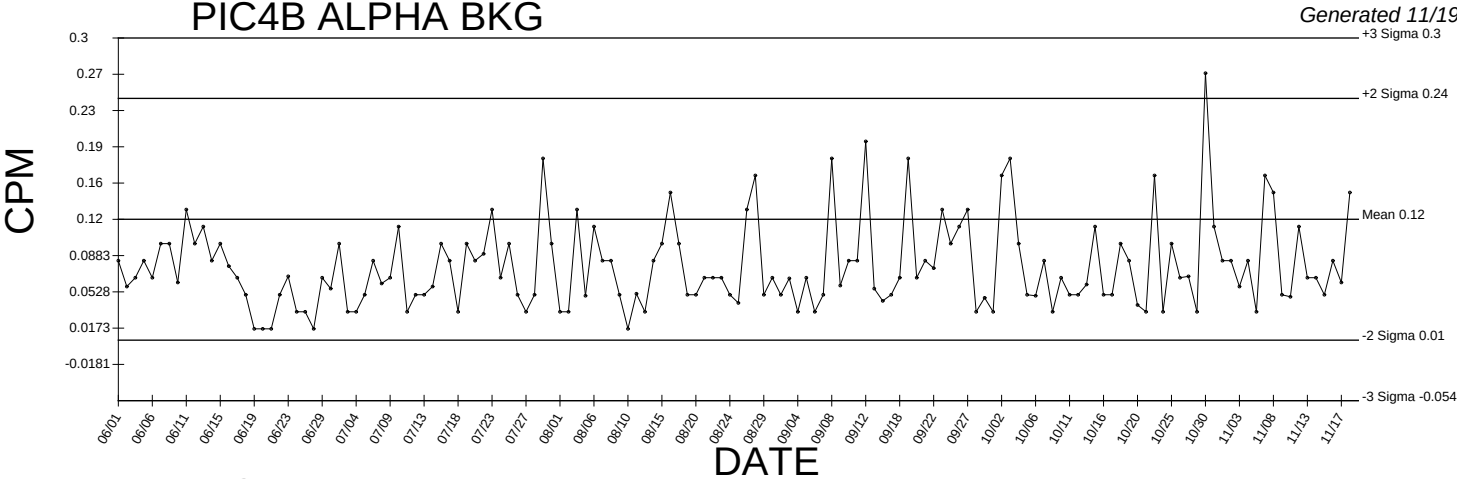
● Denotes Outlier



● Denotes Outlier



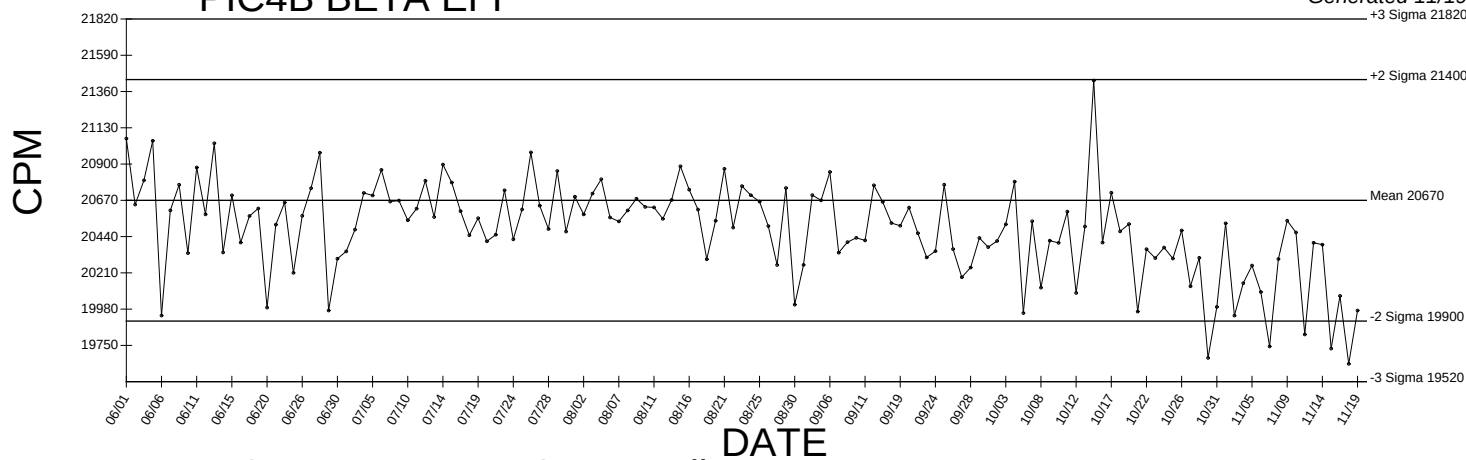
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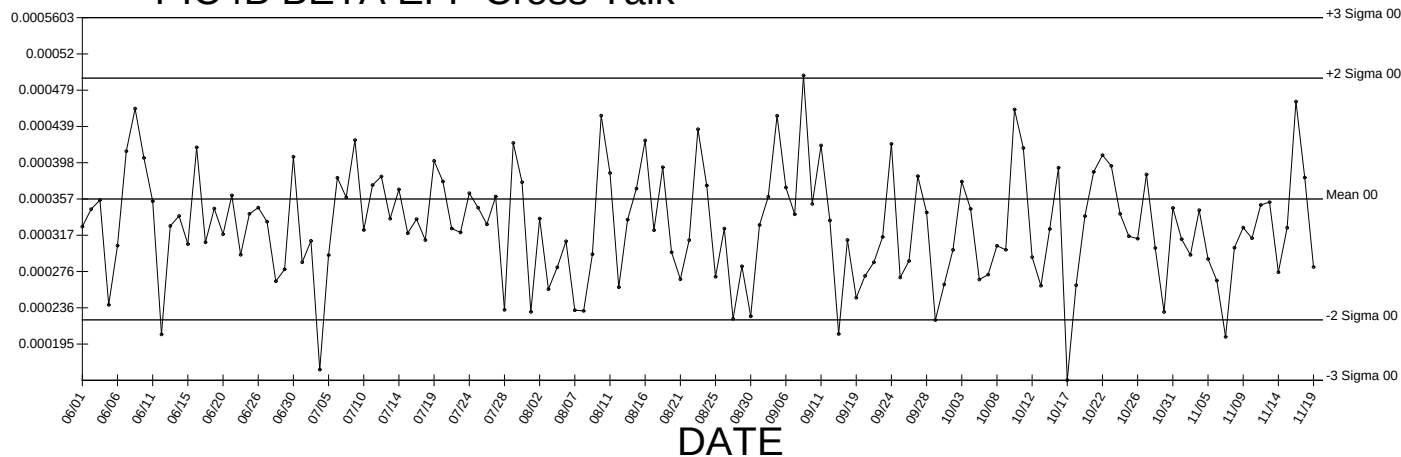
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PIC4B BETA EFF

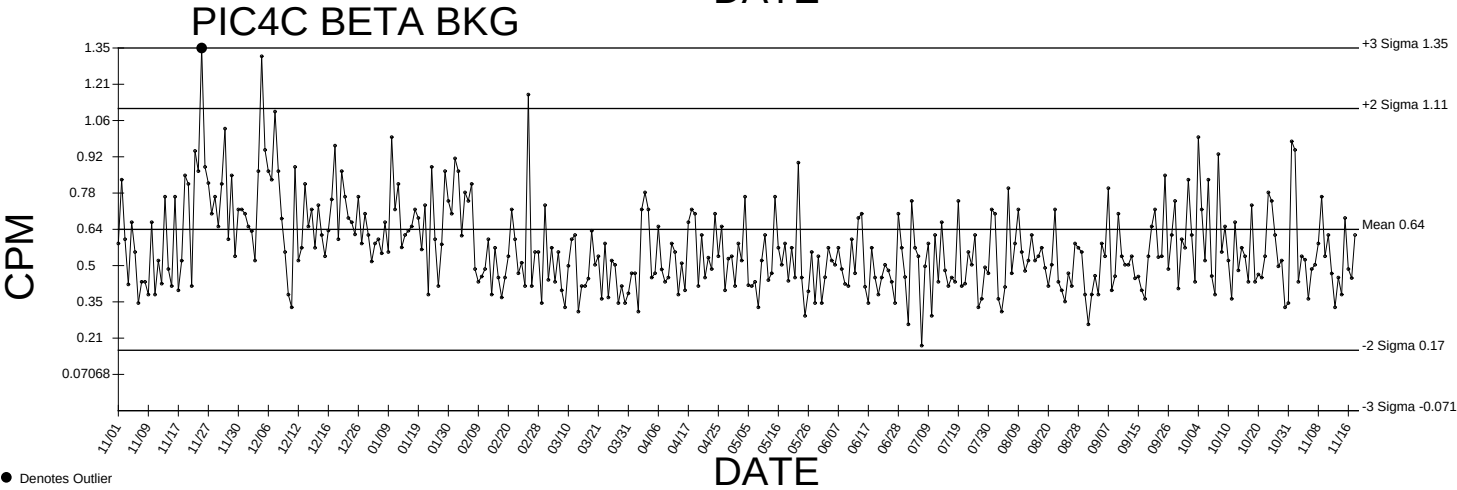
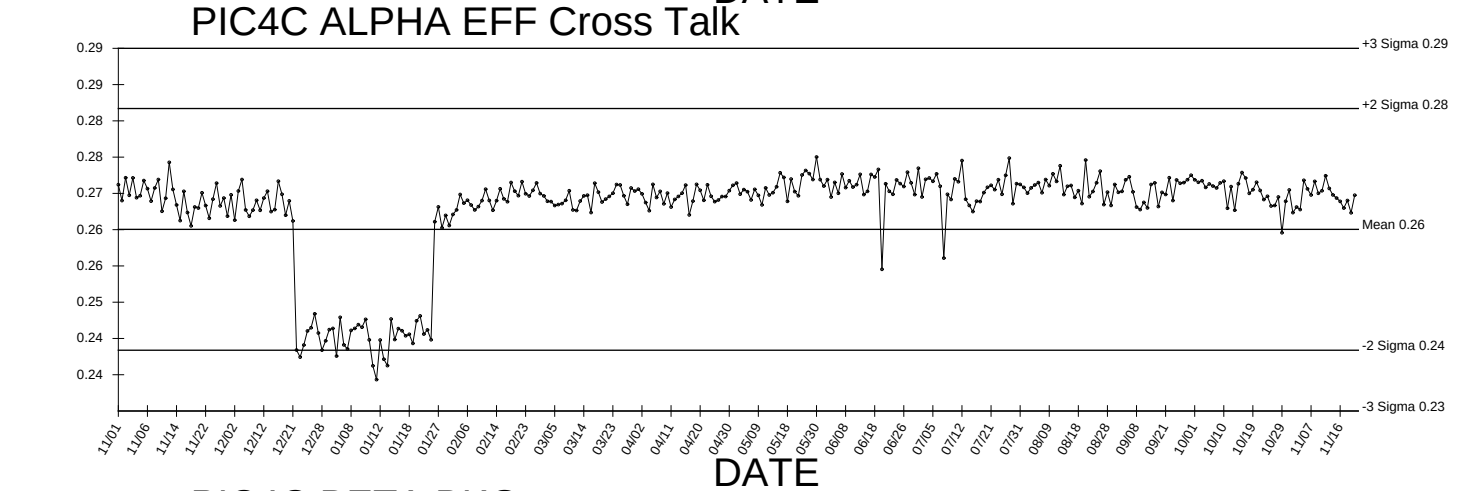
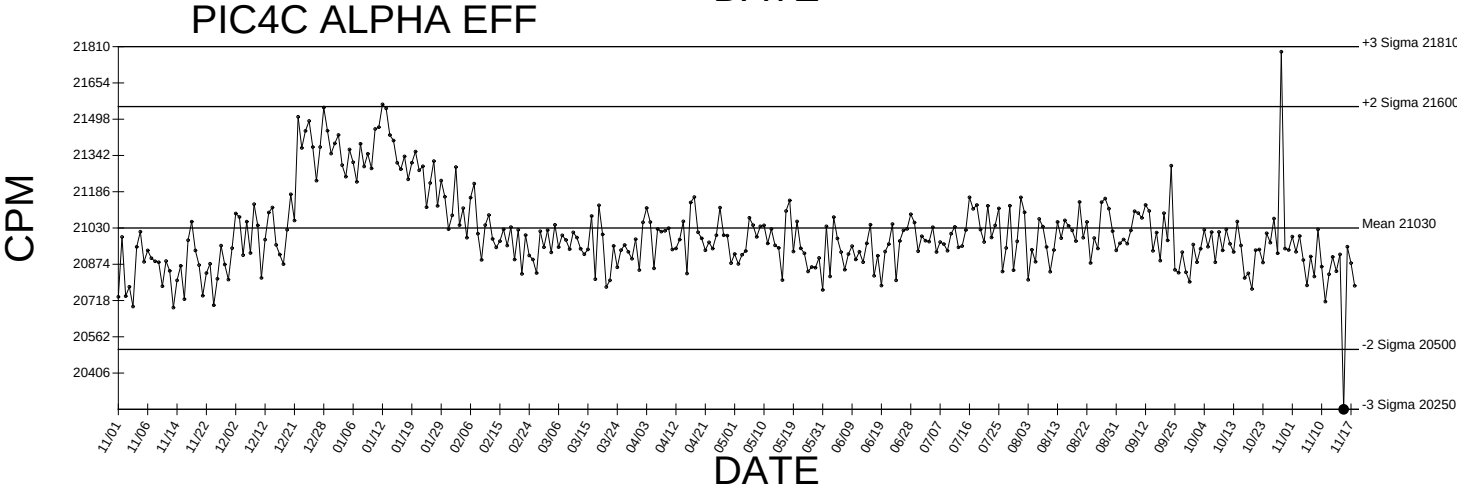
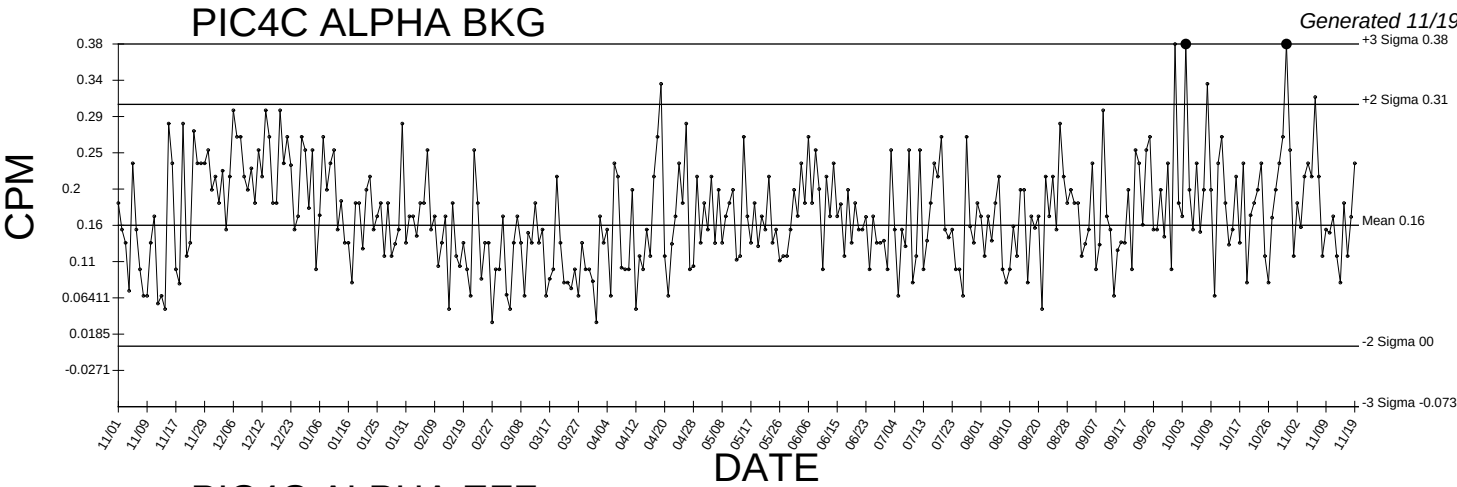
Generated 11/19/2018



PIC4B BETA EFF Cross Talk



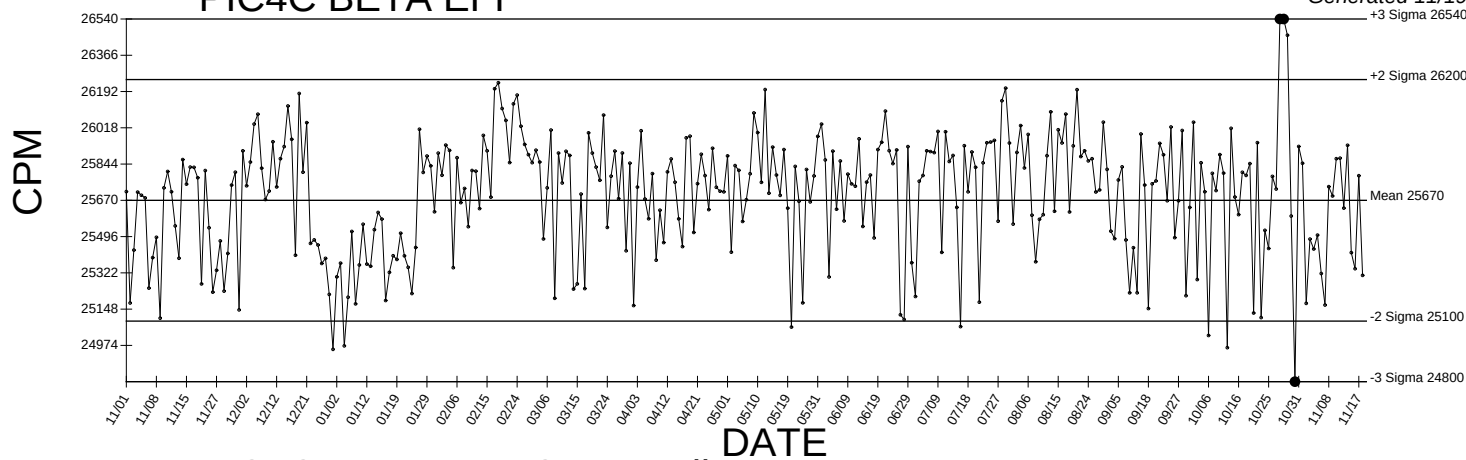
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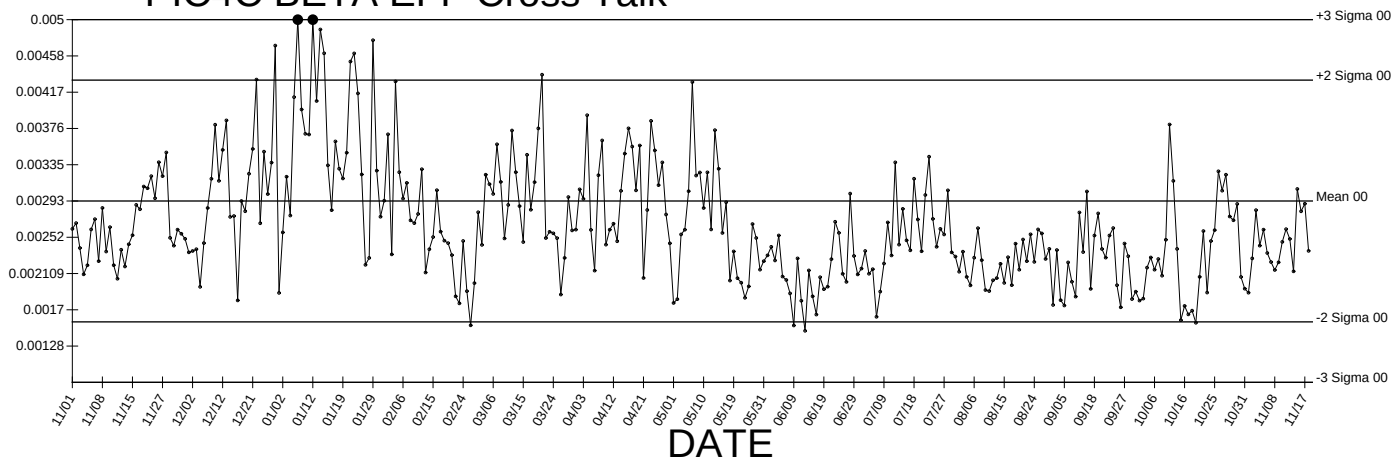
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PIC4C BETA EFF

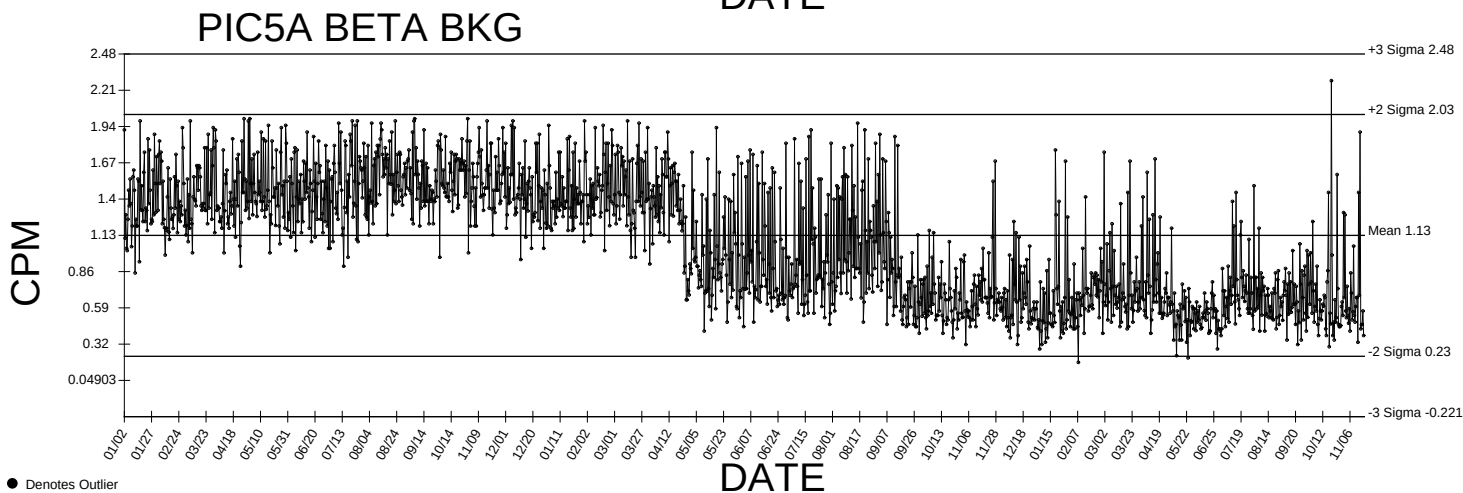
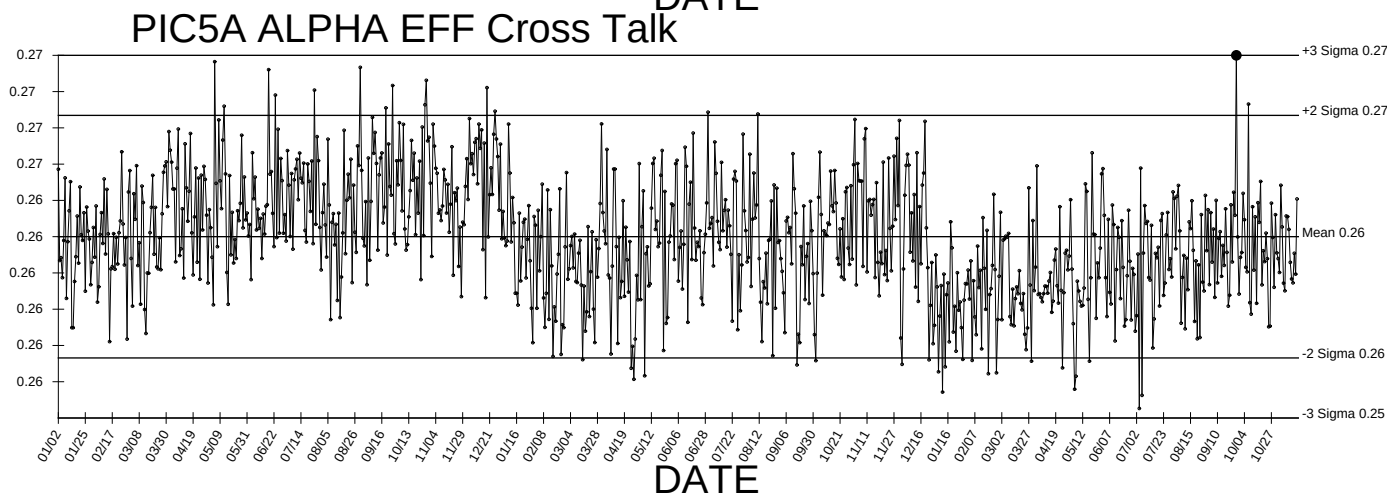
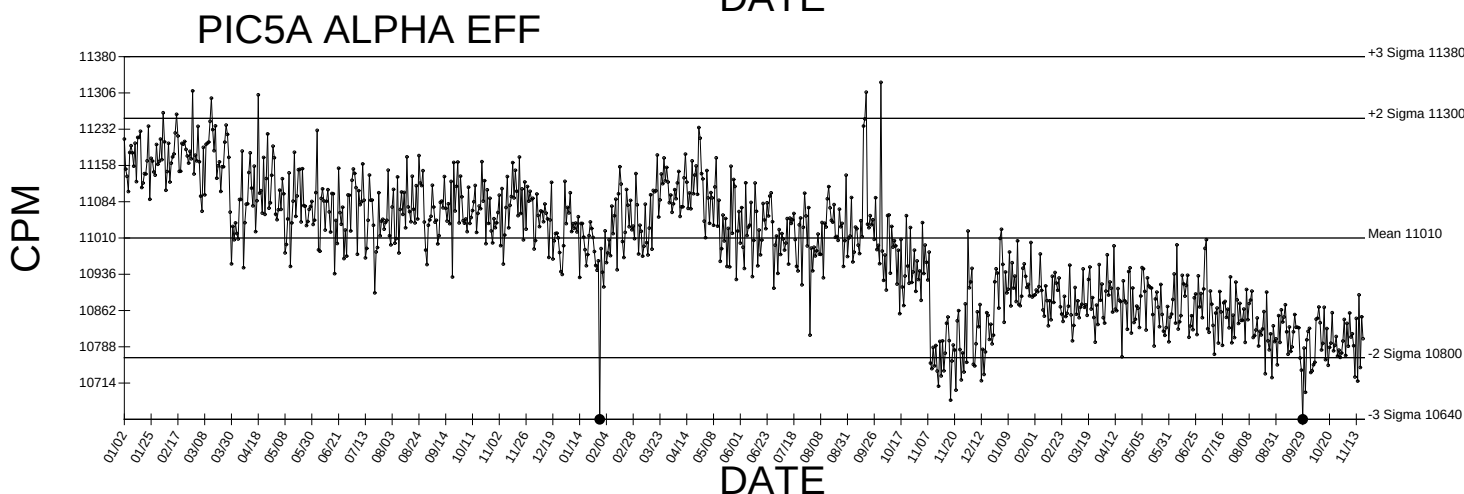
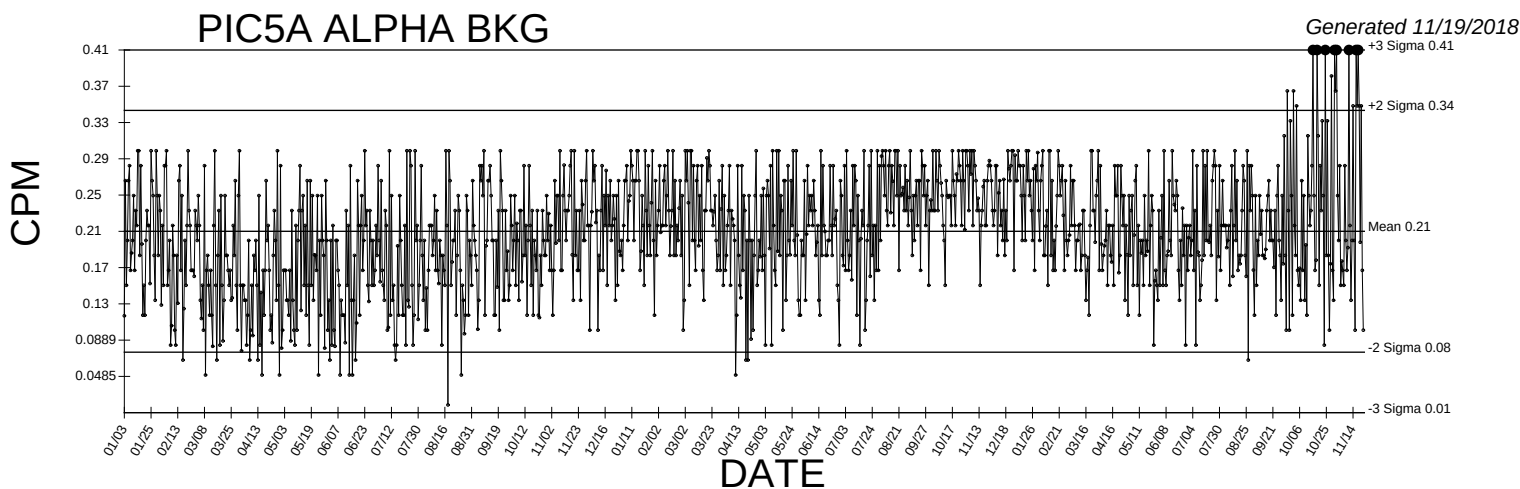
Generated 11/19/2018



PIC4C BETA EFF Cross Talk



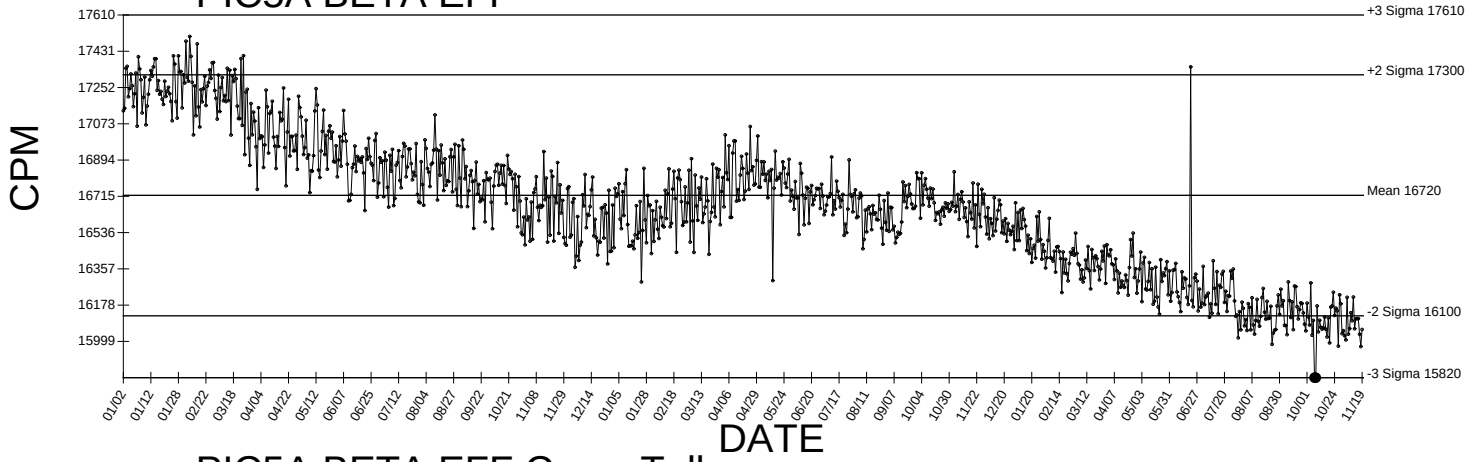
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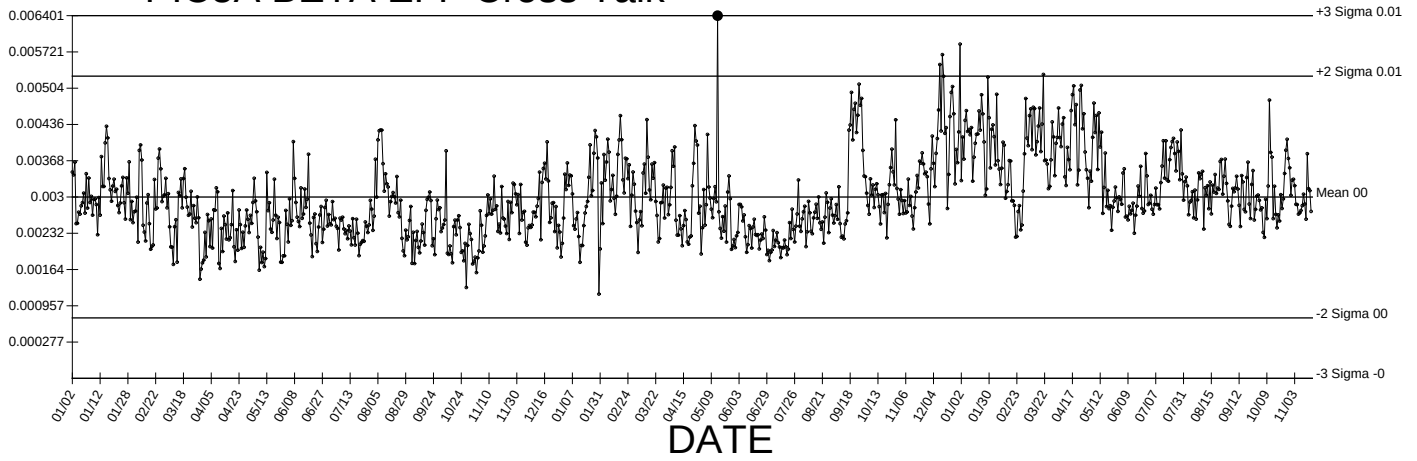
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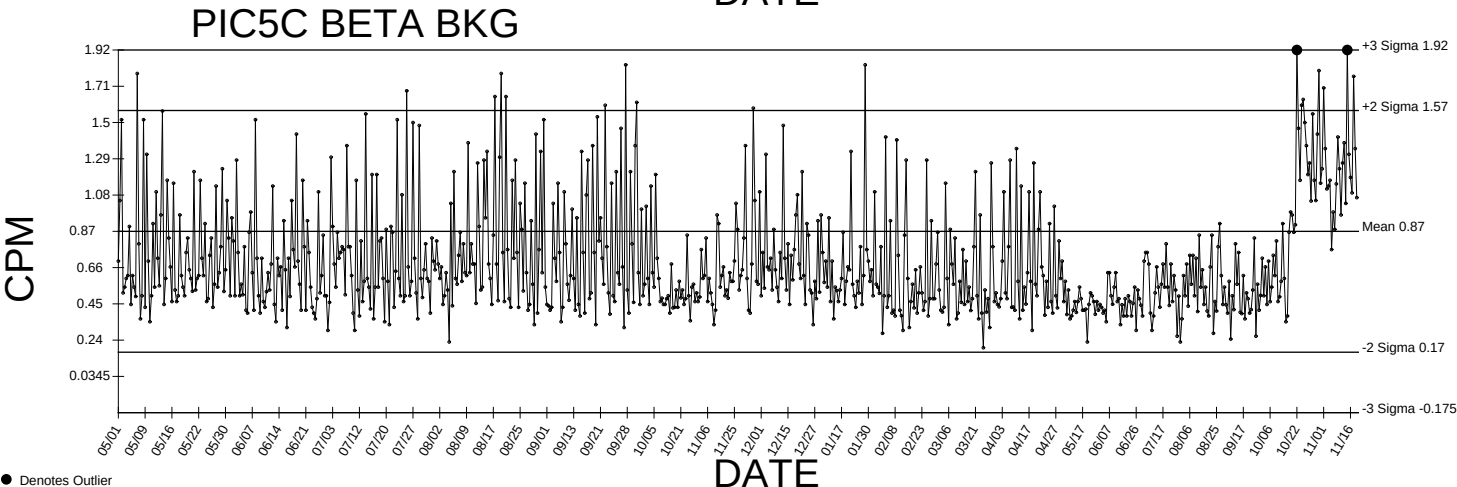
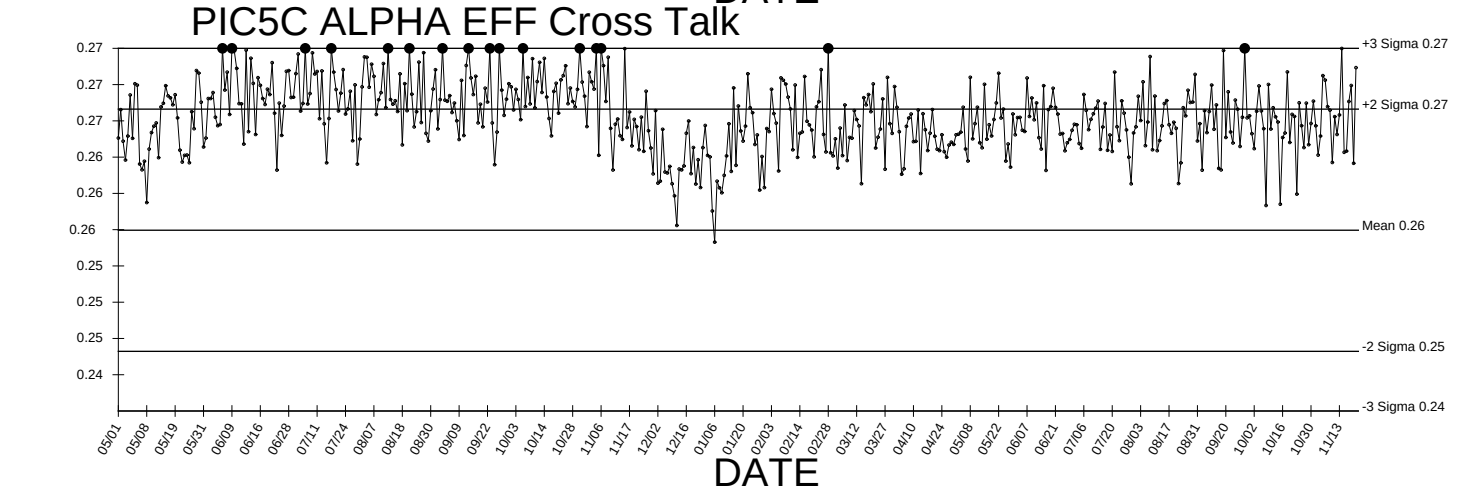
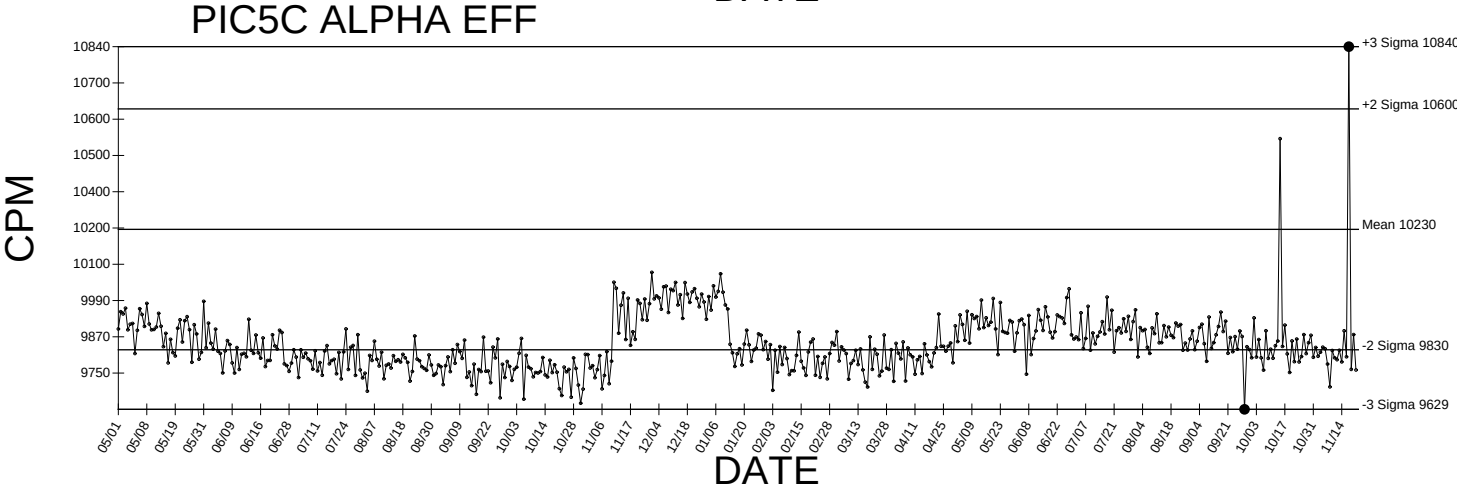
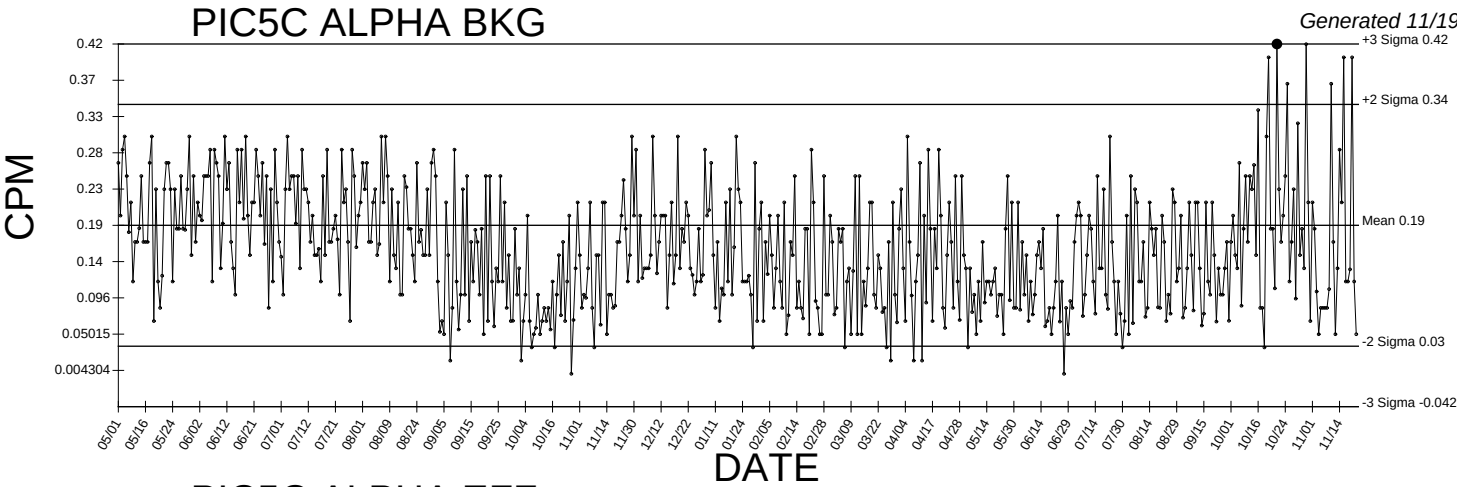
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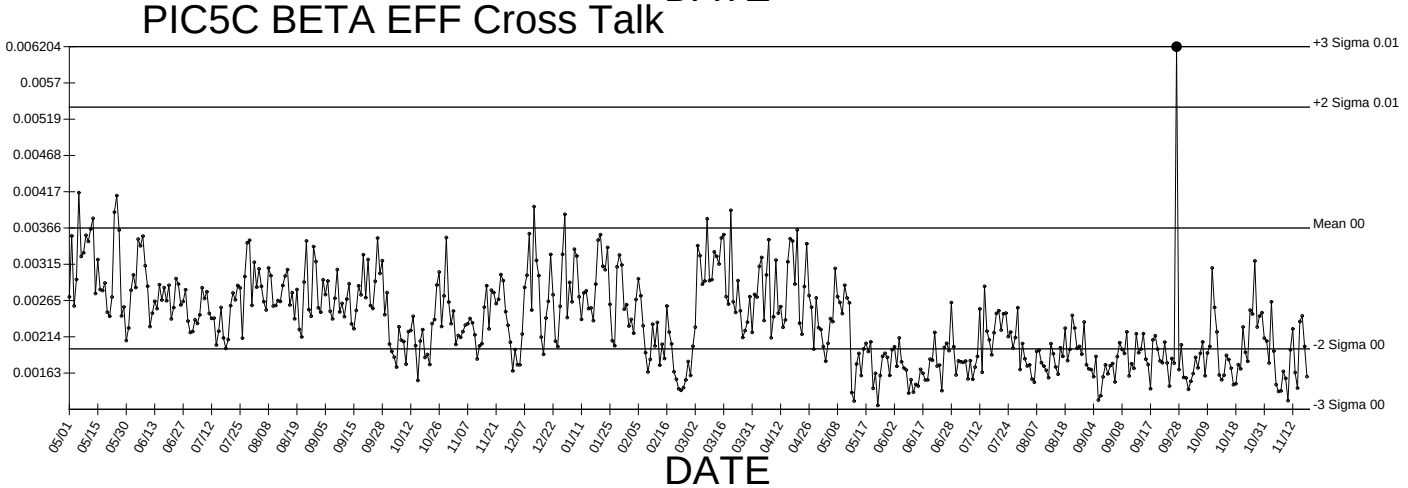
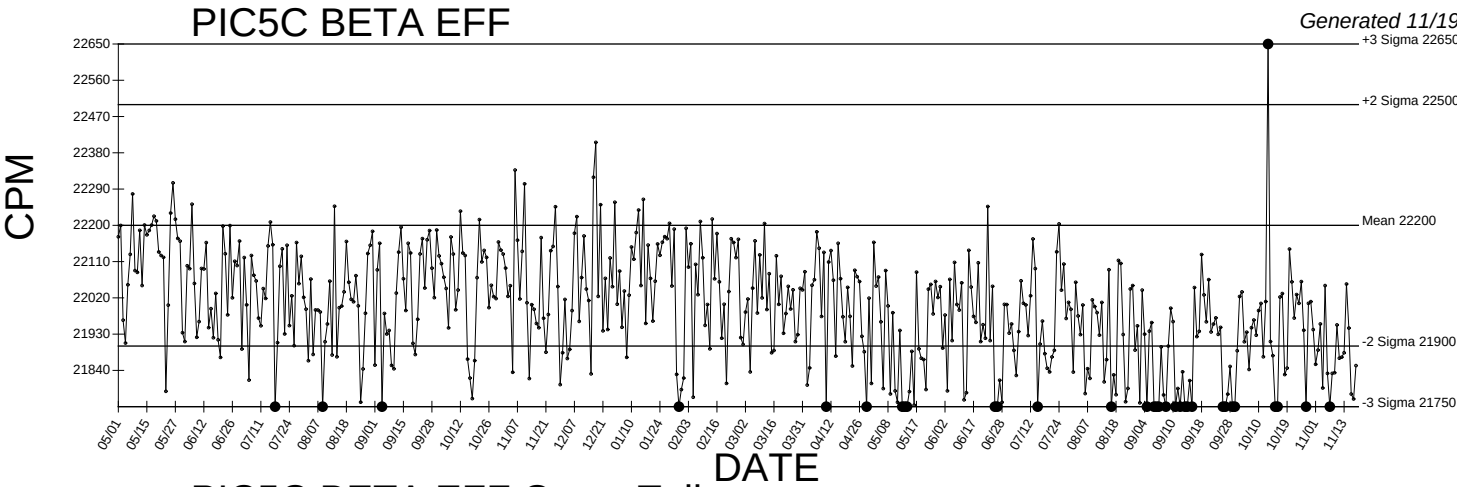
PIC5A BETA EFF Cross Talk



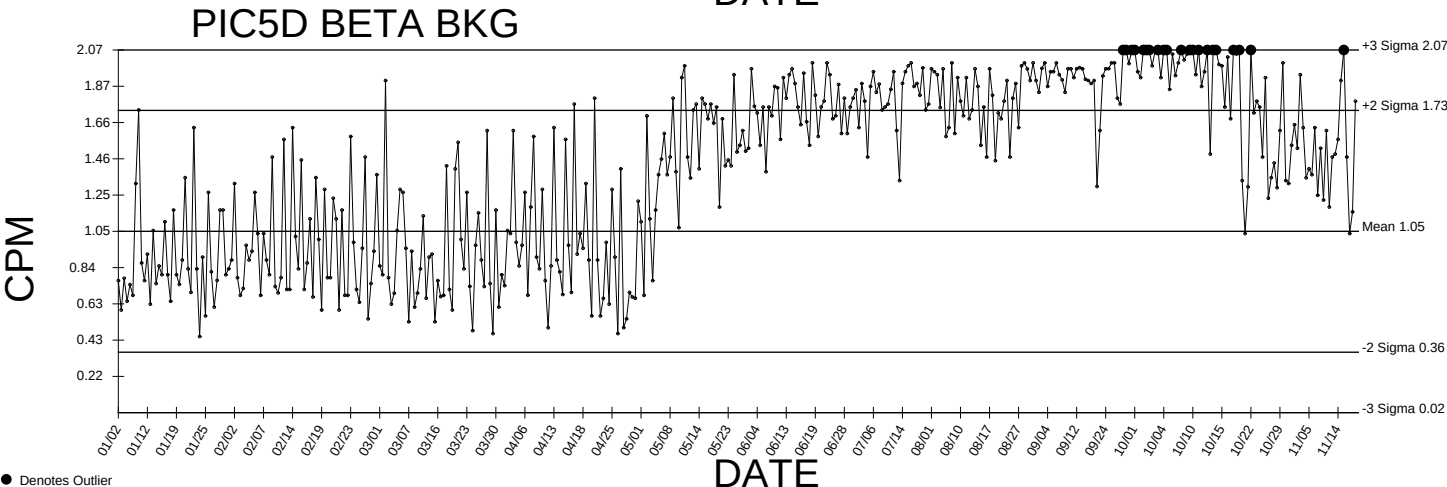
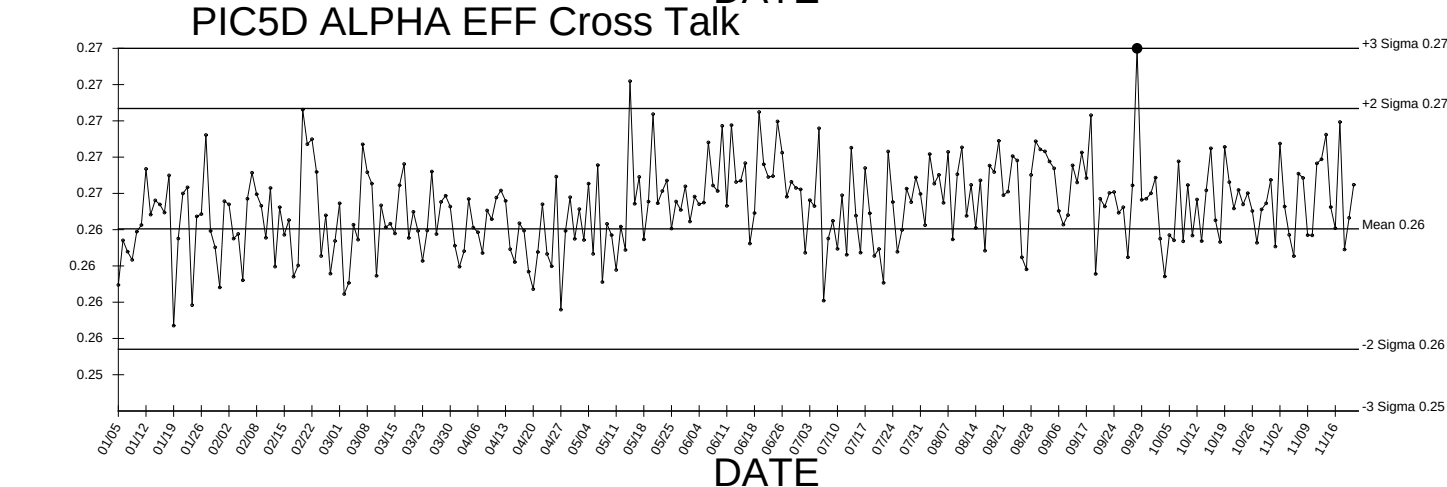
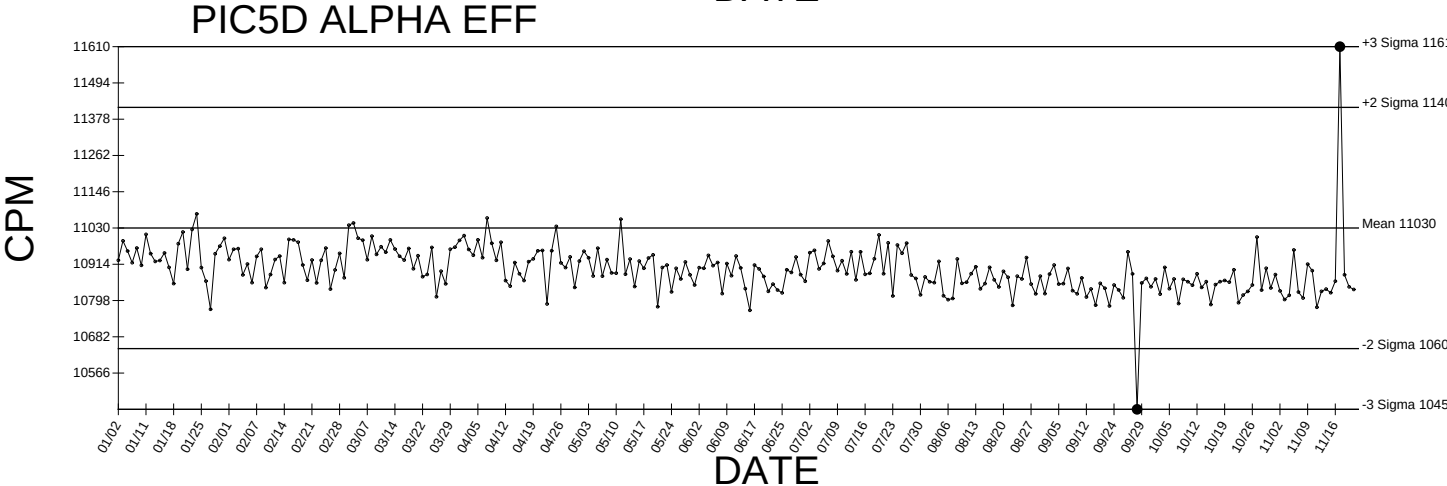
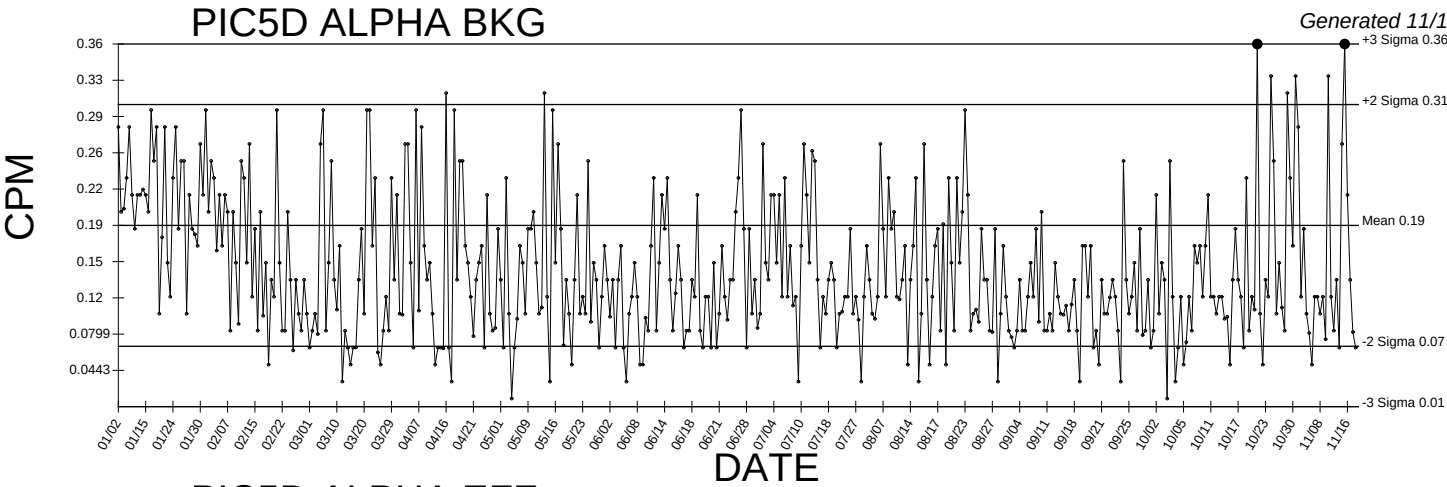
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● Denotes Outlier



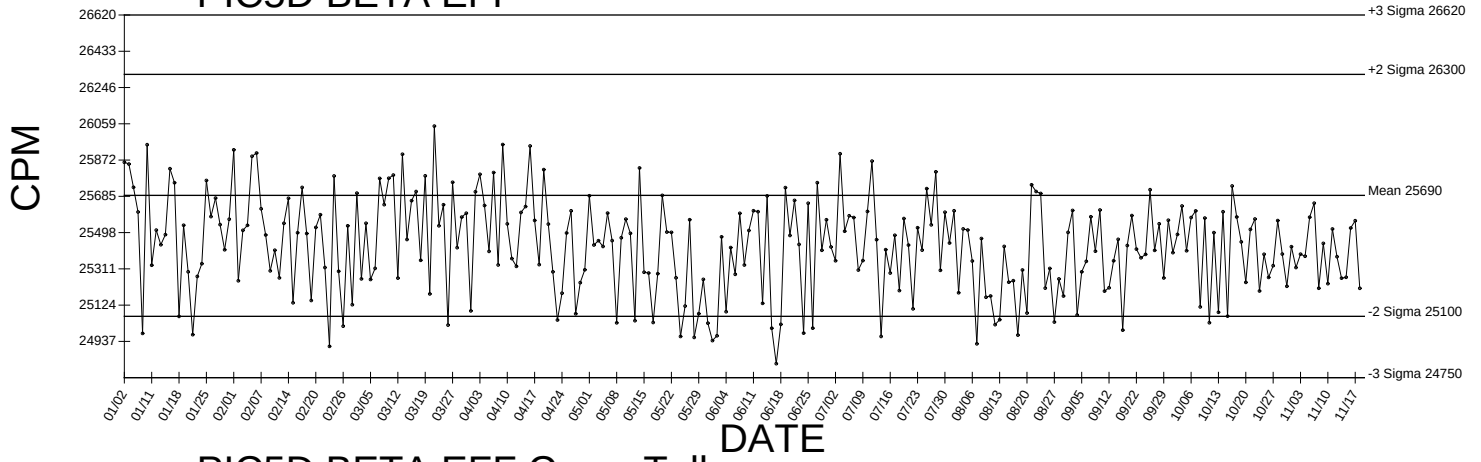
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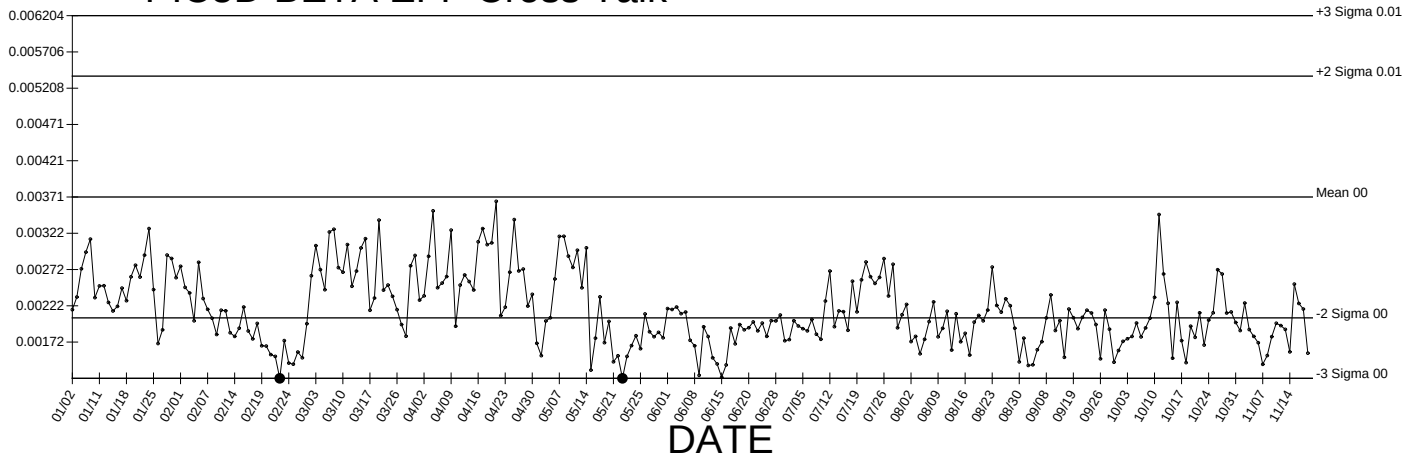
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PIC5D BETA EFF

Generated 11/19/2018



PIC5D BETA EFF Cross Talk



● Denotes Outlier

RAD Standards Traceability



National Institute of Standards & Technology

Certificate

Standard Reference Material 4251C Barium-133 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
October 1994

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have an acid concentration and a carrier concentration comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4251C
(Certified values are shown in bold type)

(Certified values are shown in bold type)

Source identification number		NIST SRM 4251C	
Physical Properties:			
Source description		Liquid in flame-sealed NIST borosilicate-glass ampoule	
Ampoule specifications		Body outside diameter	$(16.5 \pm 0.5) \text{ mm}$
		Wall Thickness	$(0.60 \pm 0.04) \text{ mm}$
		Barium content	Less than 2.5%
		Lead-oxide content	Less than 0.02%
		Other heavy elements	Trace quantities
Solution density		$(1.015 \pm 0.002) \text{ g} \cdot \text{mL}^{-1}$ at 22.1°C [b]*	
Solution mass		$(5.054 \pm 0.001) \text{ g}$ [b]	
Chemical Properties:			
Solution composition		Chemical Formula	Concentration ($\text{mol} \cdot \text{L}^{-1}$)
		H_2O	54
		HCl	1.0
		BaCl_2	6×10^{-4}
		$^{133}\text{BaCl}_2$	4×10^{-7}
		Mass Fraction ($\text{g} \cdot \text{g}^{-1}$)	
			0.96
			0.04
			1.2×10^{-4}
			8×10^{-8}
Radiological Properties:			
Radionuclide		Barium-133	
Reference time		1200 EST, 1 September 1993	
Massic activity of the solution [c] (Activity per unit mass of solution)		$4.876 \times 10^5 \text{ Bq} \cdot \text{g}^{-1}$	
Relative expanded uncertainty ($k=2$)		0.52% [d]	
Photon-emitting impurities		None detected [e]	
Half-lives used		Barium-133: $(10.52 \pm 0.13) \text{ a}$ [f]	
		Radium-226: $(1600 \pm 7) \text{ a}$ [f]	
Measuring instrument		Pressurized ^{40}K ionization chamber. A calibrated using a barium-133 solution whose activity was determined by $4\pi(\beta + X)\text{-}\gamma$ anticoincidence counting	

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [g]	Relative Sensitivity Factor, $ \partial y/\partial x_i \cdot (x_i/y)$ [h]	Relative Uncertainty Of Output Quantity, $u_c(y)/y$, (%) [i]
PIC A net response per gram of SRM 4251C, measured relative to RRS20 [j]	Standard deviation of the mean for 1000 repeated measurements (A)	0.008	1.0	0.01
PIC A background response, measured relative to RRS20	Standard deviation of the mean for >150 repeated measurements (A)	0.25	0.001 [k]	0.00
PIC A net response for RRS200, measured relative to RRS20	Standard deviation of the mean for >100 repeated measurements (A)	0.06	1.0	0.06
PIC A net response per Bq of barium-133 in solution, measured relative to RRS200.	Standard deviation of the mean for 240 repeated measurements (A)	0.02	1.0	0.02
Gravimetric measurements	Estimated (B)	0.01	1.0	0.01
Half life of barium-133 Half life of radium-226	Standard uncertainty of the half life (A)	1.24 [m] 0.44 [m]	0.004 [n] 0.004 [n]	0.00 0.00
Activity used to calibrate PIC A net response per Bq of barium-133 in solution	Standard uncertainty of the activity determined by $4\pi(\epsilon+X)$ - γ -anticoincidence counting. (B)	0.22	1.0	0.22
Live-time [p]	Estimated (B)	0.10	1.0	0.10
PIC A charge collection	Estimated (B)	0.05	1.0	0.05
Source Positioning	Estimated (B)	0.05	1.0	0.05
Photon-emitting impurities	Limit of detection for Cs-134 (B) [q]	100	0.00002	0.00
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.16
Coverage Factor, k				$\times 2$
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.32

* Notes and references are on pages 5 and 6.

NOTES

- (a) The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): 100 1.5 0.2
- (b) The stated uncertainty is two times the standard uncertainty.
- (c) **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [3].
- (d) The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the **expanded uncertainty** of y .

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

- (e) Estimated limits of detection for photon-emitting impurities are:
 $600 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 12 and 75 keV,
 $150 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 84 and 379 keV, and
 $3 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 387 and 2700 keV, provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of barium-133.
- (f) The stated uncertainty is the standard uncertainty. See reference [5].
- (g) Relative standard uncertainty of the input quantity x_i .
- (h) The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y / \partial x_i| \cdot (x_i / y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y / \partial x_i| \cdot (x_i / y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- (i) Relative component of combined standard uncertainty of output quantity y , rounded to two decimal places. The relative component of combined standard uncertainty of y is given by $u_i(y) / y = |\partial y / \partial x_i| \cdot u(x_i) / y = |\partial y / \partial x_i| \cdot (x_i / y) \cdot u(x_i) / x_i$. The numerical values of $u(x_i) / x_i$, $|\partial y / \partial x_i| \cdot (x_i / y)$, and $u_i(y) / y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

- [j] The response of pressurized ionization chamber A (PIC A) is determined from measurement of the time required to collect a given amount of charge on a stable fixed capacitor. All of the response measurements in the NIST pressurized ionization chambers are made relative to the response of one or more artifact standards. These artifact standards consist of microgram quantities of aged radium-226 in small welded stainless-steel capsules. These capsules are encapsulated in plastic rods whose dimensions are similar to those of the standard NIST ampoule. The artifact standards are called **Radium Reference Sources** and are designated as RRSx, where x is the nominal mass (in micrograms) of radium-226 in the capsule.
- [k] $|\partial y / \partial x_i| \cdot (x_i / y) = (\text{average background response}) / (\text{average net sample response})$
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y / \partial x_i| \cdot (x_i / y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i) / x_i = 100\%$. $|\partial y / \partial x_i| \cdot (x_i / y) = \{(\text{response per Bq of impurity}) / (\text{response per Bq of Ba-133})\} \cdot \{(\text{Bq of impurity}) / (\text{Bq of Ba-133})\}$. Thus $u(y) / y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] Evaluated Nuclear Structure Data File (ENSDF), April 1994.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	0487
Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL
Reference Date:	09/01/1993
Ampoule Mass (g):	5.054 g
Uncertainty:	+/- .26 %
LogBook No:	RC S 035 002

A Solution Material Info		
Isotope:	Barium-133	
Prepared By:	Angela Johnson	
Prep Date:	10/31/2002	
Verification Date:	10/10/2018	
Expiration Date:	10/10/2019	
Primary Code:	0487-A	
Dilution(mL):	100 mL	
Mass of Parent(g):	4.7696 g	
Density(g/mL):	0.9984	Balance ID:

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (100 \text{ mL}) = 1395394.1760 \text{ dpm/mL}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (0.9984 \text{ g/mL}) / (100 \text{ mL}) = 1397609.3930 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
12/18/2015	Gregory Ramsay	15.0062	1000	0487-B	20972.806 dpm/mL	11/18/2016	11/18/2017
01/17/2017	Bethany Fiem	15.1795	1000	0487-C	21215.0117 dpm/mL	01/17/2017	01/17/2018
11/08/2017	Bethany Fiem	15.5573	1000	0487-D	21708.5658 dpm/mL	10/10/2018	10/10/2019

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ba-133 Standard 0487-D

7/12

Instrument	VELLO
Analyst	BKP
Verification Prep Date	10/10/2018

Standard Information	
Source	Ba-133
Serial Number	133-12
Isotope Half Life	3.54125-03 D
Reference Date	1/1/2017
Ref Act (dpm/mL)	111,56101
Amount of Std (mL)	1
Standard Prep Date	11/1/2017

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	10/10/2018	79112	1700.00	17.90
2	10/10/2018	79112	1717.31	17.87
3	10/10/2018	79112	1387.77	17.73

Std #	Net cpm	Calculated Avg Eff	Standard dp (mL)	Measured cpm
1	1682.09	0.763551	4282.03	4282.00
2	1699.44	0.763551	4177.04	4177.31
3	1369.97	0.763551	4233.14	4233.14

Mean Value =	4282.45
Stdev =	62.50544344
Certificate Value*	4548.3
Two sigma =	126.911
10 % of Mean =	428.245
Rule A (Pass/Fail)	Pass
% Recovery	102.03%
Rule B (Pass/Fail)	Pass
Expiration Date	10/15/2019

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

* Certificate Value is decay corrected to Count Date.

The analyst prepared three standard verification sources for Ba-133 source 0487-D by transferring 1 mL portions of the standard into glass scintillation vials. 10 mL of Ecosort Ultra low scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 10 mL of Ecosort Ultra low scintillation cocktail. The standard verification vials and background source were each disposed for at least two hours and counted on LSC VELLO for Ba-133 source standard verification. The Ba-133 efficiency calibration which was used for verification calculations was performed on 10/10/2018 using Ba-133 source 1527-A.

Standard results for each verification source was calculated as follows:

$$\text{Source dpm/mL} = (A - B) / (C \cdot D)$$

where:

- A = Net source cpm
- B = BKG cpm
- C = System efficiency (cpm/cpm) and
- D = Volume used for standard verification

RAD-11021


 B. K. P.



Certificate

Received
3.11.17

Standard Reference Material[®] 4339b

1810

Radium-228 Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive radium-228 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. A unit of SRM 4339b consists of approximately 5 mL of a solution, whose composition is specified in Tables 1 and 2, contained in a flame-sealed borosilicate-glass ampoule [1].

The certified radium-228 massic activity value, at a Reference Time of 1200 EST, 07 October 2010, is:

$$(195 \pm 14) \text{ Bq}\cdot\text{g}^{-1}$$

A NIST certified value, as used within the context of this certificate, is a value for which NIST has the highest confidence in its uncertainty assessment. It is a "measurement result" [2] obtained directly or indirectly from a "primary reference measurement procedure" [3]. The certified value is traceable to the derived SI unit, Becquerel (Bq).

Additional physical, chemical, and radiological properties for this SRM, as well as details on the standardization method, are given in Tables 1 and 2. Uncertainties for the certified quantities are expanded ($k=2$). The uncertainties are calculated according to the ISO and NIST Guides [4,5]. Table 3 contains a specification of the components that comprise the uncertainty analyses.

Expiration of Certification: The certification of SRM 4339b is valid indefinitely, within the measurement uncertainty specified, provided that the SRM is handled and stored properly and that no evaporation or change in composition has occurred. The solution matrix, in an unopened ampoule, is homogeneous and stable within its half-life-dependent useful lifetime provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Handling and Storage"). Periodic recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Radiological and Chemical Hazard: Consult the Safety Data Sheet (SDS), enclosed with the SRM shipment, for radiological and chemical hazard information.

This SRM was prepared in the Physical Measurement Laboratory, Radiation and Biomolecular Physics Division, Radioactivity Group, M.P. Unterwiesing, Group Leader. The overall technical direction and physical measurement leading to certification and photon-emitting impurity analyses were provided by L. Pibida of the NIST Radioactivity Group, with production assistance by J. LaRosa, R. Collé, and L. Laureano-Pérez. Alpha-emitting impurity analyses were provided by J. LaRosa.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Lisa R. Katon, Chief
Radiation and Biomolecular Physics Division

Gaithersburg, Maryland 20899
Certificate Issue Date: 14 November 2012
SRM 4339b

Robert L. Walters, Jr., Director
Office of Reference Materials

Page 1 of 4

Table 1. Certified Massic Activity of SRM 4339b

Radionuclide	Radium-228 ^{1a)}
Reference time	1200 EST, 07 October 2010
Massic activity of the solution	195 Bq g ⁻¹
Relative expanded uncertainty ($k \approx 2$)	7.2 % ^{1b)}

^{1a)} The final ²²⁸Ra purification from the ²³²Th mother solution was performed on 02 September 2010 (0920 EST).

^{1b)} The uncertainties on certified values are expanded uncertainties, $U = k u_c$. The quantity u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides [4,5]. The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ and was chosen to obtain what is assumed to be an approximate 95 % level of confidence.

Table 2. Uncertified Information of SRM 4339b

Source description	Liquid in a flame-sealed 5 mL borosilicate-glass ampoule [1]
Solution composition	1.3 mol L ⁻¹ HNO ₃ with 19.8 μg g ⁻¹ Ba ²⁺
Solution density	(1.014 ± 0.002) g mL ⁻¹ at 20.8 °C ^{1a)}
Solution mass	(5.180 ± 0.003) g ^{1b)}
Photon-emitting impurities	²²⁸ Ra: < 0.5 Bq g ^{-1b)}
Alpha-emitting impurities	²³² Th: < 0.08 Bq g ^{-1b)}
Half-lives used	²²⁸ Ra: (5.75 ± 0.04) a [6] ²²⁸ Ac: (6.15 ± 0.02) h [7] ²²⁶ Ra: (1600 ± 7) a [8] ²³² Th: (14.02 ± 0.06) × 10 ⁹ a [9]
Calibration methods (and instruments)	The certified massic activity for ²²⁸ Ra was obtained by high-resolution gamma-ray spectrometry of three master solution ampoules (eleven separate determinations), as measured on three to five different spectrometers and geometries on each ampoule, and used assumed nuclear data for probabilities per decay for 16 gamma-ray transitions. Confirmatory measurements were performed by 2πα spectrometry of ingrown ²²⁸ Th with a planar, ion-implanted Si detector.

^{1a)} The stated uncertainty is two times the standard uncertainty. See reference 5.

^{1b)} Based on gamma-ray spectrometry of forced-fitted peak at 186.2 keV and assuming a probability per decay of 0.0355 [6].

^{1c)} The maximum ²³²Th activity concentration in ²²⁸Ra.

^{1d)} The stated uncertainty is the standard uncertainty. See reference 5.

Table 3. Uncertainty Evaluation for the Massic Activity of SRM 4339b

Uncertainty component		Assessment Type ^(a)	Relative standard uncertainty contribution on massic activity of ²²⁶ Ra (%)
1	Gamma-ray spectrometry precision; relative standard deviation of the grand mean on the average massic gamma-ray emission rates for 16 measured ²²⁶ Ac gamma-ray transitions. Each mean in the grand mean is based on 11 determinations with three sources in three to five different detectors. The uncertainty in the determination of the massic gamma-ray emission rate for any one transition in a given determination ranged from typically 0.5 % to 1.5 %. The relative standard deviation of the mean for the average of the 16 lines, for any one determination, was typically 1 %; whereas the relative standard deviation of the grand mean for the average of the 16 lines across all 11 determinations is 0.34 % ^(b) . Data passes normality test.	A	11.84
2	Uncertainty due to assumed gamma-ray probabilities per decay for the measured ²²⁶ Ac transitions [7]. The uncertainty on each transition has a shared (correlated) component of 2.5 % (see comments in [7]).	B	3.5
3	Detection efficiencies not embodied within component 1	B	0.4
4	Mass determinations for dilution factors and counting source preparations	B	0.1
5	Decay corrections for ²²⁶ Ra half-life uncertainty of 0.7 % [6]	B	0.003
6	Effect of ²²⁶ Ra and ²²⁶ Ac half-life uncertainties on secular equilibrium ratio	B	0.02
Relative combined standard uncertainty			3.6
Relative expanded uncertainty (k = 2)			7.2

^(a) Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^(b) Average massic gamma-ray emission rates of 11 geometries (R_g) for 16 measured ²²⁶Ac gamma-ray transitions with their respective energy (E_γ); assumed gamma-ray probabilities per decay (P_γ) and standard deviation of the mean (S_m).

E_γ (keV)	Assumed P_γ (%) [1]	Mean R_g (s ⁻¹ g ⁻¹) ^(a)	S_m (%) ^(b)
129.065	2.50	1347	0.38
153.967	0.754	421.6	0.40
209.249	3.97	2264	0.55
270.245	3.55	2014	0.33
328.084	3.04	1822	0.43
378.52	12.4	6712	0.43
409.46	2.02	1185	0.29
463.062	4.45	2645	0.33
755.313	1.03	593.3	0.46
772.291	1.52	599.2	0.53
794.942	4.31	2588	0.35
835.704	1.7	945.3	0.42
911.396	26.2	15609	0.29
964.786	4.99	3067	0.35
968.96	15.9	9582	0.30
1588.2	3.06	1889	0.28

(a) Grand mean for $n = 11$ determinations with three sources in three to five different detectors.

(b) Relative standard deviation of the grand mean on R_g for $n = 11$.

INSTRUCTIONS FOR HANDLING AND STORAGE

Handling: If the ampoule is transported, it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of both the radioactivity and the strong acid. The ampoule should be opened only by persons qualified to handle both radioactive material and alkaline and/or acidic solutions. Appropriate shielding and/or distance should be used to minimize personnel exposure. Refer to SDS for further information.

Storage: SRM 4339b should be stored and used at a temperature between 5 °C and 65 °C. The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material.

REFERENCES

- [1] NIST Physical Measurement Laboratory; *Storage and Handling of Radioactive Standard Reference Materials, Ampoule Specifications and Opening Procedure*, available at <http://www.nist.gov/pml/div682/gsp04/srm.cfm> (accessed Nov 2012). Note: This SRM is contained in a generic borosilicate-glass ampoule and not in the standard NIST ampoule.
- [2] JCGM 200:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 19 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [3] JCGM 200:2012: *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 18 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [4] JCGM 100:2008: *Guide to the Expression of Uncertainty in Measurement*; (ISO GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Nov 2012).
- [5] Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/> (accessed Nov 2012).
- [6] Luca, A.; June 2009, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [7] Pearce, A.; January 2010, ^{228}Ac . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ac-228_tables.pdf (accessed Nov 2012).
- [8] Christé, V. and M.M. Bé; December 2006, ^{226}Ra . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [9] Arino, A.; September 2008, ^{232}Th . LNE-LNHB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Th-232_tables.pdf (accessed Nov 2012).

Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program; telephone (301) 975-2200; fax (301) 948-3710; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	1810
Prepared By:	Tim Chandler
Carrier Conc:	1.3M HNO ₃
Reference Date:	10/07/2010
Ampoule Mass (g):	5.18 g
Uncertainty:	+/- 3.6 %
LogBook No:	GL-CED-297-103

A Solution Material Info			
Isotope:	Radium-228 SPIKE		
Prepared By:	Bethany Fiem		
Prep Date:	05/23/2018		
Verification Date:	05/23/2018		
Expiration Date:	05/23/2019		
Primary Code:	1810-A		
Dilution(mL):	200 mL		
Mass of Parent(g):	5.1447 g		
Density(g/mL):	1.0178	Balance ID:	B733529066

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (200 \text{ mL}) = 300.9650 \text{ dpm/mL}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (1.0178 \text{ g/mL}) / (200 \text{ mL}) = 295.7015 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-228 Standard

1810-A

Jar

4/1/12
MJE
5/23/2010

Isotope	Result
Ra-228	pCi/L
Ra-228 N1	29340
Ra-228 N2	28810
Ra-228 N3	29620

Mean Value (Counting) =
Stdev =

107.165

Rule B (Pass/Fail)

* Exception: taken due to the high uncertainty of the certified value

Certificate Value =
Two sigma =
10 % of Mean =
Rule A (Pass/Fail)

29056.67
473.533
29056.67
547.0656436
2905.666667
Pass

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

29056.67 ± 547.07 is stable

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1819110

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1204151331	MB	JXC9	PIC4B	NOV-19-18 10:44:47	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204151332	DUP	JXC9	PIC4C	NOV-19-18 10:44:53	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204151333	MS	JXC9	PIC5A	NOV-19-18 10:45:00	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204151334	MSD	JXC9	PIC5C	NOV-19-18 10:45:08	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204151335	LCS	JXC9	PIC5D	NOV-19-18 10:45:14	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203001	SAMPLE	JXC9	PIC1B	NOV-19-18 10:45:24	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203002	SAMPLE	JXC9	PIC1D	NOV-19-18 10:45:30	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203003	SAMPLE	JXC9	PIC2A	NOV-19-18 10:45:39	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203004	SAMPLE	JXC9	PIC2B	NOV-19-18 10:45:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203005	SAMPLE	JXC9	PIC2C	NOV-19-18 10:45:50	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203006	SAMPLE	JXC9	PIC2D	NOV-19-18 10:45:57	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463203007	SAMPLE	JXC9	PIC3B	NOV-19-18 10:46:04	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463826001	SAMPLE	JXC9	PIC3C	NOV-19-18 10:46:11	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463826002	SAMPLE	JXC9	PIC3D	NOV-19-18 10:46:18	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463826003	SAMPLE	JXC9	PIC4A	NOV-19-18 10:46:30	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1818524 Check-list

This check-list was completed on 15-NOV-18 by Lyndsey Pace

This batch was reviewed by Elizabeth Krouse on 15-NOV-18 and Lyndsey Pace on 15-NOV-18.

Batch ID:
1818524

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Radium-226 Queue Sheet

10-NOV-18

GEL Laboratories, Radiochemistry Division

Batch #: 1818524

Analyst: PCW

First Client Due Date: 11/23/2018

Internal Due Date: 11/21/2018

Spike Isotope: Radium-226

Spike Code: 171577

Expiration Date: 12/16/18

Vol: 0.1

End Initial/Degas Date/Time: 11/21/18 0800

LCS Isotope: Radium-226

LCS Code: 171577

Expiration Date: 12/16/18

Vol: 0.1

End L.S. Decant Date: 11/21/18

Prep Date: 11/09/18

Bkg Count Time: 30
Pipet ID: 27162153

(Min) Sample Count Time: 30
Balance ID: 18156293

(Min) Start Count Date: 11/12/18

Initials: PCW

Witness: NA

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDI	Client	Position (Label)	Aliquot (μl or g)	End L.S. Decant Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
463209002-1	MIX-1	SAMPLE		WATER	1 p.cvl.	LANS006	1	500	0855	0855	107	1	6	51
463209002-2	MIX-2	SAMPLE		WATER	1 p.cvl.	LANS006	2	500	0855	0855	203	2	8	5
463209002-3	MIX-3	SAMPLE		WATER	1 p.cvl.	LANS006	3	500	0855	0855	304	3	2	50
463209004-2	MIX-4	SAMPLE		WATER	1 p.cvl.	LANS006	4	500	0855	0855	400	4	4	7
463209005-1	MIX-5	SAMPLE		WATER	1 p.cvl.	LANS006	5	500	0855	0855	506	5	6	13
463209006-1	MIX-6	SAMPLE		WATER	1 p.cvl.	LANS006	6	500	0855	0855	607	6	1	21
463209007-1	FIL-201811029	SAMPLE		WATER	1 p.cvl.	LANS006	7	500	0855	0855	705	7	4	9
463221005-1	2018034650	SAMPLE		GROUND WATER	p.cvl.	DUP0007	8	500	0855	0855	804	8	2	71
463221006-1	2018034651	SAMPLE		GROUND WATER	p.cvl.	DUP0007	9	500	0855	0855	901	9	1	35
463221007-1	2018034652	SAMPLE		GROUND WATER	p.cvl.	DUP0007	10	500	0855	0855	1001	10	8	14
463221008-1	2018034653	SAMPLE		GROUND WATER	p.cvl.	DUP0007	11	500	0855	0855	1101	11	5	642
463221009-1	2018034654	SAMPLE		GROUND WATER	p.cvl.	DUP0007	12	500	0855	0855	1200	12	4	76
463221010-1	2018034655	SAMPLE		GROUND WATER	p.cvl.	DUP0007	13	500	0855	0855	1301	13	4	6
463221011-1	2018034656	SAMPLE		GROUND WATER	p.cvl.	DUP0007	14	500	0855	0855	1407	14	4	105
463221012-1	2018034657	SAMPLE		GROUND WATER	p.cvl.	DUP0007	15	500	0855	0855	1507	15	2	57
463221013-1	2018034658	SAMPLE		GROUND WATER	p.cvl.	DUP0007	16	500	0855	0855	1602	16	8	158
463221014-1	2018034659	SAMPLE		GROUND WATER	p.cvl.	DUP0007	17	500	0855	0855	1704	17	6	16
463221015-1	2018034660	SAMPLE		GROUND WATER	p.cvl.	DUP0007	18	500	0855	0855	1808	18	6	118
463221016-1	2018034661	SAMPLE		GROUND WATER	p.cvl.	DUP0007	19	500	0855	0855	1902	19	1	25
463221017-1	2018034662	SAMPLE		GROUND WATER	p.cvl.	DUP0007	20	500	0855	0855	2002	20	1	8
463221018-1	2018034663	SAMPLE		GROUND WATER	p.cvl.	DUP0007	21	500	0855	0855	2105	21	6	56
463221019-1	2018034664	SAMPLE		GROUND WATER	p.cvl.	DUP0007	22	500	0855	0855	2208	22	2	700
463221020-1	2018034665	SAMPLE		GROUND WATER	p.cvl.	DUP0007	23	500	0855	0855	2303	23	1	600
463221021-1	2018034666	SAMPLE		GROUND WATER	p.cvl.	DUP0007	24	500	0855	0855	2402	24	1	747
1204150011-1	MSP for Batch 1818524	MSP		GROUND WATER	p.cvl.	QC ACCOUNT	25	100	0624	1100	2503	25	1	600
1204150012-1	2018034650 46322100518179	MSP		GROUND WATER	p.cvl.	QC ACCOUNT	26	100	0624	1100	2603	26	1	747
1204150013-1	2018034656 46322100518179	MSP		GROUND WATER	p.cvl.	QC ACCOUNT	27	100	0624	1100	2703	27	1	747
1204150014-1	2018034651 46322100518179	MSP		WATER	1 p.cvl.	QC ACCOUNT	28	100	0624	1100	2803	28	1	747
1204150015-1	100% for Batch 1818524	LCS		GROUND WATER	p.cvl.	QC ACCOUNT	29	100	0624	1100	2903	29	1	747

Comments:

see verification sheet

Data Reviewed By:

Page 1 of 1

Radium-226 Queue Sheet

15-NOV-18

GEI Laboratories, Radiochemistry Division

Batch #: 1818524

Analyst: PCW

First Client Due Date: 11/23/2018

Internal Due Date: 11/21/2018

Spike Isotope: Radium-226

Spike Code: 1818524

Expiration Date: 12/1/18

Vol: 1

End Initial/Degas Date/Time: 11/12/18 06:34

LCS Isotope: Radium-226

LCS Code: 1818524

Expiration Date: 12/1/18

Vol: 1

End L.N. De-veg Date: 11/15/18

Prep Date: 11/15/18

Bkg Count Time: 30 (Min)

Sample Count Time: 70 (Min)

Start Count Date: 11/15/18

Witness: N/A

Pipet ID: 2.7LC/18

Balance ID: 1.1X/18

Initials: PCW

Witness: N/A

Sample #	Client Description	Type	Hazard Code	Matrix	Min CRDI	Client	Position (Label)	Aliquot (ml or g)	End LN De-veg Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
463203001-1	SW-1	SAMPLE		WATER	1 pCi/L	LANC006	1							
463203002-1	SW-2	SAMPLE		WATER	1 pCi/L	LANC006	2							
463203003-1	SW-3	SAMPLE		WATER	1 pCi/L	LANC006	3							
463203004-1	SW-4	SAMPLE		WATER	1 pCi/L	LANC006	4							
463203005-1	SW-5	SAMPLE		WATER	1 pCi/L	LANC006	5							
463203006-1	SW-6	SAMPLE		WATER	1 pCi/L	LANC006	6							
463203007-1	FW-20181029	SAMPLE		WATER	1 pCi/L	LANC006	7							
463221005-1	2018014050	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	8							
463221006-1	2018014051	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	9							
463221007-1	2018014052	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	10							
463221008-1	2018014053	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	11	SW	0425	0515	202	3	2	110
463221009-1	2018014054	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	12							
463221010-1	2018014055	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	13							
463221011-1	2018014056	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	14							
463221012-1	2018014057	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	15							
463221013-1	2018014058	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	16							
463221014-1	2018014059	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	17							
463221015-1	2018014060	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	18							
463221016-1	2018014061	SAMPLE		GROUNDFW	1 pCi/L	DEPO007	19							
1204150011-1	SW for batch 1818524	SW		WATER	1 pCi/L	QC ACCOUNT	20	SW	0435	0515	3.5	3	2	8
1204150012-1	2018014050, 463221005(MIN)	MIN		GROUNDFW	1 pCi/L	QC ACCOUNT	21							
1204150013-1	2018014050, 463221005(MIN)	MIN		GROUNDFW	1 pCi/L	QC ACCOUNT	22							
1204150014-1	2018014050, 463221005(MIN)	MIN		GROUNDFW	1 pCi/L	QC ACCOUNT	23							
1204150015-1	LCS for batch 1818524	LCS		WATER	1 pCi/L	QC ACCOUNT	24	SW	0435	0515	405	4	6	480

Comments: Verification

Data Reviewed By: [Signature]

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1818524
Analyst : PETE049
Prep Date : 11/8/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Half-life of Ra-226 : 1600 years
Ra-226 Abundance : 1.00
Half-life of Rn-222 : 3.8235 days
Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Background Counts	Background CPM	Count Time (min.)	Cell Efficiency (cpm/dpm)
1	463203001.1	0.5000	2.0256E-05	10/29/2018 11:30	107	30	11	0.367	6	0.200	30	1.5510
2	463203002.1	0.5000	2.0256E-05	10/29/2018 11:10	203	30	5	0.167	8	0.267	30	1.8290
3	463203003.1	0.5000	2.0256E-05	10/29/2018 15:00	305	30	30	1.000	2	0.067	30	1.4880
4	463203004.1	0.5000	2.0256E-05	10/29/2018 13:00	406	30	7	0.233	4	0.133	30	2.0030
5	463203005.1	0.5000	2.0256E-05	10/29/2018 13:10	506	30	15	0.500	6	0.200	30	2.0990
6	463203006.1	0.5000	2.0256E-05	10/29/2018 15:00	602	30	21	0.700	1	0.033	30	2.1000
7	463203007.1	0.5000	2.0256E-05	10/29/2018 11:00	705	30	9	0.300	4	0.133	30	1.8350
8	463221005.1	0.5000	2.0256E-05	10/31/2018 13:58	804	30	71	2.367	2	0.067	30	1.8590
9	463221006.1	0.5000	2.0256E-05	10/31/2018 14:11	101	30	35	1.167	1	0.033	30	1.5100
10	463221007.1	0.5000	2.0256E-05	10/31/2018 14:53	201	30	14	0.467	8	0.267	30	2.0070
11	463221008.1	0.5000	2.0256E-05	10/31/2018 15:13	202	30	110	3.667	2	0.067	30	1.8580
12	463222001.1	0.5000	2.0256E-05	10/30/2018 10:17	402	30	16	0.533	4	0.133	30	2.0200
13	463222002.1	0.5000	2.0256E-05	10/30/2018 10:16	501	30	6	0.200	4	0.133	30	2.0710
14	463222003.1	0.5000	2.0256E-05	10/30/2018 11:12	607	30	105	3.500	4	0.133	30	2.1300
15	463222004.1	0.5000	2.0256E-05	10/30/2018 11:12	707	30	37	1.233	2	0.067	30	2.0190
16	463222005.1	0.5000	2.0256E-05	10/30/2018 13:06	802	30	68	2.267	8	0.267	30	1.6450
17	463222006.1	0.5000	2.0256E-05	10/30/2018 13:25	104	30	16	0.533	6	0.200	30	2.0520
18	463222007.1	0.5000	2.0256E-05	10/30/2018 14:57	208	30	118	3.933	6	0.200	30	1.8820
19	463222008.1	0.5000	2.0256E-05	10/30/2018 15:17	302	30	25	0.833	1	0.033	30	1.6870
20	1204150011.1	0.5000	2.0256E-05	11/8/2018 0:00	305	30	8	0.267	2	0.067	30	1.4880
21	1204150012.1	0.5000	2.0256E-05	10/31/2018 13:58	505	30	56	1.867	6	0.200	30	1.5140
22	1204150013.1	0.1000	1.1370E-05	10/31/2018 13:58	608	30	760	25.333	2	0.067	30	1.9750
23	1204150014.1	0.1000	1.1370E-05	10/31/2018 13:58	703	30	690	23.000	1	0.033	30	1.9130
24	1204150015.1	0.5000	2.0256E-05	11/8/2018 0:00	405	30	456	15.200	6	0.200	30	1.5460

RA1818524R.xls

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-008
Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
9.300%	5/1/2018	4/30/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
9.900%	8/1/2018	7/31/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
2.900%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
5.200%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
2.500%	6/1/2018	5/31/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
2.100%	7/1/2018	6/30/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
1.800%	11/1/2018	10/31/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
4.200%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 5:35	11/12/2018 8:55	0.507	0.975	1.002	1.000
5.300%	5/1/2018	4/30/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
8.300%	8/1/2018	7/31/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
9.300%	8/1/2018	7/31/2019	11/12/2018 6:24	11/15/2018 4:25	11/15/2018 8:15	0.411	0.971	1.002	1.000
1.600%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
5.400%	6/1/2018	5/31/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
2.900%	7/1/2018	6/30/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
8.400%	11/1/2018	10/31/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
5.600%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 5:59	11/12/2018 9:30	0.508	0.974	1.002	1.000
7.800%	5/1/2018	4/30/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
5.200%	8/1/2018	7/31/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
9.700%	3/1/2018	2/28/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
2.900%	3/1/2018	2/28/2019	11/12/2018 6:24	11/15/2018 4:25	11/15/2018 8:15	0.411	0.971	1.002	1.000
4.000%	6/1/2018	5/31/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
9.100%	7/1/2018	6/30/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
6.700%	11/1/2018	10/31/2019	11/8/2018 8:00	11/12/2018 6:24	11/12/2018 10:00	0.510	0.973	1.002	1.000
2.500%	3/1/2018	2/28/2019	11/12/2018 6:24	11/15/2018 4:25	11/15/2018 8:15	0.411	0.971	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1715-D
Spike Exp Date : 12/19/2018
Spike Activity (dpm/ml): 288.42
Spike Volume Added: 0.10

LCS S/N : 1715-D
LCS Exp Date : 12/19/2018
LCS Activity (dpm/ml): 288.42
LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.3168	0.2237	1	0.5651	0.1963	82.98%	0.1667	0.1374	0.3172	0.3205		SAMPLE				
2	0.3102	0.2190	1	0.5379	-0.0999	120.59%	-0.1000	0.1202	0.2352	0.2354		SAMPLE				
3	0.1907	0.1346	1	0.3919	1.1455	20.41%	0.9333	0.1886	0.4536	0.4872		SAMPLE				
4	0.2003	0.1414	1	0.3740	0.0912	110.68%	0.1000	0.1106	0.1976	0.1982		SAMPLE				
5	0.2341	0.1653	1	0.4176	0.2610	50.98%	0.3000	0.1528	0.2605	0.2635		SAMPLE				
6	0.0955	0.0674	1	0.2218	0.5798	23.55%	0.6667	0.1563	0.2665	0.2804		SAMPLE				
7	0.2186	0.1544	1	0.4082	0.1659	72.13%	0.1667	0.1202	0.2344	0.2357		SAMPLE				
8	0.1526	0.1077	1	0.3137	2.2596	13.08%	2.3000	0.2848	0.5484	0.6646		SAMPLE				
9	0.1326	0.0936	1	0.3081	1.3686	18.43%	1.1333	0.2000	0.4734	0.5323		SAMPLE				
10	0.2823	0.1993	1	0.4894	0.1817	78.61%	0.2000	0.1563	0.2784	0.2812		SAMPLE				
11	0.1891	0.1335	1	0.3888	4.3830	13.51%	3.6000	0.3528	0.8418	1.3218		SAMPLE				
12	0.1983	0.1400	1	0.3703	0.3611	37.30%	0.4000	0.1491	0.2638	0.2691		SAMPLE				
13	0.1934	0.1366	1	0.3612	0.0587	158.21%	0.0667	0.1054	0.1819	0.1822		SAMPLE				
14	0.1881	0.1328	1	0.3512	2.8822	10.74%	3.3667	0.3480	0.5840	0.7355		SAMPLE				
15	0.1403	0.0990	1	0.2884	1.0537	19.72%	1.1667	0.2082	0.3685	0.4348		SAMPLE				
16	0.3444	0.2431	1	0.5971	2.2170	15.57%	2.0000	0.2906	0.6314	0.7485		SAMPLE				
17	0.2385	0.1684	1	0.4254	0.2955	47.55%	0.3333	0.1563	0.2717	0.2787		SAMPLE				
18	0.2601	0.1836	1	0.4639	3.6086	11.22%	3.7333	0.3712	0.7032	0.9493		SAMPLE				
19	0.1184	0.0836	1	0.2751	0.8627	23.36%	0.8000	0.1700	0.3592	0.4141		SAMPLE				
20	0.2361	0.1667	1	0.4855	0.3040	52.78%	0.2000	0.1054	0.3141	0.3176		MB				
21	0.3233	0.2282	1	0.5766	2.0026	16.25%	1.6667	0.2625	0.6181	0.7002	463221005.1	DUP	12.1%			
22	0.7154	0.5051	1	1.4706	116.3625	9.80%	25.2667	0.9201	8.3057	27.9619	463221005.1	MS			129.9188	87.8%
23	0.5222	0.3687	1	1.2129	109.1981	7.71%	22.9667	0.8762	8.1657	22.8205	463221005.1	MSD	6.4%		129.9188	82.3%
24	0.3937	0.2779	1	0.7022	21.9480	5.39%	15.0000	0.7165	2.0548	3.9263		LCS			25.9835	84.5%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 12-NOV-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	06:30	1	1.28E+05	127844	-1.33		
LUCAS2	EFF	06:30	1	1.34E+05	133993	2.43		
LUCAS3	EFF	06:30	1	1.36E+05	135902	-2.43		
LUCAS4	EFF	06:30	1	1.30E+05	129848	-1.75		
LUCAS5	EFF	06:30	1	1.32E+05	131837	-1.23		
LUCAS6	EFF	06:30	1	1.35E+05	134644	-0.05		
LUCAS7	EFF	06:30	1	1.41E+05	141097	-1.01		
LUCAS8	EFF	06:30	1	1.35E+05	135413	-1.27		

Reviewed by:

Lyndsey Pace

Date: 12-NOV-18

GEL Laboratories LLC



Ludlum Alpha Scintillation Counter Checks for 15-NOV-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	04:00	1	1.28E+05	128138	-1.1		
LUCAS2	EFF	04:00	1	1.34E+05	133727	2.3		
LUCAS3	EFF	04:00	1	1.39E+05	139421	-0.74		
LUCAS4	EFF	04:00	1	1.30E+05	129946	-1.65		
LUCAS5	EFF	04:00	1	1.34E+05	133713	0.01		
LUCAS6	EFF	04:00	1	1.34E+05	133887	-0.84		
LUCAS7	EFF	04:00	1	1.41E+05	141478	-0.53		
LUCAS8	EFF	04:00	1	1.39E+05	138543	-0.18		

Reviewed by:

Lyndsey Pace

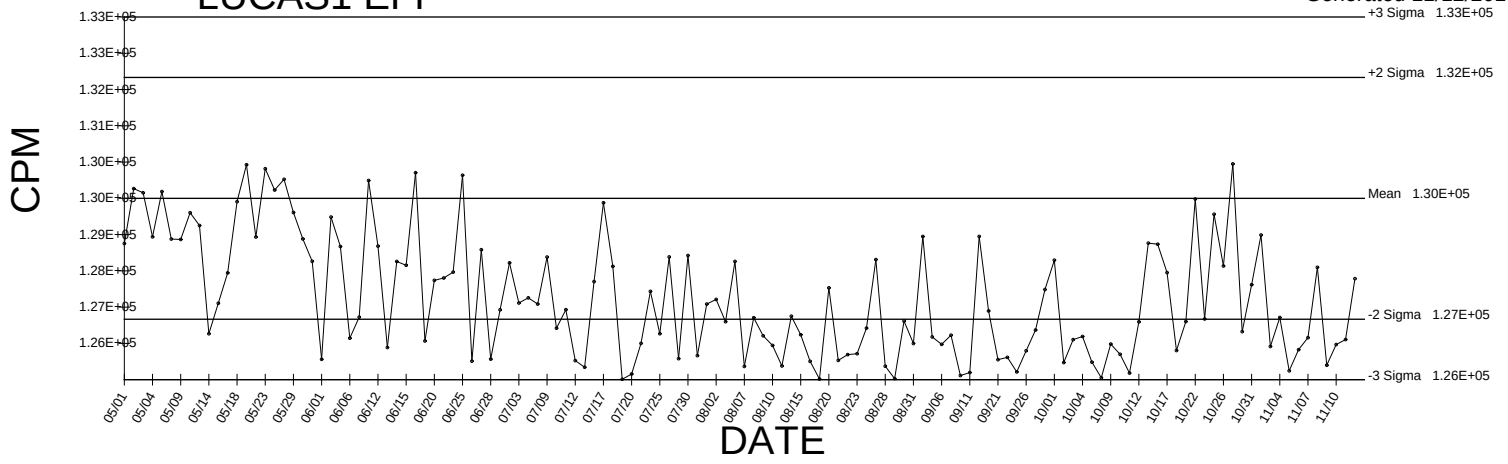
Date: 15-NOV-18

GEL Laboratories LLC

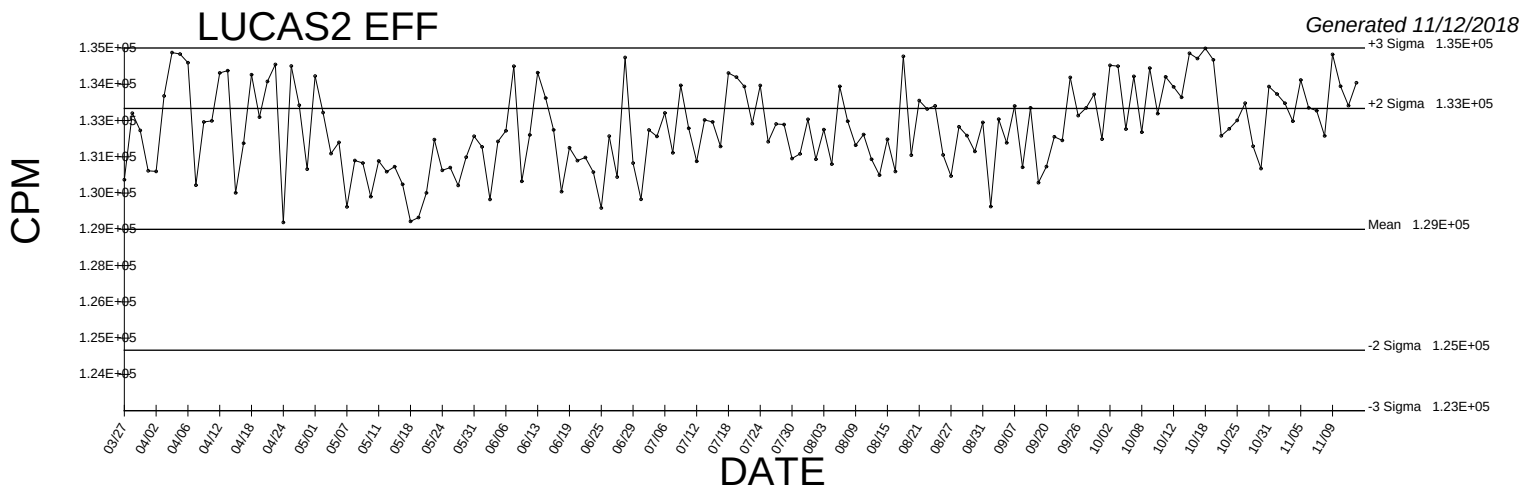
Efficiency Data

LUCAS1 EFF

Generated 11/12/2018



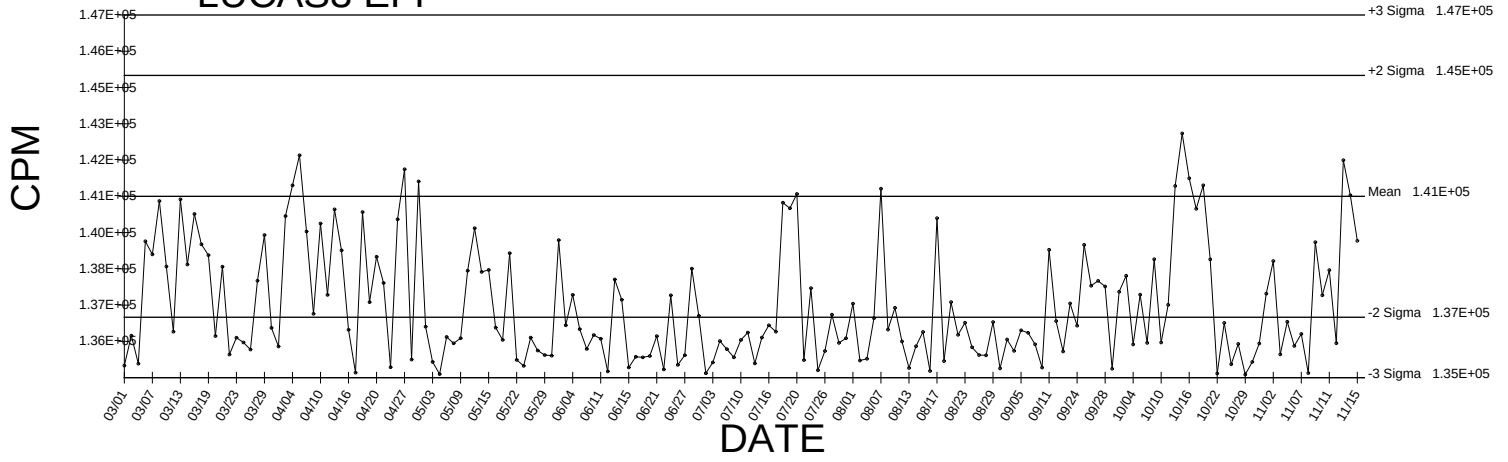
● Denotes Outlier



● Denotes Outlier

LUCAS3 EFF

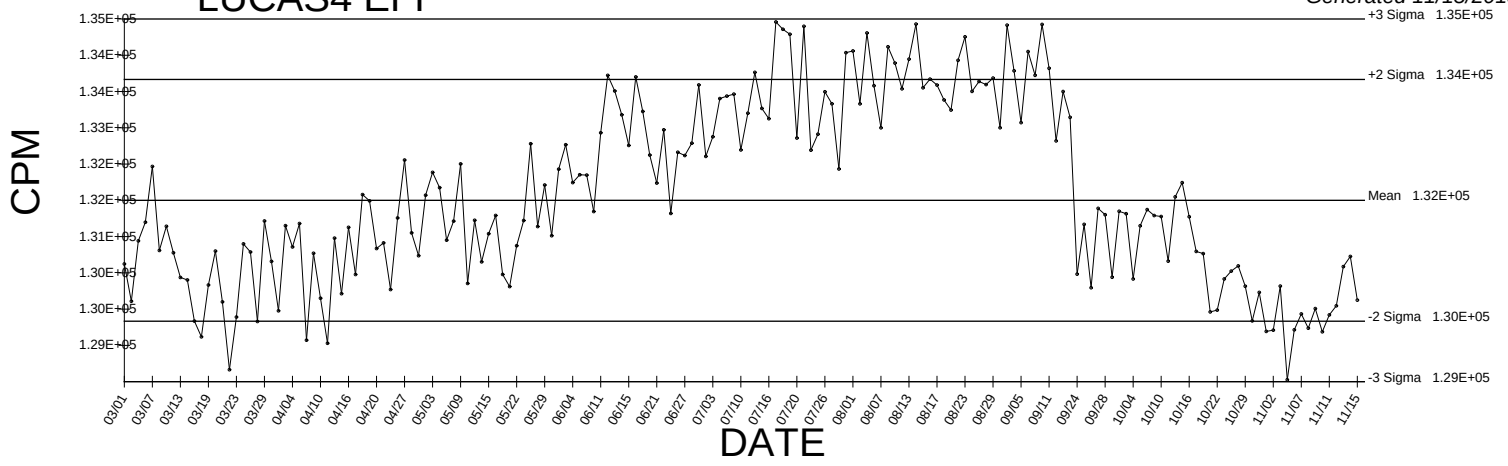
Generated 11/15/2018



● Denotes Outlier

LUCAS4 EFF

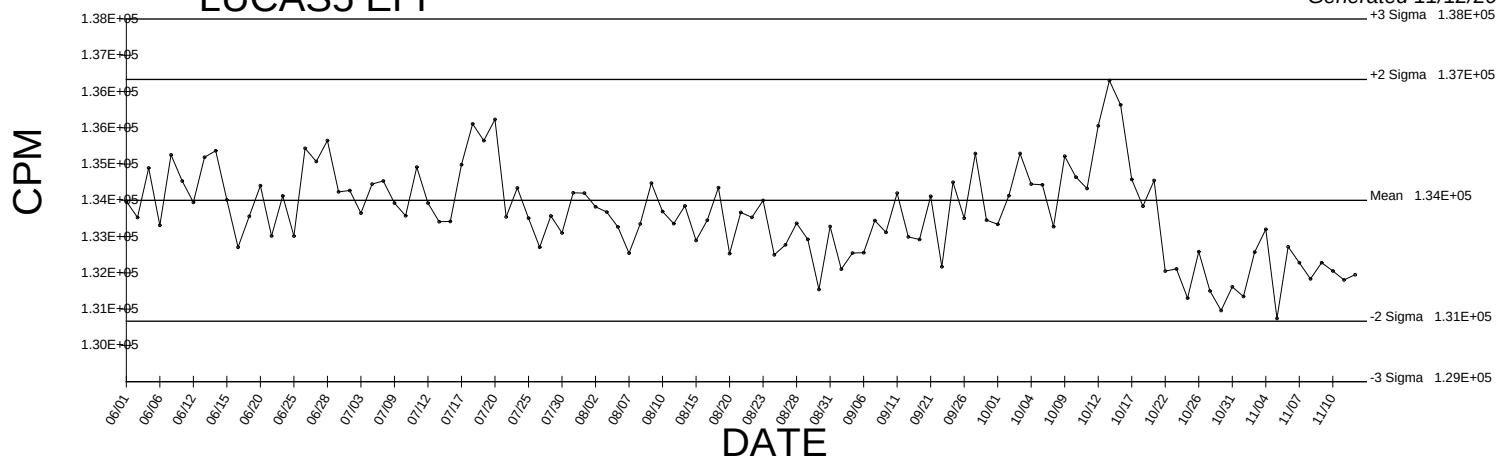
Generated 11/15/2018



● Denotes Outlier

LUCAS5 EFF

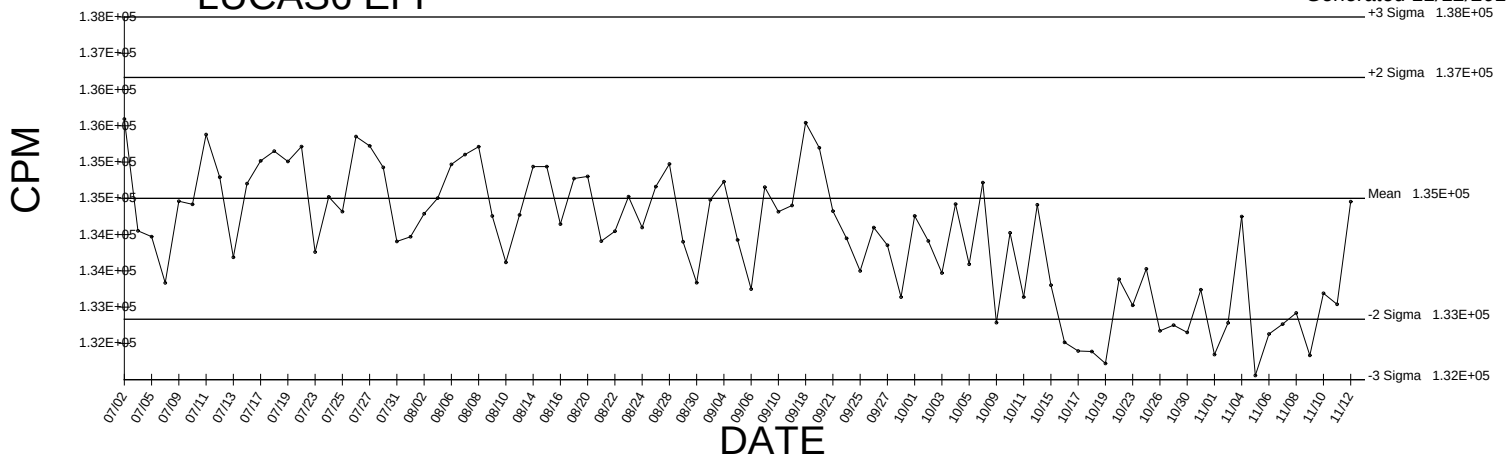
Generated 11/12/2018



● Denotes Outlier

LUCAS6 EFF

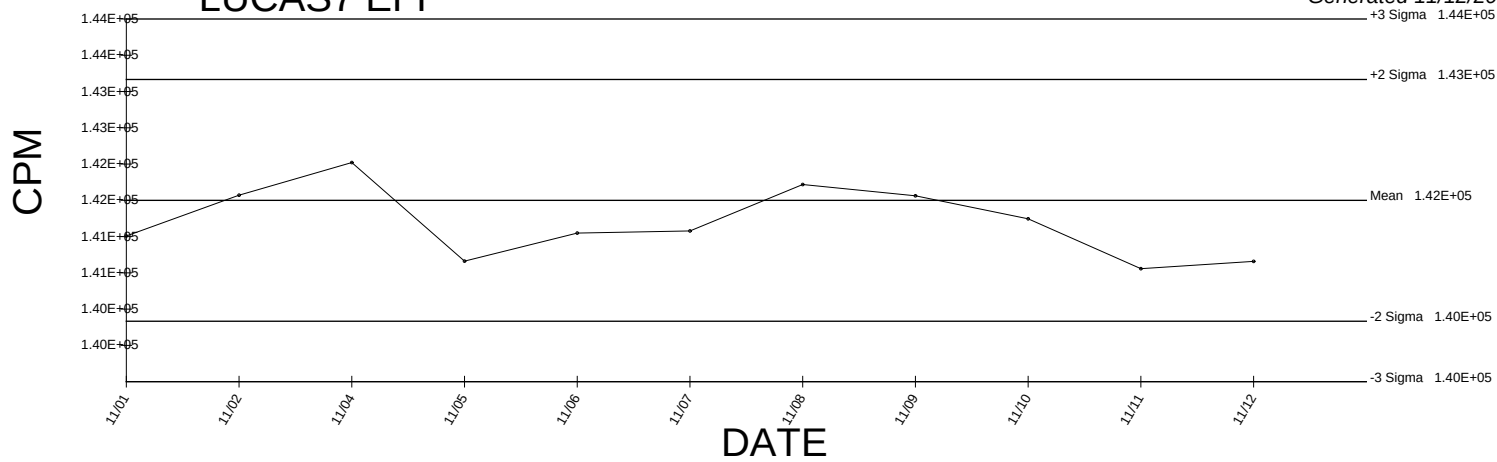
Generated 11/12/2018



● Denotes Outlier

LUCAS7 EFF

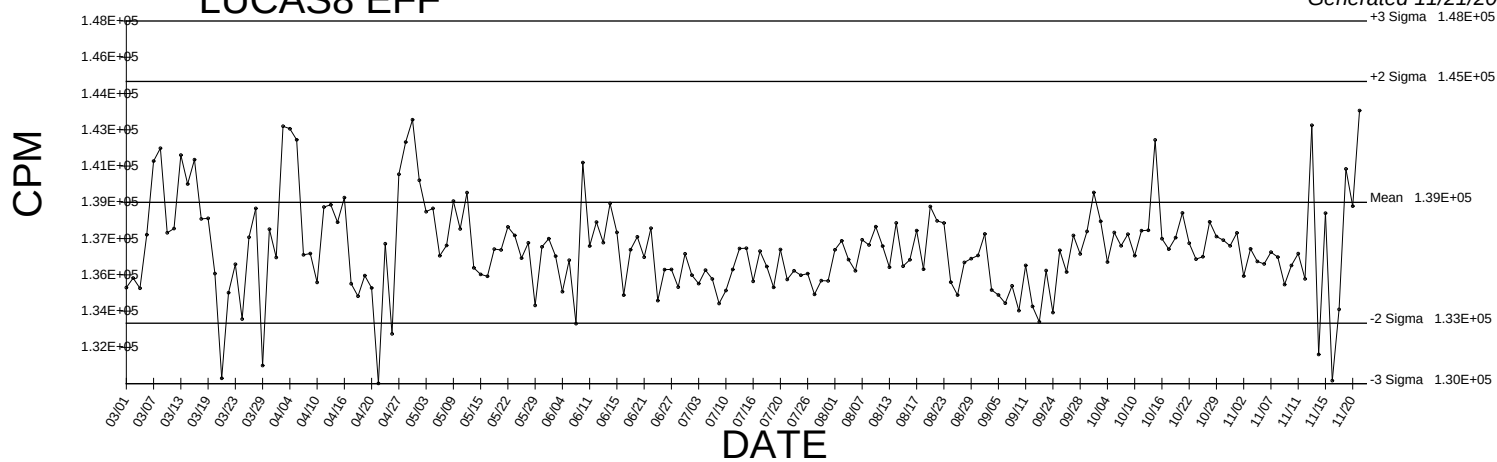
Generated 11/12/2018



● Denotes Outlier

LUCAS8 EFF

Generated 11/21/2018



RAD Standards Traceability



Eckert & Ziegler

Analytics

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Atlanta, Georgia 30318
Tel: 404-352-8677
Fax: 404-352-2817
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

1215

98307

Ra-226 5 mL Liquid in Flame Sealed Vial

Customer: GEL Laboratories, LLC

P.O. No.: GEL 1409800, Item 7

Product Code: 9825

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked by germanium gamma ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.19, Revision 2, July 2007, and compliance with ANSI N42.22-1989, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Delfray Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty ^a , %			Reference Date (12:00 PM EST)
			σ_A	σ_b	U	
Ra-226	5.844E+05	3.575E+04	1.0	2.1	4.7	09/09/2014

^aUncertainty: U = Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities (other than decay products) < 0.1%.

5.02193 g 0.1M HCl solution with approximately 30 μ g/g Ba carrier.

Source Prepared by:

R. Ormsby
R. Ormsby, Radiochemist

QC Approved:

L. Trivelpiece
L. Trivelpiece, Nuclear Metrologist

Date: 9 Sep 14

[Signature]





Standard Traceability Log Rad

Source Material Info	
Parent Code:	1715
Prepared By:	Gregory Ramsay
Carrier Conc:	0.1M HCl
Reference Date:	09/09/2014
Ampoule Mass (g):	5.02193 g
Uncertainty:	+/- 2.35 %
LogBook No:	GL-CED-297-008

A Solution Material Info			
Isotope:	Radium-226		
Prepared By:	Gregory Ramsay		
Prep Date:	07/06/2016		
Verification Date:	02/08/2017		
Expiration Date:	02/08/2018		
Primary Code:	1715-A		
Dilution(mL):	100 mL		
Mass of Parent(g):	4.9865 g		
Density(g/mL):	0.9967	Balance ID:	C31514

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21900.3937 \text{ dpm/mL}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (0.9967 \text{ g/mL}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21972.4854 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
07/06/2016	Gregory Ramsay	2.6261	200	1715-B	288.51 dpm/ml	01/25/2017	11/10/2018
02/08/2017	Gregory Ramsay	21.96	250	1715-C	1930.063 dpm/ml	02/08/2017	02/08/2018
12/19/2017	Gregory Ramsay	2.63	200	1715-D	288.938 dpm/ml	12/19/2017	12/19/2018

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-226 Standard 1715-D

Page 2

Instrument	Yellow
Analyst	CSR
Verification Prep Date	2/13/17

Standard Information	
Isotope	Ra-226
Serial Number	1715-D
Isotope Half-life	1600E+03 Y
Reference Date	3/1/2016
Ref Act (dpm/mL)	286.47
Amount of Std (mL)	1.0
Standard Prep Date	12/19/2013

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	12/22/2017	173.43	173.40	173.40
2	12/22/2017	174.10	174.10	174.10
3	12/22/2017	174.28	174.28	174.28

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	59.40	0.422157	287.41	140.71
2	59.70	0.422157	282.83	141.42
3	62.30	0.422157	296.15	147.58

Mean Value = 286.47
 Stddev = 7.95642063
 Certificate Value* = 286.5
 Two sigma = 15.111
 10 % of Mean = 28.647
 Rule A (Pass/Fail) Pass
 % Recovery 59.23%
 Rule B (Pass/Fail) Pass
 Expiration Date 12/19/2019

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
 Rule B = The determined mean value shall be within 5% of the certificate value.

* Certificate Value is decay corrected to Count Date.

The analysis prepared three standard verification sources for Ra-226 source 1715-D by transferring 0.5 mL portions of the standard into glass liquid scintillation vials 10 mL of Ecosint Ultra liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A blank vial was prepared in a similar fashion using 10 mL of Ecosint Ultra liquid scintillation cocktail. The standard verification vials and background source were dark adapted for at least two hours and counted on LSC Yellow for Ra-226 source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 12/22/2017 using Ra-226 source 0299-1.

Standard results for each verification source was calculated as follows

$$\text{Source dpm/mL} = (A - B) / (C(D))$$

where:

- A = Net source cpm
- B = Bkg cpm
- C = System efficiency (cpm/dpm), and
- D = volume used for standard verification

RAD-M-031

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1818524

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
463203001	SAMPLE	PCW	LUCAS1	NOV-12-18 08:55:00	DONE	Lucas Cell	01-MAY-18 00:00
463203002	SAMPLE	PCW	LUCAS2	NOV-12-18 08:55:00	DONE	Lucas Cell	01-AUG-18 00:00
463203003	SAMPLE	PCW	LUCAS3	NOV-12-18 08:55:00	DONE	Lucas Cell	01-MAR-18 00:00
463203004	SAMPLE	PCW	LUCAS4	NOV-12-18 08:55:00	DONE	Lucas Cell	01-MAR-18 00:00
463203005	SAMPLE	PCW	LUCAS5	NOV-12-18 08:55:00	DONE	Lucas Cell	01-JUN-18 00:00
463203006	SAMPLE	PCW	LUCAS6	NOV-12-18 08:55:00	DONE	Lucas Cell	01-JUL-18 00:00
463203007	SAMPLE	PCW	LUCAS7	NOV-12-18 08:55:00	DONE	Lucas Cell	01-NOV-18 00:00
463221005	SAMPLE	PCW	LUCAS8	NOV-12-18 08:55:00	DONE	Lucas Cell	01-MAR-18 00:00
463221006	SAMPLE	PCW	LUCAS1	NOV-12-18 09:30:00	DONE	Lucas Cell	01-MAY-18 00:00
463221007	SAMPLE	PCW	LUCAS2	NOV-12-18 09:30:00	DONE	Lucas Cell	01-AUG-18 00:00
463222001	SAMPLE	PCW	LUCAS4	NOV-12-18 09:30:00	DONE	Lucas Cell	01-MAR-18 00:00
463222002	SAMPLE	PCW	LUCAS5	NOV-12-18 09:30:00	DONE	Lucas Cell	01-JUN-18 00:00
463222003	SAMPLE	PCW	LUCAS6	NOV-12-18 09:30:00	DONE	Lucas Cell	01-JUL-18 00:00
463222004	SAMPLE	PCW	LUCAS7	NOV-12-18 09:30:00	DONE	Lucas Cell	01-NOV-18 00:00
463222005	SAMPLE	PCW	LUCAS8	NOV-12-18 09:30:00	DONE	Lucas Cell	01-MAR-18 00:00
463222006	SAMPLE	PCW	LUCAS1	NOV-12-18 10:00:00	DONE	Lucas Cell	01-MAY-18 00:00
463222007	SAMPLE	PCW	LUCAS2	NOV-12-18 10:00:00	DONE	Lucas Cell	01-AUG-18 00:00
463222008	SAMPLE	PCW	LUCAS3	NOV-12-18 10:00:00	DONE	Lucas Cell	01-MAR-18 00:00
1204150012	DUP	PCW	LUCAS5	NOV-12-18 10:00:00	DONE	Lucas Cell	01-JUN-18 00:00
1204150013	MS	PCW	LUCAS6	NOV-12-18 10:00:00	DONE	Lucas Cell	01-JUL-18 00:00
1204150014	MSD	PCW	LUCAS7	NOV-12-18 10:00:00	DONE	Lucas Cell	01-NOV-18 00:00
463221008	SAMPLE	PCW	LUCAS2	NOV-15-18 08:15:00	DONE	Lucas Cell	01-AUG-18 00:00
1204150011	MB	PCW	LUCAS3	NOV-15-18 08:15:00	DONE	Lucas Cell	01-MAR-18 00:00
1204150015	LCS	PCW	LUCAS4	NOV-15-18 08:15:00	DONE	Lucas Cell	01-MAR-18 00:00

Type III Data Package

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Project: PSEG Mercer
Groundwater and Water Samples
Collected on 12/06/18

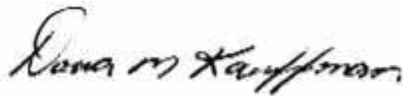
SDG# GEJ62

GROUP	SAMPLE NUMBERS
2016608	9931021-9931027

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-18-27
AZ Cert. # AZ0780

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by:



Date: 01/15/2019

Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Kerri Sachtleben at (717)-556-7376.

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**Sample Reference List for SDG Number GEJ62
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Mercer

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9931021	MW-1	12/06/2018 10:10	12/07/2018 19:30
9931022	MW-2	12/06/2018 10:10	12/07/2018 19:30
9931023	MW-3	12/06/2018 13:30	12/07/2018 19:30
9931024	MW-4	12/06/2018 11:35	12/07/2018 19:30
9931025	MW-5	12/06/2018 12:40	12/07/2018 19:30
9931026	MW-6	12/06/2018 14:20	12/07/2018 19:30
9931027	FB-20181206	12/06/2018 12:00	12/07/2018 19:30

Sample pH Log

SDG: GEJ62

<u>LLI Sample Number</u>	<u>Bottle Code</u>	<u>Actual pH</u>	<u>Exp. pH</u>	<u>*pH Check Code</u>	<u>Adj. pH</u>	<u>Adjusted Date</u>	<u>Adjusted Time</u>	<u>Preservative Added</u>	<u>Preservative Lot #</u>	<u>LLI Supplied Bottle?</u>	<u>Sulfide Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>**Chlorine Present?</u>	<u>Corrective Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9931021	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:08:30PM	12616
9931021	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:15:47PM	12665
9931021	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:14:09PM	12665
9931021	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:17:11AM	12616
9931021	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:06:52PM	12665
9931021	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:08:30PM	12616
9931021	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:17:11AM	12616
9931022	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:11:46PM	12616
9931022	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:13:32PM	12665
9931022	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 7:59:51PM	12665
9931022	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:15:00AM	12616
9931022	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:57:01PM	12665
9931022	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:11:46PM	12616
9931022	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:15:00AM	12616
9931023	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:13:42PM	12616
9931023	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:17:55PM	12665
9931023	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 7:59:36PM	12665
9931023	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:12:52AM	12616
9931023	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:13:15PM	12665
9931023	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:13:42PM	12616
9931023	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:12:52AM	12616
9931024	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:09:03PM	12616
9931024	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 7:58:49PM	12665
9931024	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:12:28PM	12665
9931024	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:20:15AM	12616
9931024	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:43:49PM	12665
9931024	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:22:42PM	12665
9931024	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:09:03PM	12616
9931024	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:20:15AM	12616
9931025	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:03:08PM	12616
9931025	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:14:23PM	12665
9931025	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:14:37PM	12665
9931025	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:19:42AM	12616
9931025	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:16:02PM	12665
9931025	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:03:08PM	12616
9931025	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:19:42AM	12616
9931026	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:06:43PM	12616
9931026	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:16:57PM	12665

<u>LLI Sample</u> <u>Number</u>	<u>Bottle</u> <u>Code</u>	<u>Actual</u> <u>pH</u>	<u>Exp.</u> <u>pH</u>	<u>*pH Check</u> <u>Code</u>	<u>Adj.</u> <u>pH</u>	<u>Adjusted</u> <u>Date</u>	<u>Adjusted</u> <u>Time</u>	<u>Preservative</u> <u>Added</u>	<u>Preservative</u> <u>Lot #</u>	<u>LLI</u> <u>Supplied</u> <u>Bottle?</u>	<u>Sulfide</u> <u>Present?</u>	<u>Corrective</u> <u>Substance</u>	<u>CS Lot #</u>	<u>**Chlorine</u> <u>Present?</u>	<u>Corrective</u> <u>Substance</u>	<u>CS Lot #</u>	<u>Record Date</u>	<u>Employee</u>
9931026	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:17:25PM	12665
9931026	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:17:57AM	12616
9931026	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:25:05PM	12665
9931026	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:06:43PM	12616
9931026	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:17:57AM	12616
9931027	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:19:49PM	12616
9931027	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:16:41PM	12665
9931027	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:17:09PM	12665
9931027	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:13:54AM	12616
9931027	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:20:00PM	12665
9931027	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 12:19:49PM	12616
9931027	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:13:54AM	12616

<u>*pH Check Code Key</u>	<u>**Chlorine Present Code Key</u>
PK = Original container checked - pH is within the correct range. (No preservative was added) PA = Original container checked - pH adjusted to correct range. (Preservative was added) PV = Volatile container checked PC = pH checked (unpreserved container) SPK = Subsampled from an original container. Original container checked - pH is within correct range SPA = Subsampled from an original container. Subsample container checked - pH adjusted to correct range. SPC = Subsampled from an original container. pH checked (unpreserved container). SUP = Subsampled from original container. Unable to be preserved due to the matrix of the sample. UP = Unable to preserve due to matrix of the sample. NA = Not applicable	NA = Chlorine Not Checked Y = Chlorine Present N = Chlorine Not Present

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 · 717-656-2300 Fax: 717-656-2681 · www.lancasterlabs.com**00259 Mercury**

The solution resulting from the mercury digestion is analyzed by Cold Vapor AA.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

14044 ICP-WW, 3005A (tot rec) - U345

The sample is digested with nitric acid and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3005A, July 1992

14047 ICPMS - Water, 3020A - U345

The sample is digested with nitric and hydrochloric acid.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992

05713 WW SW846 Hg Digest

The sample is heated at 95 c with nitric acid, sulfuric acid, potassium persulfate, and potassium permanganate. Excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

07046 Barium
08014 Boron
01750 Calcium
07051 Chromium
07052 Cobalt
01756 Lithium
07036 Selenium
07022 Thallium

The solution resulting from the metals digestion is analyzed by Trace ICP.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6010D, Rev. 4, July 2014.

06024 Antimony
06025 Arsenic
06027 Beryllium
06028 Cadmium
06035 Lead
06038 Molybdenum

The solution resulting from the metals digestion is analyzed by ICP/MS.

Reference: Test Methods for Evaluating Solid Wastes, SW-846 Update V, Method 6020B, Rev.2, July 2014.

00224 Chloride
01504 Fluoride
00228 Sulfate

A small volume of sample is introduced into an ion chromatograph. The anions are then separated and measured by a system consisting of a guard column, separator column, suppressor, and conductivity detector.

Reference: Method 300.0, Revision 2.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

12152 pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2011

00212 Total Dissolved Solids

A well-mixed sample is filtered through a glass fiber filter. The filtrate is collected in a tared beaker, evaporated in a steam bath and dried in an oven at 180C +/- 2C to a constant weight. The increase in weight is the total dissolved solids.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2540 C-2011

12151 Temperature of pH

The temperature of the sample measured during the pH analysis.

Reference: Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010

Analysis Reports / Field Chain of Custody



ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn MA 01801

Report Date: December 26, 2018 14:51

Project: PSEG Mercer

Account #: 07701
Group Number: 2016608
SDG: GEJ62
PO Number: 1504710
State of Sample Origin: NJ

Electronic Copy To GEI Consultants, Inc.
Electronic Copy To GEI Consultants, Inc.

Attn: Jason Kohl
Attn: Data Group

Respectfully Submitted,



(717)-556-7376

To view our laboratory's current scopes of accreditation please go to <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>. Historical copies may be requested through your project manager.



SAMPLE INFORMATION

<u>Client Sample Description</u>	<u>Sample Collection</u> <u>Date/Time</u>	<u>ELLE#</u>
MW-1 Grab Groundwater	12/06/2018 10:10	9931021
MW-2 Grab Groundwater	12/06/2018 10:10	9931022
MW-3 Grab Groundwater	12/06/2018 13:30	9931023
MW-4 Grab Groundwater	12/06/2018 11:35	9931024
MW-5 Grab Groundwater	12/06/2018 12:40	9931025
MW-6 Grab Groundwater	12/06/2018 14:20	9931026
FB-20181206 Grab Water	12/06/2018 12:00	9931027

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



DATA OF KNOWN QUALITY CONFORMANCE/NON-CONFORMANCE SUMMARY QUESTIONNAIRE

Laboratory Name: Eurofins Lancaster Laboratories Environmental

Client: GEI Consultants, Inc.

Project: PSEG Mercer

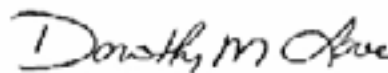
Sampling Date(s): 12/06/18

Laboratory Sample ID(s): 9931021-9931027

List DKQP Methods Used (e.g., 8260, 8270, et cetera)

EPA 300.0; SM 2540 C-2011; SM 2550 B-2010; SM 4500-H+ B-2011; SW-846 6010D Rev.4, July 2014; SW-846 6020B Rev.2, July 2014; SW-846 7470A

		Yes or No
1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the NJDEP Data of Known Quality performance standards?	Yes
1A	Were the method specified handling, preservation, and holding time requirements met?	No
1B	EPH Method: Was the EPH method conducted without significant modifications (see Section 11.3 of respective DKQ methods)?	NA
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	Yes
3	Were samples received at an appropriate temperature ($\leq 6^{\circ}\text{C}$)?	Yes
4	Were all QA/QC performance criteria specified in the NJDEP DKQP standards achieved?	No
5A	Were reporting limits* specified or referenced on the chain-of-custody or communicated to the laboratory prior to sample receipt?	Yes
5B	Were these reporting limits met?	No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the DKQP documents and/or site-specific QAPP?	No
7	Are project-specific matrix spikes and/or laboratory duplicates included in this data set?	No
Notes: For all questions to which the response was "No" (with the exception of question #7), additional information should be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Data of Known Quality." *The Limit of Quantitation (LOQ) meets requirements for the Reporting Limit (RL) as defined in the NJDEP Data of Known Quality performance standards, unless otherwise noted.		



Dorothy M. Love
Director

12/26/2018



Project Name: PSEG Mercer
ELLE Group #: 2016608

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Sample #s: 9931021-9931027

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

Analysis Specific Comments:**SW-846 6010D Rev.4, July 2014, Metals Dissolved**

Sample #s: 9931021, 9931022, 9931023, 9931024, 9931025, 9931026, 9931027

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.

Batch #: 183481404402 (Sample number(s): 9931021-9931027 UNSPK: 9931026 BKG: 9931026)

The recovery(ies) for the following analyte(s) in the MS and/or MSD exceeded the acceptance window indicating a positive bias: Calcium

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Lithium

SW-846 6020B Rev.2, July 2014, Metals Dissolved

Sample #s: 9931021, 9931022, 9931023, 9931024, 9931025, 9931027

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

SM 2540 C-2011, Wet Chemistry

Batch #: 18346921202A (Sample number(s): 9931023-9931026 UNSPK: 9931026 BKG: 9931026)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Total Dissolved Solids

Sample Description: MW-1 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931021
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 10:10
SDG#: GEJ62-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.140	0.0010	0.0050	1
08014	Boron	7440-42-8	2.18	0.0120	0.0500	1
01750	Calcium	7440-70-2	312	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0015 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0158 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	0.00015 J	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0577	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	87.0	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	571	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,570	160	480	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931021
ELLE Group #: 2016608
Matrix: Groundwater**Project Name:** PSEG Mercer**Submission Date/Time:** 12/07/2018 19:30
Collection Date/Time: 12/06/2018 10:10
SDG#: GEJ62-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.0	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.1	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:10	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:57	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:10	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:10	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 12:57	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:10	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:10	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:57	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:31	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:46	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:31	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:46	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:46	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:46	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:15	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: MW-1 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931021
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 10:10
SDG#: GEJ62-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120315B	12/15/2018 00:45	Hallie A Burnett	50
01504	Fluoride	EPA 300.0	1	18348120315B	12/15/2018 00:28	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315B	12/15/2018 00:45	Hallie A Burnett	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921201A	12/12/2018 10:36	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 21:05	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 21:05	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931022
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 10:10
SDG#: GEJ62-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0287	0.0010	0.0050	1
08014	Boron	7440-42-8	0.201	0.0120	0.0500	1
01750	Calcium	7440-70-2	39.0	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D. K1	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0039	0.00068	0.0020	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0089	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	3.1	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	26.4	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	153	20.0	60.0	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931022
ELLE Group #: 2016608
Matrix: Groundwater**Project Name:** PSEG Mercer**Submission Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/06/2018 10:10**SDG#:** GEJ62-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.4	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.7	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:13	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:07	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:13	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:13	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:07	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:13	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:13	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:07	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:46	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:54	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:46	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:54	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:54	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:54	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:17	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: MW-2 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931022
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 10:10
SDG#: GEJ62-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120315B	12/15/2018 01:01	Hallie A Burnett	5
01504	Fluoride	EPA 300.0	1	18348120315B	12/17/2018 21:50	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18348120315B	12/15/2018 01:01	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921201A	12/12/2018 10:37	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:39	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:39	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931023
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 13:30
SDG#: GEJ62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.196	0.0010	0.0050	1
08014	Boron	7440-42-8	0.260	0.0120	0.0500	1
01750	Calcium	7440-70-2	54.8	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0038 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0254 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0059	0.00068	0.0020	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0122	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	68.5	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	25.1	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	328	40.0	120	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931023
ELLE Group #: 2016608
Matrix: Groundwater**Project Name:** PSEG Mercer**Submission Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/06/2018 13:30**SDG#:** GEJ62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.4	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.1	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:22	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:10	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:22	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:22	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 13:00	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:22	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:22	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:10	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:48	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:56	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:48	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:56	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:56	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:56	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:19	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: MW-3 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931023
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 13:30
SDG#: GEJ62-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120315B	12/15/2018 02:25	Hallie A Burnett	50
01504	Fluoride	EPA 300.0	1	18348120315B	12/15/2018 02:08	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315B	12/15/2018 02:08	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921202A	12/12/2018 10:41	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:48	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:48	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931024
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 11:35
SDG#: GEJ62-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.0057	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0142 J	0.0120	0.0500	1
01750	Calcium	7440-70-2	2.94	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D. K1	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0029	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	1.4 J	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	2.1 J	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	34.0 J	20.0	60.0	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931024
ELLE Group #: 2016608
Matrix: Groundwater**Project Name:** PSEG Mercer**Submission Date/Time:** 12/07/2018 19:30
Collection Date/Time: 12/06/2018 11:35
SDG#: GEJ62-04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.5	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 6.4	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:25	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:14	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:25	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:25	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:14	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:25	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:25	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:14	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:50	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:58	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:50	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:58	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:58	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:58	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:21	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: MW-4 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931024
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 11:35
SDG#: GEJ62-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120315B	12/15/2018 02:42	Hallie A Burnett	5
01504	Fluoride	EPA 300.0	1	18348120315B	12/15/2018 02:42	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315B	12/15/2018 02:42	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921202A	12/12/2018 10:41	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:30	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:30	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931025
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submission Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 12:40
SDG#: GEJ62-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.202	0.0010	0.0050	1
08014	Boron	7440-42-8	0.444	0.0120	0.0500	1
01750	Calcium	7440-70-2	105	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D. K1	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.						
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0185	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	94.5	10.0	20.0	50
01504	Fluoride	16984-48-8	0.58	0.25	0.50	5
00228	Sulfate	14808-79-8	103	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	660	80.0	240	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931025
ELLE Group #: 2016608
Matrix: Groundwater**Project Name:** PSEG Mercer**Submission Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/06/2018 12:40**SDG#:** GEJ62-05

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.5	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.3	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:28	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:17	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:28	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:28	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:17	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:28	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:28	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:17	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:53	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:59	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:53	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:59	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:59	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:59	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:23	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: MW-5 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931025
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 12:40
SDG#: GEJ62-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120215B	12/15/2018 22:44	Hallie A Burnett	50
01504	Fluoride	EPA 300.0	1	18348120215B	12/17/2018 22:26	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18348120215B	12/15/2018 22:44	Hallie A Burnett	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921202A	12/12/2018 10:41	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003102A	12/10/2018 21:37	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003102A	12/10/2018 21:37	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931026
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 14:20
SDG#: GEJ62-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved		SW-846 6010D Rev.4, July 2014	mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	0.211	0.0010	0.0050	1
08014	Boron	7440-42-8	0.157	0.0120	0.0500	1
01750	Calcium	7440-70-2	38.5	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0024 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0150 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
07022	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0022	0.00031	0.0020	1
00259	SW-846 7470A		mg/l	mg/l	mg/l	
	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277	Lab Filtration - Metals					
	The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.					
Wet Chemistry		EPA 300.0	mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	261	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	6.3	1.5	5.0	5
00212	SM 2540 C-2011		mg/l	mg/l	mg/l	
	Total Dissolved Solids	n.a.	504	80.0	240	1
12151	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
	Temperature of pH	n.a.	22.3	0.010	0.010	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931026
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 14:20
SDG#: GEJ62-06

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	6.8	0.010	0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample Comments

State of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:16	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 22:51	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:16	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:16	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 12:35	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:16	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:16	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 22:51	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183551404708A	12/22/2018 22:25	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183551404708A	12/23/2018 13:07	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183551404708A	12/23/2018 13:07	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183551404708A	12/23/2018 13:07	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183551404708A	12/22/2018 22:25	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183551404708C	12/22/2018 22:25	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:25	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183551404708	12/21/2018 15:10	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1

*=This limit was used in the evaluation of the final result

Sample Description: MW-6 Grab Groundwater
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931026
ELLE Group #: 2016608
Matrix: Groundwater

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 14:20
SDG#: GEJ62-06

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00224	Chloride	EPA 300.0	1	18348120215B	12/15/2018 23:17	Hallie A Burnett	50
01504	Fluoride	EPA 300.0	1	18348120215B	12/15/2018 23:01	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120215B	12/15/2018 23:01	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921202A	12/12/2018 10:42	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 21:01	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 21:01	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Sample Description: FB-20181206 Grab Water
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931027
ELLE Group #: 2016608
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 12:00
SDG#: GEJ62-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Metals Dissolved						
	SW-846 6010D Rev.4, July 2014		mg/l	mg/l	mg/l	
07046	Barium	7440-39-3	N.D.	0.0010	0.0050	1
08014	Boron	7440-42-8	N.D.	0.0120	0.0500	1
01750	Calcium	7440-70-2	0.157 J	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D. K1	0.0015	0.0050	1
01756	Lithium	7439-93-2	N.D.	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
07022	Thallium	7440-28-0	N.D.	0.0140	0.0300	1
	The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.					
	SW-846 6020B Rev.2, July 2014		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0020	1
06025	Arsenic	7440-38-2	N.D.	0.00068	0.0020	1
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	N.D.	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	N.D.	0.00031	0.0020	1
	SW-846 7470A		mg/l	mg/l	mg/l	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00020	1
03277 Lab Filtration - Metals						
The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.						
Wet Chemistry						
	EPA 300.0		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	N.D.	0.20	0.40	1
01504	Fluoride	16984-48-8	N.D.	0.050	0.10	1
00228	Sulfate	14808-79-8	N.D.	0.30	1.0	1
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	N.D.	20.0	60.0	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	

*=This limit was used in the evaluation of the final result

Sample Description: FB-20181206 Grab Water
PSEG Mercer / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931027
ELLE Group #: 2016608
Matrix: Water**Project Name:** PSEG Mercer**Submittal Date/Time:** 12/07/2018 19:30
Collection Date/Time: 12/06/2018 12:00
SDG#: GEJ62-07FB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 22.1	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 6.2	Std. Units 0.010	Std. Units 0.010	1
The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.						

Sample CommentsState of New Jersey Lab Certification No. PA011
This sample was lab filtered for dissolved metals.**Laboratory Sample Analysis Record**

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07046	Barium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:31	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:20	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:31	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:31	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:20	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:31	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:31	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/19/2018 00:20	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:34	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 19:02	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:34	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 19:02	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 19:02	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 19:02	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:27	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183481404402	12/17/2018 05:40	Annamaria Kuhns	1

* = This limit was used in the evaluation of the final result

Sample Description: FB-20181206 Grab Water
PSEG Mercer / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931027
ELLE Group #: 2016608
Matrix: Water

Project Name: PSEG Mercer

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/06/2018 12:00
SDG#: GEJ62-07FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183471404706	12/14/2018 03:44	James L Mertz	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	2	183511404702	12/18/2018 04:51	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183470571303	12/14/2018 10:15	Denise L Trimby	1
00224	Chloride	EPA 300.0	1	18348120215B	12/15/2018 23:34	Hallie A Burnett	1
01504	Fluoride	EPA 300.0	1	18348120215B	12/15/2018 23:34	Hallie A Burnett	1
00228	Sulfate	EPA 300.0	1	18348120215B	12/15/2018 23:34	Hallie A Burnett	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18346921201A	12/12/2018 10:37	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:52	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:52	Jeremy L Bolf	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 12/26/2018 14:51

Group Number: 2016608

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 183470571303	Sample number(s): 9931021-9931027		
Mercury	N.D.	0.000050	0.00020
Batch number: 183481404402	Sample number(s): 9931021-9931027		
Barium	N.D.	0.0010	0.0050
Boron	N.D.	0.0120	0.0500
Calcium	N.D.	0.0330	0.500
Chromium	N.D.	0.0053	0.0150
Cobalt	N.D.	0.0015	0.0050
Lithium	N.D.	0.0110	0.0500
Selenium	N.D.	0.0210	0.0500
Thallium	N.D.	0.0140	0.0300
Batch number: 183511404702A	Sample number(s): 9931021-9931025,9931027		
Antimony	N.D.	0.00041	0.0020
Arsenic	N.D.	0.00068	0.0020
Beryllium	N.D.	0.000091	0.00050
Cadmium	N.D.	0.00015	0.0010
Lead	N.D.	0.0011	0.0030
Batch number: 183511404702C	Sample number(s): 9931021-9931025,9931027		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 183551404708A	Sample number(s): 9931026		
Antimony	N.D.	0.00041	0.0020
Arsenic	N.D.	0.00068	0.0020
Beryllium	N.D.	0.000091	0.00050
Cadmium	N.D.	0.00015	0.0010
Lead	N.D.	0.0011	0.0030
Batch number: 183551404708C	Sample number(s): 9931026		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 18348120215B	Sample number(s): 9931025-9931027		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18348120315B	Sample number(s): 9931021-9931024		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 12/26/2018 14:51

Group Number: 2016608

Method Blank (continued)

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 18346921201A Total Dissolved Solids	Sample number(s): 9931021-9931022,9931027 N.D.	20.0	60.0
Batch number: 18346921202A Total Dissolved Solids	Sample number(s): 9931023-9931026 N.D.	20.0	60.0

LCS/LCSD

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 183470571303 Mercury	Sample number(s): 9931021-9931027 0.00100	0.000846			85		80-120		
Batch number: 183481404402 Barium	Sample number(s): 9931021-9931027 2.00	2.03			102		80-120		
Boron	2.00	1.94			97		80-120		
Calcium	4.00	4.20			105		80-120		
Chromium	0.200	0.204			102		80-120		
Cobalt	0.500	0.541			108		80-120		
Lithium	1.00	1.03			103		80-120		
Selenium	0.150	0.150			100		80-120		
Thallium	0.150	0.159			106		80-120		
Batch number: 183511404702A Antimony	Sample number(s): 9931021-9931025,9931027 0.00600	0.00525	0.00600	0.00519	87	87	80-120	1	20
Arsenic	0.0100	0.0115	0.0100	0.0102	115	102	80-120	13	20
Beryllium	0.00400	0.00407	0.00400	0.00424	102	106	80-120	4	20
Cadmium	0.00500	0.00526	0.00500	0.00506	105	101	80-120	4	20
Lead	0.0150	0.0157	0.0150	0.0156	105	104	80-120	1	20
Batch number: 183511404702C Molybdenum	Sample number(s): 9931021-9931025,9931027 0.0500	0.0528	0.0500	0.0518	106	104	80-120	2	20
Batch number: 183551404708A Antimony	Sample number(s): 9931026 0.00600	0.00533	0.00600	0.00515	89	86	80-120	3	20
Arsenic	0.0100	0.00901	0.0100	0.0105	90	105	80-120	16	20
Beryllium	0.00400	0.00391	0.00400	0.00372	98	93	80-120	5	20
Cadmium	0.00500	0.00548	0.00500	0.00471	110	94	80-120	15	20
Lead	0.0150	0.0149	0.0150	0.0140	99	93	80-120	6	20
Batch number: 183551404708C Molybdenum	Sample number(s): 9931026 0.0500	0.0527	0.0500	0.0501	105	100	80-120	5	20

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

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(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 12/26/2018 14:51

Group Number: 2016608

LCS/LCSD (continued)

Analysis Name	LCS Spike Added mg/l	LCS Conc mg/l	LCSD Spike Added mg/l	LCSD Conc mg/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 18348120215B	Sample number(s): 9931025-9931027								
Chloride	3.00	3.09			103		90-110		
Fluoride	0.750	0.692			92		90-110		
Sulfate	7.50	7.88			105		90-110		
Batch number: 18348120315B	Sample number(s): 9931021-9931024								
Chloride	3.00	3.06			102		90-110		
Fluoride	0.750	0.704			94		90-110		
Sulfate	7.50	7.76			104		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18346921201A	Sample number(s): 9931021-9931022,9931027								
Total Dissolved Solids	200	199			100		62-127		
Batch number: 18346921202A	Sample number(s): 9931023-9931026								
Total Dissolved Solids	200	193			97		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18344003101A	Sample number(s): 9931021-9931024,9931026-9931027								
pH	7.00	7.00			100		95-105		
Batch number: 18344003102A	Sample number(s): 9931025								
pH	7.00	7.01			100		95-105		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 183481404402	Sample number(s): 9931021-9931027 UNSPK: 9931026									
Barium	0.211	2.00	2.24	2.00	2.25	101	102	75-125	0	20
Boron	0.157	2.00	2.16	2.00	2.14	100	99	75-125	1	20
Calcium	38.5	4.00	43.69	4.00	43.39	130 (2)	122 (2)	75-125	1	20
Chromium	N.D.	0.200	0.203	0.200	0.201	102	101	75-125	1	20
Cobalt	0.00243	0.500	0.529	0.500	0.523	105	104	75-125	1	20
Lithium	0.0150	1.00	1.04	1.00	1.03	102	102	75-125	1	20
Selenium	N.D.	0.150	0.156	0.150	0.155	104	103	75-125	0	20
Thallium	N.D.	0.150	0.153	0.150	0.155	102	104	75-125	2	20
	mg/l	mg/l	mg/l	mg/l	mg/l					

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 12/26/2018 14:51

Group Number: 2016608

MS/MSD (continued)

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc mg/l	MS Spike Added mg/l	MS Conc mg/l	MSD Spike Added mg/l	MSD Conc mg/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 18346921202A	Sample number(s): 9931023-9931026 UNSPK: 9931026									
Total Dissolved Solids	504	800	1318			102		62-127		

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc mg/l	DUP Conc mg/l	DUP RPD	DUP RPD Max
Batch number: 183481404402	Sample number(s): 9931021-9931027 BKG: 9931026			
Barium	0.211	0.217	3	20
Boron	0.157	0.159	2 (1)	20
Calcium	38.5	39.53	3	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	0.00243	0.00238	2 (1)	20
Lithium	0.0150	0.0188	22* (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20
	mg/l	mg/l		
Batch number: 18346921202A	Sample number(s): 9931023-9931026 BKG: 9931026			
Total Dissolved Solids	504	560	11* (1)	5

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

eurofins

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For Lurline/Lancaster Laboratories Environments, use only

Group 8

Sample #

COC # 571680

Eurofys Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717.656.2300 • FOR FULL COMPLIANCE - OHM CHECK OUT! <http://www.bluelink.us/ohmcheck>



Group Number(s): 206608

Client: GEI Consultants, Inc.**Delivery and Receipt Information**

Delivery Method: ELFE Courier Arrival Timestamp: 12/07/2018 19:30
 Number of Packages: 4 Number of Projects: 2
 State/Province of Origin: NJ

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6 mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Melvin Sanchez (8943) at 22:46 on 12/07/2018**Samples Chilled Details**

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT42-02	3.2	DT	Wet	Y	Bagged	N
2	DT42-02	1.4	DT	Wet	Y	Bagged	N
3	DT42-02	1.9	DT	Wet	Y	Bagged	N
4	DT42-02	1.2	DT	Wet	Y	Bagged	N

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	mL	milliliter(s)
C	degrees Celsius	MPN	Most Probable Number
cfu	colony forming units	N.D.	non-detect
CP Units	cobalt-chloroplatinate units	ng	nanogram(s)
F	degrees Fahrenheit	NTU	nephelometric turbidity units
g	gram(s)	pg/L	picogram/liter
IU	International Units	RL	Reporting Limit
kg	kilogram(s)	TNTC	Too Numerous To Count
L	liter(s)	µg	microgram(s)
lb.	pound(s)	µL	microliter(s)
m3	cubic meter(s)	umhos/cm	micromhos/cm
meq	milliequivalents	MCL	Maximum Contamination Limit
mg	milligram(s)		
<	less than		
>	greater than		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value $\geq$ the Method Detection Limit (MDL or DL) and $<$ the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column $>40\%$. The lower result is reported.
P^	Concentration difference between the primary and confirmation column $>40\%$. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column $>100\%$. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.

Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Metals in Liquid Data

Case Narrative/Conformance Summary

Metals in Liquid

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9931021	MW-1	X		1	
9931022	MW-2	X		1	
9931023	MW-3	X		1	
9931024	MW-4	X		1	
9931025	MW-5	X		1	
9931026	MW-6	X		1	
9931027	FB-20181206	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Method defined actions are taken for any failed matrix QC.

Batch#: 183481404402 (Sample number(s): 9931021-9931027, UNSPK: 9931026, BKG: 9931026)
The recovery(ies) for the following analyte(s) in the MS exceeded the acceptance window indicating a positive bias: Calcium

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

ICP Metals

Fraction: Metals in Liquid

Sample Duplicate

Batch#: 183481404402 (Sample number(s): 9931021-9931027, UNSPK: 9931026, BKG: 9931026)
The duplicate RPD for the following analyte(s) is outside the acceptance window: Lithium

SAMPLE ANALYSIS:

The instrument detection limits (IDLs) are used for determining the U flags on the initial and continuing calibration blanks. The highest IDL is selected when multiple instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9931021-9931027)

The holding time was not met for dissolved sample filtration. The filtration time for dissolved metals is to be within 15 minutes from collection. Since the filtration occurred after receipt in the laboratory, the 15 minute criteria was exceeded. This sample was not collected per applicable Clean Water Act (40CFR136) or SW-846 regulations.

(Sample number(s): 9931021-9931027: Analysis: 07036)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.

(Sample number(s): 9931021-9931027: Analysis: 07022)

The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The analyte was evaluated using the MDL.

(Sample number(s): 9931021-9931025, 9931027: Analysis: 06025)

The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

BKG – Background	AF - Cold Vapor Atomic Fluorescence
DUP – Duplicate	U - Below MDL
MS - Matrix Spike	B - Below LOQ
MSD - Matrix Spike Dup	N - Matrix Spike out of specifications
B – Blank	* - Duplicate out of specifications
Q - Laboratory Control Sample	E - Matrix Effects exist as proven by Serial Dilution or Spiked Dilution
Y - Laboratory Control Sample Duplicate	A - Post Digestion Spike

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

ICP Metals

Fraction: Metals in Liquid

P - ICP Atomic Emission Spectrometer	L - Serial Dilution
MS - ICP Mass Spectrometry	R - Internal Standard Relative Intensity OOS
CV - Cold Vapor	NR - Not Required

Sample Data

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931021
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	140			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	2180			P
7440-43-9	Cadmium	0.15	B		MS
7440-70-2	Calcium	312000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	15.8	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	57.7			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931022
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.9			MS
7440-39-3	Barium	28.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	201			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	39000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	8.9			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931023
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	5.9			MS
7440-39-3	Barium	196			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	260			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	54800			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.8	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	25.4	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	12.2			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931024
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	5.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	14.2	B		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	2940			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.9			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931025
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	202			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	444			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	105000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	18.5			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931026, 9931026BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	211			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	157			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	38500			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.4	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	15.0	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.2			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931027
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	12.0	U		P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	157	B		P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	11.0	U		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.31	U		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	14.0	U		P

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence
NR = Not Required

CONCENTRATION QUALIFIERS:

U = Below MDL,
B = Below LOQ

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ62

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	183481404402	9931021
Boron		9931022
Calcium		9931023
Chromium		9931024
Cobalt		9931025
Lithium		9931026BKG
Selenium		9931026MS
Thallium		9931026MSD
		9931026DUP
		9931027
		P34804BB
		P34804BQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ62

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	183511404702	*31001BKG
Arsenic		9931021
Beryllium		9931022
Cadmium		9931023
Lead		9931024
Molybdenum		9931025
		9931027
		P35104BB
		P35104BQ
		P35104BY

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ62

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	183551404708	9931026BKG
Arsenic		P35504HB
Beryllium		P35504HQ
Cadmium		P35504HY
Lead		
Molybdenum		

LEGEND:

BKG = Background	B = Blank
DUP = Duplicate	Q = Laboratory Control Sample
MS = Matrix Spike	Y = Laboratory Control Sample Duplicate
MSD = Matrix Spike Duplicate	

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ62

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	183470571303	*31001BKG
		9931021
		9931022
		9931023
		9931024
		9931025
		9931026
		9931027
		P34771CB
		P34771CQ

LEGEND:

BKG = Background

DUP = Duplicate

MS = Matrix Spike

MSD = Matrix Spike Duplicate

B = Blank

Q = Laboratory Control Sample

Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P
Run Name: 1835202T70
Calibration Date(s): 12/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium		600.0	600.03	100.0	500.0	502.47	100.5	500.0	509.86	102.0
Boron										
Calcium		30000.0	30469.96	101.6	25000.0	25644.06	102.6	25000.0	25645.97	102.6
Chromium		600.0	596.64	99.4	500.0	501.03	100.2	500.0	505.74	101.1
Cobalt										
Lithium		600.0	602.23	100.4	500.0	513.19	102.6	500.0	531.72	106.3
Selenium		600.0	606.15	101.0	500.0	511.36	102.3	500.0	505.35	101.1
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P

Run Name: 1835202T70

Calibration Date(s): 12/18/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	513.01	102.6	500.0	495.24	99.0
Boron										
Calcium					25000.0	25691.68	102.8	25000.0	25169.26	100.7
Chromium					500.0	496.38	99.3	500.0	480.91	96.2
Cobalt										
Lithium					500.0	527.56	105.5	500.0	496.80	99.4
Selenium					500.0	505.02	101.0	500.0	486.43	97.3
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P
Run Name: 1835202T70
Calibration Date(s): 12/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium					500.0	501.70	100.3			
Boron										
Calcium					25000.0	25304.33	101.2			
Chromium					500.0	486.51	97.3			
Cobalt										
Lithium					500.0	509.08	101.8			
Selenium					500.0	499.73	99.9			
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P

Run Name: 1835208T72

Calibration Date(s): 12/18/2018 - 12/19/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron		600.0	643.17	107.2	500.0	500.61	100.1	500.0	509.67	101.9
Calcium										
Chromium										
Cobalt		600.0	606.97	101.2	500.0	508.53	101.7	500.0	514.80	103.0
Lithium										
Selenium										
Thallium		600.0	609.90	101.7	500.0	502.02	100.4	500.0	520.12	104.0

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P

Run Name: 1835208T72

Calibration Date(s): 12/18/2018 - 12/19/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron					500.0	510.61	102.1	500.0	515.44	103.1
Calcium										
Chromium										
Cobalt					500.0	520.97	104.2	500.0	519.57	103.9
Lithium										
Selenium										
Thallium					500.0	523.19	104.6	500.0	524.32	104.9

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P
Run Name: 1835208T72
Calibration Date(s): 12/18/2018 - 12/19/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron					500.0	505.29	101.1			
Calcium										
Chromium										
Cobalt					500.0	522.18	104.4			
Lithium										
Selenium										
Thallium					500.0	524.32	104.9			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P
Run Name: 1835402T70
Calibration Date(s): 12/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron										
Calcium										
Chromium										
Cobalt		600.0	595.15	99.2	500.0	486.47	97.3	500.0	492.24	98.4
Lithium										
Selenium										
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P

Run Name: 1835402T70

Calibration Date(s): 12/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron										
Calcium										
Chromium										
Cobalt					500.0	494.25	98.9	500.0	501.74	100.3
Lithium										
Selenium										
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: P

Run Name: 1835402T70

Calibration Date(s): 12/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron										
Calcium										
Chromium										
Cobalt					500.0	508.53	101.7			
Lithium										
Selenium										
Thallium										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835407E03
Calibration Date(s): 12/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75	500.0	477.19	95.4	250.0	248.24	99.3	250.0	273.63	109.5
Beryllium										
Cadmium	111	50.0	48.05	96.1	25.0	26.24	105.0	25.0	26.25	105.0
Lead	208	50.0	49.29	98.6	25.0	25.89	103.6	25.0	25.61	102.4
Molybdenum	98	50.0	46.03	92.1	25.0	24.75	99.0	25.0	25.20	100.8

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835407E03
Calibration Date(s): 12/20/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75				250.0	266.03	106.4	250.0	272.78	109.1
Beryllium										
Cadmium	111				25.0	27.14	108.6	25.0	27.17	108.7
Lead	208				25.0	25.54	102.2	25.0	27.06	108.2
Molybdenum	98				25.0	25.77	103.1	25.0	26.84	107.4

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS

Run Name: 1835503E05

Calibration Date(s): 12/21/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	50.61	101.2	25.0	23.70	94.8	25.0	23.65	94.6
Arsenic										
Beryllium	9	50.0	49.67	99.3	25.0	24.84	99.4	25.0	25.64	102.6
Cadmium										
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835503E05
Calibration Date(s): 12/21/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	23.22	92.9	25.0	27.24	109.0
Arsenic										
Beryllium	9				25.0	25.27	101.1	25.0	25.25	101.0
Cadmium										
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835603E03
Calibration Date(s): 12/22/2018 - 12/23/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121	50.0	54.96	109.9	25.0	26.51	106.0	25.0	26.06	104.2
Arsenic										
Beryllium										
Cadmium										
Lead	208	50.0	51.64	103.3	25.0	24.79	99.2	25.0	24.93	99.7
Molybdenum	98	50.0	51.24	102.5	25.0	23.44	93.8	25.0	25.13	100.5

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835603E03
Calibration Date(s): 12/22/2018 - 12/23/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	24.66	98.6	25.0	27.37	109.5
Arsenic										
Beryllium										
Cadmium										
Lead	208				25.0	24.63	98.5	25.0	25.23	100.9
Molybdenum	98				25.0	23.90	95.6	25.0	26.86	107.4

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS
Run Name: 1835603E03
Calibration Date(s): 12/22/2018 - 12/23/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony	121				25.0	25.33	101.3			
Arsenic										
Beryllium										
Cadmium										
Lead	208				25.0	25.40	101.6			
Molybdenum	98				25.0	24.77	99.1			

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: MS

Run Name: 1835702E05

Calibration Date(s): 12/23/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Antimony										
Arsenic	75	500.0	507.65	101.5	250.0	260.25	104.1	250.0	258.99	103.6
Beryllium	9	50.0	50.28	100.6	25.0	24.18	96.7	25.0	24.46	97.8
Cadmium	111	50.0	50.94	101.9	25.0	26.83	107.3	25.0	27.43	109.7
Lead										
Molybdenum										

(1) Control Limits: 90 - 110

(2) Control Limits: 90 - 110

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: CV
Run Name: 1834901M09
Calibration Date(s): 12/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury		2.5	2.42	96.8	1.0	1.02	102.0	1.0	1.01	101.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: CV
Run Name: 1834901M09
Calibration Date(s): 12/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.02	102.0	1.0	1.01	101.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: CV
Run Name: 1834901M09
Calibration Date(s): 12/15/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	1.02	102.0	1.0	1.00	100.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ62

Method: CV

Run Name: 1834901M09

Calibration Date(s): 12/15/2018

Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Mercury					1.0	0.99	99.0	1.0	1.00	100.0

(1) Control Limits: 90 - 110

(2) Control Limits: 80 - 120

* Outside Limits. If Continuing Calibration is outside limits, high, only ND samples are accepted.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: P
Run Name: 1835202T70
Calibration Date(s): 12/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	4.91	98.2		
Boron						
Calcium		500.0	513.14	102.6		
Chromium		15.0	14.70	98.0		
Cobalt						
Lithium		50.0	47.82	95.6		
Selenium		50.0	47.25	94.5		
Thallium						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: P

Run Name: 1835208T72

Calibration Date(s): 12/18/2018 - 12/19/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron		50.0	49.44	98.9		
Calcium						
Chromium						
Cobalt		5.0	6.93	138.6		
Lithium						
Selenium						
Thallium		30.0	34.53	115.1		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: P

Run Name: 1835402T70

Calibration Date(s): 12/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron						
Calcium						
Chromium						
Cobalt		5.0	5.11	102.2		
Lithium						
Selenium						
Thallium						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: MS

Run Name: 1835407E03

Calibration Date(s): 12/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic	75	2.0	2.00	100.0		
Beryllium						
Cadmium	111	1.0	1.14	114.0		
Lead	208	3.0	2.96	98.7		
Molybdenum	98	2.0	1.83	91.5		

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: MS

Run Name: 1835503E05

Calibration Date(s): 12/21/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	2.09	104.5		
Arsenic						
Beryllium	9	0.5	0.56	112.0		
Cadmium						
Lead						
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: MS

Run Name: 1835603E03

Calibration Date(s): 12/22/2018 - 12/23/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	1.90	95.0	1.79	89.5
Arsenic						
Beryllium						
Cadmium						
Lead	208	3.0	2.62	87.3	2.67	89.0
Molybdenum	98	2.0	1.66	83.0	1.68	84.0

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: MS

Run Name: 1835702E05

Calibration Date(s): 12/23/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic	75	2.0	1.97	98.5		
Beryllium	9	0.5	0.52	104.0		
Cadmium	111	1.0	1.11	111.0		
Lead						
Molybdenum						

Control limits: 80% - 120%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ62

Method: CV

Run Name: 1834901M09

Calibration Date(s): 12/15/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.21	105.0	0.22	110.0

Control limits: 50% - 150%

For 6010B - Control limits apply to values up to 10 times the true value of the low level check standard. If LLC is out of specification, high, results < RL are acceptable.

For 6010C - If Low Level Check (LLC) is out of specification, results > CCV are acceptable. If LLC is out of specification, high, results < RL are acceptable.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ62

Method: P

Run Name: 1835202T70

Calibration Date(s): 12/18/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)				Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Batch Number
Barium		0.33U	0.33U		0.33U		0.33U		1.000U183481404402
Boron									
Calcium		33.4U	33.4U		33.4U		33.4U		33.000U183481404402
Chromium		0.96U	0.96U		0.96U		0.96U		5.300U183481404402
Cobalt									
Lithium		9.6U	9.6U		10.0B		9.6U		11.000U183481404402
Selenium		8.4U	8.4U		8.4U		8.4U		21.000U183481404402
Thallium									

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: P
Run Name: 1835202T70
Calibration Date(s): 12/18/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium				0.33	U	0.33	U				
Boron											
Calcium				75.6	B	33.4	U				
Chromium				0.96	U	0.96	U				
Cobalt											
Lithium				9.6	U	9.6	U				
Selenium				8.4	U	8.4	U				
Thallium											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: P

Run Name: 1835208T72

Calibration Date(s): 12/18/2018 - 12/19/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)				Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Batch Number
Barium									
Boron		8.4U	8.4U		8.4U		8.4U		12.000U183481404402
Calcium									
Chromium									
Cobalt		3.2B	0.82B		0.54B		0.54U		1.500U183481404402
Lithium									
Selenium									
Thallium		3.8U	3.8U		3.8U		3.8U		14.000U183481404402

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: P

Run Name: 1835208T72

Calibration Date(s): 12/18/2018 - 12/19/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass	C	Batch Number
Barium											
Boron			8.4	U	8.4	U					
Calcium											
Chromium											
Cobalt			0.54	U	0.54	U					
Lithium											
Selenium											
Thallium			3.8	U	4.1	B					

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: P
Run Name: 1835402T70
Calibration Date(s): 12/20/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Barium											
Boron											
Calcium											
Chromium											
Cobalt		0.54U		0.54U		0.54U		0.54U			
Lithium											
Selenium											
Thallium											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: P
Run Name: 1835402T70
Calibration Date(s): 12/20/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
		C	1	C	2	C	3	C	Mass	C	Batch Number
Barium											
Boron											
Calcium											
Chromium											
Cobalt			0.54	U	0.54	U					
Lithium											
Selenium											
Thallium											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS

Run Name: 1835407E03

Calibration Date(s): 12/20/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony											
Arsenic	75	0.40U		0.40U		0.40U		0.40U		75	0.680U183511404702A
Beryllium											
Cadmium	111	0.17U		0.17U		0.17U		0.17U		111	0.150U183511404702A
Lead	208	0.20U		0.20U		0.20U		0.20U		208	1.100U183511404702A
Molybdenum	98	0.25U		0.25U		0.25U		0.25U		98	0.310U183511404702A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS
Run Name: 1835407E03
Calibration Date(s): 12/20/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony											
Arsenic	75			0.40	U						
Beryllium											
Cadmium	111			0.17	U						
Lead	208			0.20	U						
Molybdenum	98			0.25	U						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS

Run Name: 1835503E05

Calibration Date(s): 12/21/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)				
			C	1	C	2	C	3	C	Mass		C	Batch Number
Antimony	121	0.52	U	0.52	U	0.52	U	0.52	U	121	0.410	U	183511404702A
Arsenic													
Beryllium	9	0.067	U	0.067	U	0.067	U	0.067	U	9	0.091	U	183511404702A
Cadmium													
Lead													
Molybdenum													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS
Run Name: 1835503E05
Calibration Date(s): 12/21/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony	121			0.52	U						
Arsenic											
Beryllium	9			0.067	U						
Cadmium											
Lead											
Molybdenum											

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS

Run Name: 1835603E03

Calibration Date(s): 12/22/2018 - 12/23/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)			
			C	1	C	2	C	3	C	Mass		C	Batch Number
Antimony	121	0.52	U	0.52	U	0.52	U	0.52	U	121	-0.437	B	183551404708A
Arsenic													
Beryllium													
Cadmium													
Lead	208	-0.40	B	-0.40	B	-0.42	B	-0.41	B	208	1.100	U	183551404708A
Molybdenum	98	-0.30	B	-0.27	B	-0.33	B	-0.31	B	98	-0.358	B	183551404708A

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS

Run Name: 1835603E03

Calibration Date(s): 12/22/2018 - 12/23/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Antimony	121			0.52	U	0.52	U				
Arsenic											
Beryllium											
Cadmium											
Lead	208			-0.44	B	-0.43	B				
Molybdenum	98			-0.32	B	0.25	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: MS

Run Name: 1835702E05

Calibration Date(s): 12/23/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass		C Batch Number
Antimony												
Arsenic	75	0.45	B	0.40	U	0.46	B			75	0.680	U183551404708A
Beryllium	9	0.067	U	0.067	U	0.067	U			9	0.091	U183551404708A
Cadmium	111	0.17	U	0.17	U	0.17	U			111	0.150	U183551404708A
Lead												
Molybdenum												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: CV

Run Name: 1834901M09

Calibration Date(s): 12/15/2018

Preparation Blank Matrix: WATER

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)	
			C	1	C	2	C	3	C	Batch Number
Mercury		0.050	U	0.050	U	0.050	U	0.050	U	183470571303

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: CV
Run Name: 1834901M09
Calibration Date(s): 12/15/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	C	Continuing Calibration Blank (ug/L)			C	Preparation Blank (UG/L)			C	Batch Number
				1	C	2	C	3	C	Mass		
Mercury				0.050	U	0.050	U	0.050	U			

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ62

Method: CV
Run Name: 1834901M09
Calibration Date(s): 12/15/2018

Analyte	Mass	Initial Calibration Blank (ug/L)	Continuing Calibration Blank (ug/L)						Preparation Blank (UG/L)		
			C	1	C	2	C	3	C	Mass	Batch Number
Mercury				0.050	U	0.050	U				

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below IDL/MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ62

Instrument ID: 11016
Run Name: 1835202T70
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		502404	100.5						
Barium	0		1							
Boron										
Calcium	500000		495564	99.1						
Chromium	0		16							
Cobalt										
Iron	200000		200863	100.4						
Lithium	0		6							
Magnesium	500000		464944	93.0						
Selenium	0		-27							
Thallium										

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ62

Instrument ID: 16417
Run Name: 1835208T72
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		532647	106.5						
Barium										
Boron	0		10							
Calcium	500000		502555	100.5						
Chromium										
Cobalt	0		1							
Iron	200000		196085	98.0						
Lithium										
Magnesium	500000		451335	90.3						
Selenium										
Thallium	0		-3							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ62

Instrument ID: 11016
Run Name: 1835402T70
Concentration Units: ug/L

Analyte	True		Initial Found				Final Found			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	500000		503058	100.6						
Barium										
Boron										
Calcium	500000		497748	99.5						
Chromium										
Cobalt	0		1							
Iron	200000		199766	99.9						
Lithium										
Magnesium	500000		457986	91.6						
Selenium										
Thallium										

Control Limits: All Metals 80%-120%

Instrument ID: 11332
Run Name: 1835407E03
Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		94923	94.9		
Antimony							
Arsenic	75	0		1			
Beryllium							
Cadmium	111	0		0			
Calcium	44	300000		280842	93.6		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		254343	101.7		
Lead	208	0		0			
Magnesium	24	100000		98835	98.8		
Molybdenum	98	2000		1938	96.9		
Phosphorus	31	10000		NA			
Potassium	39	100000		107723	107.7		
Sodium	23	250000		243167	97.3		
Sulfur	34	10000		NA			
Titanium	47	2000		2118	105.9		

Control Limits: All Metals 80%-120%

Instrument ID: 19204
 Run Name: 1835503E05
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		93411	93.4		
Antimony	121	0		1			
Arsenic							
Beryllium	9	0		0			
Cadmium							
Calcium	44	300000		247033	82.3		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		224496	89.8		
Lead							
Magnesium	24	100000		91268	91.3		
Molybdenum	98	2000		2086	104.3		
Phosphorus	31	10000		NA			
Potassium	39	100000		91426	91.4		
Sodium	23	250000		218949	87.6		
Sulfur	34	10000		NA			
Titanium	47	2000		2085	104.3		

Control Limits: All Metals 80%-120%

Instrument ID: 11332
 Run Name: 1835603E03
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000	100000	98848	98.8	99698.8	99.7
Antimony	121	0	0	1		0.9	
Arsenic							
Beryllium							
Cadmium							
Calcium	44	300000	300000	287487	95.8	293982.4	98.0
Carbon	13	20000	20000	NA		NA	
Chloride	37	100000	100000	NA		NA	
Iron	57	250000	250000	244246	97.7	239109.4	95.6
Lead	208	0	0	0		-0.1	
Magnesium	24	100000	100000	95394	95.4	98457.0	98.5
Molybdenum	98	2000	2000	2017	100.9	1951.3	97.6
Phosphorus	31	10000	10000	NA		NA	
Potassium	39	100000	100000	99043	99.0	99234.3	99.2
Sodium	23	250000	250000	257733	103.1	255509.7	102.2
Sulfur	34	10000	10000	NA		NA	
Titanium	47	2000	2000	1973	98.7	2065.3	103.3

Control Limits: All Metals 80%-120%

Instrument ID: 11332
 Run Name: 1835603E03
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000	100000	102019	102.0	103614.5	103.6
Antimony	121	0	0	1		1.0	
Arsenic							
Beryllium							
Cadmium							
Calcium	44	300000	300000	303776	101.3	311065.9	103.7
Carbon	13	20000	20000	NA		NA	
Chloride	37	100000	100000	NA		NA	
Iron	57	250000	250000	245664	98.3	253064.9	101.2
Lead	208	0	0	0		-0.2	
Magnesium	24	100000	100000	101395	101.4	101203.9	101.2
Molybdenum	98	2000	2000	1987	99.4	2068.1	103.4
Phosphorus	31	10000	10000	NA		NA	
Potassium	39	100000	100000	102572	102.6	106798.5	106.8
Sodium	23	250000	250000	259188	103.7	273634.0	109.5
Sulfur	34	10000	10000	NA		NA	
Titanium	47	2000	2000	2118	105.9	2185.9	109.3

Control Limits: All Metals 80%-120%

Instrument ID: 19204
 Run Name: 1835702E05
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000	100000	108640	108.6	100957.7	101.0
Antimony							
Arsenic	75	0	100	0		112.0	112.0
Beryllium	9	0	0	0		0.0	
Cadmium	111	0	100	0		106.9	106.9
Calcium	44	300000	300000	314818	104.9	301258.5	100.4
Carbon	13	20000	20000	NA		NA	
Chloride	37	100000	100000	NA		NA	
Iron	57	250000	250000	264078	105.6	251291.5	100.5
Lead							
Magnesium	24	100000	100000	111255	111.3	105283.6	105.3
Molybdenum	98	2000	2000	2262	113.1	2277.7	113.9
Phosphorus	31	10000	10000	NA		NA	
Potassium	39	100000	100000	109322	109.3	103899.0	103.9
Sodium	23	250000	250000	270125	108.1	259036.1	103.6
Sulfur	34	10000	10000	NA		NA	
Titanium	47	2000	2000	2292	114.6	2015.4	100.8

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9931026BKG Matrix Spike Lab Sample ID: 9931026MS Matrix Spike Duplicate Lab Sample ID: 9931026MSD
Batch Number(s): 183481404402

Analyte	Mass	BKG Sample		MS Sample		MSD Sample		MS Spike Added	MSD Spike Added	Units	MS		MSD		RPD	Q	Control Limit		M
		Result	C	Result	C	Result	C				%R	Q	%R	Q			%R	RPD	
Barium		211.2600		2238.4600		2247.7100		2000.0000	2000.0000	UG/L	101		102		0		75 - 125	20	P
Boron		156.5100		2159.5600		2141.3700		2000.0000	2000.0000	UG/L	100		99		1		75 - 125	20	P
Calcium		38500.6600		43687.6100		43393.3800		4000.0000	4000.0000	UG/L	130		122		1				P
Chromium		5.3000	U	203.0400		201.2300		200.0000	200.0000	UG/L	102		101		1		75 - 125	20	P
Cobalt		2.4300	B	528.6300		523.4500		500.0000	500.0000	UG/L	105		104		1		75 - 125	20	P
Lithium		15.0200	B	1039.7300		1033.8900		1000.0000	1000.0000	UG/L	102		102		1		75 - 125	20	P
Selenium		21.0000	U	155.5400		154.7700		150.0000	150.0000	UG/L	104		103		0		75 - 125	20	P
Thallium		14.0000	U	153.0300		155.4500		150.0000	150.0000	UG/L	102		104		2		75 - 125	20	P

Note: Results shown are reported on an as-received basis.

If Matrix Spike/ Matrix Spike Duplicate were out of specification, see Post Digestion Spike form.

METHODS:

P = ICP Atomic Emission Spectrometer

CV = Cold Vapor

MS = ICP Mass Spectrometry

AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL, B= Below LOQ

FLAGS:

N = Matrix Spike OOS, * = Duplicate OOS



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ62

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9931026BKG

9931026DUP

Batch Number(s): 1834814044

02

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Max RPD	Q	M
Barium			211.2600		216.6100		3		P	
Boron		50.0	156.5100		159.4000		2		P	
Calcium			38500.6600		39534.7100		3		P	
Chromium			5.3000	U	5.3000	U			P	
Cobalt			2.4300	B	2.3800	B	2		P	
Lithium			15.0200	B	18.7600	B	22		P	
Selenium			21.0000	U	21.0000	U			P	
Thallium			14.0000	U	14.0000	U			P	

NOTE: An asterisk (*) in column "Q" indicates poor duplicate precision (RPD > Max OR $|(S) - (D)| > LOQ$ for values < 5x LOQ).

The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample.

Note: Results shown are reported on an as-received basis.

METHODS: P = ICP Atomic Emission Spectrometer MS = ICP Mass Spectrometry CV = Cold Vapor AF = Cold Vapor Atomic Fluorescence	CONCENTRATION QUALIFIERS: U= Below MDL B= Below LOQ FLAGS: * = Duplicate Out of Spec



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ62
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Barium		183481404402	UG/L	2000.000	2030.960		80 - 120	102	P	Yes
Boron		183481404402	UG/L	2000.000	1935.970		80 - 120	97	P	Yes
Calcium		183481404402	UG/L	4000.000	4199.180		80 - 120	105	P	Yes
Chromium		183481404402	UG/L	200.000	203.680		80 - 120	102	P	Yes
Cobalt		183481404402	UG/L	500.000	541.200		80 - 120	108	P	Yes
Lithium		183481404402	UG/L	1000.000	1028.870		80 - 120	103	P	Yes
Mercury		183470571303	UG/L	1.000	0.846		80 - 120	85	CV	Yes
Selenium		183481404402	UG/L	150.000	149.850		80 - 120	100	P	Yes
Thallium		183481404402	UG/L	150.000	159.140		80 - 120	106	P	Yes

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 7 (LCS/LCSD)

LABORATORY CONTROL SAMPLE/SAMPLE DUPLICATE

SDG No.: GEJ62

Matrix: WATER

Analyte	Mass	Lab Sample ID		Batch Number	Units	True	LCS			LCSD			Control Limits (%)	RPD	M	In Spec
		LCS	LCSD				Found	C	%R	Found	C	%R				
Antimony	121	P35104BQ	P35104BY	183511404702	UG/L	6.000	5.247		87	5.192		87	80 - 120	1	MS	Yes
Arsenic	75	P35104BQ	P35104BY	183511404702	UG/L	10.000	11.536		115	10.159		102	80 - 120	13	MS	Yes
Beryllium	9	P35104BQ	P35104BY	183511404702	UG/L	4.000	4.071		102	4.240		106	80 - 120	4	MS	Yes
Cadmium	111	P35104BQ	P35104BY	183511404702	UG/L	5.000	5.261		105	5.060		101	80 - 120	4	MS	Yes
Lead	208	P35104BQ	P35104BY	183511404702	UG/L	15.000	15.736		105	15.623		104	80 - 120	1	MS	Yes
Molybdenum	98	P35104BQ	P35104BY	183511404702	UG/L	50.000	52.786		106	51.795		104	80 - 120	2	MS	Yes

RPD Control Limit: 20

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL

B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 7 (LCS/LCSD)

LABORATORY CONTROL SAMPLE/SAMPLE DUPLICATE

SDG No.: GEJ62

Matrix: WATER

Analyte	Mass	Lab Sample ID		Batch Number	Units	True	LCS			LCSD			Control Limits (%)	RPD	M	In Spec
		LCS	LCSD				Found	C	%R	Found	C	%R				
Antimony	121	P35504HQ	P35504HY	183551404708	UG/L	6.000	5.335		89	5.152		86	80 - 120	3	MS	Yes
Arsenic	75	P35504HQ	P35504HY	183551404708	UG/L	10.000	9.007		90	10.549		105	80 - 120	16	MS	Yes
Beryllium	9	P35504HQ	P35504HY	183551404708	UG/L	4.000	3.913		98	3.716		93	80 - 120	5	MS	Yes
Cadmium	111	P35504HQ	P35504HY	183551404708	UG/L	5.000	5.475		110	4.712		94	80 - 120	15	MS	Yes
Lead	208	P35504HQ	P35504HY	183551404708	UG/L	15.000	14.861		99	14.012		93	80 - 120	6	MS	Yes
Molybdenum	98	P35504HQ	P35504HY	183551404708	UG/L	50.000	52.696		105	50.145		100	80 - 120	5	MS	Yes

RPD Control Limit: 20

METHODS:

P = ICP Atomic Emission Spectrometer

MS = ICP Mass Spectrometry

CV = Cold Vapor

AF = Cold Vapor Atomic Fluorescence

CONCENTRATION QUALIFIERS:

U= Below MDL

B= Below LOQ



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ62

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *31001BKG

Serial Dilution Lab Sample ID: *31001L

Batch Number(s): 183511404702

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	0.7577	B	2.0300	U	100		MS
Arsenic	75	1.9808	B	4.0397	B	104		MS
Beryllium	9	0.0910	U	0.4550	U			MS
Cadmium	111	0.1510	U	0.7550	U			MS
Lead	208	1.0700	U	5.3500	U			MS
Molybdenum	98	2.6967		2.9998	B	11		MS

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ62

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9931026BKG Serial Dilution Lab Sample ID: 9931026L

Batch Number(s): 183551404708, 183481404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	0.4060	U	2.0300	U			MS
Arsenic	75	0.6800	U	3.4000	U			MS
Barium		211.2600		203.4500		4		P
Beryllium	9	0.0910	U	0.4550	U			MS
Boron		156.5100		170.8000	B	9		P
Cadmium	111	0.1510	U	0.7550	U			MS
Calcium		38500.6600		37868.8000		2		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		2.4300	B	7.5000	U	100		P
Lead	208	1.0700	U	5.3500	U			MS
Lithium		15.0200	B	55.0000	U	100		P
Molybdenum	98	2.2219		1.5450	U	100		MS
Selenium		21.0000	U	105.0000	U			P
Thallium		14.0000	U	70.0000	U			P

NOTE: An E in column Q indicates the presence of a chemical or physical interference in the matrix when the % difference is greater than 10%. This applies only when (I) is greater than or equal to 50x MDL for ICP, 100x MDL for ICP-MS (6020), 50x MDL for ICP-MS (200.8), or 25x MDL for GFAA.

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry

CONCENTRATION QUALIFIERS:

U= Below MDL
B= Below LOQ

FLAGS:

E = Matrix Effects exist as proven by
Serial Dilution or Spiked Dilution

Method: P
Instrument ID: 11016
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium	455.40		0.33
Boron			
Calcium	317.93		33.4
Chromium	267.72		0.96
Cobalt	228.62		0.53
Lithium	670.78		9.6
Selenium	196.09		8.4
Thallium			

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: P
Instrument ID: 16417
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron	249.67		8.4
Calcium			
Chromium			
Cobalt	228.62		0.54
Lithium			
Selenium			
Thallium	190.86		3.8

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 11332
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.34
Arsenic	75		0.40
Beryllium			
Cadmium	111		0.14
Lead	208		0.20
Molybdenum	98		0.25

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: MS
Instrument ID: 19204
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.52
Arsenic	75		0.40
Beryllium	9		0.067
Cadmium	111		0.17
Lead			
Molybdenum			

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

Method: CV
Instrument ID: 23283
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Mercury			0.050

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ62
Matrix: WATER

Method: P
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium	455.40		5.0	1.0
Boron	249.67		50.0	12.0
Calcium	317.93		500	33.0
Chromium				
Cobalt	228.62		5.0	1.5
Lithium	670.78		50.0	11.0
Selenium				
Thallium				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ62
Matrix: WATER

Method: P
Date: 09/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Barium				
Boron				
Calcium				
Chromium	267.72		15.0	5.3
Cobalt				
Lithium				
Selenium	196.09		50.0	21.0
Thallium	190.86		30.0	14.0

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ62
Matrix: WATER

Method: MS
Date: 07/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony	121		2.0	0.41
Arsenic				
Beryllium	9		0.50	0.091
Cadmium	111		1.0	0.15
Lead				
Molybdenum	98		2.0	0.31

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ62
Matrix: WATER

Method: MS
Date: 09/2018

Analyte	Mass	Background	LOQ (UG/L)	MDL (UG/L)
Antimony				
Arsenic	75		2.0	0.68
Beryllium				
Cadmium				
Lead	208		3.0	1.1
Molybdenum				

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ62
Matrix: WATER

Method: CV
Date: 06/2018

Analyte	Wavelength (nm)	Background	LOQ (UG/L)	MDL (UG/L)
Mercury			0.20	0.050

The LOQ/MDL must be adjusted for % Solids and Sample Weight for samples reporting in mg/kg and ug/L.

Comments:

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

US EPA Tune Check Report

Operator Name US19_USR_INS14259
Acq/Data Batch C:\Agilent\ICPMH\1\DATA\~EPATUNEaa.b
Acq. Date-Time 12/20/2018 5:41:57 PM
Report Comment ICP-MS #19204 (E05) Daily Tune Check
Instrument Name G3281A JP12071581

[No Gas]

Sensitivity

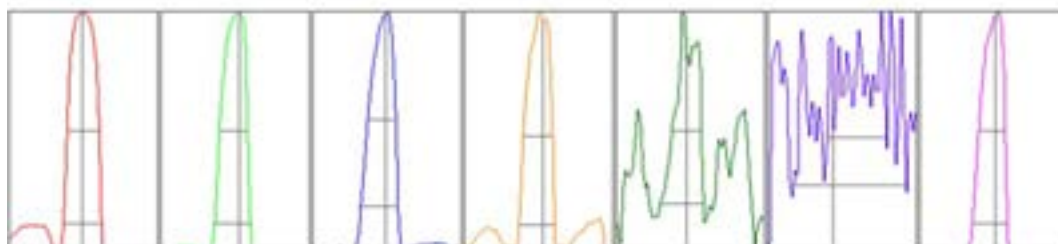
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	1129	11290.75			1.263	5.000
89	10.00	2194	21935.38			0.683	5.000
205	10.00	581	5806.88			0.857	5.000
70	1.00	39	388.73	0.00		8.088	
156	1.00	5	46.00	0.00		10.398	
220	1.00	2	22.40	0.00		14.672	
140	10.00	1440	14402.18	0.00		0.714	

Mass	RSD% (Flag)
7	
89	
205	
70	
156	
220	
140	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	1150	1119	1122	1117	1138
89	2184	2176	2205	2213	2190
205	580	580	587	582	574
70	39	36	41	43	36
156	4	5	4	4	5
220	3	3	2	2	2
140	1430	1440	1431	1444	1456

Integration Time [sec] 0.1

Resolution/Axis



US EPA Tune Check Report

Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	1794.04	7.00	6.90 - 7.10	
89	3956.19	89.10	88.90 - 89.10	
205	1057.51	205.00	204.90 - 205.10	
70	66.66	70.10	-	
156	6.60	155.95	-	
220	1.85	219.85	-	
140	2749.44	140.05	-	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.65	0.770	0.800	
89	0.58	0.728	0.800	
205	0.56	0.749	0.800	
70	0.60	0.720		
156	0.60	0.896		
220	1.19	2.275		
140	0.54	0.715		

Integration Time [sec] 0.1
 Acquisition Time [sec] 260.3
 Y Axis Linear

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	0.25 L/min	Dilution Gas	0.70 L/min
RF Power	1600 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.60 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	10.0 mm	S/C Temp	20 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	4.1 V	Deflect	12.6 V
Extract 2	-100.0 V	Cell Entrance	-32 V	Plate Bias	-20 V
Omega Bias	-75 V	Cell Exit	-59 V		

Cell Parameters

Use Gas	No	3rd Gas Flow	---	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OctP Bias	-8.0 V		
H2 Flow	0.0 mL/min	OctP RF	180 V		

QP Parameters

Mass Gain	122	Axis Gain	0.9986	QP Bias	-3.0 V
Mass Offset	126	Axis Offset	0.06		

Hardware Settings

Torch

Torch H	1.0 mm	Torch V	-1.5 mm

EM

Discriminator	4.5 mV	Analog HV	1742 V	Pulse HV	1501 V

US EPA Tune Check Report

Operator Name US19_USR_INS14259
Acq/Data Batch C:\Agilent\ICPMH\1\DATA\~EPATUNEaa.b
Acq. Date-Time 12/22/2018 2:01:38 PM
Report Comment ICP-MS #19204 (E05) Daily Tune Check
Instrument Name G3281A JP12071581

[No Gas]

Sensitivity

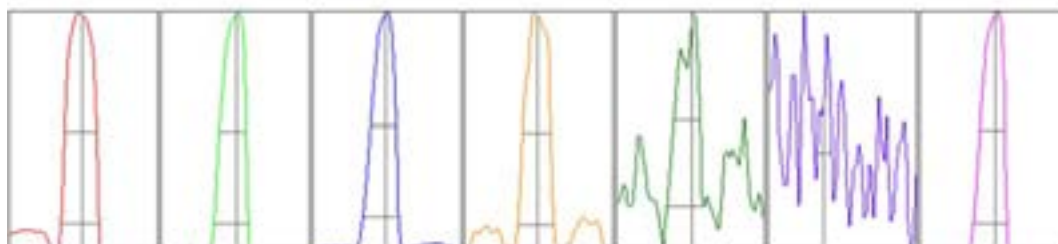
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	524	5239.81			1.984	5.000
89	10.00	2047	20466.68			1.246	5.000
205	10.00	555	5551.34			2.454	5.000
70	1.00	28	279.02	0.00		4.224	
156	1.00	4	40.60	0.00		13.917	
220	1.00	2	20.80	0.00		31.508	
140	10.00	1374	13737.25	0.00		0.757	

Mass	RSD% (Flag)
7	
89	
205	
70	
156	
220	
140	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	533	533	524	522	508
89	2063	2080	2042	2015	2034
205	566	573	546	546	544
70	28	27	30	27	28
156	5	4	4	4	4
220	1	2	2	2	3
140	1386	1383	1368	1362	1369

Integration Time [sec] 0.1

Resolution/Axis



US EPA Tune Check Report

Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	836.64	7.00	6.90 - 7.10	
89	3871.53	89.05	88.90 - 89.10	
205	1092.74	205.00	204.90 - 205.10	
70	50.70	70.00	-	
156	7.35	156.05	-	
220	2.50	219.65	-	
140	2774.67	140.05	-	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.65	0.764	0.800	
89	0.55	0.694	0.800	
205	0.51	0.720	0.800	
70	0.58	0.726		
156	0.52	0.749		
220	0.28			
140	0.51	0.690		

Integration Time [sec] 0.1
 Acquisition Time [sec] 260.3
 Y Axis Linear

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	0.25 L/min	Dilution Gas	0.70 L/min
RF Power	1600 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.60 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	10.0 mm	S/C Temp	20 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	5.5 V	Deflect	13.8 V
Extract 2	-105.0 V	Cell Entrance	-32 V	Plate Bias	-20 V
Omega Bias	-85 V	Cell Exit	-59 V		

Cell Parameters

Use Gas	No	3rd Gas Flow	---	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OctP Bias	-8.0 V		
H2 Flow	0.0 mL/min	OctP RF	190 V		

QP Parameters

Mass Gain	123	Axis Gain	0.9989	QP Bias	-3.0 V
Mass Offset	126	Axis Offset	0.01		

Hardware Settings

Torch

Torch H	1.2 mm	Torch V	-2.0 mm

EM

Discriminator	4.5 mV	Analog HV	1741 V	Pulse HV	1505 V



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 11332

Start Date: 12/20/2018

Run Name: 1835407E03

End Date: 12/20/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-1-115	AS,MO	TB-1-159	CD,PB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-1-115	Q	Element TB-1-159	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	17:59	100		100									
S	18:00	106		108									
ICV	18:02	112		109									
ICB	18:04	98		97									
LLC	18:05	102		100									
ICSA	18:07	106		102									
LRS2	18:08	107		111									
LRS3	18:10	112		111									
CCS	18:12	97		94									
CCS	18:13	95		93									
CCV	18:15	104		99									
CCB	18:16	91		91									
P35104BB	18:18	100		100									
P35104BQ	18:19	102		101									
P35104BY	18:21	106		102									
*31001BKG	18:23	94		95									
ZZZZZZ	18:24												
*31001L	18:26	104		101									
ZZZZZZ	18:27												
ZZZZZZ	18:29												
ZZZZZZ	18:31												
CCV	18:32	103		98									
CCB	18:34	98		94									
ZZZZZZ	18:35												
ZZZZZZ	18:37												
ZZZZZZ	18:38												
ZZZZZZ	18:40												
ZZZZZZ	18:42												
ZZZZZZ	18:43												
ZZZZZZ	18:45												
9931021	18:46	106		102									
9931023	18:48												
9931023	18:50												

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 11332

Start Date: 12/20/2018

Run Name: 1835407E03

End Date: 12/20/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-1-115	AS,MO	TB-1-159	CD,PB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-1-115	Q	Element TB-1-159	Q	Element	Q	Element	Q	Element	Q	Element	Q
CCV	18:51	104		102									
CCB	18:53	96		93									
9931022	18:54	102		100									
9931023	18:56	105		102									
9931024	18:58	97		95									
9931025	18:59	106		104									
9931025	19:01												
9931027	19:02	101		98									
CCV	19:04	98		97									
CCB	19:05	94		91									

LEGEND:

BKG = Background MS = Matrix Spike
DUP = Duplicate MSD = Matrix Spike Duplicate
L = Serial Dilution A = Post Digest Spike
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
BI = Bismuth SC = Scandium
GE = Germanium TB = Terbium
HO = Holmium Y = Yttrium
IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 19204

Start Date: 12/21/2018

Run Name: 1835503E05

End Date: 12/21/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-3-115	SB	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-3-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	08:16	100		100									
S	08:18	100		98									
ICV	08:21	101		96									
ICB	08:24	102		93									
LLC	08:26	102		98									
ICSA	08:28	103		90									
LRS2	08:31	105		93									
LRS3	08:33	103		90									
CCS	08:36	99		93									
CCS	08:38	99		88									
CCV	08:40	101		93									
CCB	08:43	101		93									
P35104BB	08:45	99		93									
ZZZZZZ	08:48												
ZZZZZZ	08:50												
P35104BY	08:53	100		89									
P35104BY	08:55	100		99									
*31001BKG	08:57	100		85									
ZZZZZZ	09:00												
*31001L	09:02	111		99									
ZZZZZZ	09:05												
CCV	09:07	110		100									
CCB	09:09	106		96									
ZZZZZZ	09:12												
ZZZZZZ	09:14												
ZZZZZZ	09:17												
ZZZZZZ	09:19												
ZZZZZZ	09:21												
ZZZZZZ	09:24												
ZZZZZZ	09:26												
ZZZZZZ	09:29												
9931021	09:31	111		100									
9931027	09:34	110		98									

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 19204

Start Date: 12/21/2018

Run Name: 1835503E05

End Date: 12/21/2018

Standard	Elements Applies to	Standard	Elements Applies to
IN-3-115	SB	SC-1-45	BE

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-3-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
CCV	09:36	109		104									
CCB	09:38	109		99									
P35104BQ	09:41	111		103									
P35104BQ	09:43	109		101									
9931022	09:46	108		101									
9931023	09:48	107		97									
9931024	09:50	106		101									
9931025	09:53	106		95									
9931025	09:55												
CCV	09:58	105		94									
CCB	10:00	104		100									

LEGEND:

BKG = Background MS = Matrix Spike
DUP = Duplicate MSD = Matrix Spike Duplicate
L = Serial Dilution A = Post Digest Spike
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
BI = Bismuth SC = Scandium
GE = Germanium TB = Terbium
HO = Holmium Y = Yttrium
IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 11332

Start Date: 12/22/2018

Run Name: 1835603E03

End Date: 12/23/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	IN-1-115	MO, SB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-1-115	Q	Element BI-1-209	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	21:20	100		100									
S	21:22	99		103									
ICV	21:24	100		103									
ICB	21:25	95		100									
LLC	21:27	100		104									
ICSA	21:28	95		95									
ICSAB	21:30	94		92									
LRS2	21:32	95		95									
LRS3	21:33	96		98									
CCS	21:35	97		100									
CCS	21:36	97		101									
CCV	21:38	101		104									
CCB	21:39	100		101									
ZZZZZZ	21:41												
ZZZZZZ	21:43												
ZZZZZZ	21:44												
ZZZZZZ	21:46												
ZZZZZZ	21:48												
ZZZZZZ	21:50												
ZZZZZZ	21:51												
ZZZZZZ	21:53												
ZZZZZZ	21:55												
ZZZZZZ	21:56												
CCV	21:58	102		100									
CCB	21:59	103		102									
ZZZZZZ	22:01												
ZZZZZZ	22:02												
ZZZZZZ	22:04												
ZZZZZZ	22:06												
ZZZZZZ	22:07												
ZZZZZZ	22:09												
ZZZZZZ	22:10												
ZZZZZZ	22:12												

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 11332

Start Date: 12/22/2018

Run Name: 1835603E03

End Date: 12/23/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-1-209	PB	IN-1-115	MO, SB

Lab Sample ID	Time	Internal Standards %RI For:											
		Element IN-1-115	Q	Element BI-1-209	Q	Element	Q	Element	Q	Element	Q	Element	Q
ZZZZZZ	22:14												
CCV	22:15	105		104									
CCB	22:17	96		95									
P35504HB	22:18	99		100									
P35504HQ	22:20	96		99									
P35504HY	22:23	99		102									
9931026BKG	22:25	101		99									
9931026A	22:27	96		95									
9931026L	22:28	98		99									
CCV	22:30	94		100									
CCB	22:32	94		92									
LLC	22:33	98		100									
ICSA	22:35	93		89									
ICSAB	22:36	94		94									
ZZZZZZ	22:38												
CCV	22:39	99		99									
CCB	22:41	97		100									

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ62

Instrument ID: 19204

Start Date: 12/23/2018

Run Name: 1835702E05

End Date: 12/23/2018

Standard	Elements Applies to	Standard	Elements Applies to
GE-3-72	AS	IN-3-115	CD
SC-1-45	BE		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element GE-3-72	Q	Element IN-3-115	Q	Element	Q	Element	Q	Element	Q
S0	12:28	100		100		100							
S	12:31	99		101		105							
ICV	12:34	99		97		101							
ICB	12:36	100		97		100							
LLC	12:39	101		100		100							
ICSA	12:41	99		92		95							
ICSAB	12:43	101		93		95							
LRS2	12:46	102		99		92							
LRS3	12:48	103		97		95							
CCS	12:51	102		96		100							
CCS	12:53	100		96		93							
CCV	12:55	104		96		94							
CCB	12:58	97		94		90							
P35504HB	13:00	98		98		93							
P35504HQ	13:03	99		99		93							
P35504HY	13:05	103		100		99							
9931026BKG	13:07	96		100		104							
9931026A	13:10	106		101									
9931026L	13:12	103		97		100							
CCV	13:15	102		100		96							
CCB	13:17	99		97		96							

LEGEND:

BKG = Background MS = Matrix Spike
 DUP = Duplicate MSD = Matrix Spike Duplicate
 L = Serial Dilution A = Post Digest Spike
 B = Blank
 Q = Laboratory Control Sample
 Y = Laboratory Control Sample Duplicate

FLAG:

R = Internal Standard Relative Intensity OOS

INTERNAL STANDARD ELEMENTS:

BE = Beryllium LI = Lithium
 BI = Bismuth SC = Scandium
 GE = Germanium TB = Terbium
 HO = Holmium Y = Yttrium
 IN = Indium

Preparation and Run Logs

Metals in Liquid



Method: P

Batch Number: 183481404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931021	12/17/2018	50.00	50
9931022	12/17/2018	50.00	50
9931023	12/17/2018	50.00	50
9931024	12/17/2018	50.00	50
9931025	12/17/2018	50.00	50
9931027	12/17/2018	50.00	50
9931026BKG	12/17/2018	50.00	50
9931026DUP	12/17/2018	50.00	50
9931026MSD	12/17/2018	50.00	50
9931026MS	12/17/2018	50.00	50
P34804BB	12/17/2018	50.00	50
P34804BQ	12/17/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Method: MS
Batch Number: 183511404702

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931021	12/18/2018	50.00	50
9931022	12/18/2018	50.00	50
9931023	12/18/2018	50.00	50
9931024	12/18/2018	50.00	50
9931025	12/18/2018	50.00	50
9931027	12/18/2018	50.00	50
*31001BKG	12/18/2018	50.00	50
P35104BB	12/18/2018	50.00	50
P35104BQ	12/18/2018	1.00	1
P35104BY	12/18/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ62

Method: MS
Batch Number: 183551404708

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931026BKG	12/21/2018	50.00	50
P35504HB	12/21/2018	50.00	50
P35504HQ	12/21/2018	1.00	1
P35504HY	12/21/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ62

Method: CV
Batch Number: 183470571303

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931021	12/14/2018	40.00	40
9931022	12/14/2018	40.00	40
9931023	12/14/2018	40.00	40
9931024	12/14/2018	40.00	40
9931025	12/14/2018	40.00	40
9931026	12/14/2018	40.00	40
9931027	12/14/2018	40.00	40
*31001BKG	12/14/2018	40.00	40
P34771CB	12/14/2018	40.00	40
P34771CQ	12/14/2018	1.00	1

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ62

Method: P

Instrument ID: 11016

Run Name: 1835202T70

Run Start Date: 12/18/2018

Run End Date: 12/18/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	06:22			X				X	X			X			X														
S	1.00	06:25							X																					
S	1.00	06:28			X								X			X														
S	1.00	06:31								X																				
ICV	1.00	06:34			X				X	X			X			X														
ICB	1.00	06:36			X				X	X			X			X														
LLC	1.00	06:39			X				X	X			X			X														
ICSA	1.00	06:42			X				X	X			X			X														
CCV	1.00	06:45			X				X	X			X			X														
CCB	1.00	06:48			X				X	X			X			X														
LRS2	1.00	06:51			X				X	X			X			X														
LRS4	1.00	06:55			X				X	X			X			X														
LRS3	1.00	06:58			X				X	X			X			X														
LRS5	1.00	07:01			X				X	X			X			X														
CCV	1.00	07:04			X				X	X			X			X														
CCB	1.00	07:07			X				X	X			X			X														
P34804BB	1.00	07:10			X				X	X			X			X														
P34804BQ	1.00	07:13			X				X	X			X			X														
9931026BKG	1.00	07:16			X				X	X			X			X														
9931026A	1.00	07:19																												
9931026DUP	1.00	07:22			X				X	X			X			X														
9931026MS	1.00	07:25			X				X	X			X			X														
9931026MSD	1.00	07:28			X				X	X			X			X														
9931026L	5.00	07:31			X				X	X			X			X														
ZZZZZZ	1.00	07:34																												
ZZZZZZ	1.00	07:37																												
CCV	1.00	07:41			X				X	X			X			X														
CCB	1.00	07:44			X				X	X			X			X														
ZZZZZZ	1.00	07:46																												
ZZZZZZ	1.00	07:49																												
ZZZZZZ	1.00	07:53																												
ZZZZZZ	1.00	07:56																												
ZZZZZZ	1.00	07:59																												
ZZZZZZ	1.00	08:02																												
ZZZZZZ	1.00	08:04																												
ZZZZZZ	1.00	08:07																												
9931021	1.00	08:10			X				X	X			X			X														
9931022	1.00	08:13			X				X	X			X			X														

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: P
Instrument ID: 11016
Run Name: 1835202T70

Run Start Date: 12/18/2018
Run End Date: 12/18/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
CCV	1.00	08:16			X				X	X			X			X														
CCB	1.00	08:19			X				X	X			X			X														
9931023	1.00	08:22			X				X	X			X			X														
9931024	1.00	08:25			X				X	X			X			X														
9931025	1.00	08:28			X				X	X			X			X														
9931027	1.00	08:31			X				X	X			X			X														
ZZZZZZ	1.00	08:34																												
ZZZZZZ	1.00	08:36																												
CCV	1.00	08:39			X				X	X			X			X														
CCB	1.00	08:42			X				X	X			X			X														

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: P
Instrument ID: 16417
Run Name: 1835208T72

Run Start Date: 12/18/2018
Run End Date: 12/19/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	21:49					X				X						X													
S	1.00	21:52																												
S	1.00	21:55					X				X						X													
S	1.00	21:59																												
ICV	1.00	22:02					X				X						X													
ICB	1.00	22:06					X				X						X													
LLC	1.00	22:09					X				X						X													
ICSA	1.00	22:12					X				X						X													
CCV	1.00	22:16					X				X						X													
CCB	1.00	22:19					X				X						X													
LRS2	1.00	22:22					X				X						X													
LRS4	1.00	22:26					X				X						X													
LRS3	1.00	22:30					X				X						X													
LRS5	1.00	22:34					X				X						X													
CCV	1.00	22:37					X				X						X													
CCB	1.00	22:40					X				X						X													
P34804BB	1.00	22:44					X				X						X													
P34804BQ	1.00	22:47					X				X						X													
9931026BKG	1.00	22:51					X										X													
9931026A	1.00	22:54																												
9931026DUP	1.00	22:57					X										X													
9931026MS	1.00	23:01					X				X						X													
9931026MSD	1.00	23:04					X				X						X													
9931026L	5.00	23:08					X										X													
ZZZZZZ	1.00	23:11																												
ZZZZZZ	1.00	23:15																												
CCV	1.00	23:19					X				X						X													
CCB	1.00	23:22					X				X						X													
ZZZZZZ	5.00	23:26																												
ZZZZZZ	1.00	23:29																												
ZZZZZZ	1.00	23:33																												
ZZZZZZ	1.00	23:36																												
ZZZZZZ	1.00	23:40																												
ZZZZZZ	1.00	23:43																												
ZZZZZZ	1.00	23:47																												
ZZZZZZ	1.00	23:50																												
ZZZZZZ	1.00	23:53																												
9931021	1.00	23:57					X										X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: P
Instrument ID: 16417
Run Name: 1835208T72

Run Start Date: 12/18/2018
Run End Date: 12/19/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
CCV	1.00	00:00					X				X						X													
CCB	1.00	00:04					X				X						X													
9931022	1.00	00:07					X				X						X													
9931023	1.00	00:10					X										X													
9931024	1.00	00:14					X				X						X													
9931025	1.00	00:17					X				X						X													
9931027	1.00	00:20					X				X						X													
CCV	1.00	00:24					X				X						X													
CCB	1.00	00:27					X				X						X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ62

Method: P

Instrument ID: 11016

Run Name: 1835402T70

Run Start Date: 12/20/2018

Run End Date: 12/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	10:52									X																			
S	1.00	10:55																												
S	1.00	10:58									X																			
S	1.00	11:01																												
ICV	1.00	11:04									X																			
ICB	1.00	11:06									X																			
LLC	1.00	11:09									X																			
ICSA	1.00	11:12									X																			
CCV	1.00	11:15									X																			
CCB	1.00	11:18									X																			
LRS2	1.00	11:21									X																			
LRS4	1.00	11:25									X																			
LRS3	1.00	11:28									X																			
LRS5	1.00	11:31									X																			
CCV	1.00	11:34									X																			
CCB	1.00	11:37									X																			
ZZZZZZ	1.00	11:40																												
ZZZZZZ	1.00	11:43																												
ZZZZZZ	1.00	11:46																												
ZZZZZZ	1.00	11:49																												
ZZZZZZ	1.00	11:53																												
ZZZZZZ	1.00	11:56																												
ZZZZZZ	1.00	11:59																												
ZZZZZZ	5.00	12:02																												
ZZZZZZ	1.00	12:05																												
ZZZZZZ	1.00	12:08																												
CCV	1.00	12:11									X																			
CCB	1.00	12:14									X																			
ZZZZZZ	1.00	12:17																												
ZZZZZZ	1.00	12:20																												
ZZZZZZ	1.00	12:23																												
ZZZZZZ	1.00	12:26																												
CCV	1.00	12:29									X																			
CCB	1.00	12:32									X																			
9931026BKG	1.00	12:35									X																			
9931026A	1.00	12:38																												
9931026DUP	1.00	12:41									X																			
9931026L	5.00	12:44									X																			

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: P
Instrument ID: 11016
Run Name: 1835402T70

Run Start Date: 12/20/2018
Run End Date: 12/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
ZZZZZZ	1.00	12:47																												
ZZZZZZ	1.00	12:50																												
ZZZZZZ	1.00	12:54																												
9931021	1.00	12:57										X																		
9931023	1.00	13:00										X																		
CCV	1.00	13:03										X																		
CCB	1.00	13:06										X																		

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ62

Method: MS

Instrument ID: 11332

Run Name: 1835407E03

Run Start Date: 12/20/2018

Run End Date: 12/20/2018

Lab Sample ID	D/F	Time	Analytes																									
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L											
S0	1.00	17:59	X					X				X			X													
S	1.00	18:00	X					X				X			X													
ICV	1.00	18:02	X					X				X			X													
ICB	1.00	18:04	X					X				X			X													
LLC	1.00	18:05	X					X				X			X													
ICSA	1.00	18:07	X					X				X			X													
LRS2	1.00	18:08	X					X				X			X													
LRS3	1.00	18:10	X					X				X			X													
CCS	1.00	18:12	X					X				X			X													
CCS	1.00	18:13	X					X				X			X													
CCV	1.00	18:15	X					X				X			X													
CCB	1.00	18:16	X					X				X			X													
P35104BB	1.00	18:18	X					X				X			X													
P35104BQ	1.00	18:19	X					X				X			X													
P35104BY	1.00	18:21	X					X				X			X													
*31001BKG	1.00	18:23	X					X				X			X													
ZZZZZZ	1.00	18:24																										
*31001L	5.00	18:26	X					X				X			X													
ZZZZZZ	1.00	18:27																										
ZZZZZZ	20.00	18:29																										
ZZZZZZ	1.00	18:31																										
CCV	1.00	18:32	X					X				X			X													
CCB	1.00	18:34	X					X				X			X													
ZZZZZZ	1.00	18:35																										
ZZZZZZ	1.00	18:37																										
ZZZZZZ	1.00	18:38																										
ZZZZZZ	1.00	18:40																										
ZZZZZZ	1.00	18:42																										
ZZZZZZ	1.00	18:43																										
ZZZZZZ	1.00	18:45																										
9931021	1.00	18:46	X					X				X			X													
9931023	20.00	18:48																										
9931023	50.00	18:50																										
CCV	1.00	18:51	X					X				X			X													
CCB	1.00	18:53	X					X				X			X													
9931022	1.00	18:54	X					X				X			X													
9931023	1.00	18:56	X					X				X			X													
9931024	1.00	18:58	X					X				X			X													

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: MS

Instrument ID: 11332

Run Name: 1835407E03

Run Start Date: 12/20/2018

Run End Date: 12/20/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
9931025	1.00	18:59		X				X				X			X															
9931025	20.00	19:01																												
9931027	1.00	19:02		X				X				X			X															
CCV	1.00	19:04		X				X				X			X															
CCB	1.00	19:05		X				X				X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ62

Method: MS

Instrument ID: 19204

Run Name: 1835503E05

Run Start Date: 12/21/2018

Run End Date: 12/21/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
S0	1.00	08:16	X			X																								
S	1.00	08:18	X			X																								
ICV	1.00	08:21	X			X																								
ICB	1.00	08:24	X			X																								
LLC	1.00	08:26	X			X																								
ICSA	1.00	08:28	X			X																								
LRS2	1.00	08:31	X			X																								
LRS3	1.00	08:33	X			X																								
CCS	1.00	08:36	X			X																								
CCS	1.00	08:38	X			X																								
CCV	1.00	08:40	X			X																								
CCB	1.00	08:43	X			X																								
P35104BB	1.00	08:45	X			X																								
ZZZZZZ	1.00	08:48																												
ZZZZZZ	1.00	08:50																												
P35104BY	1.00	08:53	X			X																								
P35104BY	1.00	08:55																												
*31001BKG	1.00	08:57	X			X																								
ZZZZZZ	1.00	09:00																												
*31001L	5.00	09:02	X			X																								
ZZZZZZ	1.00	09:05																												
CCV	1.00	09:07	X			X																								
CCB	1.00	09:09	X			X																								
ZZZZZZ	1.00	09:12																												
ZZZZZZ	1.00	09:14																												
ZZZZZZ	1.00	09:17																												
ZZZZZZ	1.00	09:19																												
ZZZZZZ	1.00	09:21																												
ZZZZZZ	1.00	09:24																												
ZZZZZZ	1.00	09:26																												
ZZZZZZ	1.00	09:29																												
9931021	1.00	09:31	X			X																								
9931027	1.00	09:34	X			X																								
CCV	1.00	09:36	X			X																								
CCB	1.00	09:38	X			X																								
P35104BQ	1.00	09:41	X			X																								
P35104BQ	1.00	09:43																												
9931022	1.00	09:46	X			X																								

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: MS

Instrument ID: 19204

Run Name: 1835503E05

Run Start Date: 12/21/2018

Run End Date: 12/21/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
9931023	1.00	09:48	X			X																								
9931024	1.00	09:50	X			X																								
9931025	1.00	09:53	X			X																								
9931025	20.00	09:55																												
CCV	1.00	09:58	X			X																								
CCB	1.00	10:00	X			X																								

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ62

Method: MS

Instrument ID: 11332

Run Name: 1835603E03

Run Start Date: 12/22/2018

Run End Date: 12/23/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	21:20	X									X			X															
S	1.00	21:22	X									X			X															
ICV	1.00	21:24	X									X			X															
ICB	1.00	21:25	X									X			X															
LLC	1.00	21:27	X									X			X															
ICSA	1.00	21:28	X									X			X															
ICSAB	1.00	21:30	X									X			X															
LRS2	1.00	21:32	X									X			X															
LRS3	1.00	21:33	X									X			X															
CCS	1.00	21:35	X									X			X															
CCS	1.00	21:36	X									X			X															
CCV	1.00	21:38	X									X			X															
CCB	1.00	21:39	X									X			X															
ZZZZZZ	1.00	21:41																												
ZZZZZZ	1.00	21:43																												
ZZZZZZ	1.00	21:44																												
ZZZZZZ	1.00	21:46																												
ZZZZZZ	1.00	21:48																												
ZZZZZZ	1.00	21:50																												
ZZZZZZ	1.00	21:51																												
ZZZZZZ	5.00	21:53																												
ZZZZZZ	1.00	21:55																												
ZZZZZZ	1.00	21:56																												
CCV	1.00	21:58	X									X			X															
CCB	1.00	21:59	X									X			X															
ZZZZZZ	1.00	22:01																												
ZZZZZZ	1.00	22:02																												
ZZZZZZ	1.00	22:04																												
ZZZZZZ	1.00	22:06																												
ZZZZZZ	1.00	22:07																												
ZZZZZZ	1.00	22:09																												
ZZZZZZ	1.00	22:10																												
ZZZZZZ	1.00	22:12																												
ZZZZZZ	1.00	22:14																												
CCV	1.00	22:15	X									X			X															
CCB	1.00	22:17	X									X			X															
P35504HB	1.00	22:18	X									X			X															
P35504HQ	1.00	22:20	X									X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: MS

Instrument ID: 11332

Run Name: 1835603E03

Run Start Date: 12/22/2018

Run End Date: 12/23/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
P35504HY	1.00	22:23	X									X			X															
9931026BKG	1.00	22:25	X									X			X															
9931026A	1.00	22:27																												
9931026L	5.00	22:28	X									X			X															
CCV	1.00	22:30	X									X			X															
CCB	1.00	22:32	X									X			X															
LLC	1.00	22:33	X									X			X															
ICSA	1.00	22:35	X									X			X															
ICSAB	1.00	22:36	X									X			X															
ZZZZZZ	1.00	22:38																												
CCV	1.00	22:39	X									X			X															
CCB	1.00	22:41	X									X			X															

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
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MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: MS

Instrument ID: 19204

Run Name: 1835702E05

Run Start Date: 12/23/2018

Run End Date: 12/23/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	12:28		X		X		X																						
S	1.00	12:31		X		X		X																						
ICV	1.00	12:34		X		X		X																						
ICB	1.00	12:36		X		X		X																						
LLC	1.00	12:39		X		X		X																						
ICSA	1.00	12:41		X		X		X																						
ICSAB	1.00	12:43		X		X		X																						
LRS2	1.00	12:46		X		X		X																						
LRS3	1.00	12:48		X		X		X																						
CCS	1.00	12:51		X		X		X																						
CCS	1.00	12:53		X		X		X																						
CCV	1.00	12:55		X		X		X																						
CCB	1.00	12:58		X		X		X																						
P35504HB	1.00	13:00		X		X		X																						
P35504HQ	1.00	13:03		X		X		X																						
P35504HY	1.00	13:05		X		X		X																						
9931026BKG	1.00	13:07		X		X		X																						
9931026A	1.00	13:10																												
9931026L	5.00	13:12		X		X		X																						
CCV	1.00	13:15		X		X		X																						
CCB	1.00	13:17		X		X		X																						

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: CV

Instrument ID: 23283

Run Name: 1834901M09

Run Start Date: 12/15/2018

Run End Date: 12/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S B	A S	B A	B E	B E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
S0	1.00	06:21												X																
S0.2	1.00	06:23												X																
S0.5	1.00	06:25												X																
S1.0	1.00	06:27												X																
S2.5	1.00	06:29												X																
S5.0	1.00	06:31												X																
ICV	1.00	06:33												X																
ICB	1.00	06:35												X																
CRA	1.00	06:37												X																
CCV	1.00	06:39												X																
CCB	1.00	06:41												X																
ZZZZZZ	1.00	06:43																												
ZZZZZZ	1.00	06:45																												
ZZZZZZ	1.00	06:47																												
ZZZZZZ	1.00	06:49																												
ZZZZZZ	1.00	06:51																												
ZZZZZZ	1.00	06:53																												
ZZZZZZ	1.00	06:55																												
ZZZZZZ	1.00	06:57																												
ZZZZZZ	1.00	06:59																												
ZZZZZZ	1.00	07:01																												
CCV	1.00	07:04												X																
CCB	1.00	07:06												X																
ZZZZZZ	1.00	07:08																												
ZZZZZZ	1.00	07:10																												
ZZZZZZ	1.00	07:12																												
ZZZZZZ	1.00	07:14																												
ZZZZZZ	1.00	07:16																												
ZZZZZZ	1.00	07:18																												
ZZZZZZ	1.00	07:20																												
ZZZZZZ	1.00	07:22																												
ZZZZZZ	1.00	07:24																												
ZZZZZZ	1.00	07:26																												
CCV	1.00	07:28												X																
CCB	1.00	07:30												X																
ZZZZZZ	1.00	07:32																												
ZZZZZZ	1.00	07:34																												
ZZZZZZ	1.00	07:36																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
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MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
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Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: CV

Instrument ID: 23283

Run Name: 1834901M09

Run Start Date: 12/15/2018

Run End Date: 12/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	07:38																												
ZZZZZZ	1.00	07:40																												
ZZZZZZ	1.00	07:42																												
ZZZZZZ	1.00	07:44																												
ZZZZZZ	1.00	07:46																												
ZZZZZZ	1.00	07:48																												
ZZZZZZ	1.00	07:50																												
CCV	1.00	07:52													X															
CCB	1.00	07:54													X															
ZZZZZZ	1.00	07:56																												
ZZZZZZ	1.00	07:59																												
ZZZZZZ	1.00	08:01																												
ZZZZZZ	1.00	08:03																												
ZZZZZZ	1.00	08:05																												
ZZZZZZ	1.00	08:07																												
ZZZZZZ	1.00	08:09																												
ZZZZZZ	1.00	08:11																												
ZZZZZZ	1.00	08:13																												
ZZZZZZ	1.00	08:15																												
CCV	1.00	08:17													X															
CCB	1.00	08:19													X															
ZZZZZZ	1.00	08:21																												
ZZZZZZ	1.00	08:23																												
ZZZZZZ	1.00	08:25																												
ZZZZZZ	1.00	08:27																												
ZZZZZZ	1.00	08:29																												
ZZZZZZ	1.00	08:31																												
P34771CB	1.00	08:33													X															
P34771CQ	1.00	08:35													X															
P34771CQ	1.00	08:37																												
*31001BKG	1.00	08:39													X															
CCV	1.00	08:41													X															
CCB	1.00	08:43													X															
ZZZZZZ	1.00	08:46																												
ZZZZZZ	1.00	08:48																												
ZZZZZZ	1.00	08:50																												
ZZZZZZ	1.00	08:52																												
ZZZZZZ	1.00	08:54																												

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
AF = Cold Vapor Atomic Fluorescence

LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ62

Method: CV

Instrument ID: 23283

Run Name: 1834901M09

Run Start Date: 12/15/2018

Run End Date: 12/15/2018

Lab Sample ID	D/F	Time	Analytes																											
			S	A	B	B	B	C	C	C	C	P	L	H	M	S	T													
ZZZZZZ	1.00	08:56	B	S	A	E		D	A	R	O	B	I	G	O	E	L													
ZZZZZZ	1.00	08:58																												
ZZZZZZ	1.00	09:00																												
ZZZZZZ	1.00	09:02																												
ZZZZZZ	1.00	09:04																												
CCV	1.00	09:06												X																
CCB	1.00	09:08												X																
ZZZZZZ	1.00	09:11																												
ZZZZZZ	1.00	09:13																												
9931021	1.00	09:15												X																
9931022	1.00	09:17												X																
9931023	1.00	09:19												X																
9931024	1.00	09:21												X																
9931025	1.00	09:23												X																
9931026	1.00	09:25												X																
9931027	1.00	09:27												X																
CRA	1.00	09:29												X																
CCV	1.00	09:31												X																
CCB	1.00	09:33												X																

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
CV = Cold Vapor
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LEGEND:

BKG = Background
DUP = Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
A = Post Digest Spike
L = Serial Dilution
B = Blank
Q = Laboratory Control Sample
Y = Laboratory Control Sample Duplicate

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9931021	MW-1	X		
9931022	MW-2	X		
9931023	MW-3	X		
9931024	MW-4	X		
9931025	MW-5	X		
9931026	MW-6	X		
9931027	FB-20181206	X		Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

MS/MSD

Matrix QC may not be included if site-specific QC were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, laboratory spike data (LCS) are provided.

SAMPLE ANALYSIS:

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Samples	Chloride	Fluoride	Sulfate
9931021	DF50	DF5	DF50
9931022	DF5	DF5	DF5
9931023	DF50	DF5	DF5
9931024	DF5	DF5	DF5
9931025	DF50	DF5	DF50
9931026	DF50	DF5	DF5
9931027	DF1	DF1	DF1

No problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18348120215A	P34820OB	12/15/2018 12:55:00	X	X	X
	P34820OQ	12/15/2018 12:39:00	X		X
	P34820OQ	12/17/2018 18:36:00		X	
18348120215B	9931025	12/15/2018 22:44:00	X		X
	9931025	12/17/2018 22:26:00		X	
	9931026	12/15/2018 23:01:00		X	X
	9931026	12/15/2018 23:17:00	X		
	9931027	12/15/2018 23:34:00	X	X	X
18348120315A	P34820OB	12/14/2018 13:54:00	X	X	X
	P34820OQ	12/14/2018 13:37:00	X		X
	P34820OQ	12/17/2018 19:11:00		X	
18348120315B	9931021	12/15/2018 00:28:00		X	
	9931021	12/15/2018 00:45:00	X		X
	9931022	12/15/2018 01:01:00	X		X
	9931022	12/17/2018 21:50:00		X	
	9931023	12/15/2018 02:08:00		X	X
	9931023	12/15/2018 02:25:00	X		
	9931024	12/15/2018 02:42:00	X	X	X

Fraction: Instrumental Wet Chemistry

18348120215A / P34820OB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	12/15/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	12/15/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	12/15/18	N.D.	mg/l	0.30	1.0

18348120315A / P34820OB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	12/14/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	12/14/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	12/14/18	N.D.	mg/l	0.30	1.0

SDG: GEJ62
Matrix: LIQUID

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P348200Q	Batch: 18348120215B (Sample number(s): 9931025-9931027)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	3.09	NA	103	NA	90-110	NA	NA
Fluoride	IC	0.750	0.692	NA	92	NA	90-110	NA	NA
Sulfate	IC	7.50	7.88	NA	105	NA	90-110	NA	NA

LCS: P348200Q	Batch: 18348120315B (Sample number(s): 9931021-9931024)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chloride	IC	3.00	3.06	NA	102	NA	90-110	NA	NA
Fluoride	IC	0.750	0.704	NA	94	NA	90-110	NA	NA
Sulfate	IC	7.50	7.76	NA	104	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ62

Instrument ID: 18919
Calibration Date: 12/04/2018

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.281281	1.033924	2.520746	5.109426	7.804229	0.9992	0.9996
Fluoride	0.064926	0.430258	1.142152	2.445807	3.872725	0.9993	0.9997
Sulfate	0.172605	0.618016	1.598239	3.329984	5.119110	0.9996	0.9998

Concentration units: mg/L

Batch Numbers: 18348120215B, 18348120315B
Run Start Dates: 12/15/2018, 12/14/2018
Run Names: 1834901D12, 1834801D12

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	3.0060	100	7.5	7.5930	101	0.75	0.8225	110
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0660	102	7.5	7.8296	104	0.75	0.7905	105
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1346	104	7.5	7.9526	106	0.75	0.8737	116
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0576	102	7.5	7.8194	104	0.75	0.7961	106
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0908	103	7.5	7.9170	106	0.75	0.8759	117
CCB	0	ND	NA	0	ND	NA	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ62

Instrument ID: 12115
Calibration Date: 12/10/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	1.030185	2.165587	5.258500	10.990816	16.706969	0.9990	0.9995
Fluoride	0.167108	0.632801	1.681146	3.645534	5.913734	0.9987	0.9993
Sulfate	0.631483	1.341601	3.279257	6.951146	10.853394	0.9994	0.9997

Acceptance Range:
ICV/CCV: 90%-110%
ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18348120215B, 18348120315B
Run Start Dates: 12/14/2018
Run Names: 1834801D15

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.7175	91	7.5	6.9813	93	0.75	0.7137	95
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1346	104	7.5	8.1077	108	0.75	0.8544	114
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9915	100	7.5	7.7740	104	0.75	0.8273	110
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1712	106	7.5	8.1649	109	0.75	0.8590	115
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1597	105	7.5	8.1747	109	0.75	0.8478	113
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1877	106	7.5	8.2821	110	0.75	0.8519	114
CCB	0	ND	NA	0	ND	NA	0	ND	NA

* = Out of Specifications



Lancaster Laboratories
Environmental

Quality Control Summary
Initial And Continuing Calibration
Instrumental Analysis/Anion Scan

SDG: GEJ62

Instrument ID: 17694
Calibration Date: 12/13/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Fluoride	0.086588	0.309096	0.877335	1.942084	3.111997	0.9998	0.9999

Acceptance Range:

ICV/CCV: 90%-110%

ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18348120215B, 18348120315B

Run Start Dates: 12/17/2018

Run Names: 1835101D09

Sample	Fluoride		
	True	Result	%Rec
ICV	0.75	0.7353	98
ICB	0	ND	NA
CCV2	0.75	0.7092	95
CCB	0	ND	NA
CCV2	0.75	0.7442	99
CCB	0	ND	NA
CCV2	0.75	0.7055	94
CCB	0	ND	NA

* = Out of Specifications

Fraction: Instrumental Wet Chemistry

00224: Chloride Analyte Name	Default MDL	Default LOQ	Units
Chloride	0.20	0.40	mg/l

01504: Fluoride Analyte Name	Default MDL	Default LOQ	Units
Fluoride	0.050	0.10	mg/l

00228: Sulfate Analyte Name	Default MDL	Default LOQ	Units
Sulfate	0.30	1.0	mg/l

Wet Chemistry Data

Case Narrative/Conformance Summary

Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9931021	MW-1	X		1	
9931022	MW-2	X		1	
9931023	MW-3	X		1	
9931024	MW-4	X		1	
9931025	MW-5	X		1	
9931026	MW-6	X		1	
9931027	FB-20181206	X		1	Field Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE RECEIPT:

Samples were received in good condition and within temperature requirements.

HOLDING TIME:

All holding times were met.

PREPARATION/EXTRACTION/DIGESTION:

No problems were encountered.

CALIBRATION/STANDARDIZATION:

All criteria were met.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Sample Duplicate

Method defined actions are taken for any failed matrix QC.

Batch#: 18346921202A (Sample number(s): 9931023-9931026, UNSPK: 9931026, BKG: 9931026)
The duplicate RPD for the following analyte(s) is outside the acceptance window: Total Dissolved Solids

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

(Sample number(s): 9931021-9931027: Analysis: 12152)

The 40 CFR Part 136 requires that this analysis be performed immediately (within 15 minutes) upon sample collection. Because this was not possible, the result may not be used for reporting purposes.

No other problems were encountered with the analysis of the samples.

Abbreviation Key

U = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
R = Matrix Spike (MS)	MDL = Method Detection Limit
M = Matrix Spike Duplicate (MSD)	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	NA = Not Applicable
HS = High Spike	ME = Method
LS = Low Spike	CO = Colorimetric
SS = Soluble Spike	G = Gravimetric
IS = Insoluble Spike	IR = Infrared Spectrophotometry
ISD = Insoluble Spike Duplicate	MTR = Meter
PDS = Post Digestion Spike	OD = Oven Dried
* = Out of Specification	TI = Titration
V = Visual	TOC = Total Organic Carbon
AK = Alpkem	IC = Ion Chromatography
TC = Total Carbon	RA = Rapid Analyzer

QC Summary

Wet Chemistry

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18346921201A	B346871B	12/12/2018 10:37
		L346871Q	12/12/2018 10:37
		9931021	12/12/2018 10:36
		9931022	12/12/2018 10:37
		9931027	12/12/2018 10:37
Total Dissolved Solids	18346921202A	B346872B	12/12/2018 12:51
		L346872Q	12/12/2018 12:51
		9931023	12/12/2018 10:41
		9931024	12/12/2018 10:41
		9931025	12/12/2018 10:41
		9931026	12/12/2018 10:42
		9931026 UNSPK/BKG,MS,DUP	12/12/2018 12:51

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ62

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18344003101A	9931021	12/10/2018 21:05:00	X	X
	9931022	12/10/2018 20:39:00	X	X
	9931023	12/10/2018 20:48:00	X	X
	9931024	12/10/2018 20:30:00	X	X
	9931026	12/10/2018 21:01:00	X	X
	9931027	12/10/2018 20:52:00	X	X
	P003101Q	12/10/2018 19:22:00	X	
18344003102A	9931025	12/10/2018 21:37:00	X	X
	P003102Q	12/10/2018 21:14:00	X	

Fraction: Wet Chemistry

18346921201A / B346871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	12/12/18	N.D.	mg/l	20.0	60.0

18346921202A / B346872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	12/12/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9931026	Batch: 18346921202A (Sample number(s): 9931023-9931026)									
MS: 9931026		Spike Added	Unspiked	MS	MSD			%Rec		%RPD
Parameter	ME	mg/l	Conc	Conc	Conc	MS	MSD	Limits	%RPD	Limits
			mg/l	mg/l	mg/l	%Rec	%Rec			
Total Dissolved Solids	G	800	504.	1318.	NA	102	NA	62-127	NA	NA

Comments:

(2) The unspiked sample result is greater than four times the spike added.

* = Out of Specification

Results are being reported on an as received basis.

Water Quality

Fraction: Wet Chemistry

BKG: 9931026 DUP: 9931026	Batch: 18346921202A (Sample number(s): 9931023-9931026)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	504.	560.	11* (1)	5

Comments:

(1) The sample and/or duplicate result is less than five times the LOQ.

* = Out of Specification

Results are being reported on an as received basis.

SDG: GEJ62
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: P003101Q	Batch: 18344003101A (Sample number(s): 9931021-9931024, 9931026-9931027)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.00	NA	100	NA	95-105	NA	NA

LCS: P003102Q	Batch: 18344003102A (Sample number(s): 9931025)								
Parameter	ME	Spike Added Std. Units	LCS Conc Std. Units	LCSD Conc Std. Units	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
pH	MTR	7.00	7.01	NA	100	NA	95-105	NA	NA

LCS: L346871Q	Batch: 18346921201A (Sample number(s): 9931021-9931022, 9931027)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	199	NA	100	NA	62-127	NA	NA

LCS: L346872Q	Batch: 18346921202A (Sample number(s): 9931023-9931026)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Total Dissolved Solids	G	200	193	NA	97	NA	62-127	NA	NA

Fraction: Wet Chemistry

12152: pH Analyte Name	Default MDL	Default LOQ	Units
pH	0.010	0.010	Std. Units

12151: Temperature of pH Analyte Name	Default MDL	Default LOQ	Units
Temperature of pH	0.010	0.010	Degrees C

00212: Total Dissolved Solids Analyte Name	Default MDL	Default LOQ	Units
Total Dissolved Solids	20.0	60.0	mg/l

January 04, 2019

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994

Re: NJ Radiochemistry Analyses
Work Order: 466633

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on December 11, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,



Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody: 2016609
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 466633**

January 04, 2019

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on December 11, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
466633001	MW-1
466633002	MW-2
466633003	MW-3
466633004	MW-4
466633005	MW-5
466633006	MW-6
466633007	FB-20181206

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.



Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

€ euros :

Leifur Gunnarsson
Lancaster Laboratories

Accession # 2016609 Sample # 9931028.34

Subcontractor						GEL		Analyses Requested								For Lab Use Only	
Project Name/ID				Site ID #:		Preservation and Filtration Codes				SF #		SCR #					
Requester				P.O.#		Matrix				Total # of Containers		Remarks					
Sampler				PWSID #		Soil [] Sediment [] Tissue []				Water [] NPDES [] Surface []		Other: []					
Phone #				717-556-7383		Collection				Date		Time					
State where samples were collected				NJ		For Compliance				Yes [] No []							
Sample Identification				MW-1		Date				12/6/2018		1010		X			
MW-2				Date				12/6/2018		1010		X					
MW-3				Date				12/6/2018		1350		X					
MW-4				Date				12/6/2018		1155		X					
MW-5				Date				12/6/2018		1240		X					
MW-6				Date				12/8/2018		1420		X					
FB-20181205				Date				12/8/2018		1200		X					
Turnaround Time Requested (TAT) (please check)				Standard [] Rush []		(Rush TAT is subject to laboratory approval and surcharges.)											
Date results are needed:				Preservation Needed		Rush results requested by (please check)				E-Mail [] Phone []							
E-mail Address				ELLE Subcontracting@EurofinsUS.com		E-mail Address				ELLE Subcontracting@EurofinsUS.com							
Phone				717-556-7383		Data Package Options (please check if required)				Level IV DOD							
Type I (Volatile Non-CLP)				MA MCP [] CT RCP []		Type II (Reduced non-CLP)				1X YARP-15 []							
Type VI (Raw Data Only)				NYSDOC Category [] A or [] B		EDD Required?				Yes [] No [] If yes, format		Hazard					

Eurofins Eurocenter Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-696-2300

2150 24th

SAMPLE RECEIPT & REVIEW FORM

Client: LANC		SOG/AB/CON/Work Order: 50354245	
Received By: STACY BOONE		Date Received: 12/11/18	
Carrier and Tracking Number		Circle Applicable FedEx Express FedEx Ground UPS Field Services Courier Other	
		5035 4245 5798 - 65 5035 4245 5802 - 66	
Suspected Hazard Information	Yes ☒ No ☐	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
Shipped as a DOT Hazardous	Yes ☒ No ☐	Hazard Class Shipped: 1.1B	
COC/Samples marked or classified as radioactive?	Yes ☒ No ☐	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): ☒ CPM (mR/hr) Classified as: Rad 1 Rad 2 Rad 3	
Is package, COC, and/or Samples marked RADIOACTIVE?	Yes ☒ No ☐	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Adhesives Beryllium Other:	
Sample Receipt Criteria		Yes	No
1	Shipping containers received intact and sealed?	☒	Circle Applicable: Seals broken Damaged container Leaking container Other (describe):
2	Chain of custody documents included with shipment?	☒	
3	Samples requiring cold preservation within 40 ± 6 deg. C)?	☒	Preservation Method: Wet Ice Dry Ice None Other: Set *All temperatures are provided in Celsius. TEMP: 4°C
4	Daily check performed and passed on IR temperature run?	☒	Temperature Device Serial #: IR3-17 Secondary Temperature Device Serial #: (If Applicable):
5	Sample containers intact and sealed?	☒	Circle Applicable: Seals broken Damaged container Leaking container Other (describe):
6	Samples requiring chemical preservation at proper pH?	☒	Sample IDs and Containers Affected: If preservation added, List:
7	Do any samples require Volatile Analysis?	☒	If Yes, Are Elutecox or Sniff Kats present? Yes ___ No ___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes ___ No ___ N/A ___ (If unknown, select No) VOA vials free of headspace? Yes ___ No ___ N/A ___ Sample IDs and containers affected:
8	Samples received within holding time?	☒	IDs and tests affected:
9	Sample IDs on COC match IDs on bottles?	☒	Sample IDs and containers affected:
10	Date & time on COC match date & time on bottles?	☒	Sample IDs affected:
11	Number of containers received match number indicated on COC?	☒	Sample IDs affected:
12	Are sample containers identifiable as GEL provided?	☒	
13	COC form is properly signed in relinquished/received section?	☒	
Comments (Use Continuation Form if needed):			

Laboratory Certifications

There are no "Data Exception Reports" associated with this analytical report.

List of current GEL Certifications as of 04 January 2019

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA024
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122019-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-18-13
Utah NELAP	SC000122018-27
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Eurofins Lancaster Laboratories (LANC)
SDG #: 466633**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1830755

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
466633001	MW-1
466633002	MW-2
466633003	MW-3
466633004	MW-4
466633005	MW-5
466633006	MW-6
466633007	FB-20181206
1204178239	Method Blank (MB)
1204178240	466630008(MW-8) Sample Duplicate (DUP)
1204178241	466630008(MW-8) Matrix Spike (MS)
1204178242	466630008(MW-8) Matrix Spike Duplicate (MSD)
1204178243	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Sample 1204178241 (MW-8MS) was recounted due to low recovery. The recount is reported. Sample 1204178240 (MW-8DUP) was recounted due to high relative percent difference/relative error ratio. The recount is reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204178241 (MW-8MS) and 1204178242 (MW-8MSD), aliquots were reduced to conserve sample volume.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1830869

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
466633001	MW-1
466633002	MW-2
466633003	MW-3
466633004	MW-4
466633005	MW-5
466633006	MW-6
466633007	FB-20181206
1204178462	Method Blank (MB)
1204178463	466633007(FB-20181206) Sample Duplicate (DUP)
1204178464	466633007(FB-20181206) Matrix Spike (MS)
1204178465	466633007(FB-20181206) Matrix Spike Duplicate (MSD)
1204178466	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Duplication Criteria between MS and MSD

The Matrix Spike and Matrix Spike Duplicate (See Below) do not meet the duplication requirement; however, they both meet the spiked recovery requirement.

Sample	Analyte	Value
1204178464MS and 1204178465MSD (FB-20181206)	Radium-226	RPD 28* (0%-20%)

Technical Information

Recounts

Samples were degassed and recounted due to low recovery. Recounts are reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204178464 (FB-20181206MS) and 1204178465 (FB-20181206MSD), aliquots were reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the

requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

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Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 466633 GEL Work Order: 466633

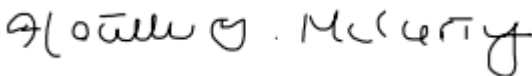
The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature: 

Name: Heather McCarty

Date: 04 JAN 2019

Title: Analyst II

Sample Data Summary

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Report Date: January 4, 2019

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-1
Sample ID: 466633001
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.

Rad Gas Flow Proportional Counting

GFPC, Ra228, Liquid "As Received"

Radium-228	U	0.777	+/-0.757	1.24	+/-0.786	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.213	+/-0.286	0.492	+/-0.290	1.00	pCi/L			PCW	12/23/18	0435	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	89	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-2
Sample ID: 466633002
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.581	+/-0.690	1.16	+/-0.708	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.220	+/-0.239	0.387	+/-0.242	1.00	pCi/L			PCW	12/23/18	0435	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	98.9	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-3
Sample ID: 466633003
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	-0.521	+/-0.857	1.68	+/-0.857	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.530	+/-0.430	0.659	+/-0.437	1.00	pCi/L			PCW	12/23/18	0435	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	102	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-4
Sample ID: 466633004
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.552	+/-0.636	1.07	+/-0.653	3.00	pCi/L			JXC9	12/27/18	1138	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.148	+/-0.153	0.226	+/-0.156	1.00	pCi/L			PCW	12/23/18	0510	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	102	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

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Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-5
Sample ID: 466633005
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228		2.40	+/-1.10	1.58	+/-1.28	3.00	pCi/L			JXC9	12/27/18	1138	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.699	+/-0.309	0.291	+/-0.327	1.00	pCi/L			PCW	12/23/18	0510	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	89.8	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-6
Sample ID: 466633006
Matrix: Water
Collect Date: 06-DEC-18
Receive Date: 11-DEC-18
Collector: Client

Project: LANC00115
Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.657	+/-0.609	0.983	+/-0.635	3.00	pCi/L			JXC9	12/27/18	1138	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.824	+/-0.484	0.666	+/-0.522	1.00	pCi/L			PCW	12/23/18	0510	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	103	(15%-125%)

Notes:
The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Mtd.: Method
DL: Detection Limit	PF: Prep Factor
Lc/LC: Critical Level	RL: Reporting Limit
MDA: Minimum Detectable Activity	TPU: Total Propagated Uncertainty
MDC: Minimum Detectable Concentration	

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
Address : 2425 New Holland Pike

Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: FB-20181206

Sample ID: 466633007

Matrix: Water

Collect Date: 06-DEC-18

Receive Date: 11-DEC-18

Collector: Client

Project: LANC00115

Client ID: LANC006

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
<i>GFPC, Ra228, Liquid "As Received"</i>														
Radium-228	U	0.654	+/-0.986	1.69	+/-1.00	3.00	pCi/L			JXC9	12/27/18	1138	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	-0.0946	+/-0.138	0.388	+/-0.138	1.00	pCi/L			PCW	12/23/18	0510	1830869	2

The following Analytical Methods were performed

Method	Description
1	EPA 904.0/SW846 9320 Modified
2	EPA 903.1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"	1830755	98	(15%-125%)

Notes:

The MDC is a sample specific MDC.

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

Lc/LC: Critical Level

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Mtd.: Method

PF: Prep Factor

RL: Reporting Limit

TPU: Total Propagated Uncertainty

Quality Control Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: January 4, 2019

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 466633

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1830755										
QC1204178240	466630008	DUP									
Radium-228		U	0.530	U	0.550	pCi/L	0		N/A	JXC9	12/27/1813:37
		Uncert:	+/-0.916		+/-1.02						
		TPU:	+/-0.928		+/-1.03						
QC1204178243	LCS										
Radium-228		16.8			19.8	pCi/L	118	(75%-125%)	JXC9	12/27/1811:38	
		Uncert:			+/-2.21						
		TPU:			+/-5.83						
QC1204178239	MB										
Radium-228				U	0.715	pCi/L			JXC9	12/27/1811:38	
		Uncert:			+/-0.988						
		TPU:			+/-1.01						
QC1204178241	466630008	MS									
Radium-228		50.7	U	0.530	41.1	pCi/L	81.1	(75%-125%)	JXC9	12/27/1813:37	
		Uncert:		+/-0.916	+/-6.10						
		TPU:		+/-0.928	+/-12.7						
QC1204178242	466630008	MSD									
Radium-228		50.7	U	0.530	45.2	pCi/L	9.4	89.1	(0%-20%)	JXC9	12/27/1811:38
		Uncert:		+/-0.916	+/-6.11						
		TPU:		+/-0.928	+/-13.8						
Rad Ra-226											
Batch	1830869										
QC1204178463	466633007	DUP									
Radium-226		U	-0.0946	U	0.0943	pCi/L	0		N/A	PCW	12/23/1805:10
		Uncert:	+/-0.138		+/-0.163						
		TPU:	+/-0.138		+/-0.164						
QC1204178466	LCS										
Radium-226		26.0			23.1	pCi/L	88.8	(75%-125%)	PCW	12/23/1805:40	
		Uncert:			+/-1.62						
		TPU:			+/-5.60						
QC1204178462	MB										
Radium-226				U	-0.0927	pCi/L			PCW	12/23/1805:10	
		Uncert:			+/-0.160						
		TPU:			+/-0.160						
QC1204178464	466633007	MS									
Radium-226		130	U	-0.0946	147	pCi/L	113	(75%-125%)	PCW	12/23/1805:10	
		Uncert:		+/-0.138	+/-9.78						
		TPU:		+/-0.138	+/-35.6						
QC1204178465	466633007	MSD									
Radium-226		130	U	-0.0946	111	pCi/L	28*	85.5	(0%-20%)	PCW	12/23/1805:10
		Uncert:		+/-0.138	+/-8.31						

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QC Summary

Workorder: 466633

Page 2 of 2

Parmname	NOM	Sample Qual	QC	Units	RPD %	REC %	Range	Anlst	Date	Time
Rad Ra-226										
Batch	1830869									
		TPU:	+/-0.138				+/-20.2			

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
 - < Result is less than value reported
 - > Result is greater than value reported
 - BD Results are either below the MDC or tracer recovery is low
 - FA Failed analysis.
 - H Analytical holding time was exceeded
 - J Value is estimated
 - K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
 - L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
 - M M if above MDC and less than LLD
 - M REMF Result > MDC/CL and < RDL
 - N/A RPD or %Recovery limits do not apply.
 - N1 See case narrative
 - ND Analyte concentration is not detected above the detection limit
 - NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
 - R Sample results are rejected
 - U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
 - UI Gamma Spectroscopy--Uncertain identification
 - UJ Gamma Spectroscopy--Uncertain identification
 - UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
 - X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - Y Other specific qualifiers were required to properly define the results. Consult case narrative.
 - ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
 - h Preparation or preservation holding time was exceeded
- N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
- ** Indicates analyte is a surrogate/tracer compound.
- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1830755 Check-list

This check-list was completed on 28-DEC-18 by Nat Long

This batch was reviewed by Nat Long on 28-DEC-18 and Kenshalla Oston on 02-JAN-19.

Batch ID:
1830755

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-009

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID:	1830755	Due Dates for Lab:	06-JAN-2019	Package:	08-JAN-2019	SDG:	10-JAN-2019		
Analyst:	Jasmine Conley (JXC9)	Type	Sample Id	Description		Serial Number	Spike Amount	Spike Units	
Method:	EPA 904.0/SW846 9320 Modified	LCS	1204178243	Radium-228 SPIKE		1810-A	.1	mL	
Lab SOP:	GL-RAD-A-063 REV# 2	MS	1204178241	Radium-228 SPIKE		1810-A	.1	mL	
Instrument:	GFC-51204863	MSD	1204178242	Radium-228 SPIKE		1810-A	.1	mL	

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	466630001	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
2	466630002	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
3	466630003	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
4	466630004	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
5	466630005	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
6	466630006	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
7	466630007	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
8	466630008	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
9	466630009	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
10	466630010	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
11	466633001	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
12	466633002	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
13	466633003	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
14	466633004	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
15	466633005	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
16	466633006	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
17	466633007	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
18	1204178239 MB	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
19	1204178240 DUP (466630008)	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46
20	1204178241 MS (466630008)	19-DEC-2018	3	100	12/20/18 13:45	12/27/18 09:46
21	1204178242 MSD (466630008)	19-DEC-2018	3	100	12/20/18 13:45	12/27/18 09:46
22	1204178243 LCS	19-DEC-2018	3	300	12/20/18 13:45	12/27/18 09:46

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	
REGNT 2662327.1	cerium 500 mg/L in 2%HCl	.2 mL	Pipet Id: RAD-GFC-1795419
REGNT 2672182	RGF-1.5 Ammonium Sulfate	10 mL	Data Entry Date2: 19-DEC-2018 00:00
REGNT 2832199.3	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 2832891.12	Hydrofluoric Acid Poly Bottle	3 mL	
REGNT 2840709	RGF-16mg/mL Barium Chloride	1 mL	
REGNT 2843889	RGF-1M Citric Acid	5 mL	
REGNT 2861465	RGF-7M Nitric Acid	25 mL	
REGNT 2869507	RGF-2M Hydrochloric Acid	20 mL	
REGNT 2871623.21	16M	5 mL	
REGNT 2873262	RGF-50% Potassium Carbonate	2 mL	
WORK 0487-D	Barium-133 TRACER	.1 mL	

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.4.2

Tracer S/N : 0487-D
Tracer Exp Date : 10/10/2019
Tracer Volume Added: 0.10

Batch : 1830755
Analyst : JAS02031
Prep Date : 12/19/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 3 pCi/L
Ra-228 Abundance : 1.00
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.15 hours

Geometry: CeF on 25mm Filter

Sample Characteristics					Tracer Calculations		Tracer Ref.	Tracer Samp.	Tracer Samp.	Tracer	Tracer
	Sample	Sample	Sample		Tracer Ref.	Tracer Ref.	Tracer Samp.	Tracer Samp.	Tracer	Tracer	
Pos.	ID	Aliquot	Aliquot	Sample	Activity	Count	Activity	Count	Aliquot	Aliquot	
		L	StDev.	Date/Time	(CPM)	(%)	(CPM)	(%)	(mL)	StDev. (mL)	
1	466630001.1	0.3000	1.8459E-05	12/3/2018 11:15	172.7	7.61%	143.7	8.34%	0.1	0.000200	
2	466630002.1	0.3000	1.8459E-05	12/3/2018 12:40	172.7	7.61%	168.3	7.71%	0.1	0.000200	
3	466630003.1	0.3000	1.8459E-05	12/3/2018 11:20	172.7	7.61%	162.0	7.86%	0.1	0.000200	
4	466630004.1	0.3000	1.8459E-05	12/3/2018 13:05	172.7	7.61%	157.6	7.97%	0.1	0.000200	
5	466630005.1	0.3000	1.8459E-05	12/4/2018 9:55	172.7	7.61%	172.8	7.61%	0.1	0.000200	
6	466630006.1	0.3000	1.8459E-05	12/4/2018 10:35	172.7	7.61%	167.7	7.72%	0.1	0.000200	
7	466630007.1	0.3000	1.8459E-05	12/4/2018 13:55	172.7	7.61%	144.8	8.31%	0.1	0.000200	
8	466630008.1	0.3000	1.8459E-05	12/4/2018 12:30	172.7	7.61%	166.9	7.74%	0.1	0.000200	
9	466630009.1	0.3000	1.8459E-05	12/4/2018 12:15	172.7	7.61%	162.0	7.86%	0.1	0.000200	
10	466630010.1	0.3000	1.8459E-05	12/3/2018 12:00	172.7	7.61%	164.8	7.79%	0.1	0.000200	
11	466633001.1	0.3000	1.8459E-05	12/6/2018 10:10	172.7	7.61%	153.8	8.06%	0.1	0.000200	
12	466633002.1	0.3000	1.8459E-05	12/6/2018 10:10	172.7	7.61%	170.9	7.65%	0.1	0.000200	
13	466633003.1	0.3000	1.8459E-05	12/6/2018 13:30	172.7	7.61%	175.8	7.54%	0.1	0.000200	
14	466633004.1	0.3000	1.8459E-05	12/6/2018 11:35	172.7	7.61%	176.0	7.54%	0.1	0.000200	
15	466633005.1	0.3000	1.8459E-05	12/6/2018 12:40	172.7	7.61%	155.1	8.03%	0.1	0.000200	
16	466633006.1	0.3000	1.8459E-05	12/6/2018 14:20	172.7	7.61%	178.0	7.50%	0.1	0.000200	
17	466633007.1	0.3000	1.8459E-05	12/6/2018 12:00	172.7	7.61%	169.2	7.69%	0.1	0.000200	
18	1204178239.1	0.3000	1.8459E-05	12/19/2018 0:00	172.7	7.61%	158.5	7.94%	0.1	0.000200	
19	1204178240.1	0.3000	1.8459E-05	12/4/2018 12:30	172.7	7.61%	151.6	8.12%	0.1	0.000200	
20	1204178241.1	0.1000	1.1370E-05	12/4/2018 12:30	172.7	7.61%	166.2	7.76%	0.1	0.000200	
21	1204178242.1	0.1000	1.1370E-05	12/4/2018 12:30	172.7	7.61%	170.9	7.65%	0.1	0.000200	
22	1204178243.1	0.3000	1.8459E-05	12/19/2018 0:00	172.7	7.61%	147.6	8.23%	0.1	0.000200	

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
Instrument SOP: GL-RAD-I-016

Count raw Data														Calculated	
	Detector	Counting	Gross Counts		Beta	Count	Ac-228	Ac-228				Ac-228	Sample	Sample	
Pos.	ID	Time	Alpha	Beta	cpm	Start	Ingrowth	Decay	Ra-228	Ac-228	Ac-228	Count	Recovery	Recovery	
		(min.)				Date/Time	Date/Time	Date/Time	Decay	Decay	Ingrowth	Correction	%	Error %	
1	1A	60	20	81	1.350	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	83.2%	5.65%	
2	1B	60	8	130	2.167	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	97.4%	5.42%	
3	1C	60	7	29	0.483	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	93.8%	5.48%	
4	1D	60	15	66	1.100	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	91.3%	5.52%	
5	2A	60	12	34	0.567	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	100%	5.39%	
6	2B	60	10	67	1.117	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	97.1%	5.43%	
7	2C	60	35	77	1.283	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	83.8%	5.64%	
8	9A	60	9	49	0.817	12/27/2018 13:37	12/20/2018 13:45	12/27/2018 9:46	0.992	0.648	1.000	1.057	96.6%	5.43%	
9	4D	60	13	30	0.500	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	93.8%	5.48%	
10	5A	60	14	23	0.383	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.992	0.808	1.000	1.057	95.4%	5.45%	
11	5B	60	12	43	0.717	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.993	0.808	1.000	1.057	89.0%	5.55%	
12	5C	60	14	46	0.767	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.993	0.807	1.000	1.057	98.9%	5.40%	
13	5D	60	8	71	1.183	12/27/2018 11:39	12/20/2018 13:45	12/27/2018 9:46	0.993	0.807	1.000	1.057	102%	5.36%	
14	11A	60	10	41	0.683	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.993	0.809	1.000	1.057	102%	5.36%	
15	11B	60	9	97	1.617	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.993	0.809	1.000	1.057	89.8%	5.54%	
16	11C	60	1	38	0.633	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.993	0.809	1.000	1.057	103%	5.35%	
17	11D	60	17	94	1.567	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.993	0.809	1.000	1.057	98.0%	5.42%	
18	12A	60	9	82	1.367	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.997	0.810	1.000	1.057	91.7%	5.51%	
19	9B	60	3	50	0.833	12/27/2018 13:37	12/20/2018 13:45	12/27/2018 9:46	0.992	0.648	1.000	1.057	87.8%	5.57%	
20	9C	60	12	235	3.917	12/27/2018 13:37	12/20/2018 13:45	12/27/2018 9:46	0.992	0.648	1.000	1.057	96.2%	5.44%	
21	12D	60	14	385	6.417	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.992	0.810	1.000	1.057	98.9%	5.40%	
22	13A	60	9	365	6.083	12/27/2018 11:38	12/20/2018 13:45	12/27/2018 9:46	0.997	0.809	1.000	1.057	85.5%	5.61%	

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	PIC	6/1/2017	5/31/2019	0.6430	0.00738	0.470	12/21/2018 17:38	500
2	PIC	6/1/2017	5/31/2019	0.6519	0.00711	1.258	12/21/2018 17:38	500
3	PIC	6/1/2017	5/31/2019	0.6443	0.00847	0.426	12/21/2018 17:38	500
4	PIC	6/1/2017	5/31/2019	0.6504	0.00692	1.218	12/21/2018 17:38	500
5	PIC	6/1/2017	5/31/2019	0.6444	0.01914	0.358	12/21/2018 17:38	500
6	PIC	6/1/2017	5/31/2019	0.6448	0.02111	0.646	12/21/2018 17:38	500
7	PIC	6/1/2017	5/31/2019	0.6389	0.01274	0.496	12/21/2018 17:38	500
8	PIC	6/1/2017	5/31/2019	0.6688	0.00758	0.678	12/21/2018 17:37	500
9	PIC	6/1/2017	5/31/2019	0.6462	0.00773	0.704	12/21/2018 17:39	500
10	PIC	6/1/2017	5/31/2019	0.6766	0.00851	0.490	12/21/2018 17:39	500
11	PIC	6/1/2017	5/31/2019	0.6547	0.00426	0.488	12/21/2018 17:39	500
12	PIC	6/1/2017	5/31/2019	0.6704	0.00657	0.572	12/21/2018 17:39	500
13	PIC	6/1/2017	5/31/2019	0.6669	0.00925	1.362	12/21/2018 17:39	500
14	PIC	6/1/2017	5/31/2019	0.6648	0.01317	0.494	12/21/2018 17:33	500
15	PIC	6/1/2017	5/31/2019	0.6620	0.00697	0.894	12/21/2018 17:33	500
16	PIC	6/1/2017	5/31/2019	0.6578	0.01278	0.408	12/21/2018 17:33	500
17	PIC	6/1/2017	5/31/2019	0.6802	0.01068	1.346	12/21/2018 17:33	500
18	PIC	6/1/2017	5/31/2019	0.6732	0.01964	1.142	12/21/2018 17:33	500
19	PIC	6/1/2017	5/31/2019	0.6716	0.00754	0.702	12/21/2018 17:37	500
20	PIC	6/1/2017	5/31/2019	0.6373	0.00584	0.512	12/21/2018 17:37	500
21	PIC	6/1/2017	5/31/2019	0.6376	0.01845	1.608	12/21/2018 17:34	500
22	PIC	6/1/2017	5/31/2019	0.6527	0.00714	0.461	12/21/2018 17:33	1000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1810-A
Spike Exp Date : 5/23/2019
Spike Activity (dpm/ml): 112.00
Spike Volume Added: 0.10

* - RPD changed to 0% due to sample & dup activity below MDA

LCS S/N : 1810-A
LCS Exp Date : 5/23/2019
LCS Activity (dpm/ml): 112.00
LCS Volume Added: 0.10

Results															
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L Recovery
1	0.8079	0.5704	3	1.3259	3.2577	18.31%	0.8800	0.1531	1.1109	1.4220		SAMPLE			
2	1.1128	0.7856	3	1.7271	2.8319	22.31%	0.9087	0.1965	1.2005	1.4244		SAMPLE			
3	0.6809	0.4807	3	1.1253	0.1879	164.71%	0.0573	0.0944	0.6062	0.6084		SAMPLE			
4	1.1721	0.8275	3	1.8219	-0.3937	122.26%	-0.1180	0.1441	0.9424	0.9425		SAMPLE			
5	0.5849	0.4130	3	0.9795	0.6408	48.64%	0.2087	0.1008	0.6067	0.6314		SAMPLE			
6	0.8091	0.5712	3	1.3005	1.4883	30.53%	0.4707	0.1411	0.8744	0.9645		SAMPLE			
7	0.8288	0.5852	3	1.3552	2.9107	19.86%	0.7873	0.1496	1.0840	1.3443		SAMPLE			
8	1.0017	0.7072	3	1.6055	0.5299	88.40%	0.1387	0.1223	0.9163	0.9275		SAMPLE			
9	0.8727	0.6161	3	1.3956	-0.6665	48.70%	-0.2040	0.0987	0.6320	0.6322		SAMPLE			
10	0.6838	0.4828	3	1.1190	-0.3273	80.67%	-0.1067	0.0858	0.5163	0.5165		SAMPLE			
11	0.7553	0.5333	3	1.2364	0.7767	50.02%	0.2287	0.1137	0.7567	0.7855		SAMPLE			
12	0.7188	0.5074	3	1.1642	0.5811	60.86%	0.1947	0.1180	0.6904	0.7081		SAMPLE			
13	1.0840	0.7653	3	1.6766	-0.5213	84.03%	-0.1787	0.1498	0.8568	0.8569		SAMPLE			
14	0.6525	0.4607	3	1.0672	0.5522	59.02%	0.1893	0.1113	0.6359	0.6533		SAMPLE			
15	1.0003	0.7062	3	1.5786	2.4016	24.11%	0.7227	0.1695	1.1041	1.2823		SAMPLE			
16	0.5926	0.4184	3	0.9825	0.6567	47.64%	0.2253	0.1066	0.6091	0.6346		SAMPLE			
17	1.0949	0.7730	3	1.6943	0.6542	77.11%	0.2207	0.1697	0.9862	1.0020		SAMPLE			
18	1.0832	0.7647	3	1.6887	0.7153	70.71%	0.2247	0.1583	0.9880	1.0072		MB			
19	1.1172	0.7887	3	1.7869	0.5501	94.33%	0.1313	0.1237	1.0152	1.0262	466630008.1	DUP	* 0.0%		
20	2.7518	1.9428	3	4.4897	41.1312	9.34%	3.4047	0.2575	6.0970	12.6939	466630008.1	MS			50.6933 81.1%
21	3.7936	2.6783	3	5.8265	45.1904	8.96%	4.8087	0.3319	6.1135	13.7507	466630008.1	MSD	9.4%		50.6933 89.1%
22	0.7414	0.5234	3	1.2231	19.8226	8.01%	5.6223	0.3191	2.2054	5.8279		LCS			16.8172 117.9%

1830755r1.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
466630001	1A	60	20	81	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630002	1B	60	8	130	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630003	1C	60	7	29	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630004	1D	60	15	66	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630005	2A	60	12	34	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630006	2B	60	10	67	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630007	2C	60	35	77	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630008	9A	60	9	49	12/27/2018 13:37	12/27/2018 14:37	PIC	1830755
466630009	4D	60	13	30	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466630010	5A	60	14	23	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466633001	5B	60	12	43	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466633002	5C	60	14	46	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466633003	5D	60	8	71	12/27/2018 11:39	12/27/2018 12:39	PIC	1830755
466633004	11A	60	10	41	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
466633005	11B	60	9	97	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
466633006	11C	60	1	38	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
466633007	11D	60	17	94	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
1204178239	12A	60	9	82	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
1204178240	9B	60	3	50	12/27/2018 13:37	12/27/2018 14:37	PIC	1830755
1204178241	9C	60	12	235	12/27/2018 13:37	12/27/2018 14:37	PIC	1830755
1204178242	12D	60	14	385	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755
1204178243	13A	60	9	365	12/27/2018 11:38	12/27/2018 12:38	PIC	1830755

ASSAY 20-Dec-18 15:37:11

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 12/20/2018
Run id. 2451

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	97	1	180.04	603.6	172.73	7.61		03:37:11
2	97	2	180.04	516.34	143.65	8.34	83.16	03:40:24
3	97	3	180.06	590.43	168.32	7.71	97.45	03:43:38
4	97	4	180.06	571.43	161.99	7.86	93.78	03:46:52
5	97	5	180.04	558.28	157.63	7.97	91.26	03:50:06
1	94	1	180.06	603.88	172.81	7.61	100.05	03:53:42
2	94	2	180.04	588.6	167.73	7.72	97.11	03:56:56
3	94	3	180.04	519.77	144.79	8.31	83.82	04:00:10
4	94	4	180.04	586.19	166.93	7.74	96.64	04:03:24
5	94	5	180.04	571.48	162.02	7.86	93.80	04:06:37
1	76	1	180.04	579.94	164.84	7.79	95.43	04:10:25
2	76	2	180.06	546.79	153.78	8.06	89.03	04:13:39
3	76	3	180.04	598.05	170.88	7.65	98.93	04:16:53
4	76	4	180.03	612.65	175.76	7.54	101.75	04:20:07
5	76	5	180.04	613.34	175.97	7.54	101.88	04:23:20
1	53	1	180.04	550.65	155.09	8.03	89.79	04:27:08
2	53	2	180.05	619.43	177.99	7.5	103.05	04:30:22
3	53	3	180.05	593.14	169.24	7.69	97.98	04:33:36
4	53	4	180.04	560.77	158.45	7.94	91.73	04:36:50
5	53	5	180.05	540.31	151.63	8.12	87.78	04:40:03
1	92	1	180.04	584.05	166.22	7.76	96.23	04:43:51
2	92	2	180.04	598.11	170.9	7.65	98.94	04:47:05
3	92	3	180.04	528.31	147.64	8.23	85.47	04:50:19

END OF ASSAY

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 27-Dec-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

Short Name	Status	Paramname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100B2	Above	Alpha bkg	27-Dec 10:59	60	0.357	-4.24E-2	0.351	+3.24
LB4100B2	Below	Alpha eff	27-Dec 09:21	5	7948	8083	10540	-3.28
LB4100B2	need 2nd	Alpha XTalk	27-Dec 09:21	5	0.289	0.207	0.293	+2.78
LB4100C1	need 2nd	Beta bkg	27-Dec 07:18	60	1.733	1.035	1.925	+1.71
LB4100E3	Above	Beta bkg	27-Dec 07:16	60	2.183	0.473	2.078	+3.39
LB4100F2	Above	Alpha bkg	27-Dec 07:16	60	0.283	-6.32E-2	0.279	+3.07
LB4100F2	need 2nd	Alpha XTalk	27-Dec 11:05	5	0.499	0.318	0.505	+2.80
LB4100G1	Above	Beta bkg	27-Dec 07:16	60	2.150	0.338	1.748	+4.71
LB4100H4	Above	Beta bkg	27-Dec 07:16	60	2.767	0.363	1.365	+11.39
LB4100J2	Above	Alpha bkg	27-Dec 07:16	60	0.383	-6.70E-2	0.379	+3.06
LB4100J4	Above	Alpha bkg	27-Dec 10:20	60	0.367	-4.35E-2	0.401	-2.51
PIC4A	Above	Alpha bkg	27-Dec 10:09	60	0.467	-4.12E-2	0.389	+4.42
PIC4A	need 2nd	Beta eff	27-Dec 09:48	5	52460	51390	55150	-1.29
PIC4C	Above	Alpha bkg	27-Dec 10:09	60	0.383	-7.27E-2	0.383	+3.00
PIC6B	Above	Alpha bkg	27-Dec 10:38	60	0.433	-2.58E-1	0.489	+2.55

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

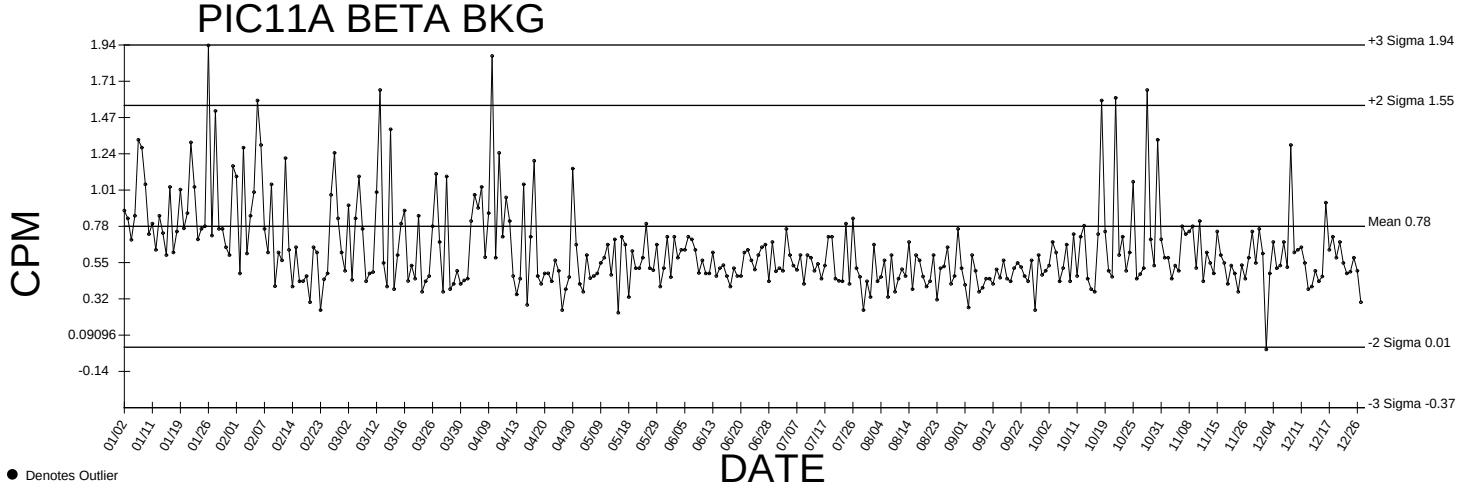
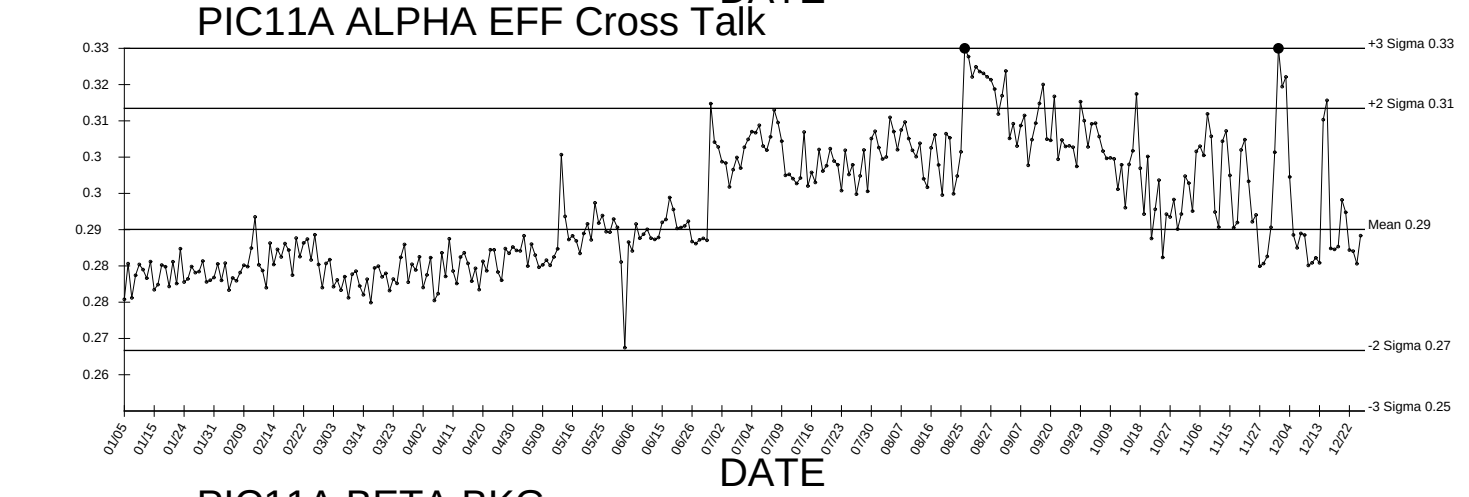
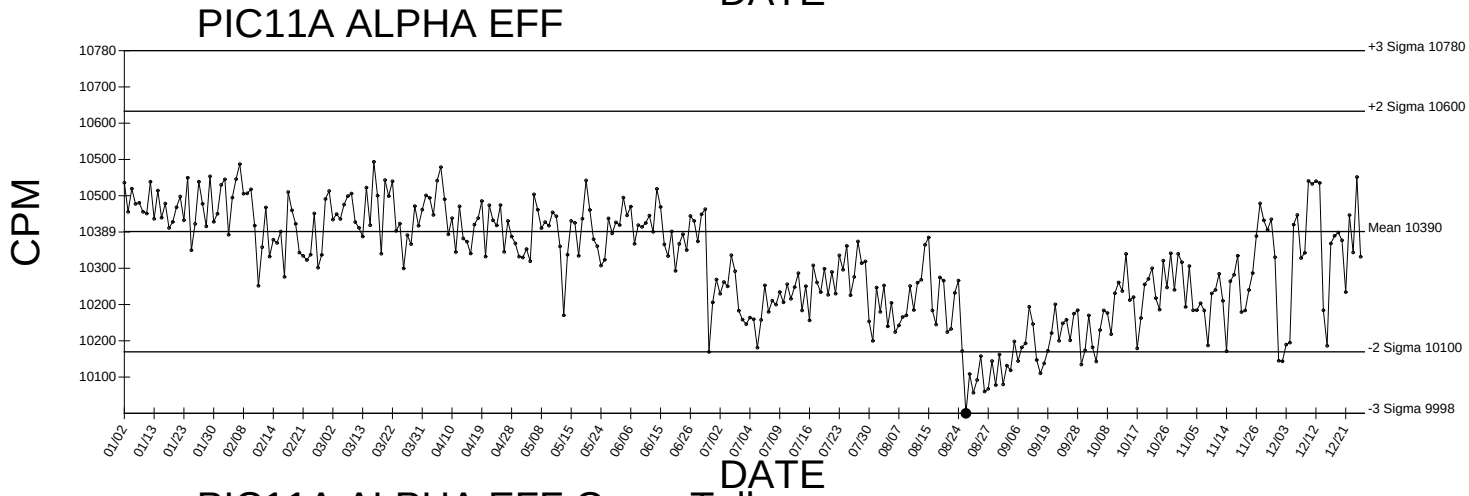
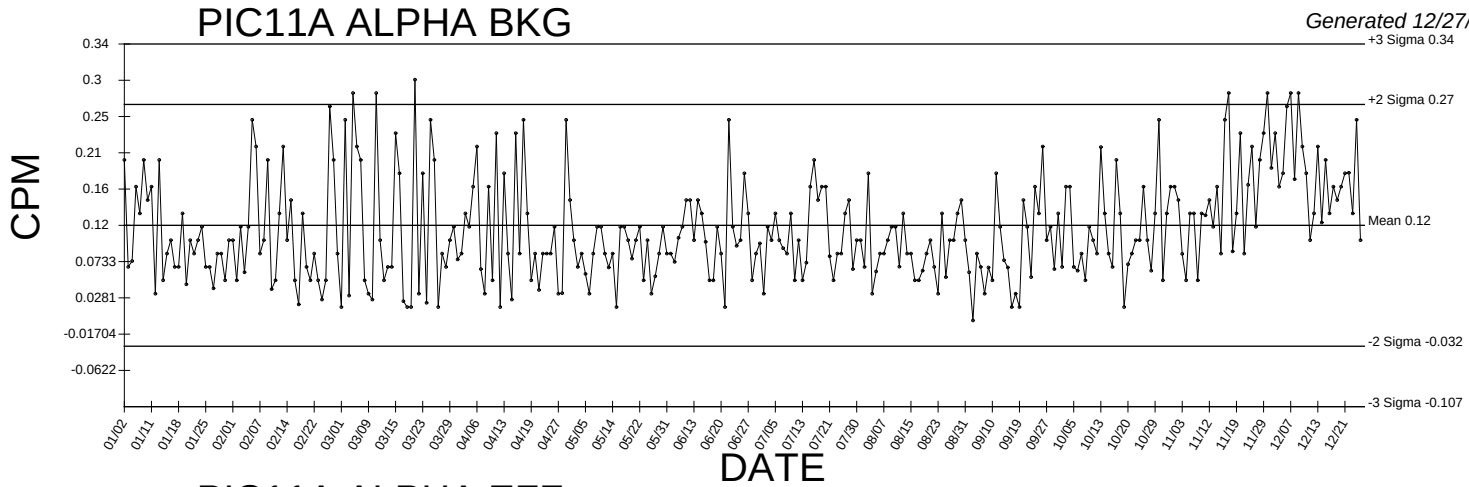
G5400W1W	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
G5400W1X	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
G5400W1Y	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
G5400W1Z	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100B3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D2	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D4	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC3A	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC6D	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC13C	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

Reviewed by

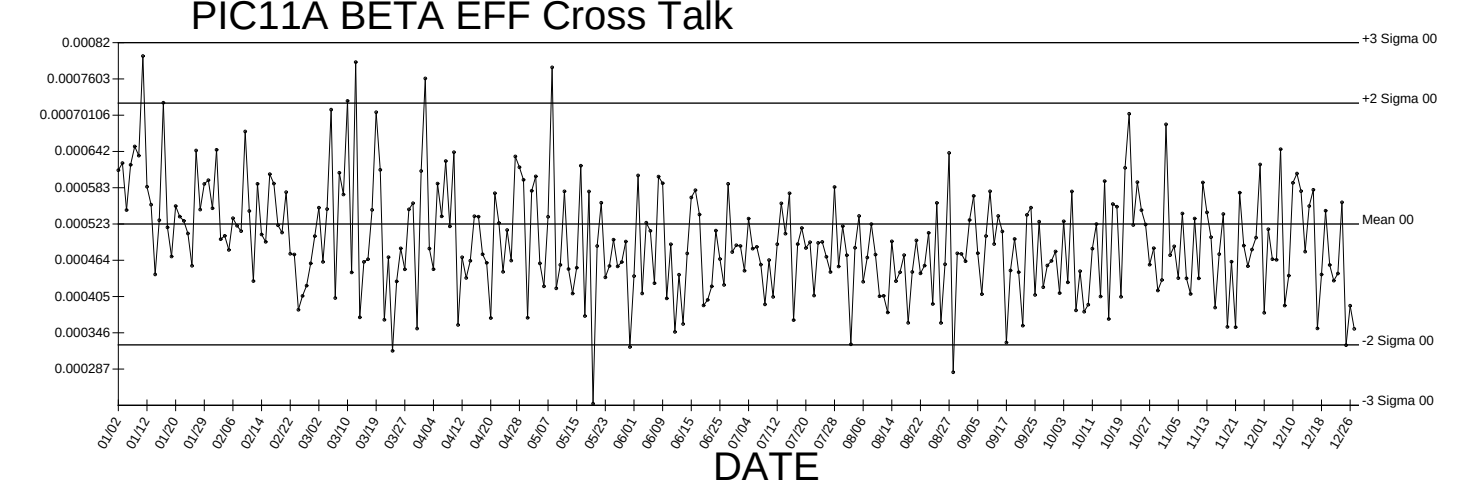
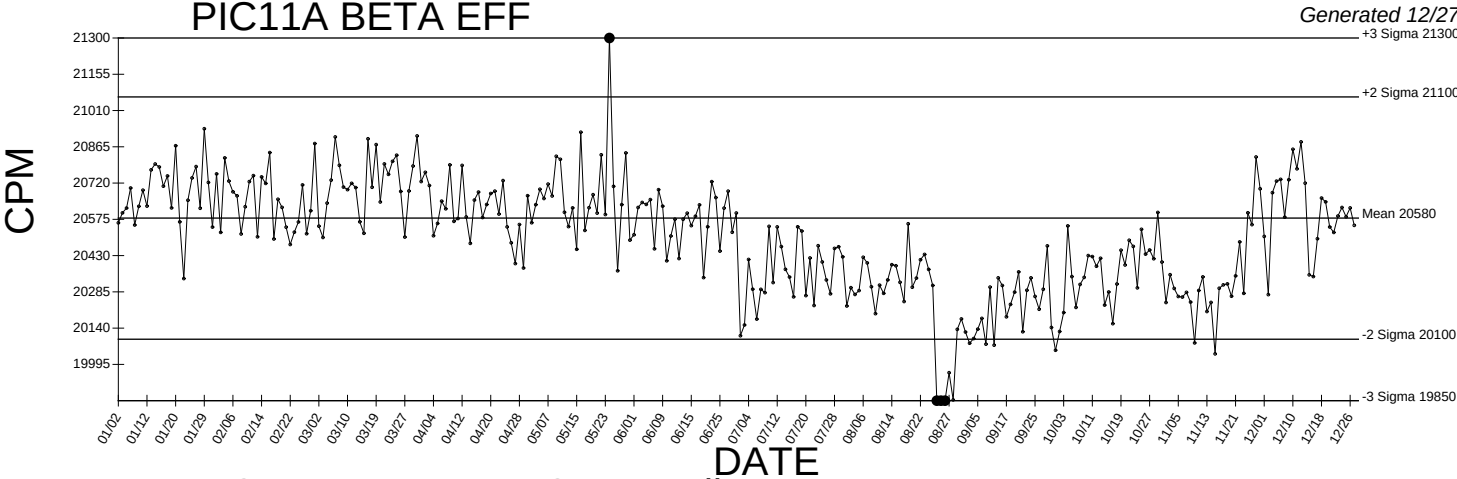
Date 12/17/18

GEL Laboratories LLC

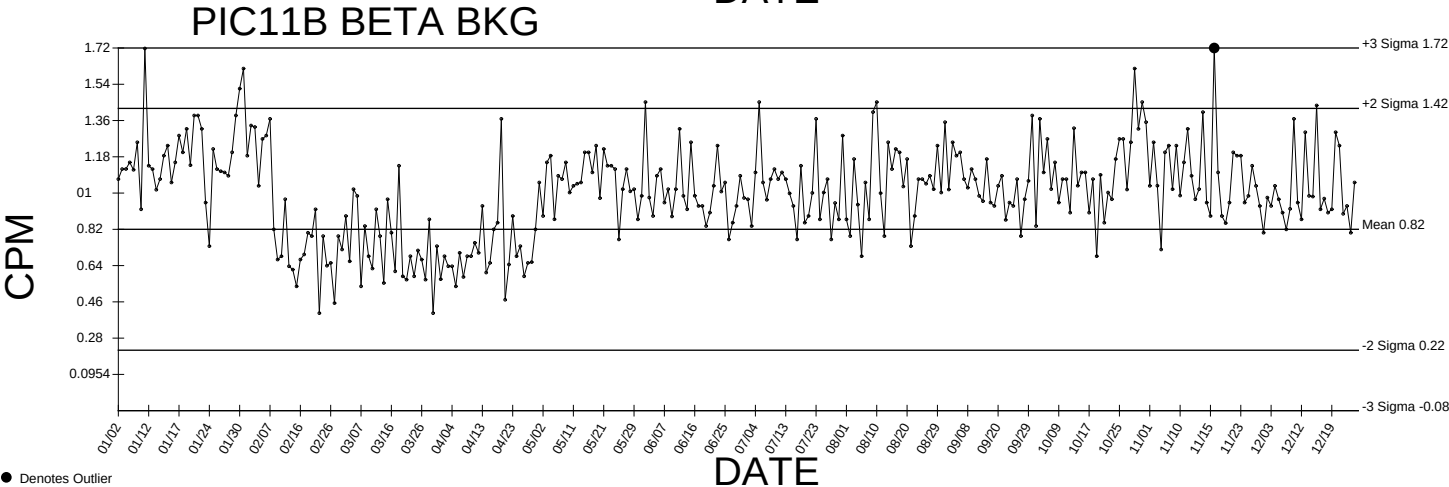
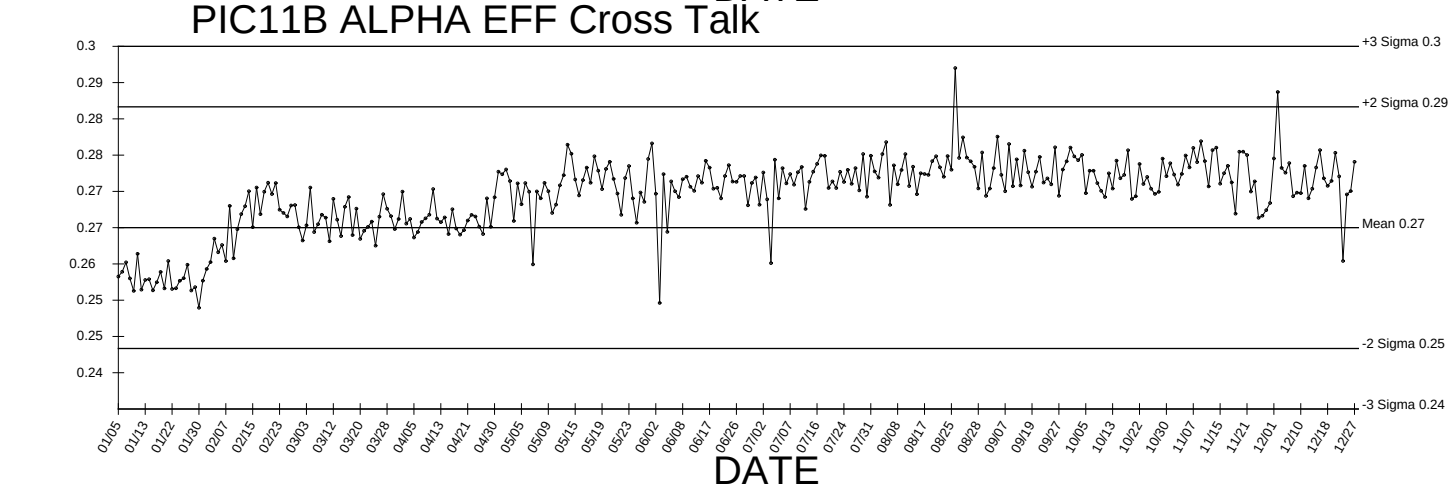
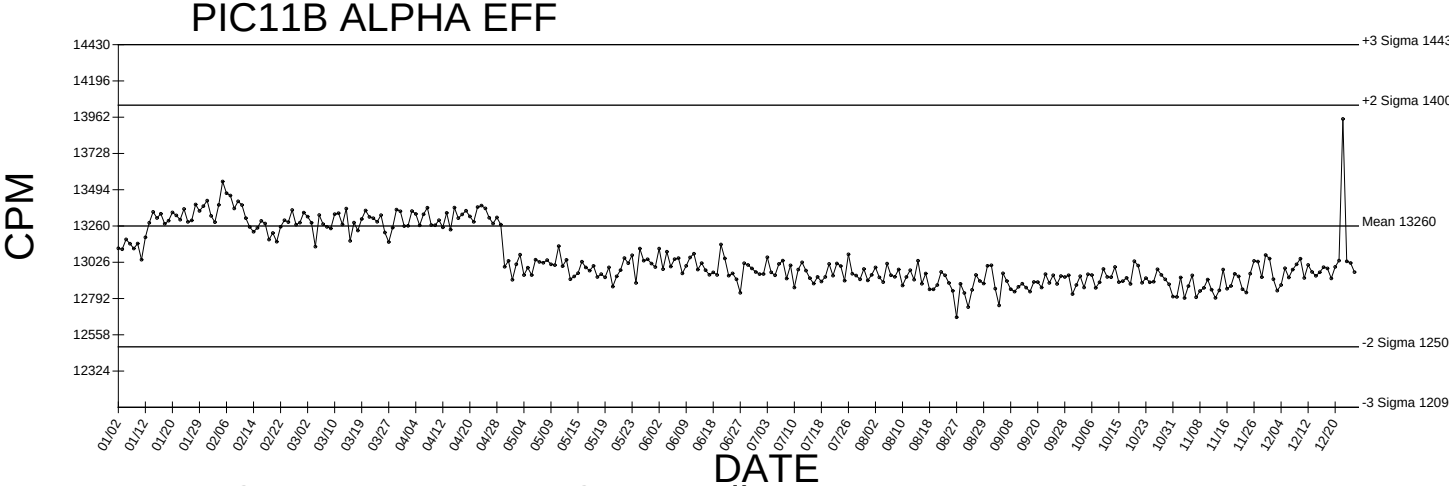
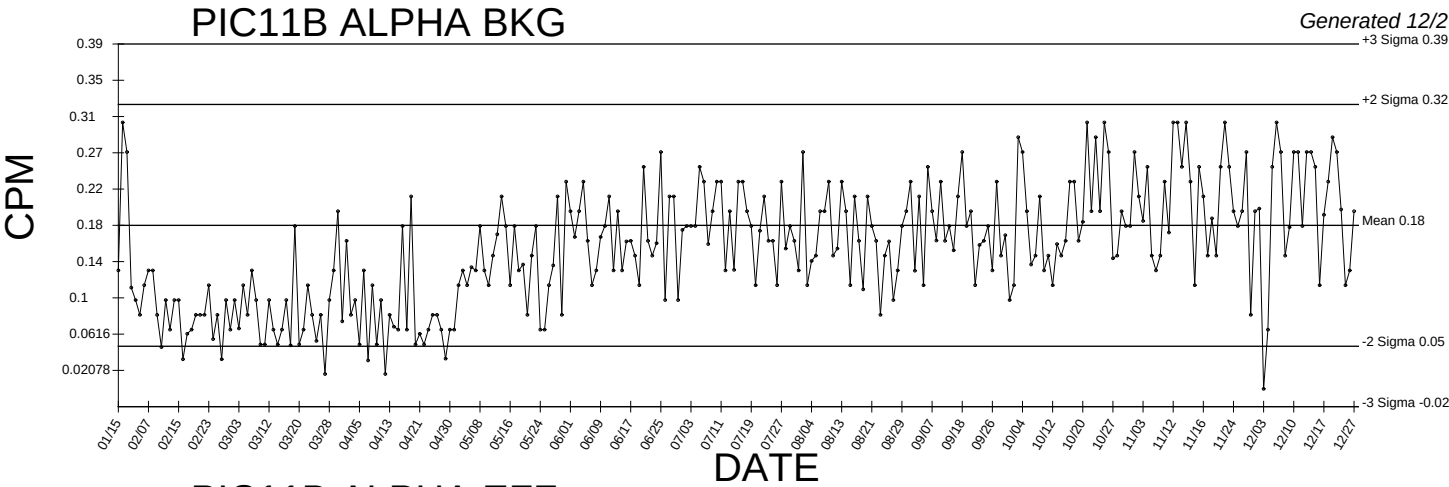
Background and Efficiency Data



● Denotes Outlier



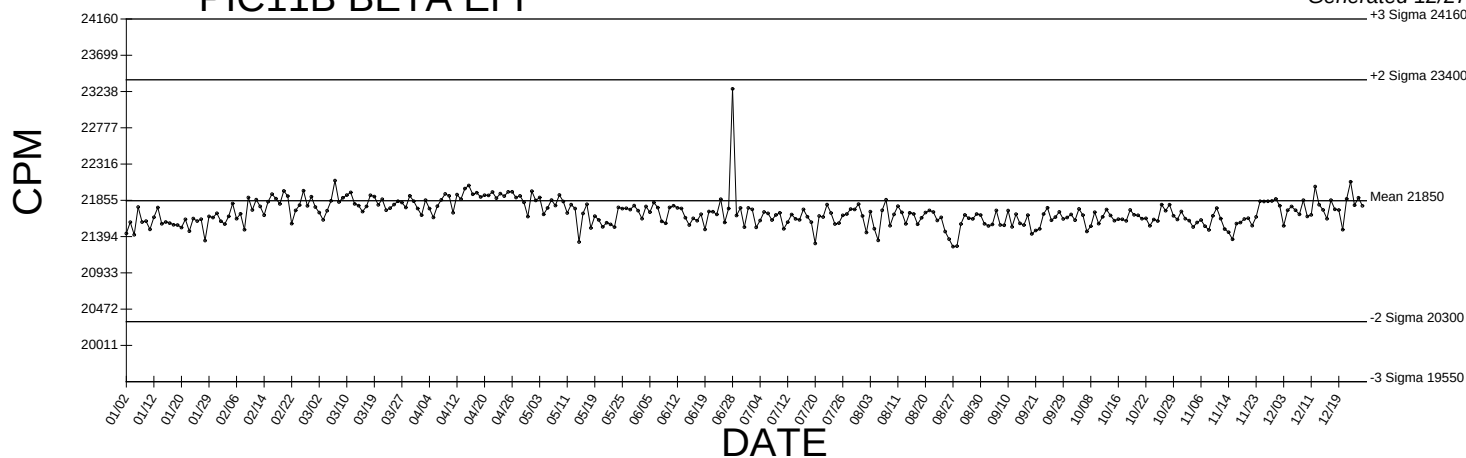
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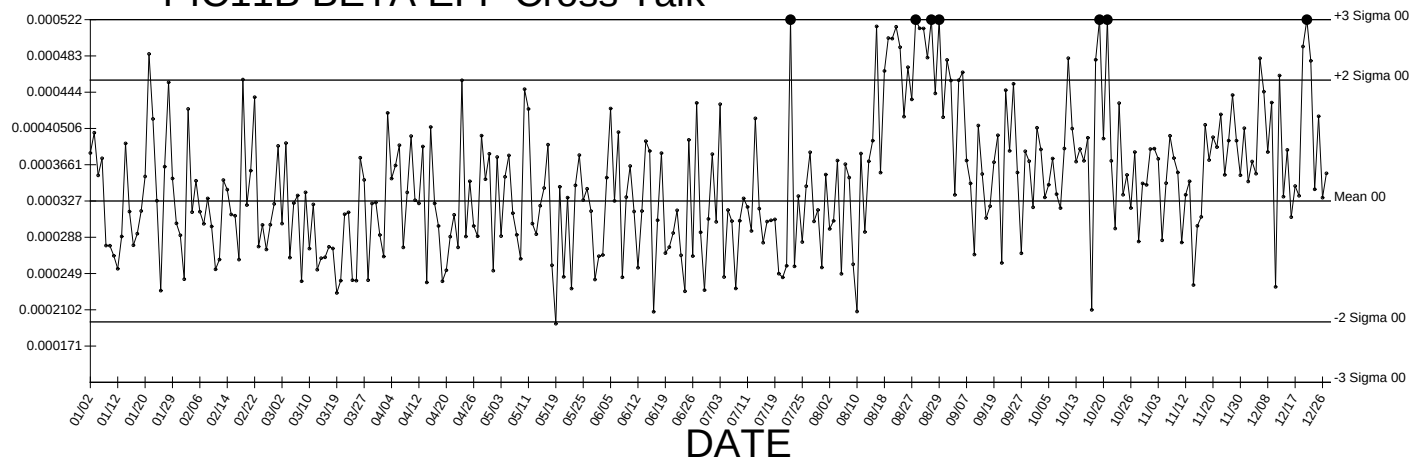
● Denotes Outlier

PIC11B BETA EFF

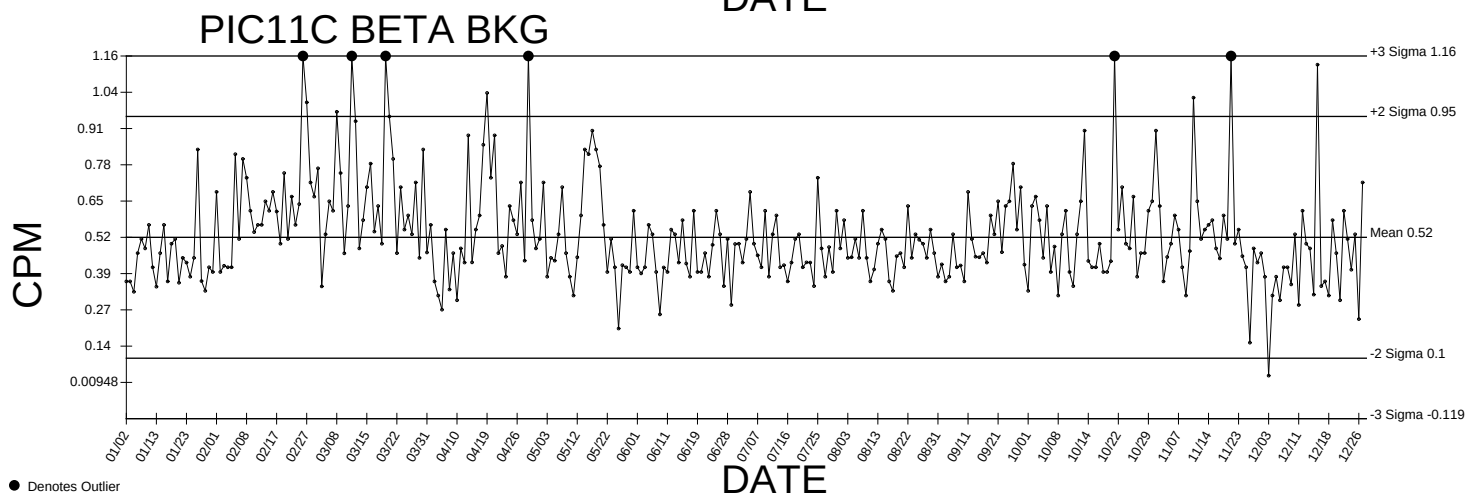
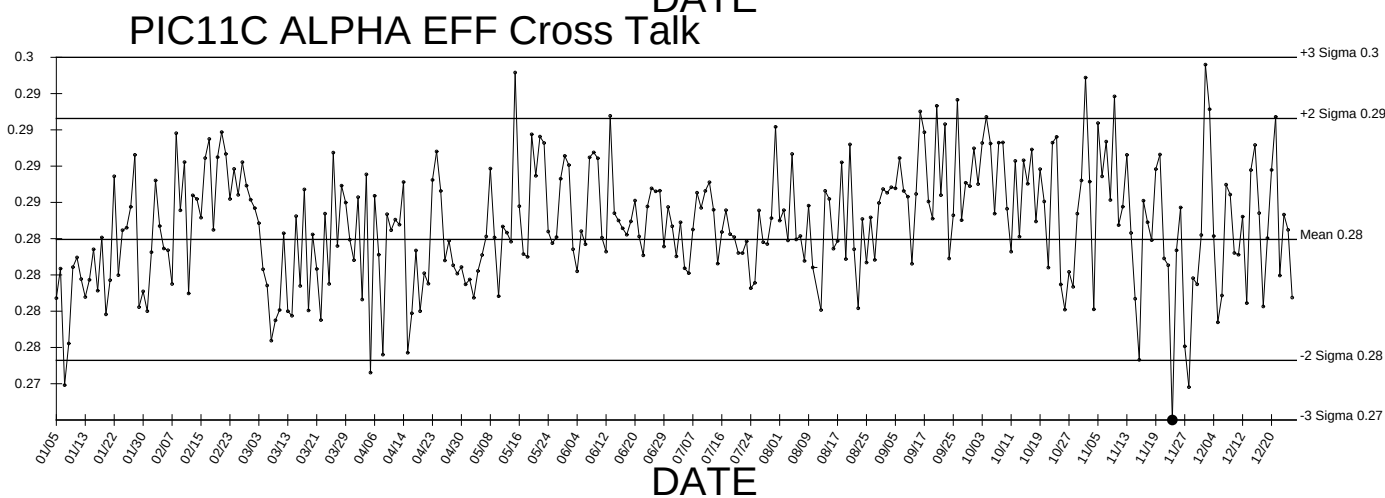
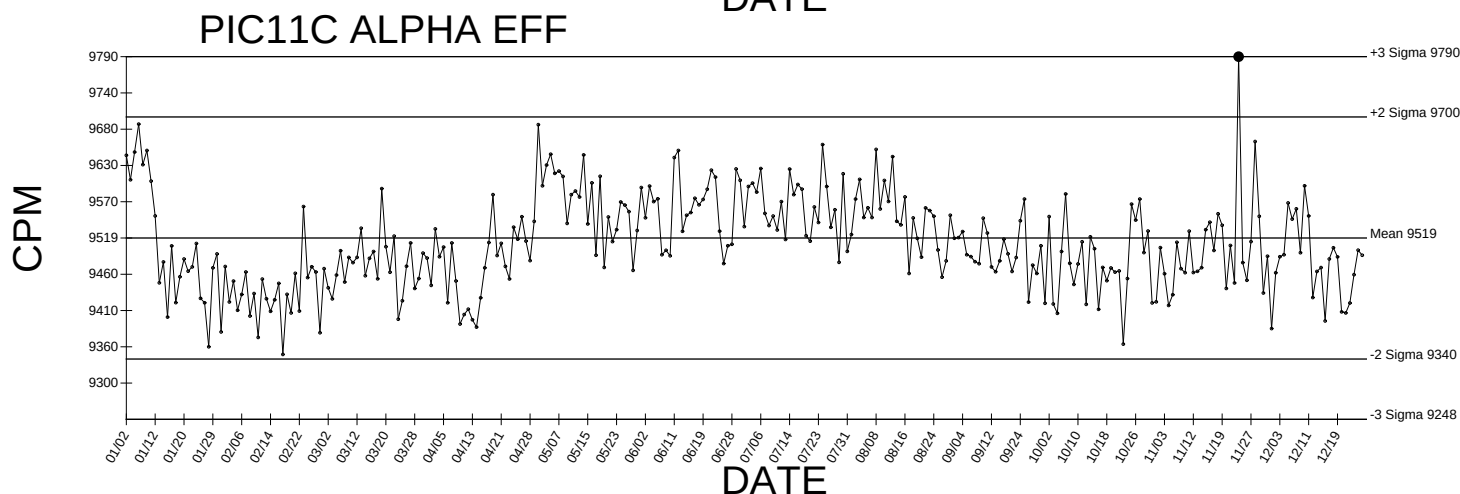
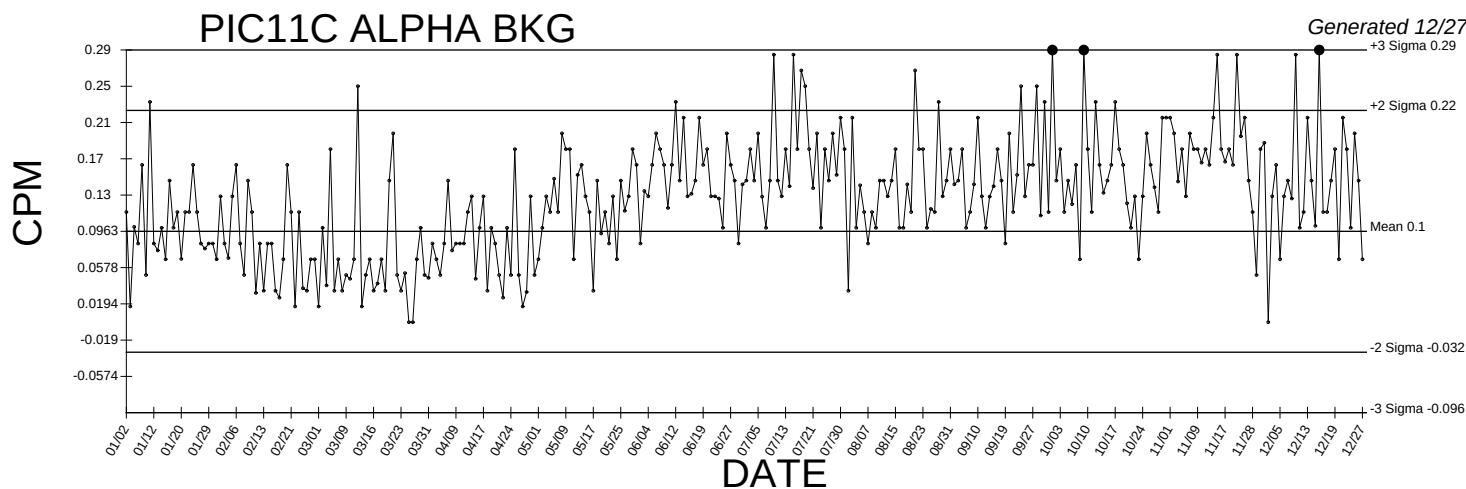
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+3 Sigma 24160



PIC11B BETA EFF Cross Talk

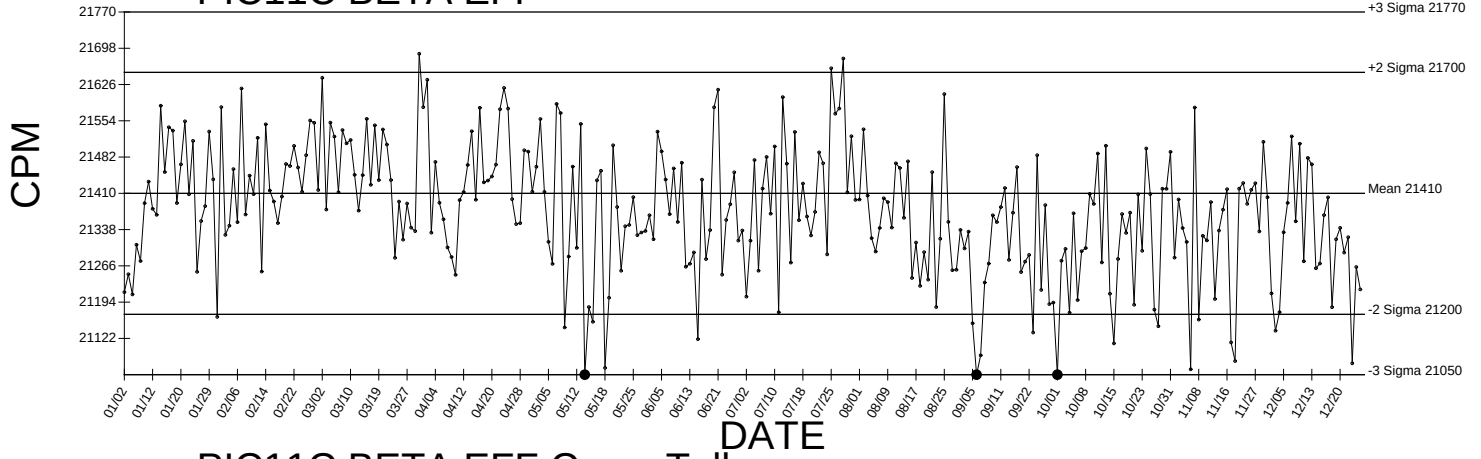


● Denotes Outlier

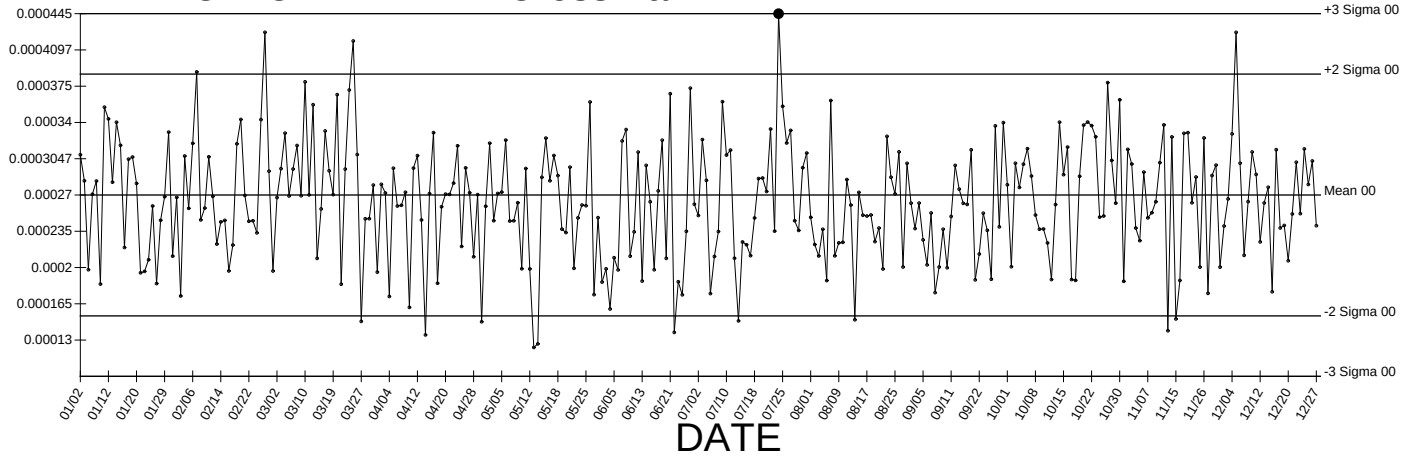


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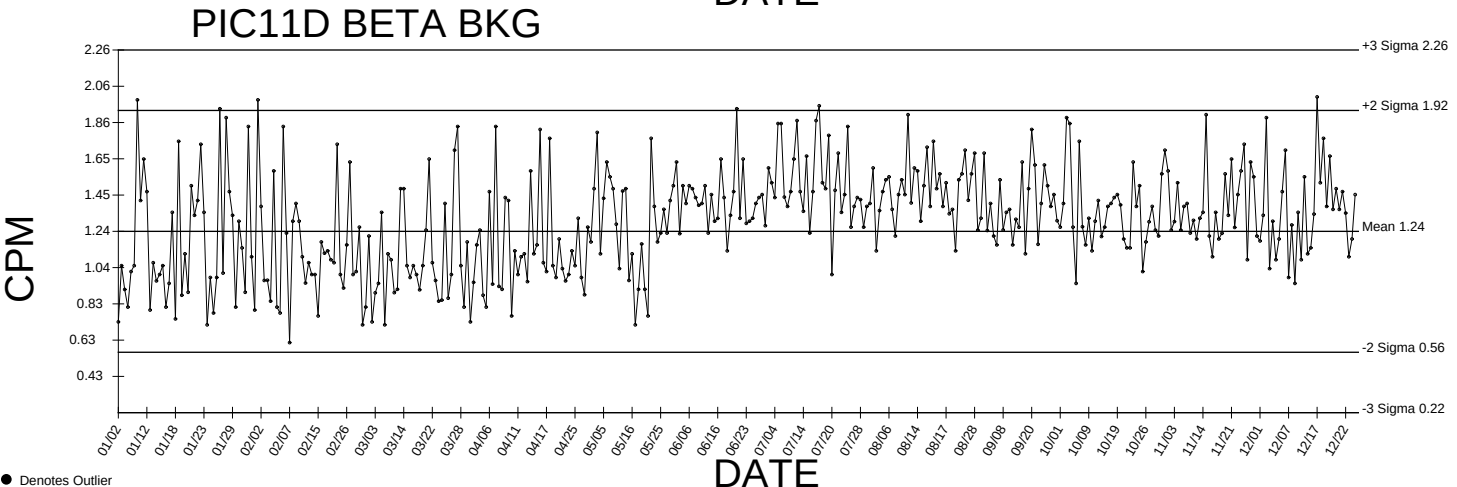
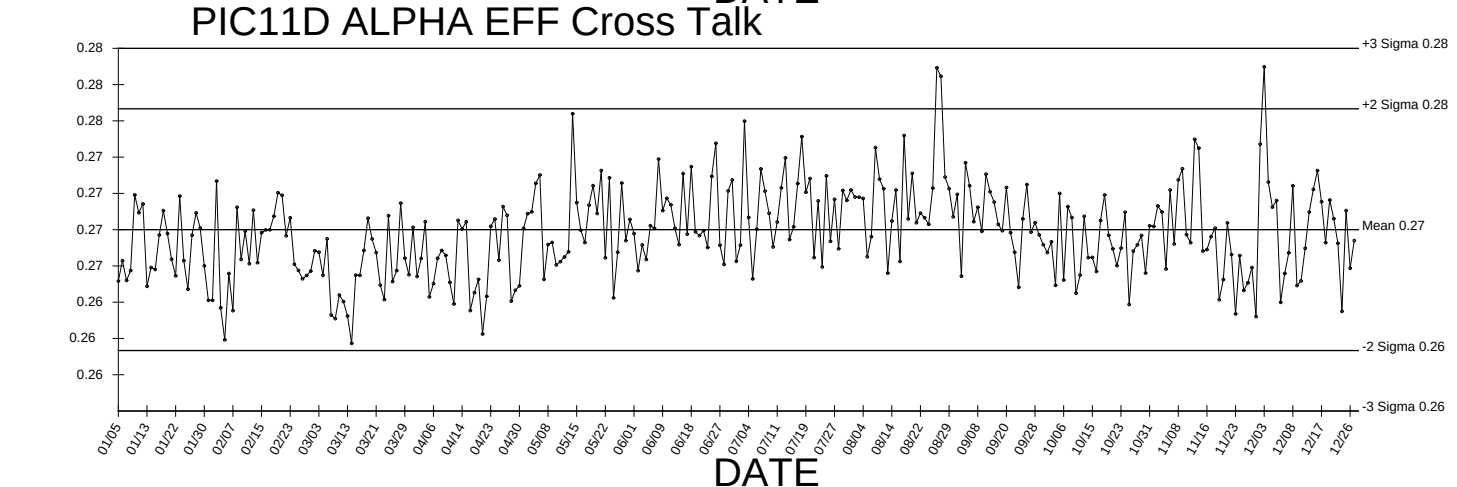
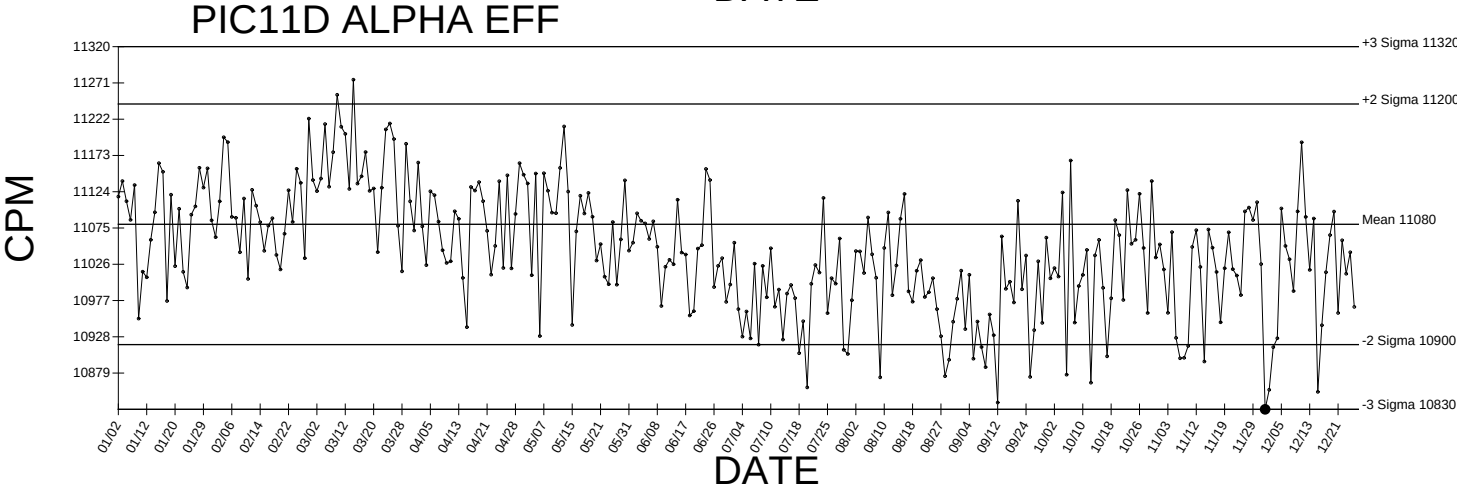
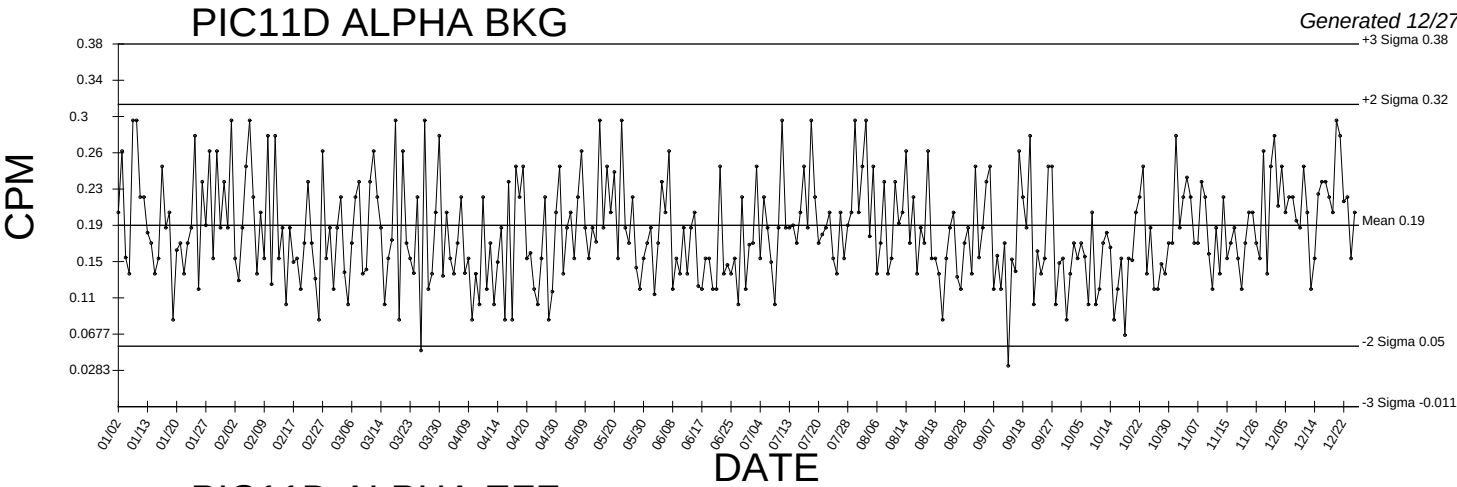
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+3 Sigma 21770



PIC11C BETA EFF Cross Talk



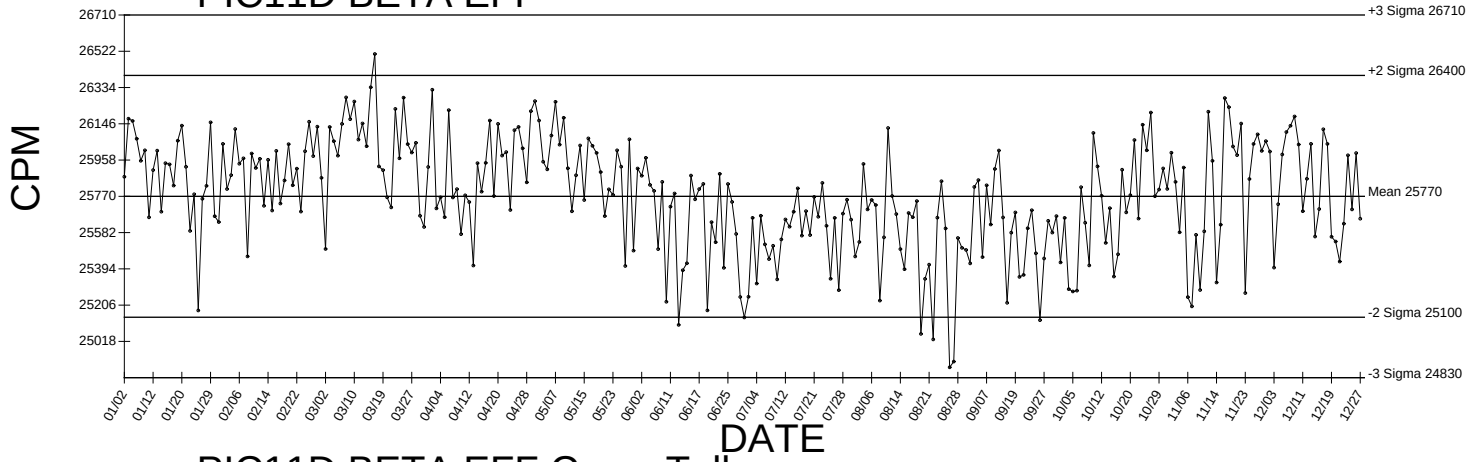
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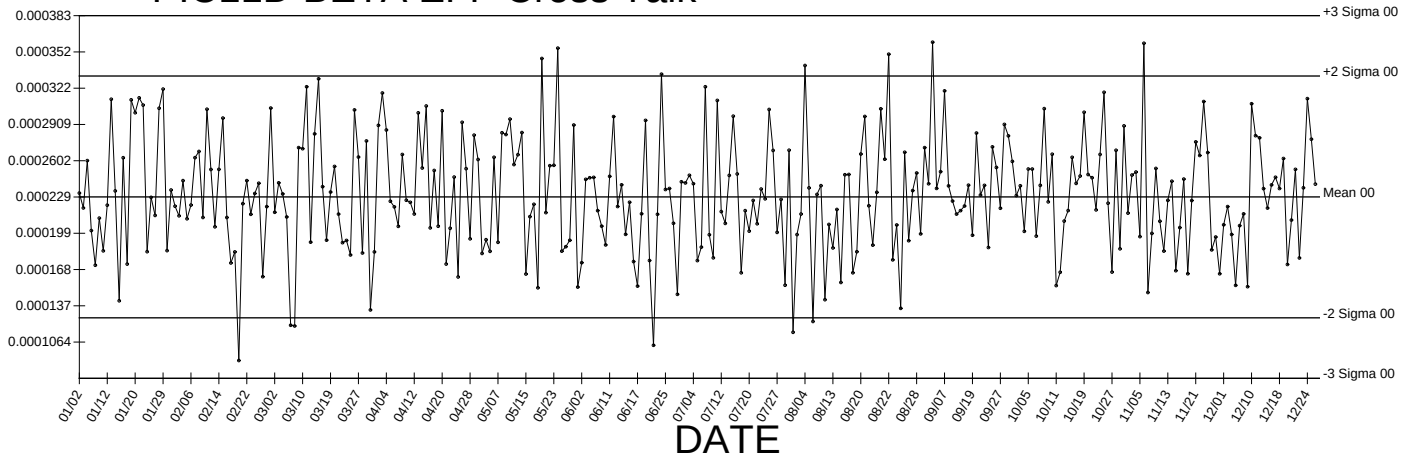
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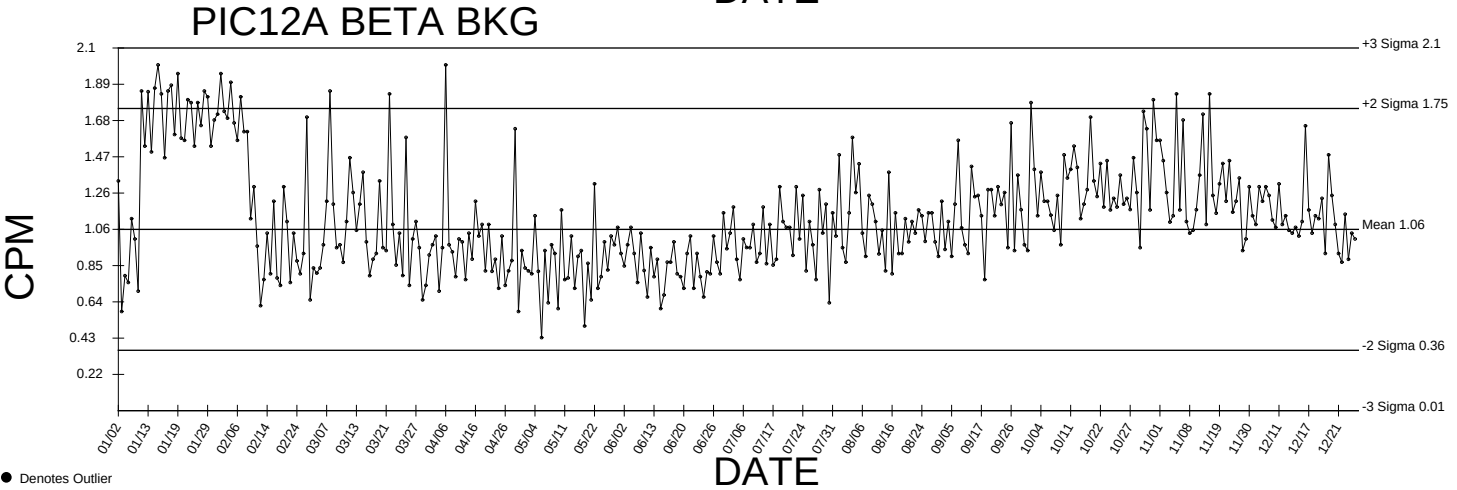
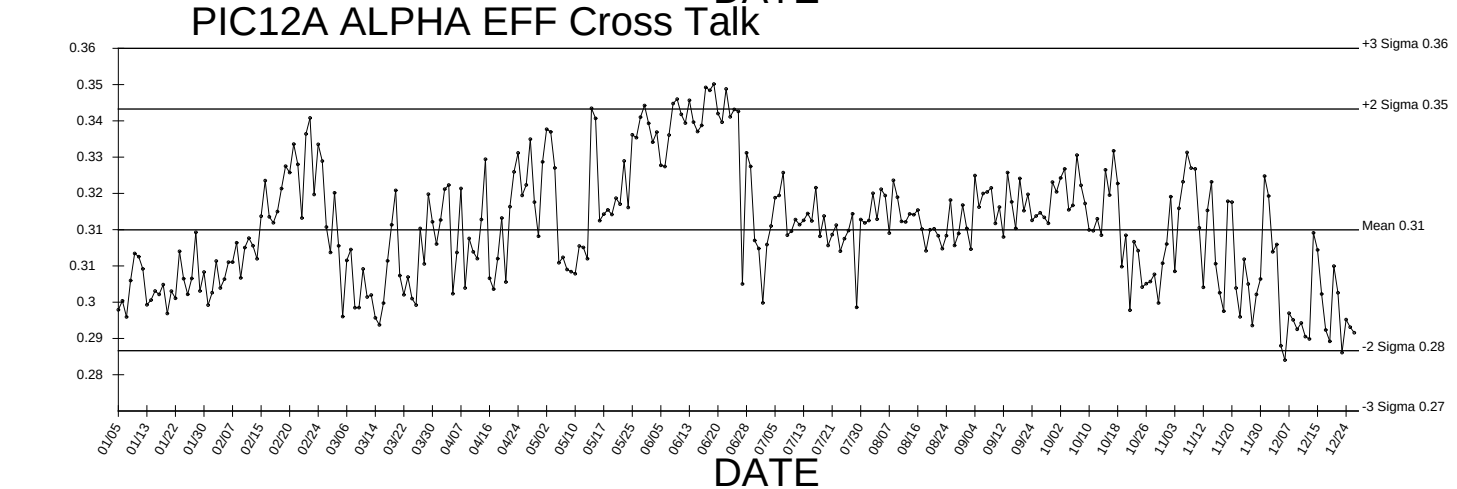
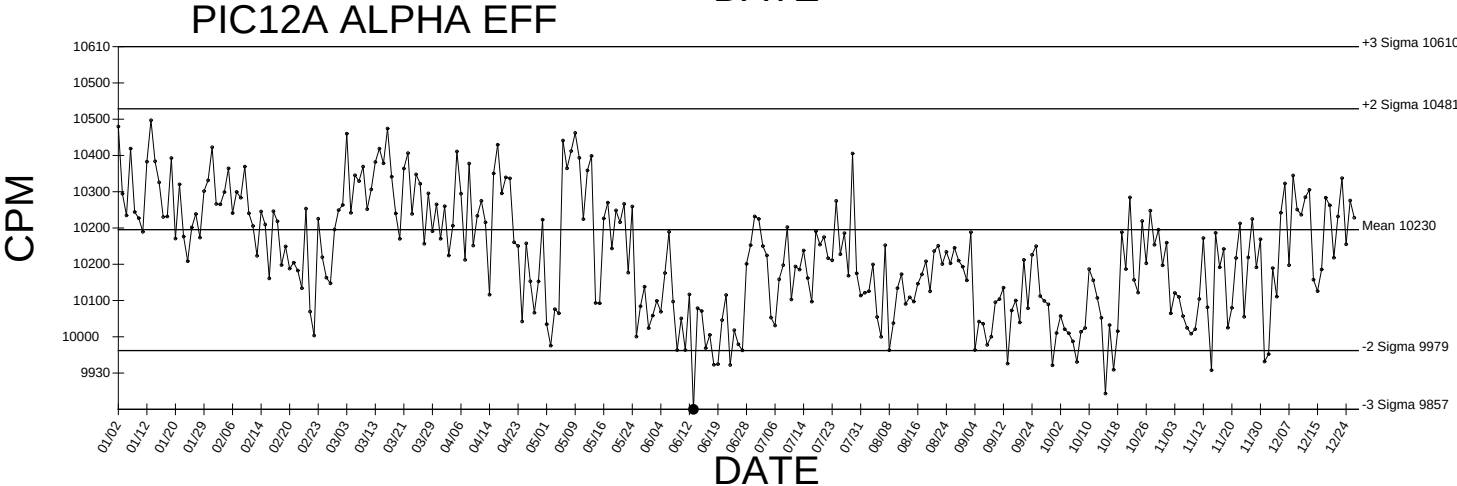
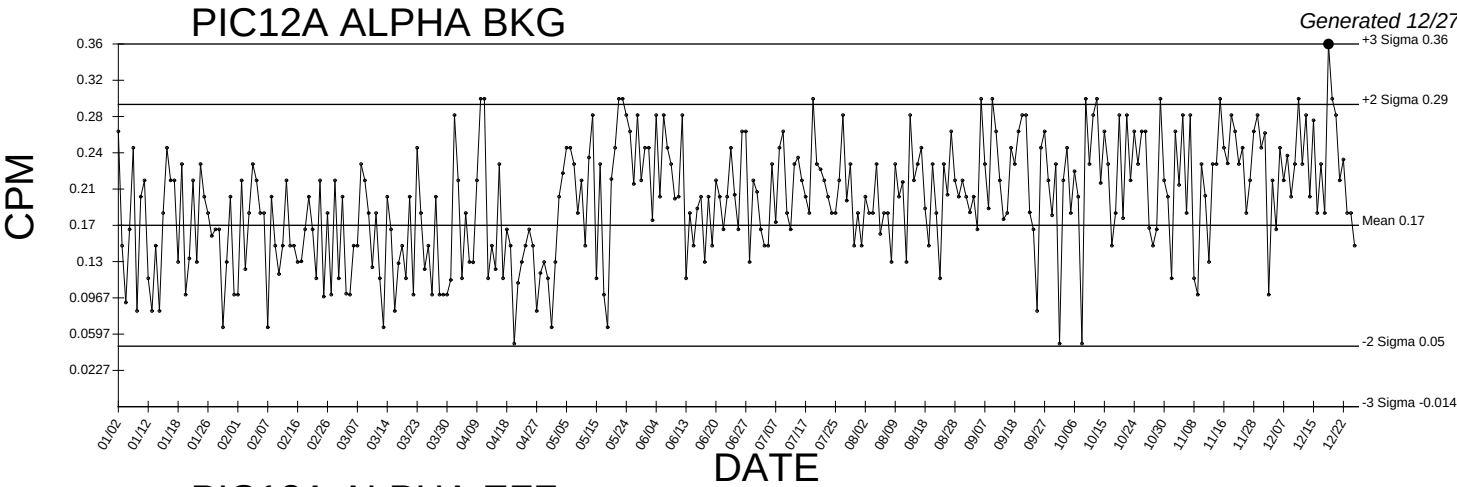
Generated 12/27/2018



PIC11D BETA EFF Cross Talk



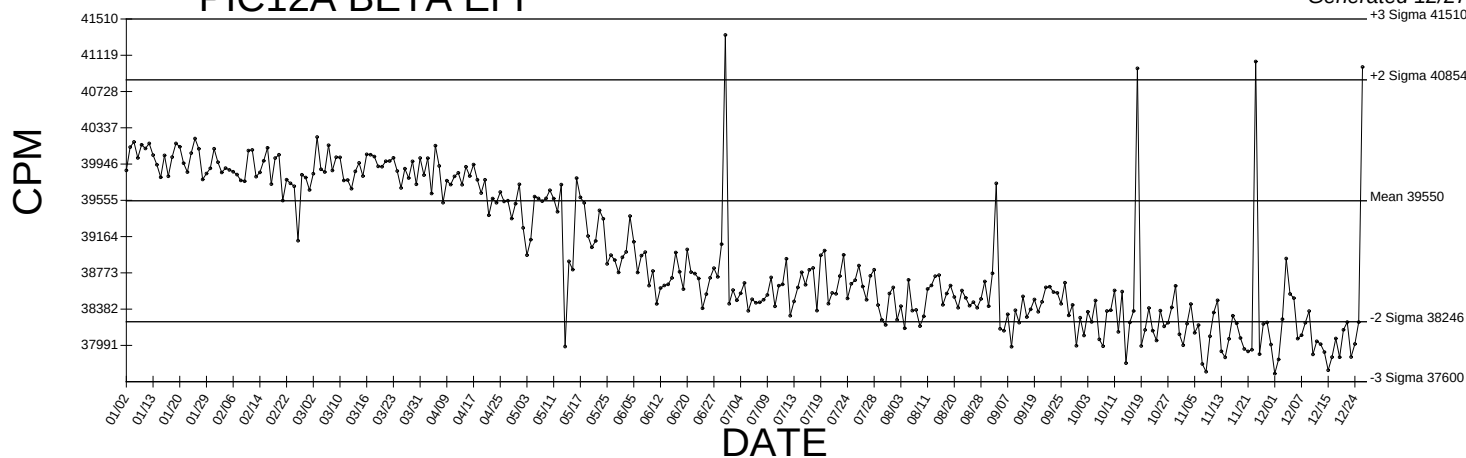
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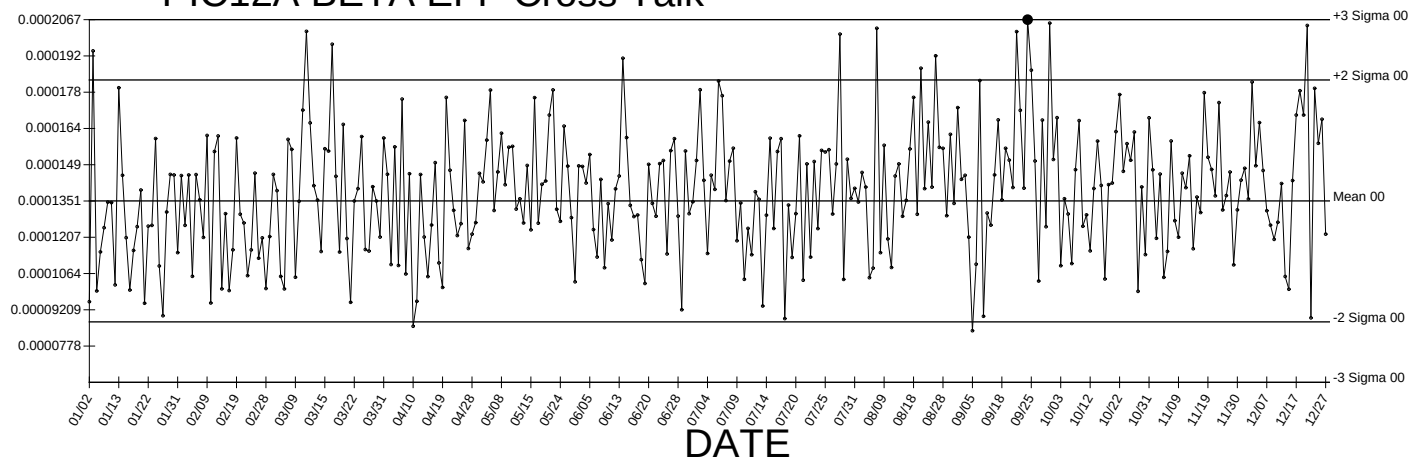
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PIC12A BETA EFF

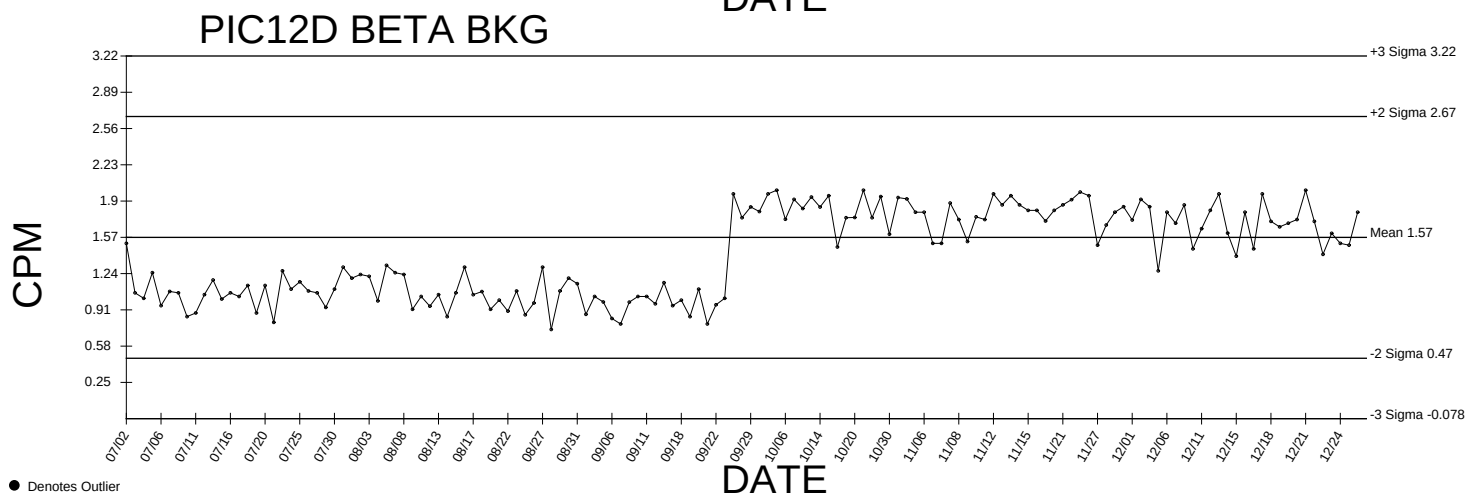
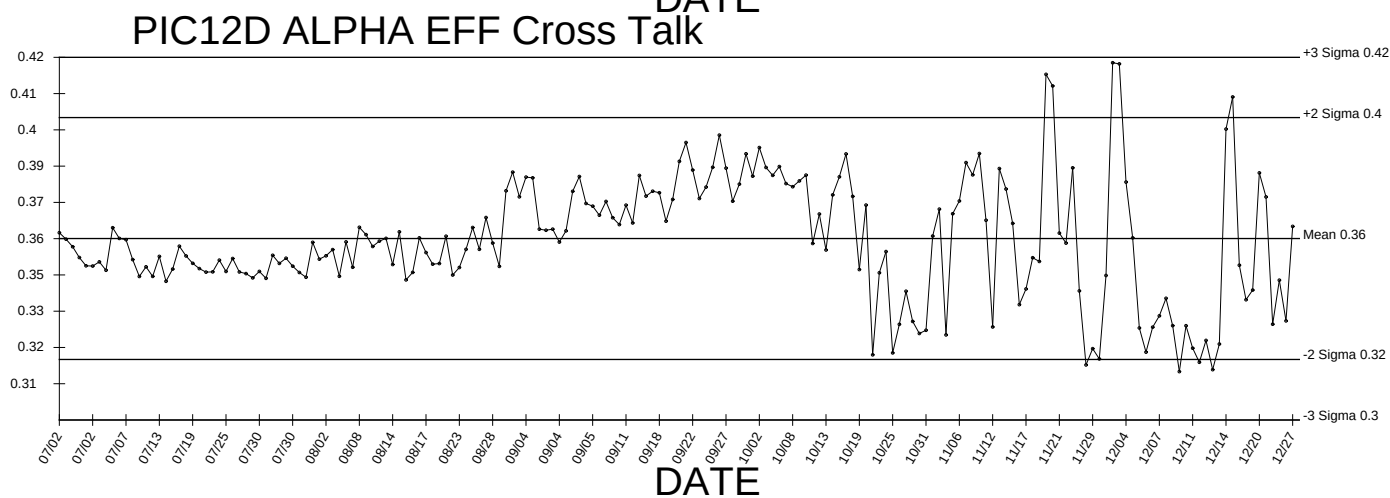
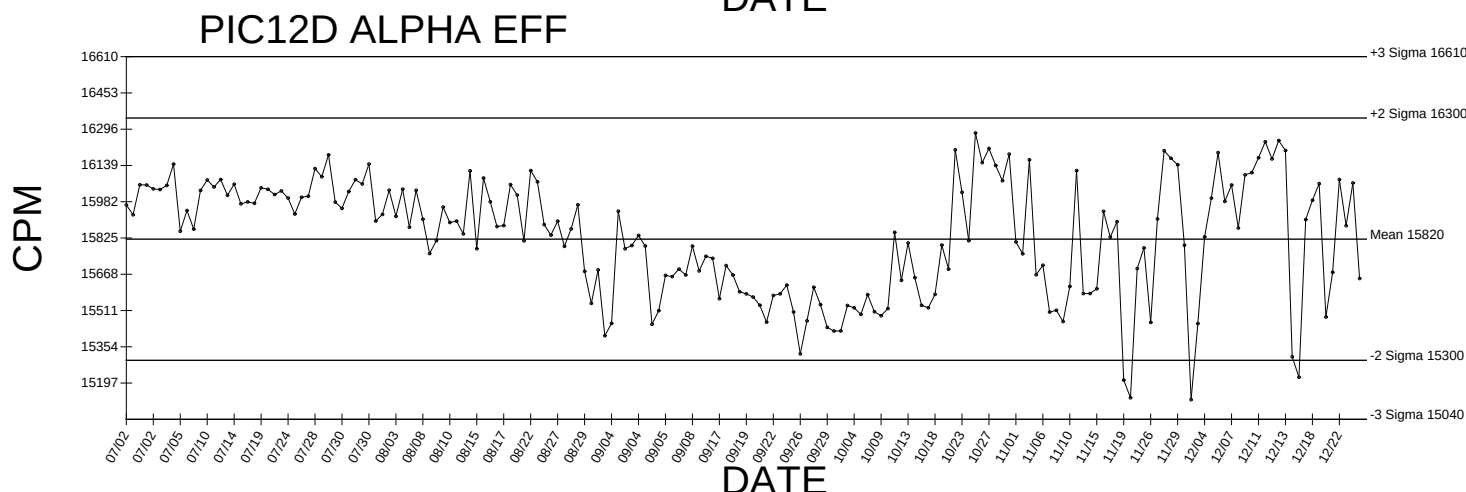
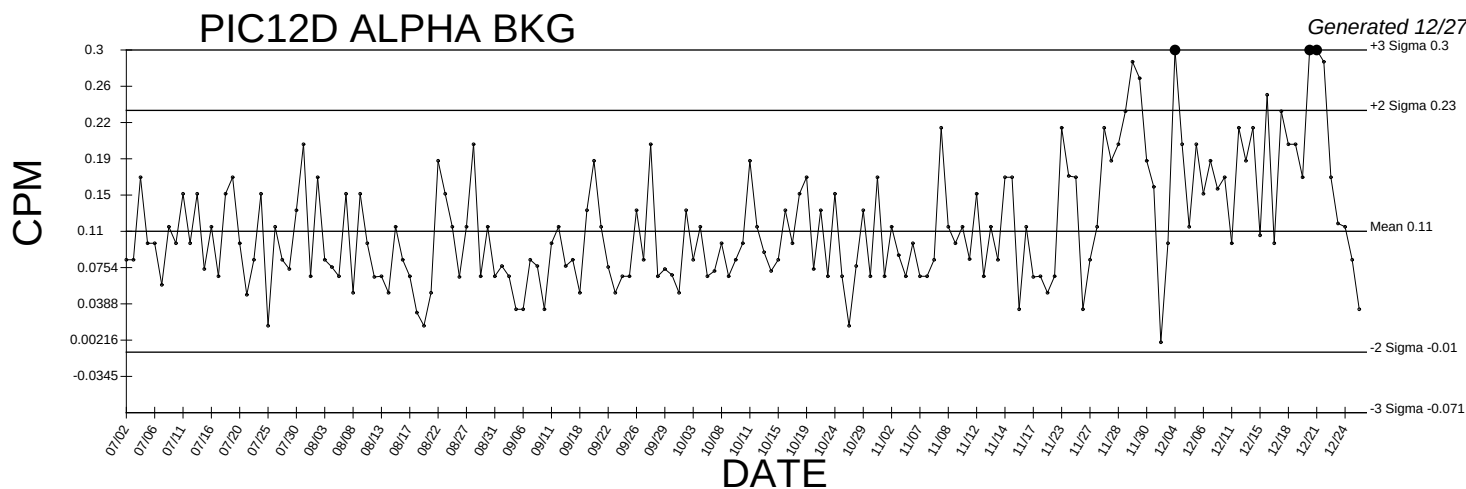
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+3 Sigma 41510



PIC12A BETA EFF Cross Talk



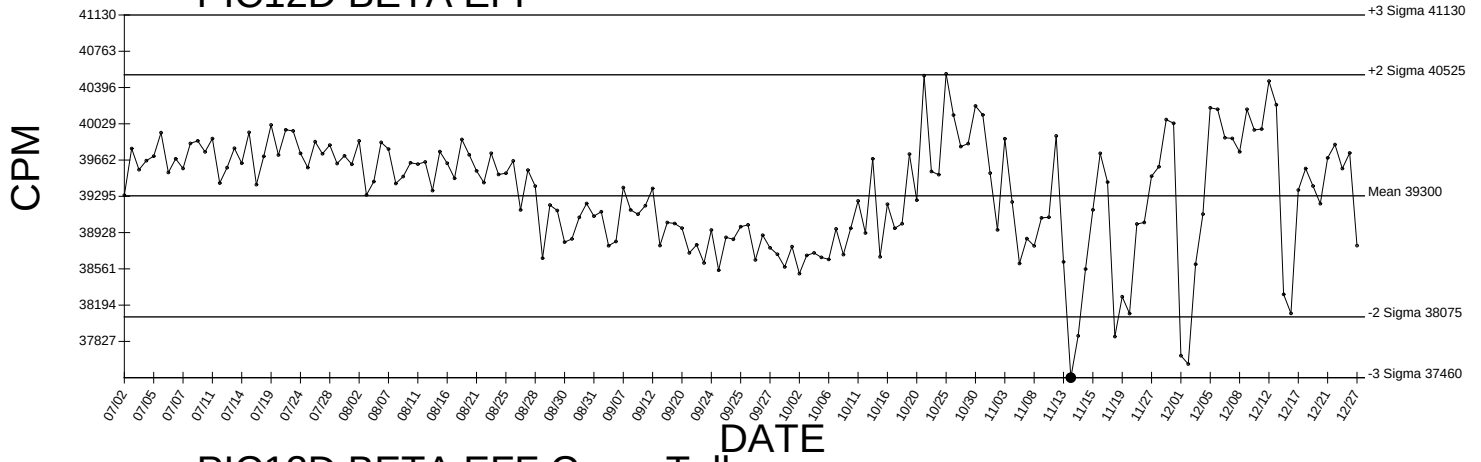
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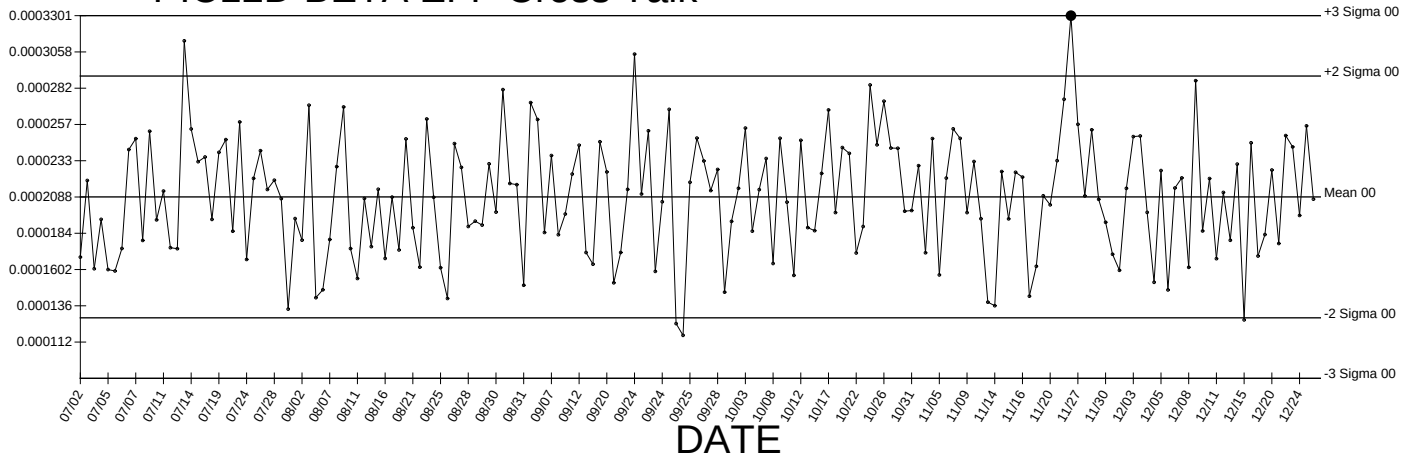
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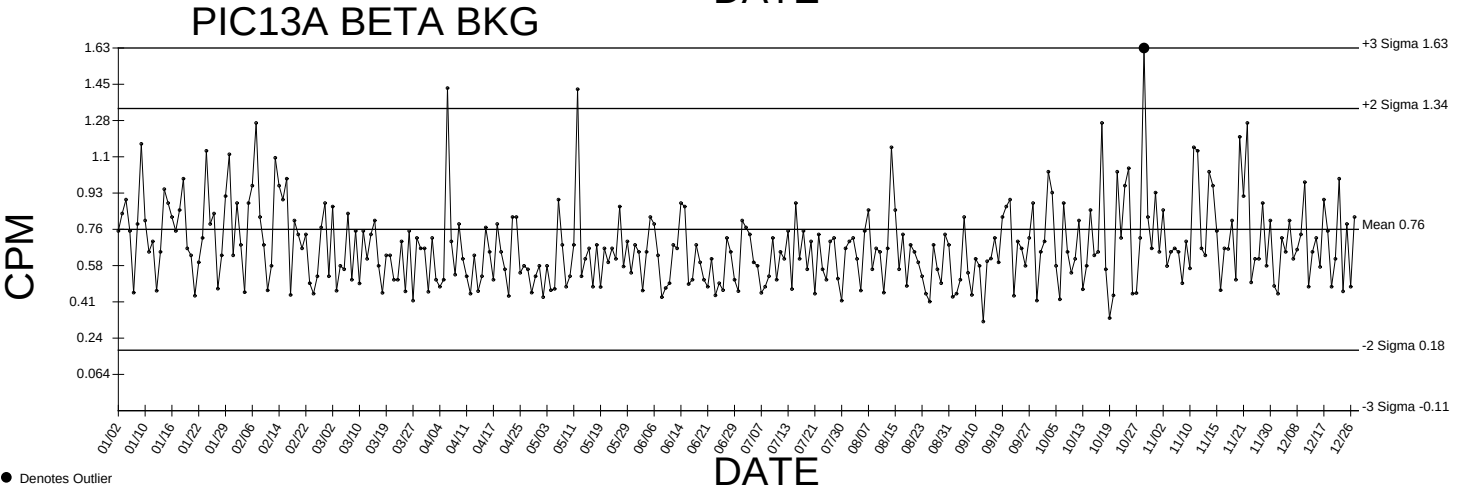
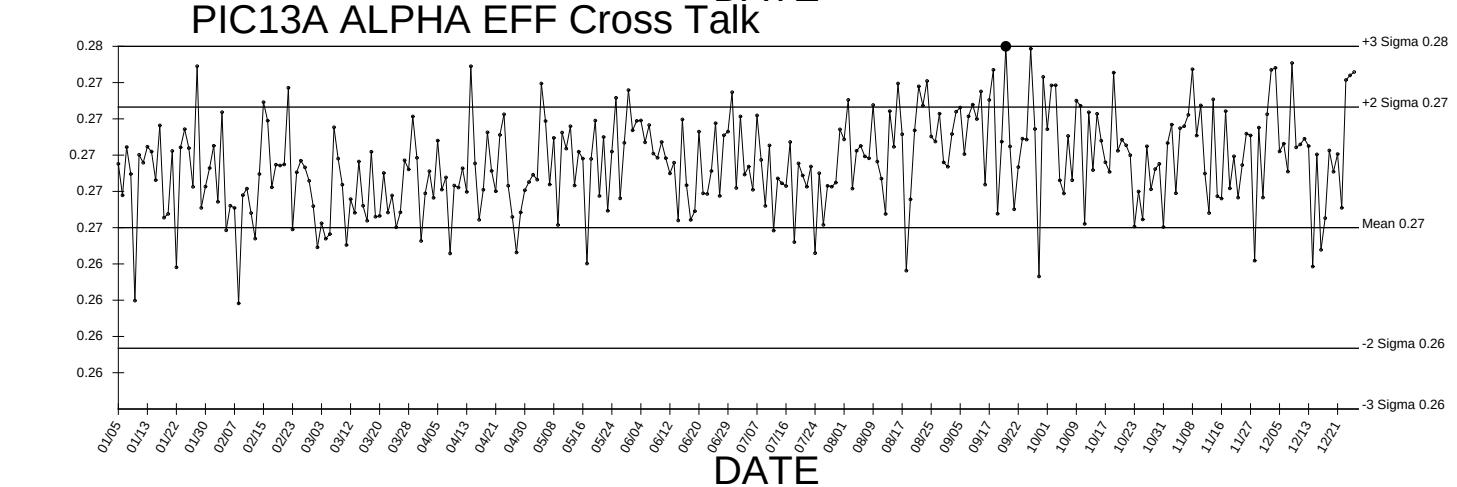
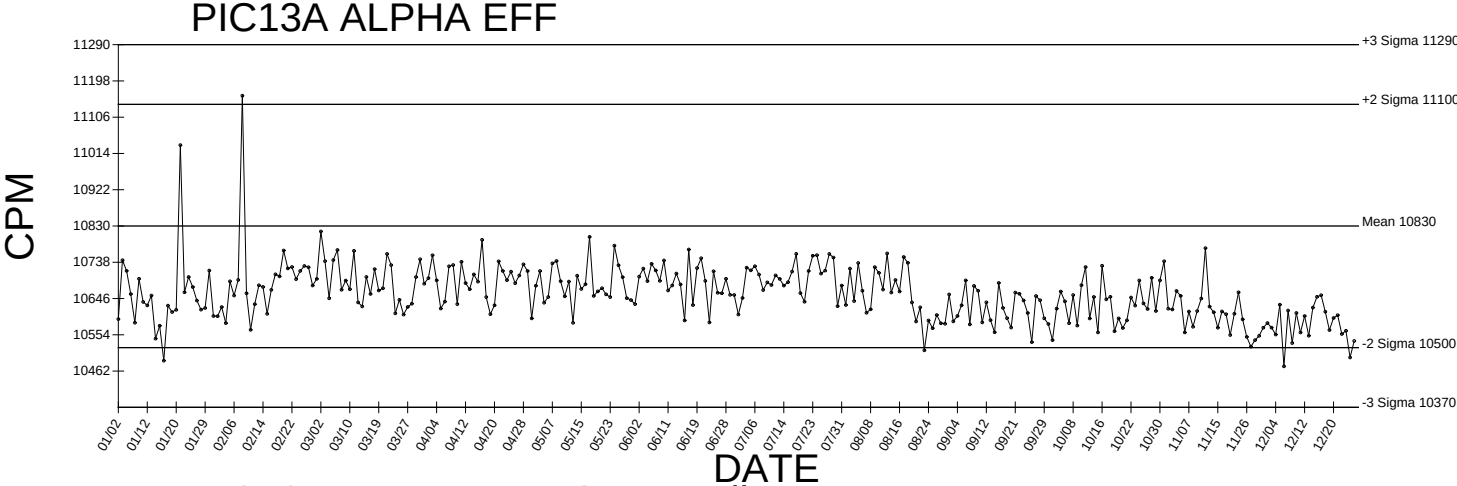
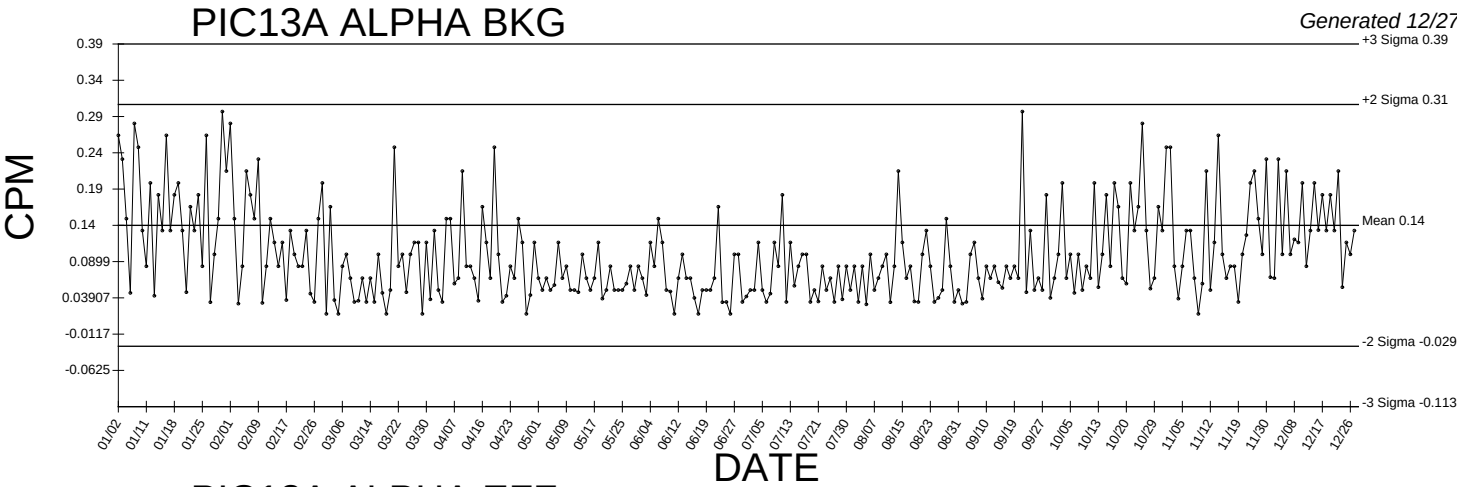
PIC12D BETA EFF

Generated 12/27/2018

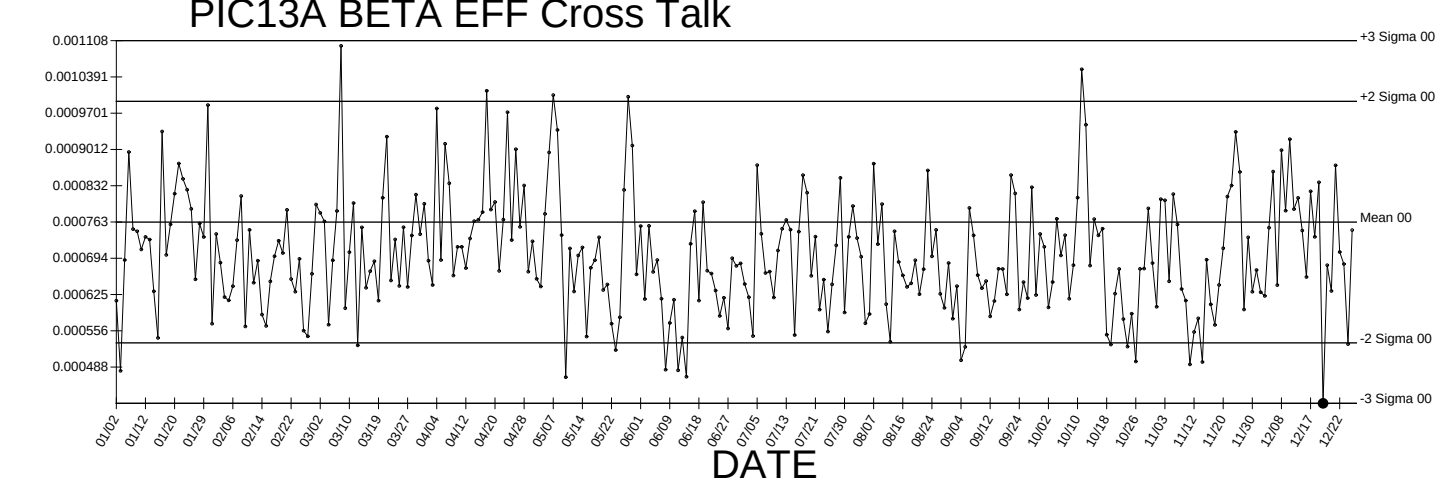
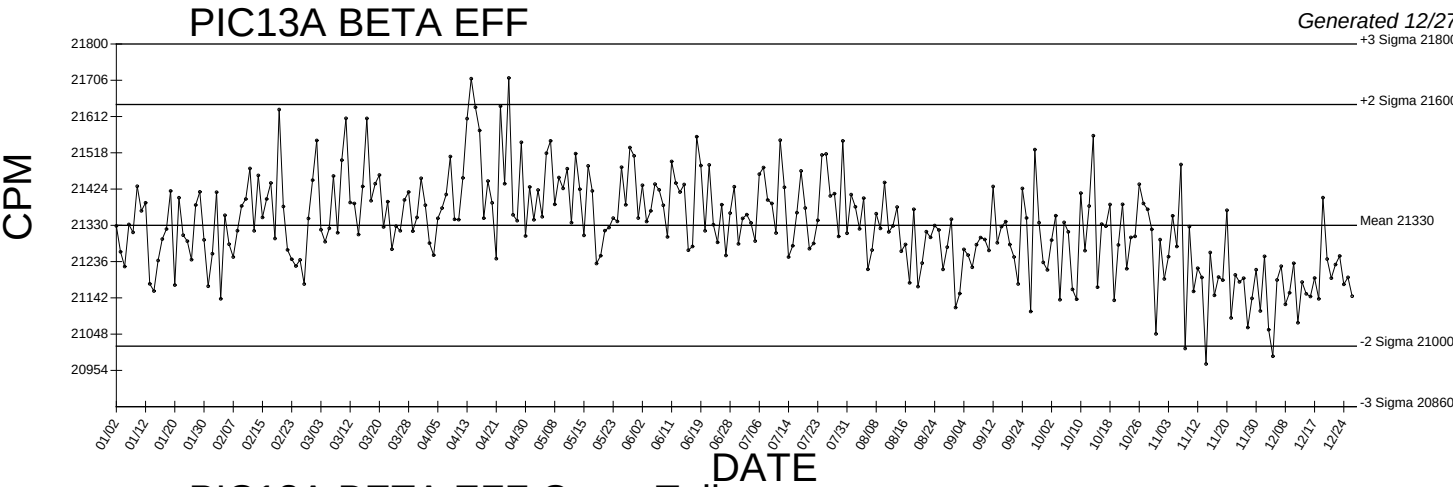


PIC12D BETA EFF Cross Talk

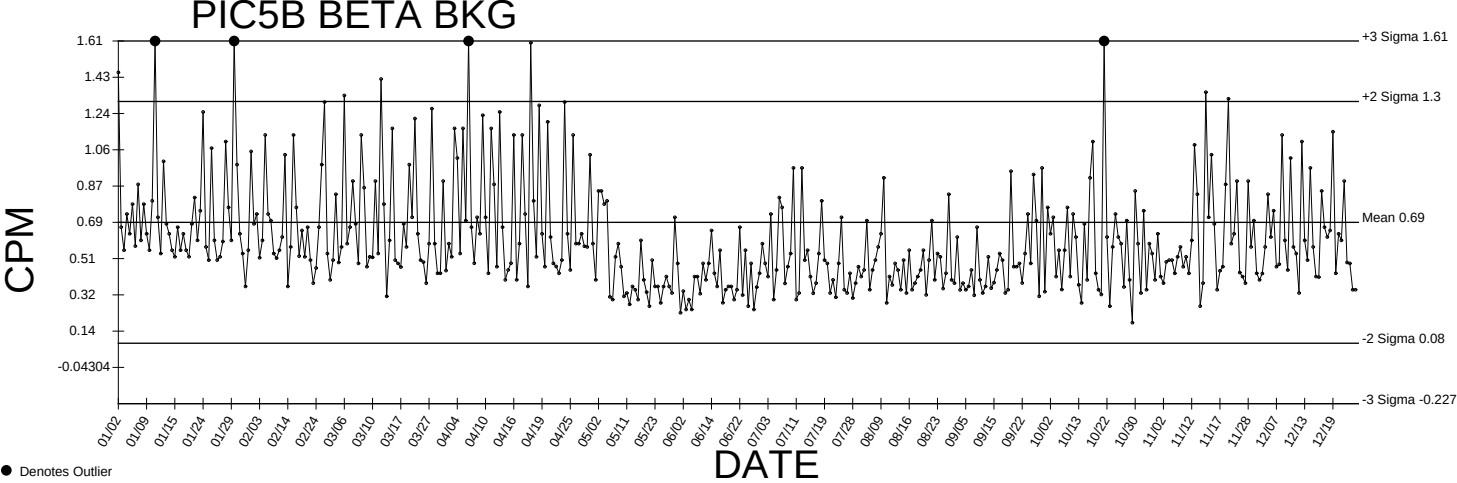
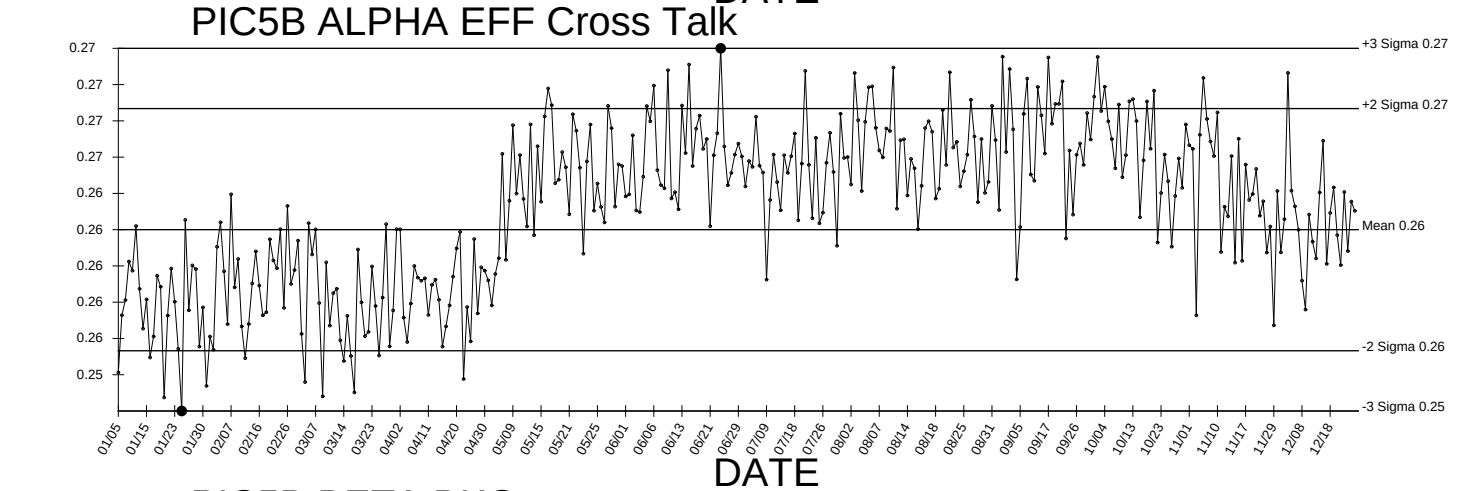
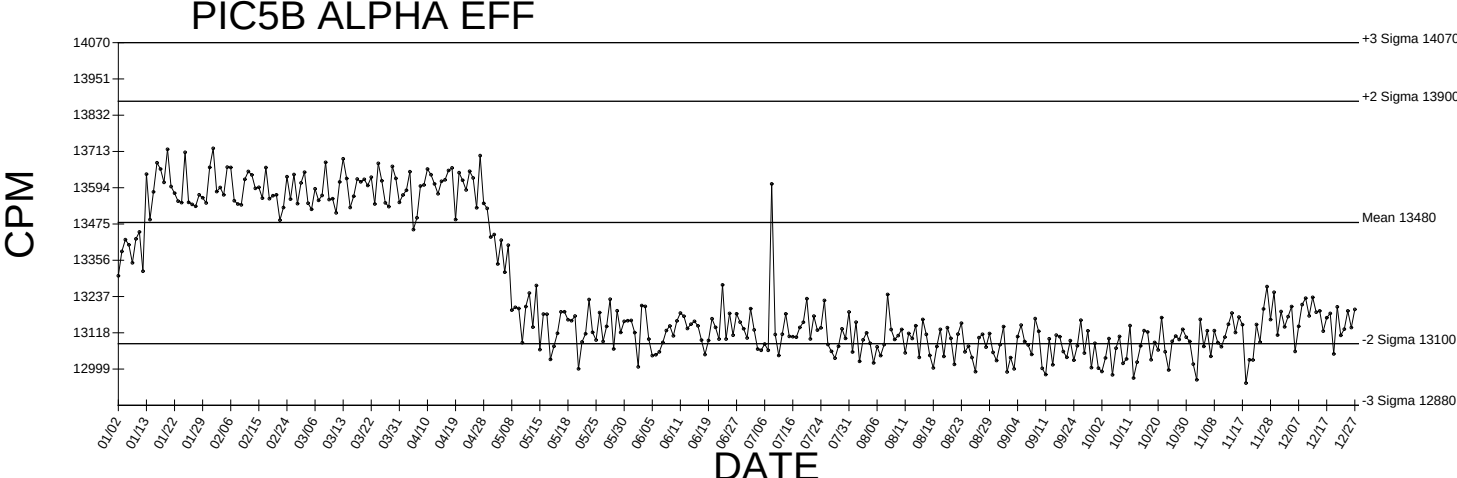
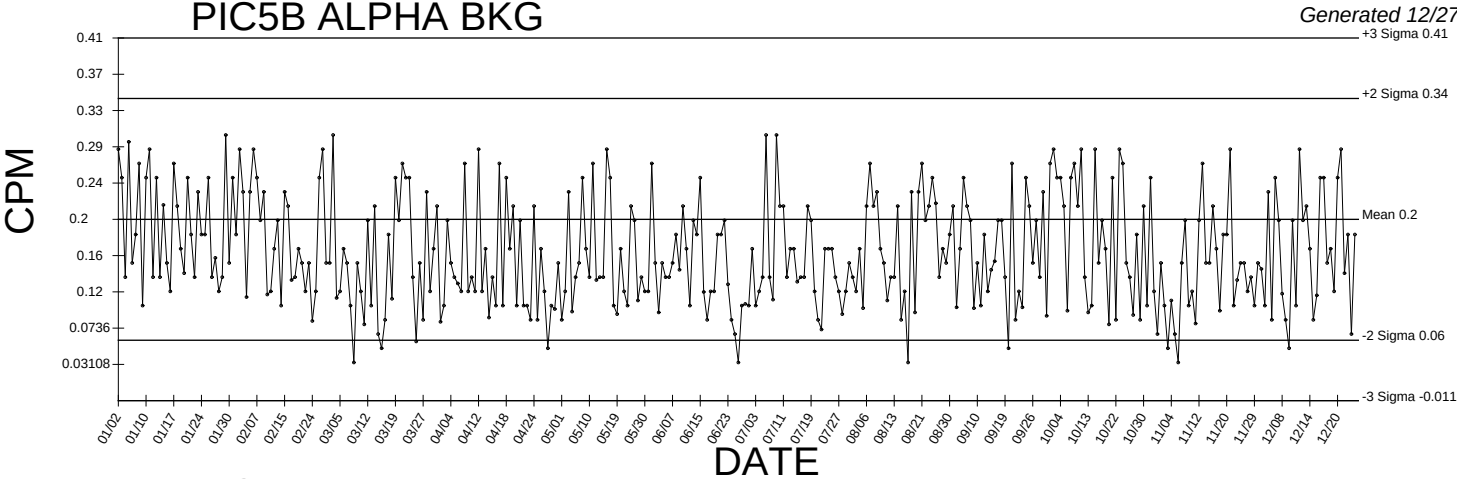




● Denotes Outlier



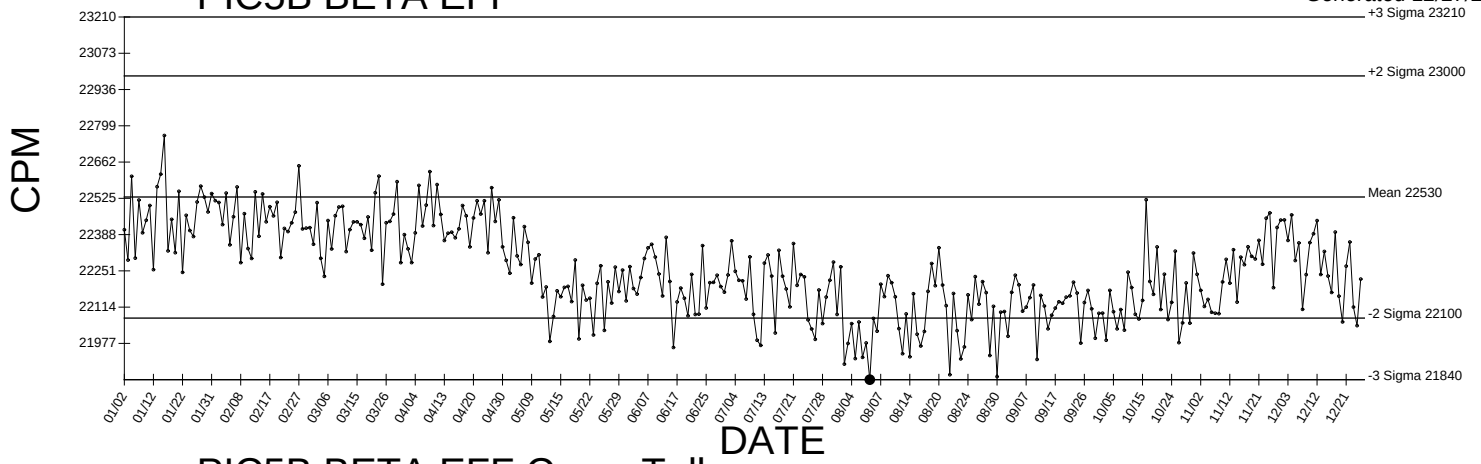
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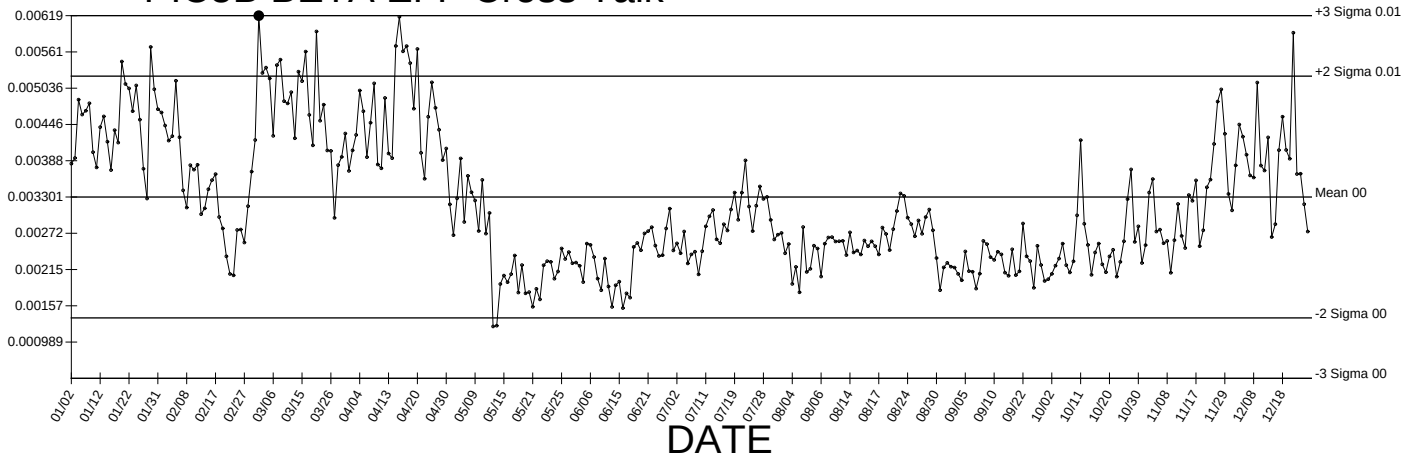
● Denotes Outlier

PIC5B BETA EFF

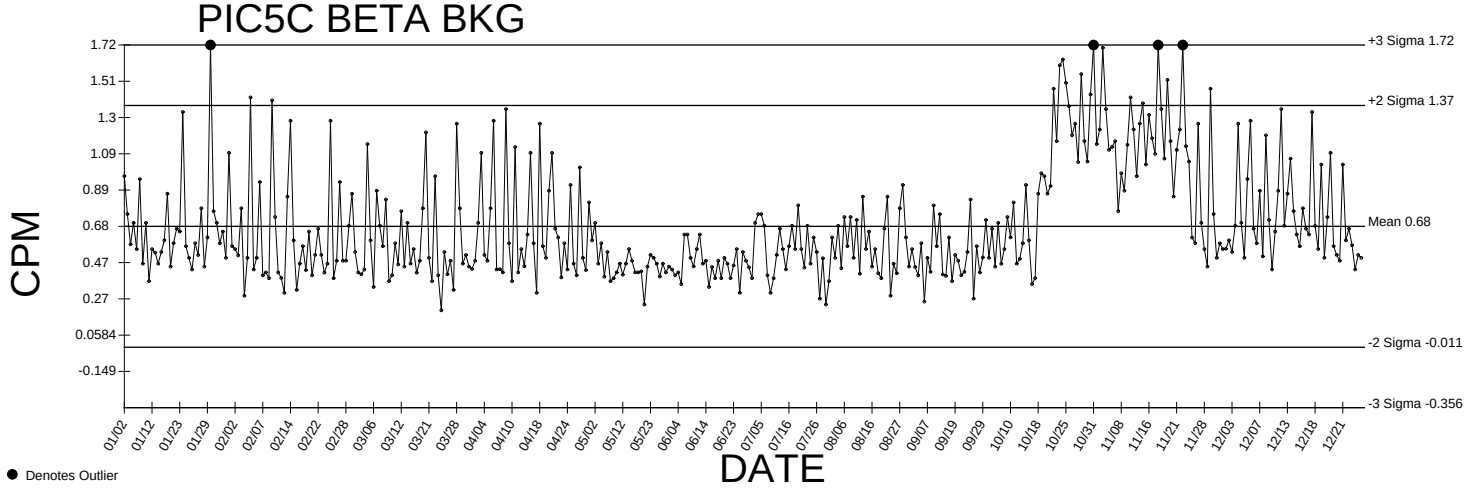
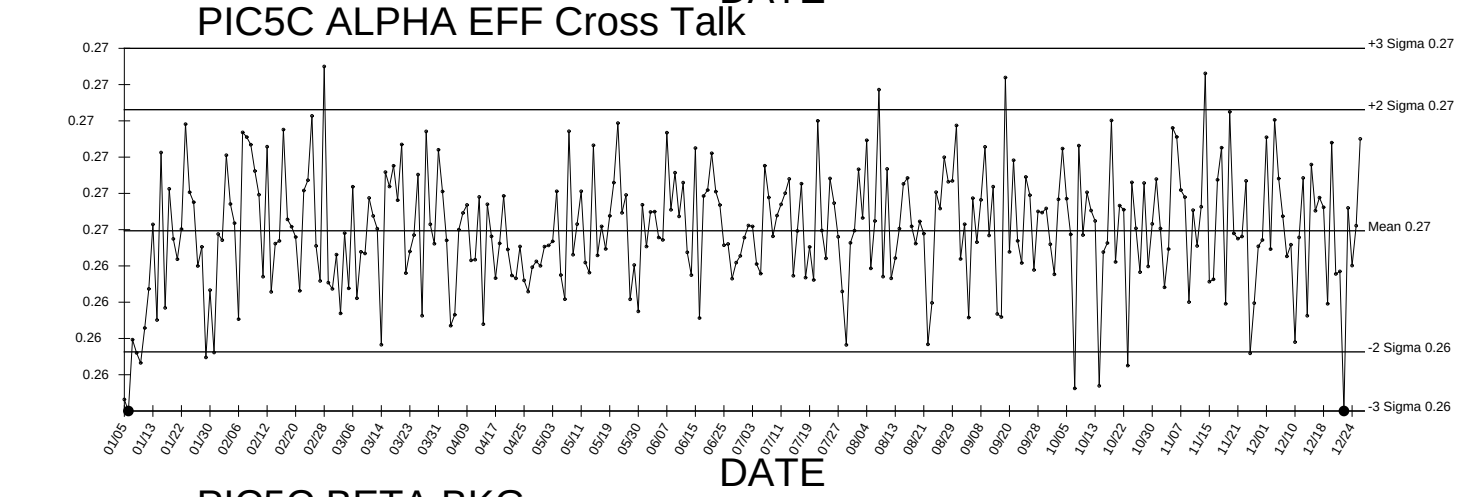
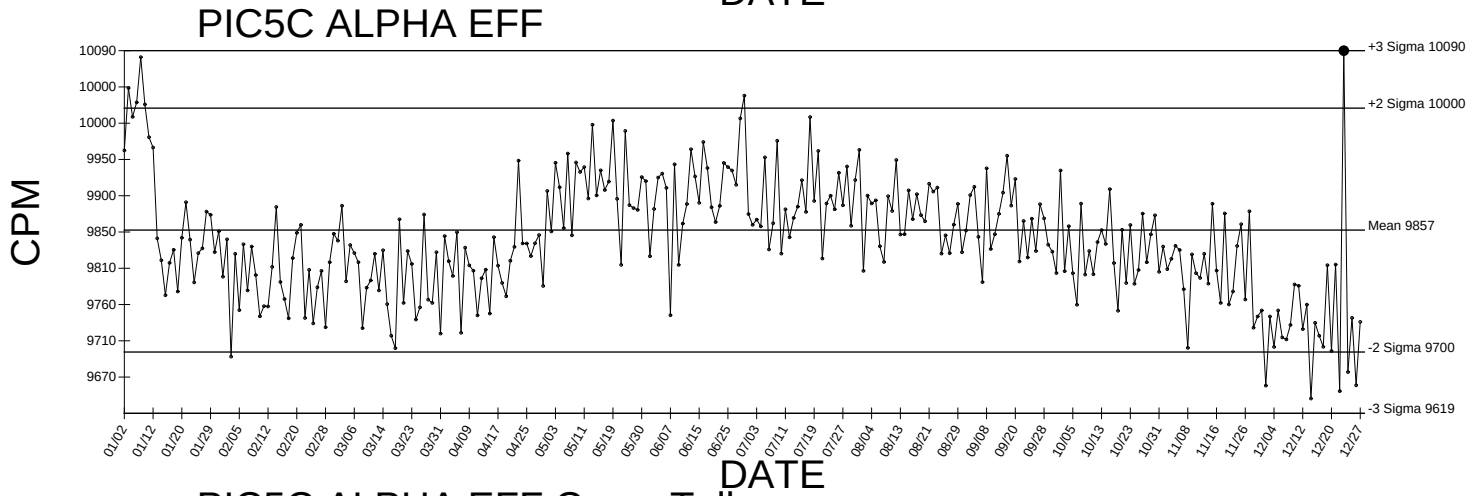
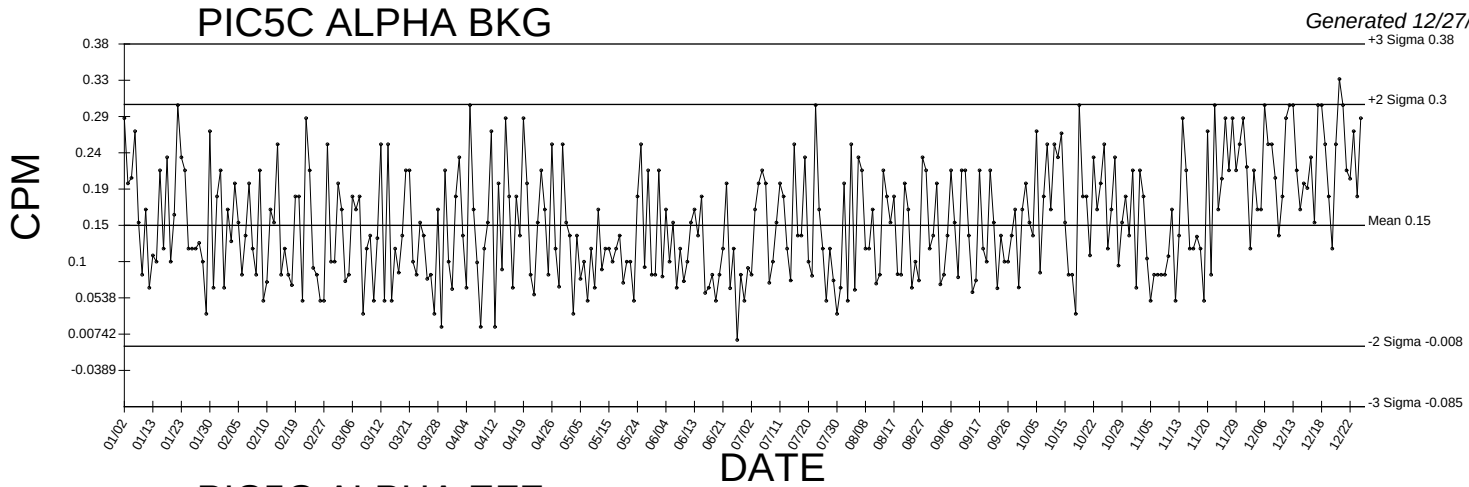
Generated 12/27/2018



PIC5B BETA EFF Cross Talk



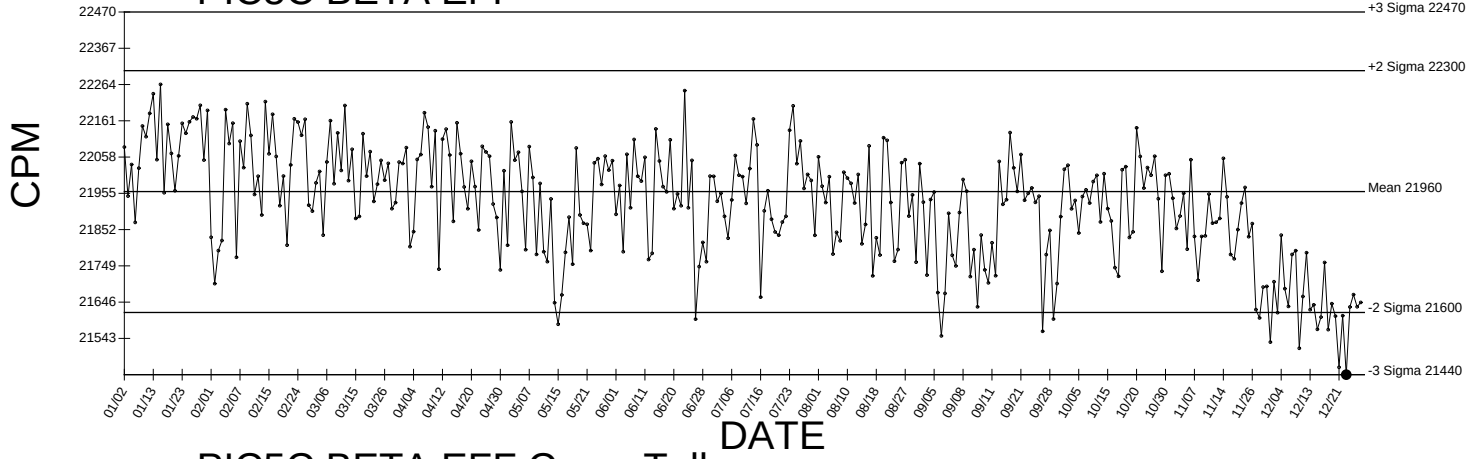
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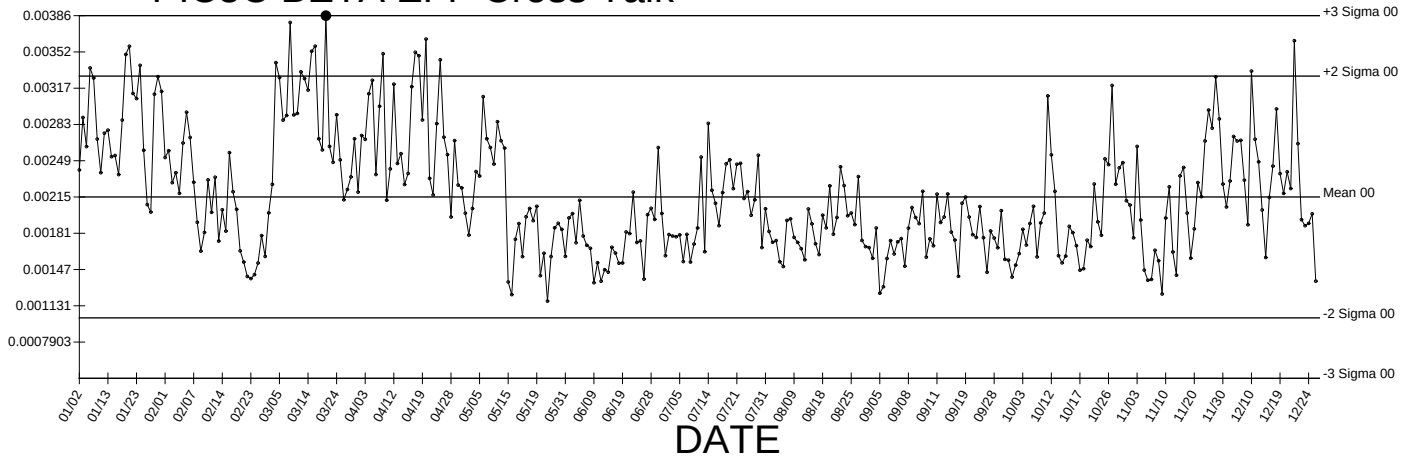
● Denotes Outlier

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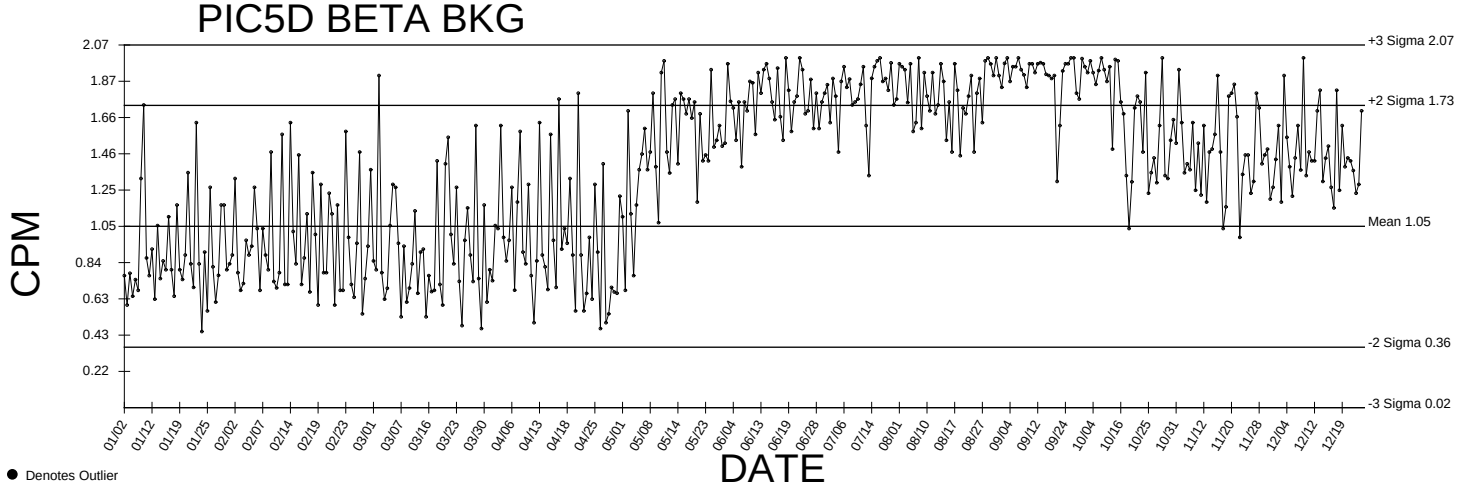
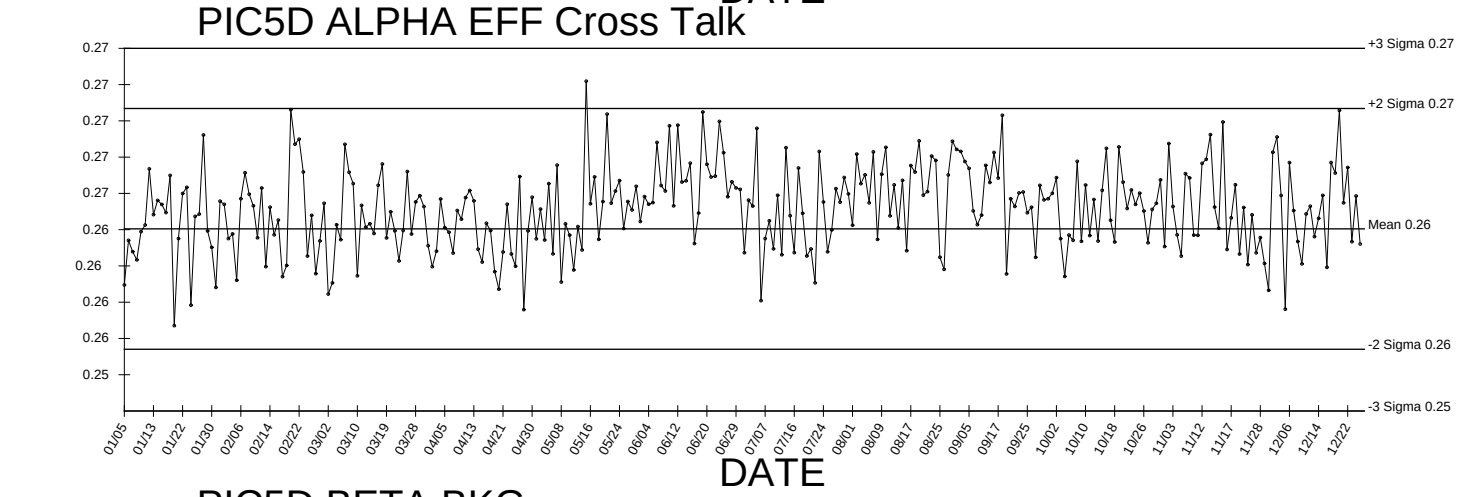
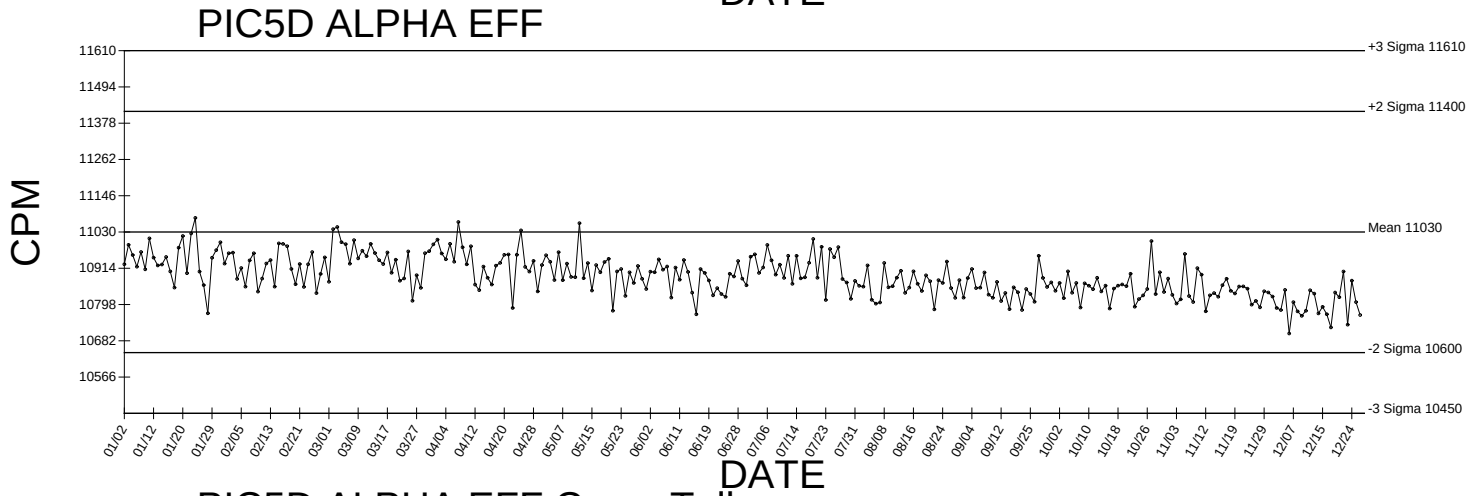
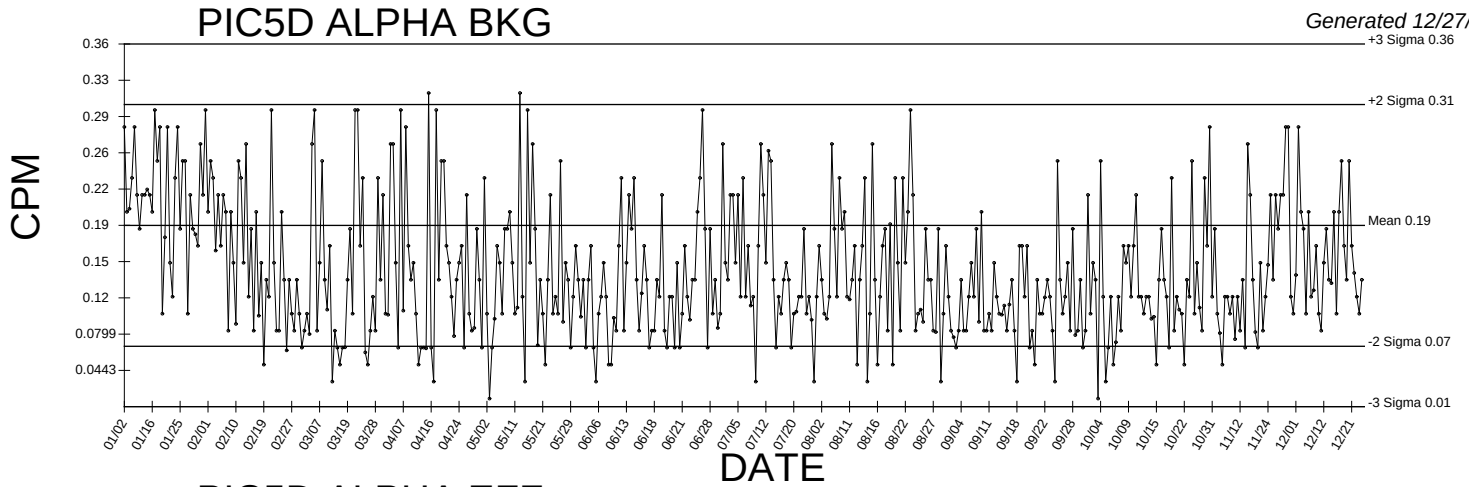
Generated 12/27/2018
+3 Sigma 22470



PIC5C BETA EFF Cross Talk



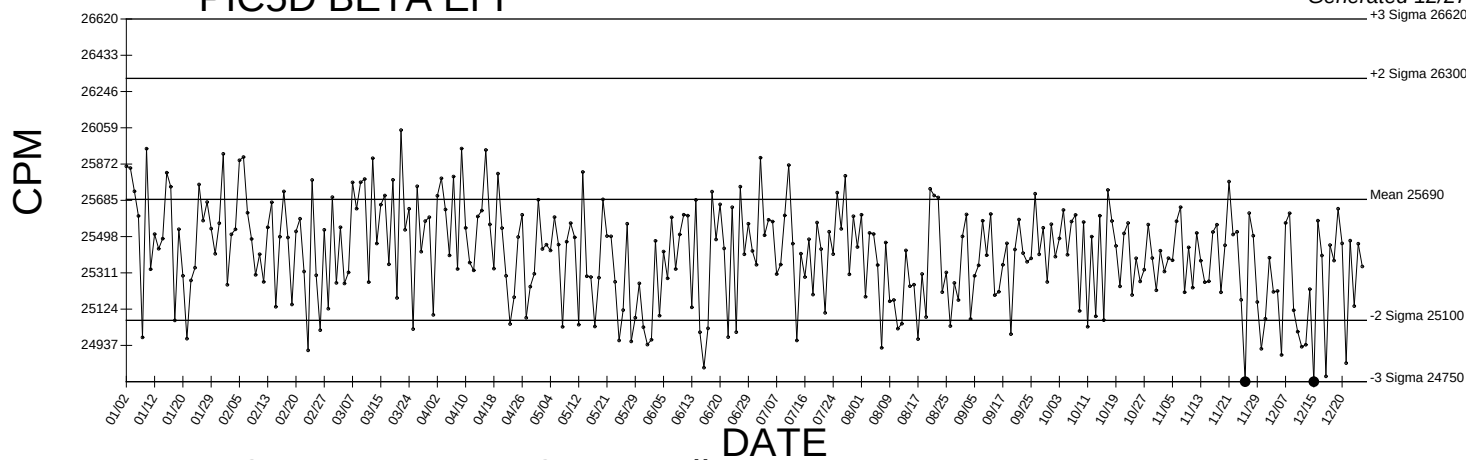
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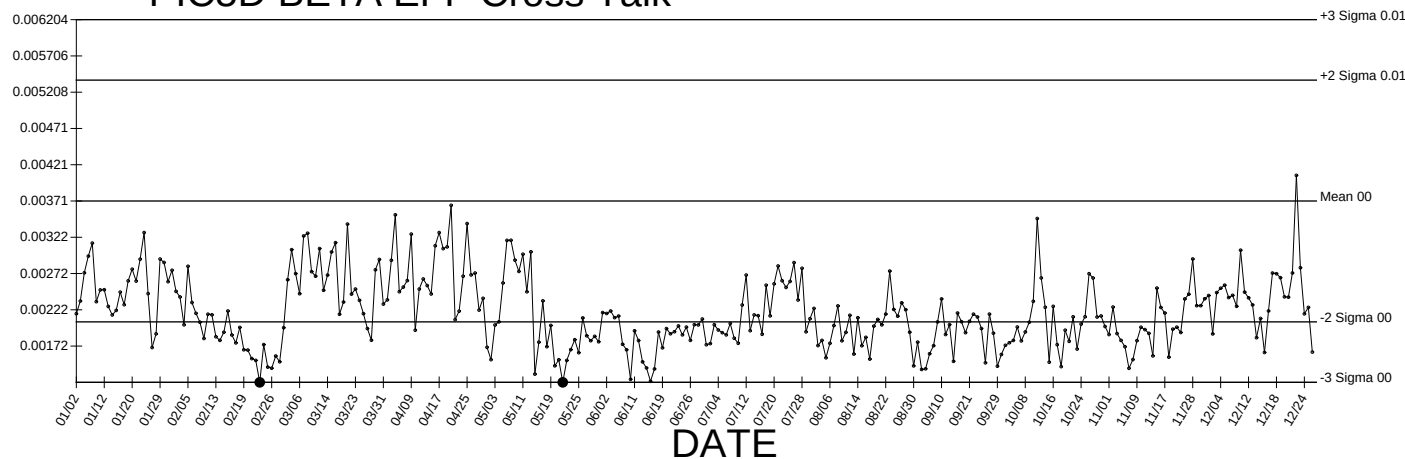
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PIC5D BETA EFF

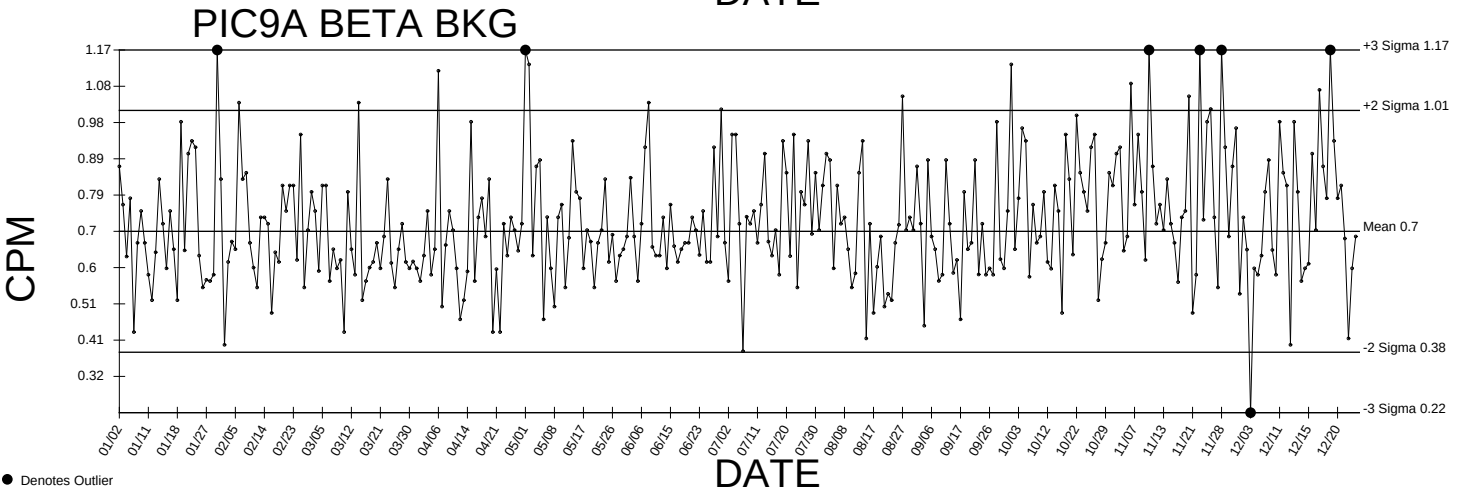
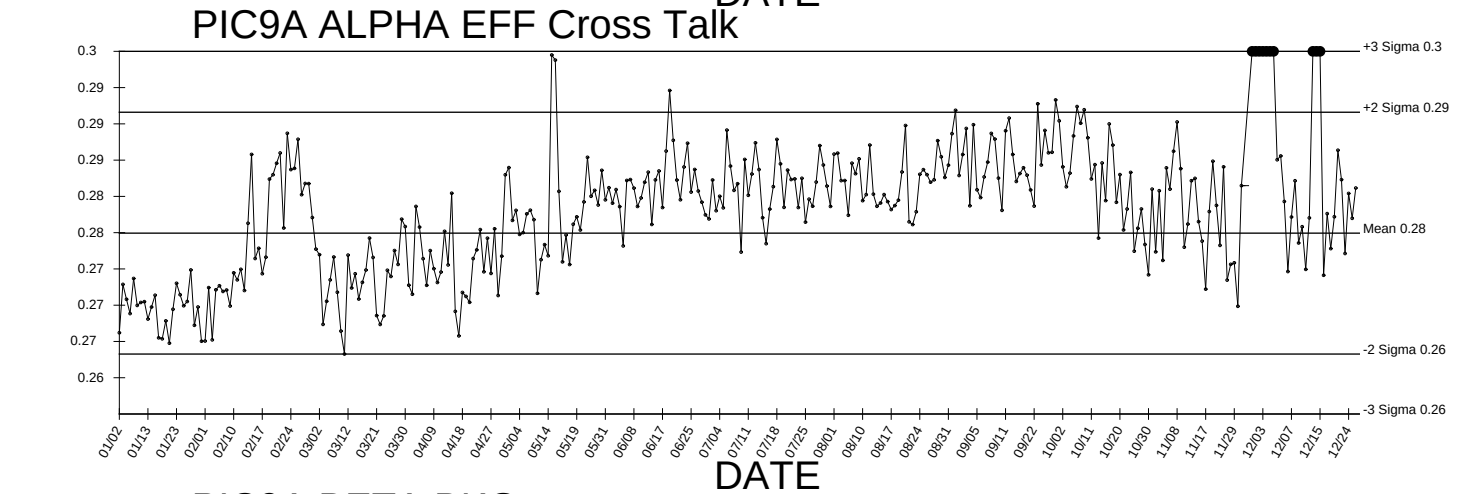
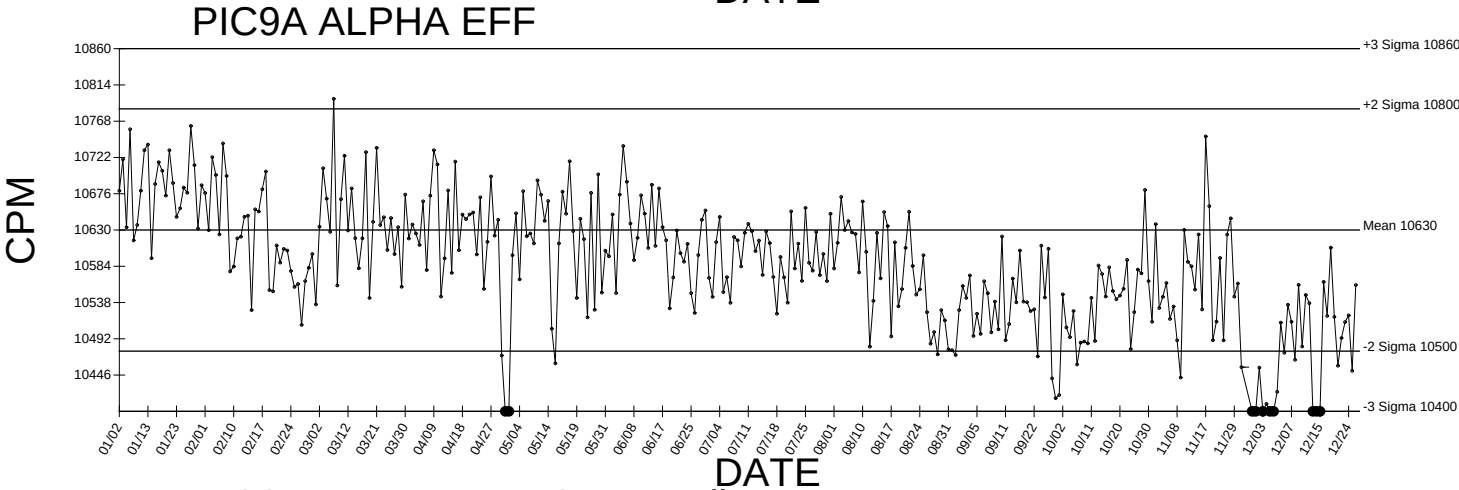
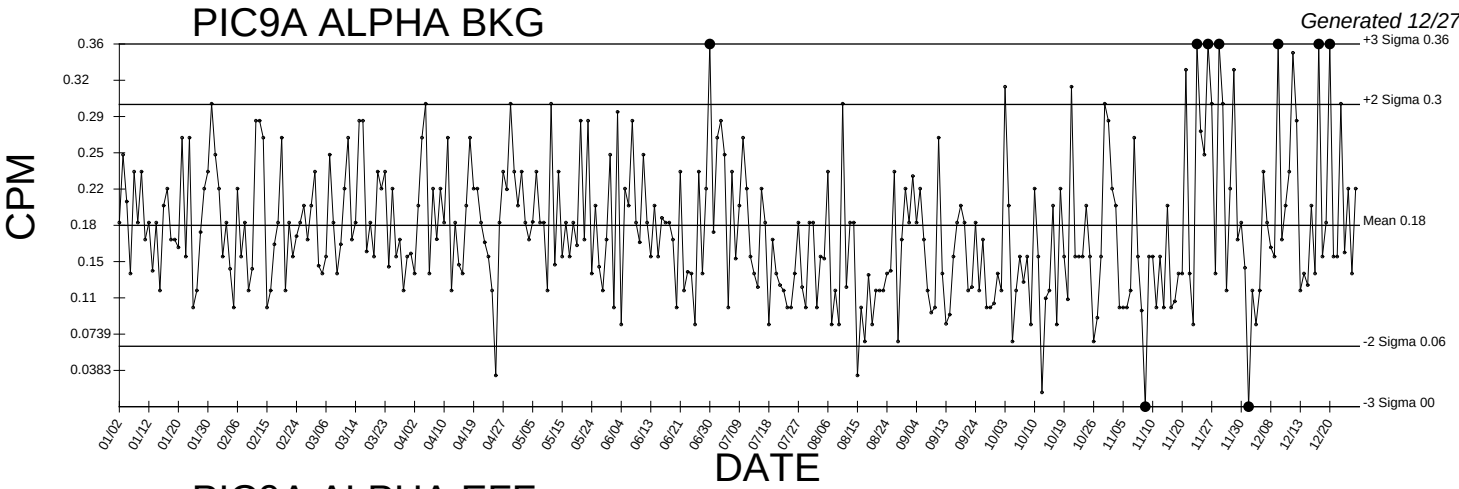
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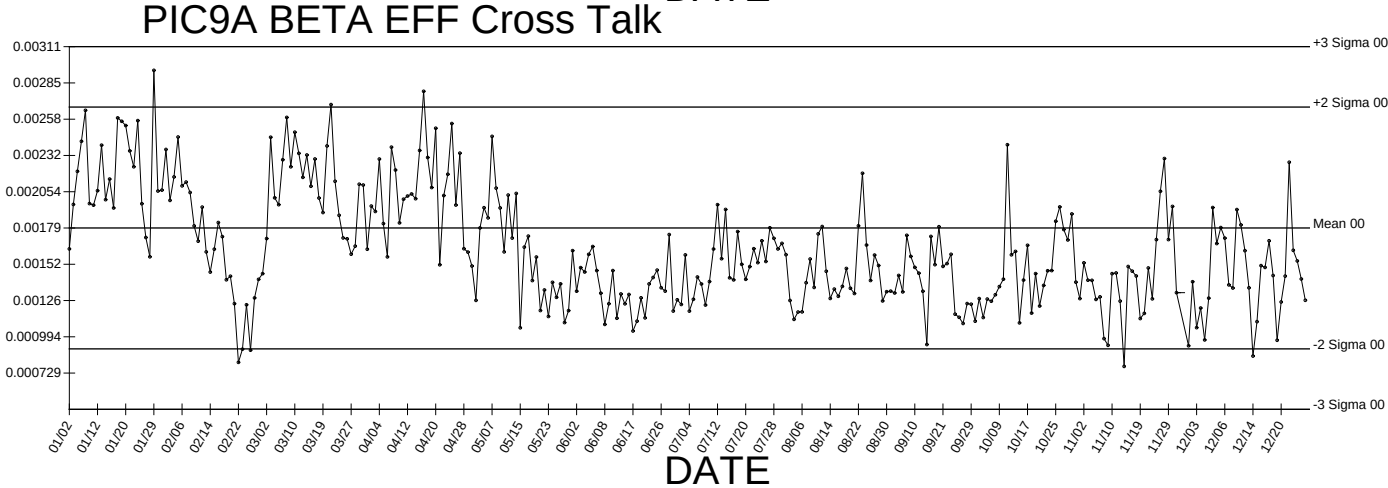
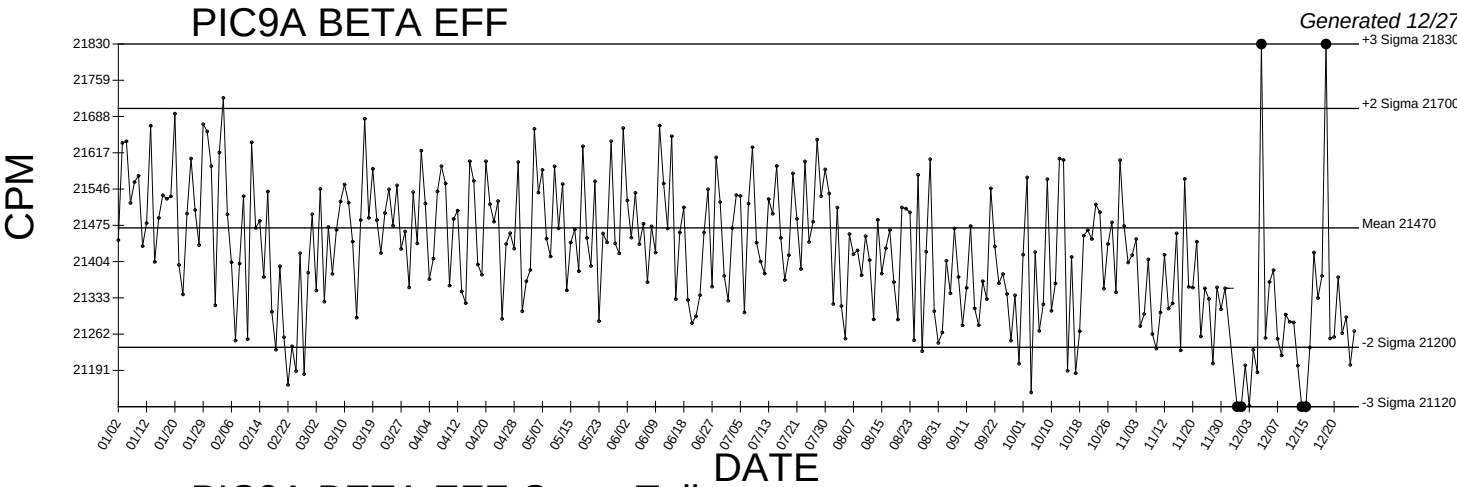
PIC5D BETA EFF Cross Talk



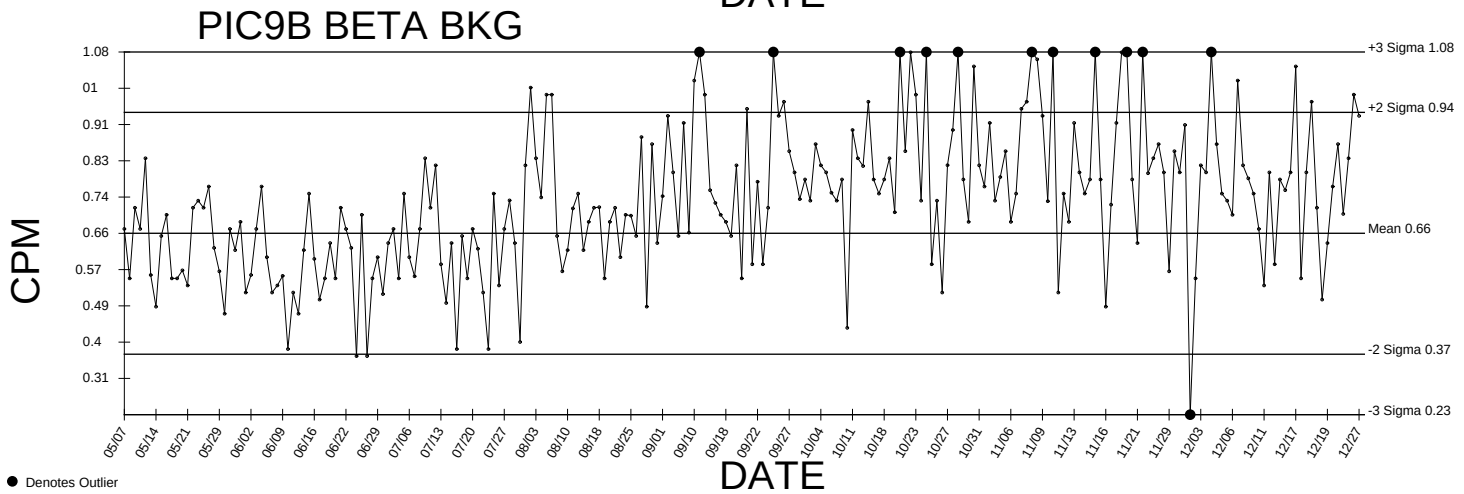
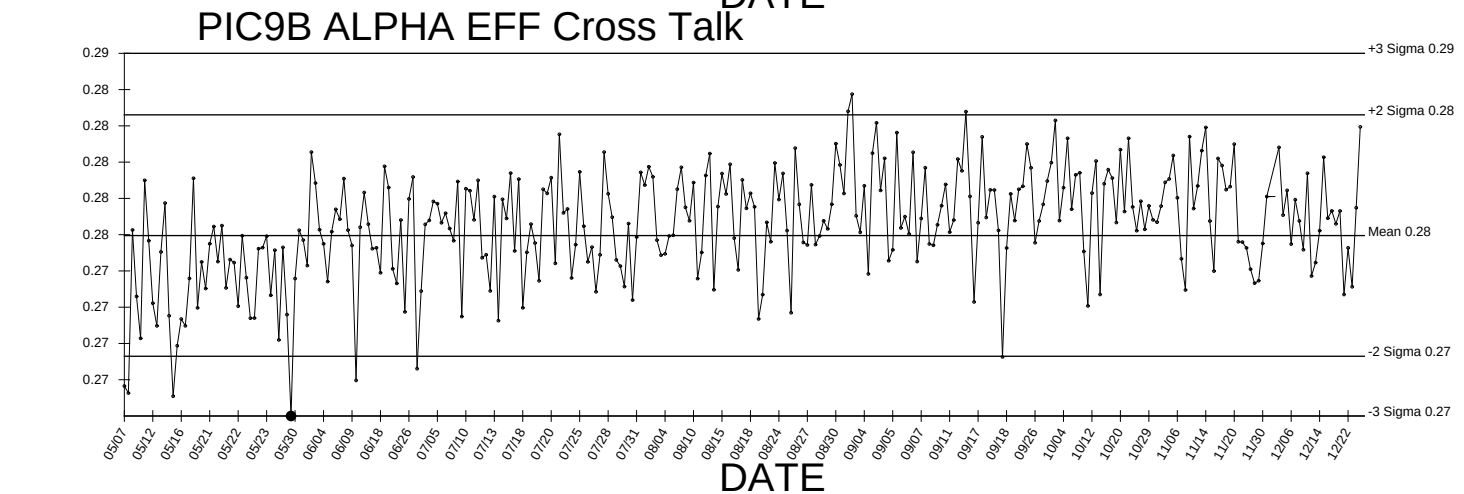
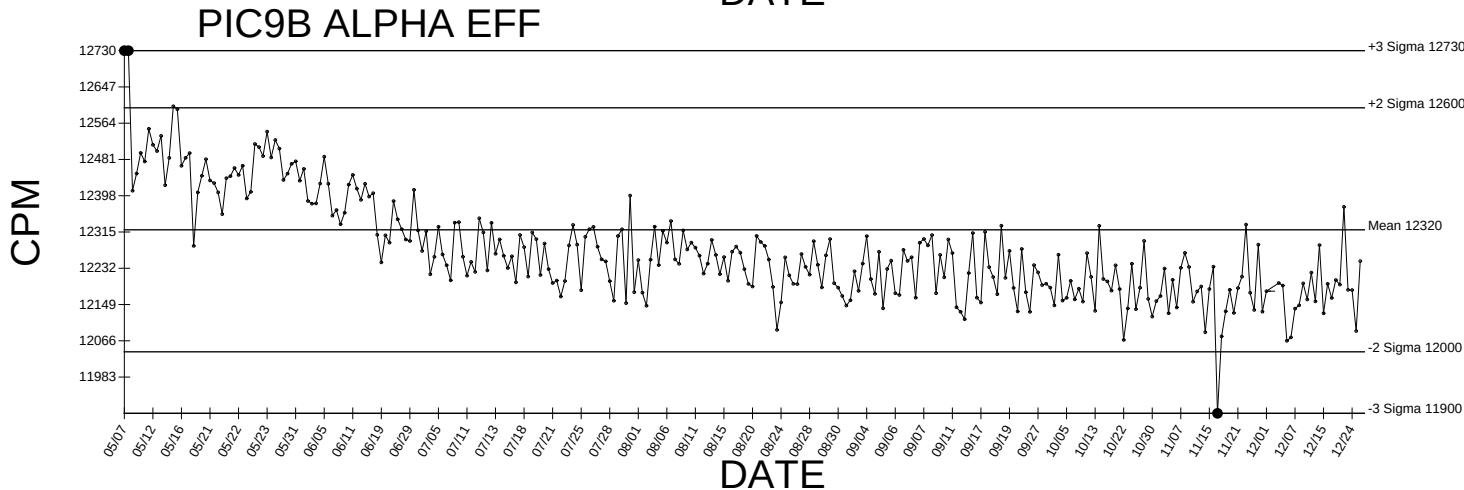
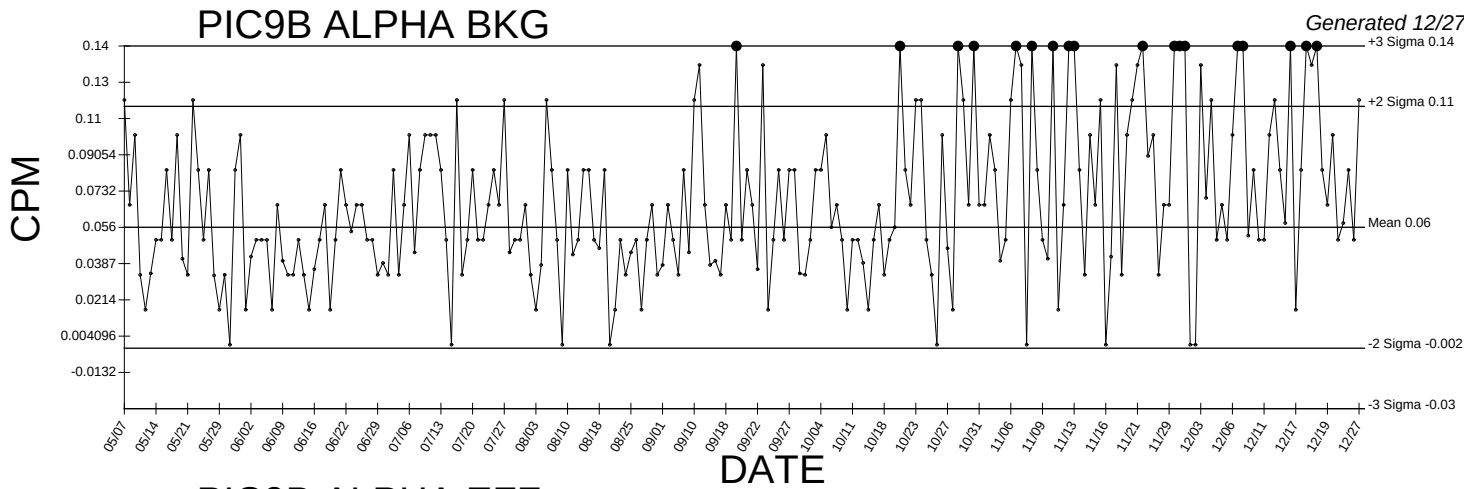
● Denotes Outlier



● Denotes Outlier



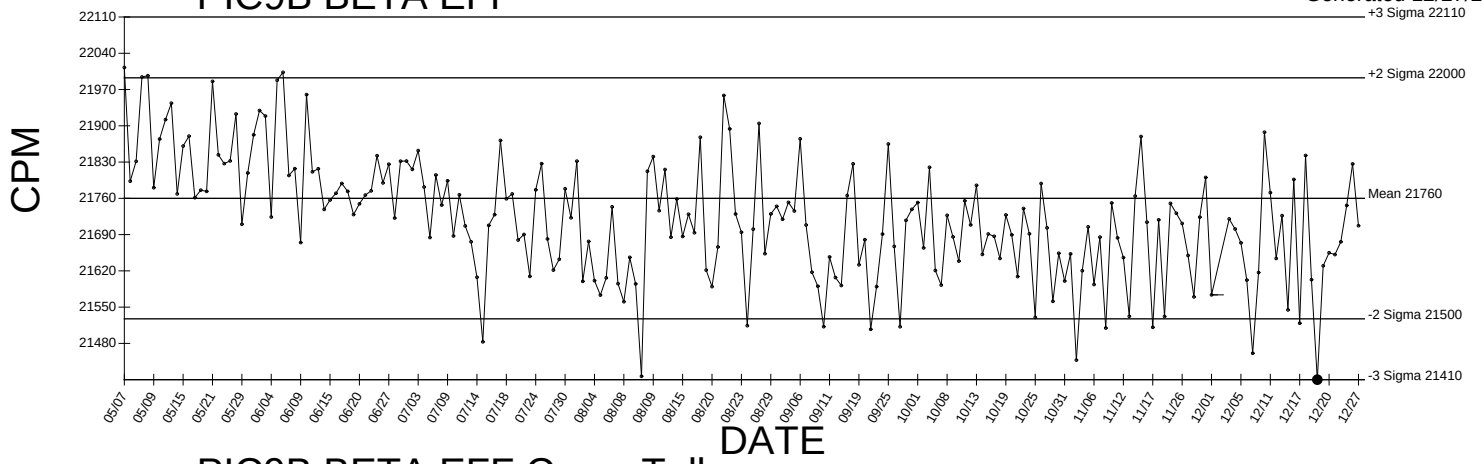
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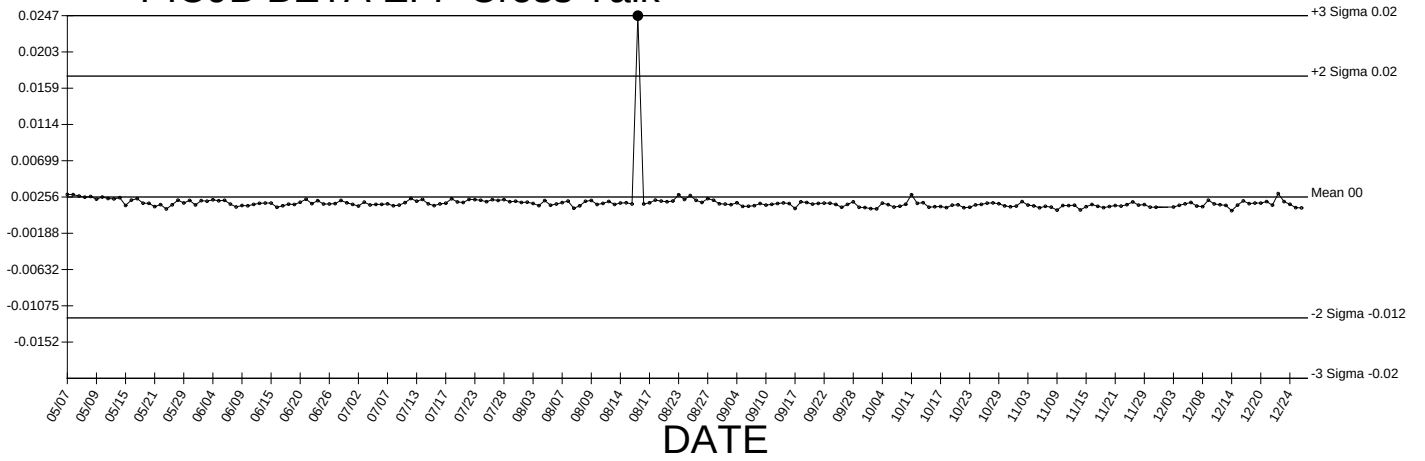
● Denotes Outlier

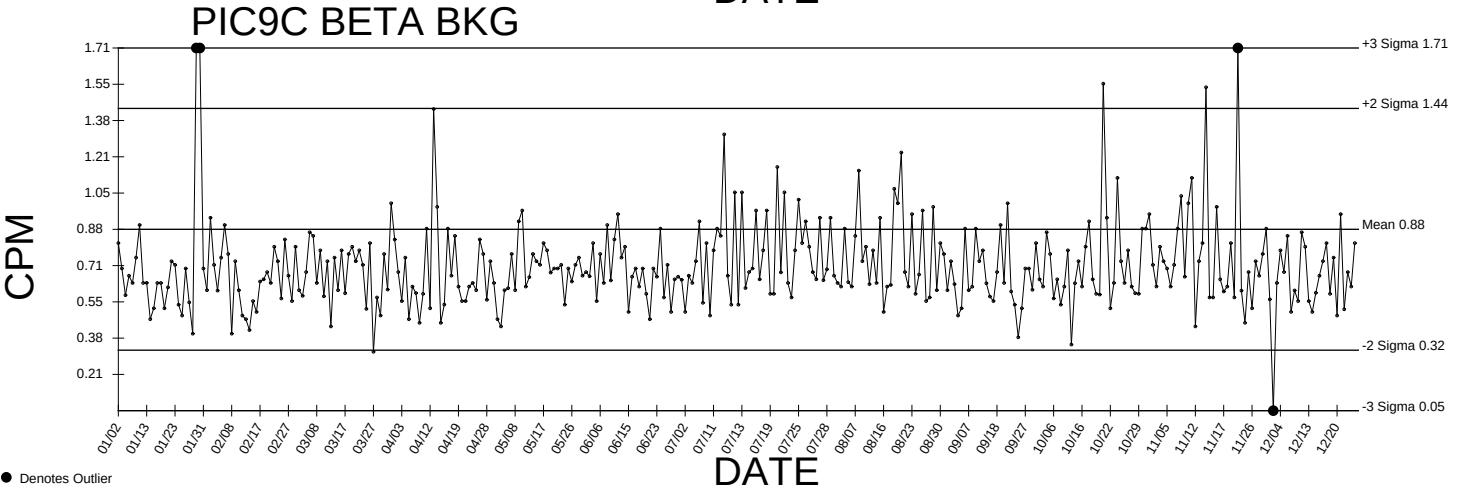
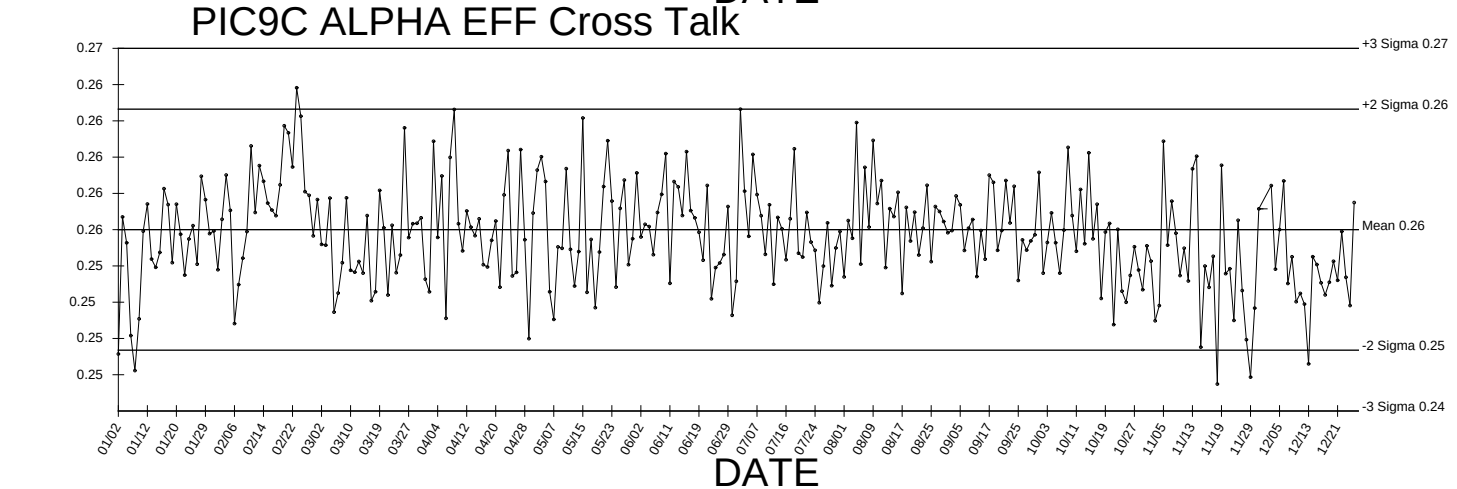
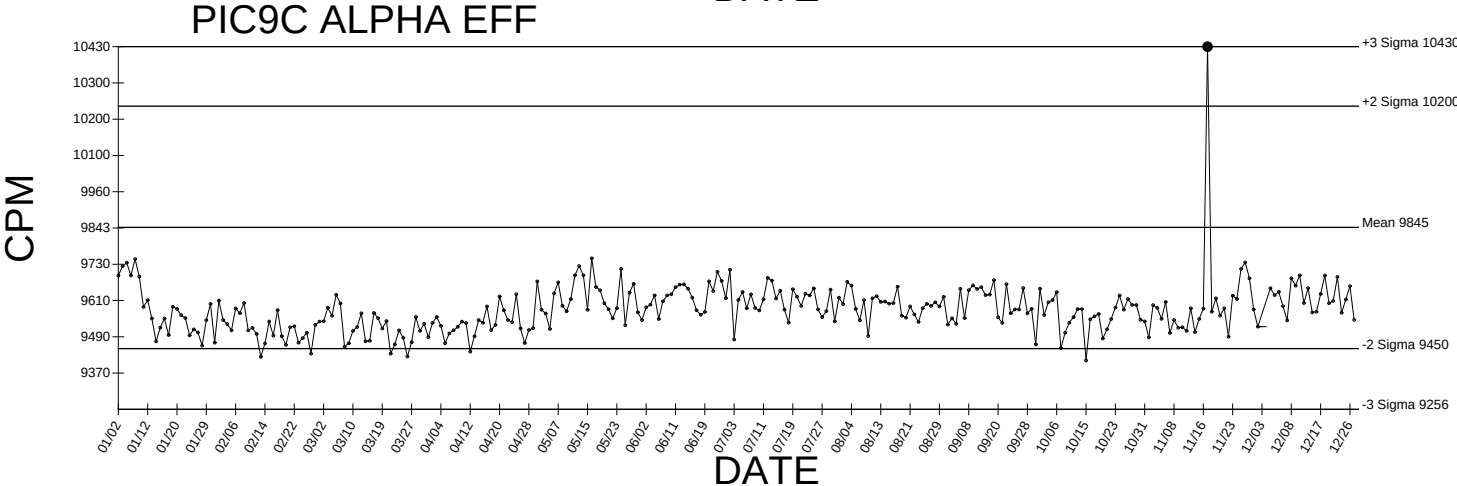
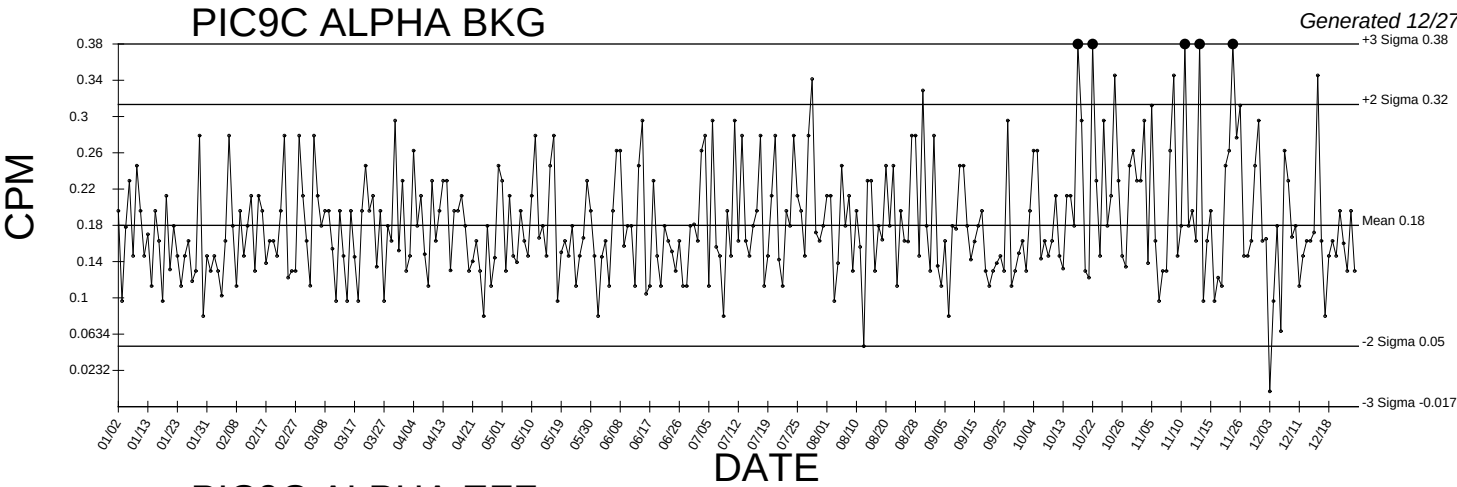
PIC9B BETA EFF

Generated 12/27/2018



PIC9B BETA EFF Cross Talk

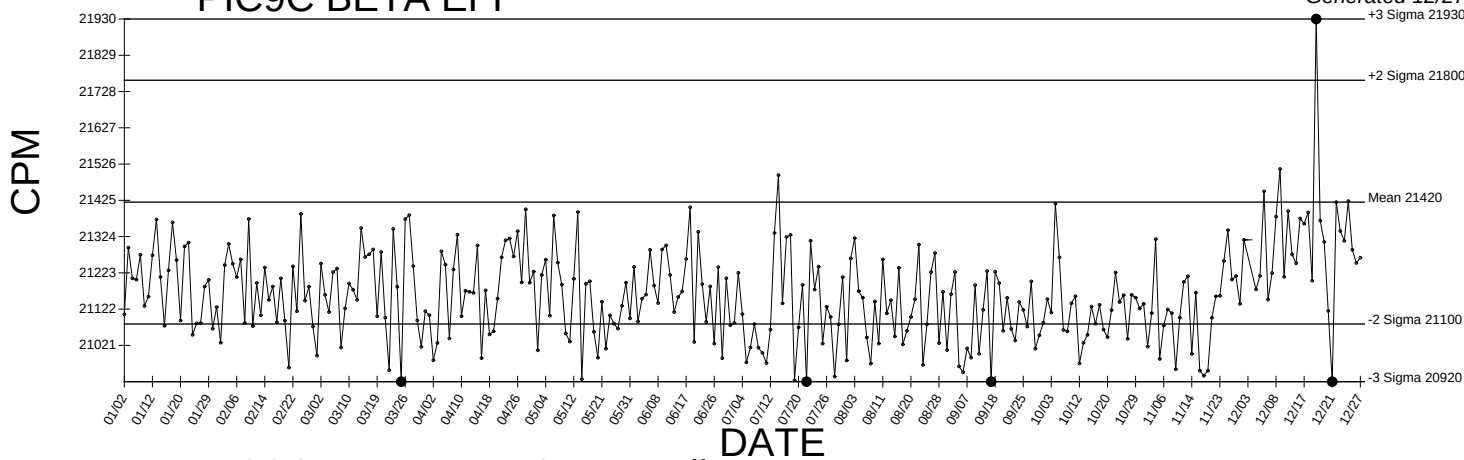




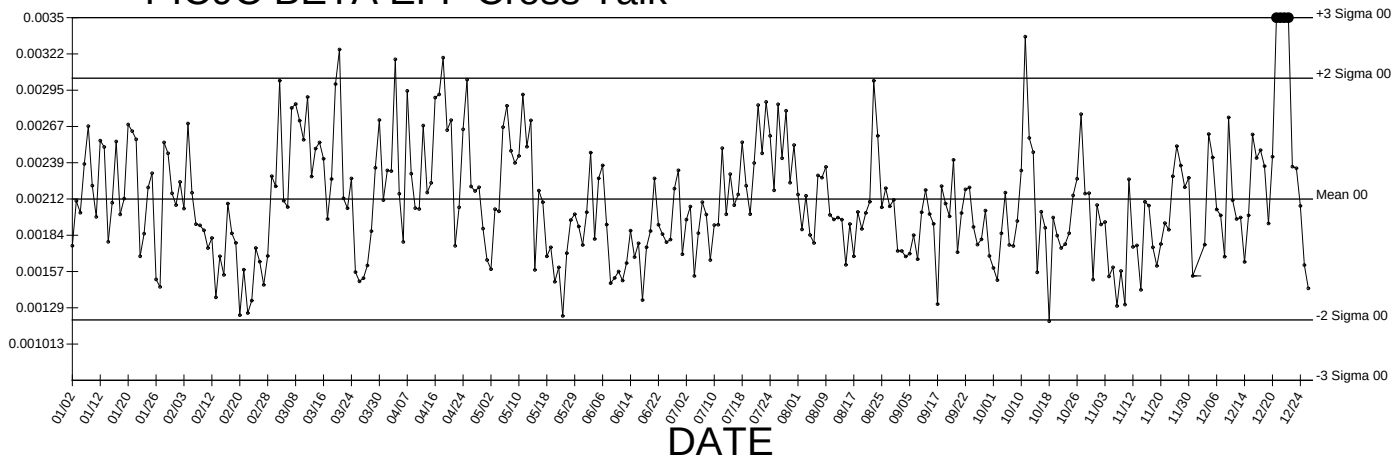
● Denotes Outlier

PIC9C BETA EFF

Generated 12/27/2018



PIC9C BETA EFF Cross Talk



● Denotes Outlier

RAD Standards Traceability



National Institute of Standards & Technology

Certificate

Standard Reference Material 4251C Barium-133 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation:

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
October 1994

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have an acid concentration and a carrier concentration comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4251C
(Certified values are shown in bold type)

(Certified values are shown in bold type)

Source identification number	NIST SRM 4251C		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	$(16.5 \pm 0.5) \text{ mm}$	
	Wall Thickness	$(0.60 \pm 0.04) \text{ mm}$	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	$(1.015 \pm 0.002) \text{ g} \cdot \text{mL}^{-1}$ at 22.1 °C [b]*		
Solution mass	$(5.054 \pm 0.001) \text{ g}$ [b]		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration ($\text{mol} \cdot \text{L}^{-1}$)	Mass Fraction ($\text{g} \cdot \text{g}^{-1}$)
	H ₂ O	54	0.96
	HCl	1.0	0.04
	BaCl ₂	6×10^{-4}	1.2×10^{-4}
	¹³³ BaCl ₂	4×10^{-7}	8×10^{-8}
Radiological Properties:			
Radionuclide	Barium-133		
Reference time	1200 EST, 1 September 1993		
Massic activity of the solution [c] (Activity per unit mass of solution)	$4.876 \times 10^5 \text{ Bq} \cdot \text{g}^{-1}$		
Relative expanded uncertainty (k=2)	0.52% [d]		
Photon-emitting impurities	None detected [e]		
Half-lives used	Barium-133: $(10.52 \pm 0.13) \text{ a}$ [f] Radium-226: $(1600 \pm 7) \text{ a}$ [f]		
Measuring instrument	Pressurized ⁴ π ^γ ionization chamber A calibrated using a barium-133 solution whose activity was determined by 4π(e+X)-γ-anticoincidence counting		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [g]	Relative Sensitivity Factor, $ \partial y/\partial x_i \cdot (x_i/y)$ [h]	Relative Uncertainty Of Output Quantity, $u_c(y)/y$, (%) [i]
PIC A net response per gram of SRM 4251C, measured relative to RRS20 [j]	Standard deviation of the mean for 1000 repeated measurements (A)	0.008	1.0	0.01
PIC A background response, measured relative to RRS20	Standard deviation of the mean for >150 repeated measurements (A)	0.25	0.001 [k]	0.00
PIC A net response for RRS200, measured relative to RRS20	Standard deviation of the mean for >100 repeated measurements (A)	0.06	1.0	0.06
PIC A net response per Bq of barium-133 in solution, measured relative to RRS200.	Standard deviation of the mean for 240 repeated measurements (A)	0.02	1.0	0.02
Gravimetric measurements	Estimated (B)	0.01	1.0	0.01
Half life of barium-133 Half life of radium-226	Standard uncertainty of the half life (A)	1.24 [m] 0.44 [m]	0.004 [n] 0.004 [n]	0.00 0.00
Activity used to calibrate PIC A net response per Bq of barium-133 in solution	Standard uncertainty of the activity determined by $4\pi(c+X)$ - γ -anticoincidence counting. (B)	0.22	1.0	0.22
Live-time [p]	Estimated (B)	0.10	1.0	0.10
PIC A charge collection	Estimated (B)	0.05	1.0	0.05
Source Positioning	Estimated (B)	0.05	1.0	0.05
Photon-emitting impurities	Limit of detection for Cs-134 (B) [q]	100	0.00002	0.00
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.26
Coverage Factor, k				<u>2</u>
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.52

*Notes and references are on pages 5 and 6.

NOTES

- (a) The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): 100 1.5 0.2
- (b) The stated uncertainty is two times the standard uncertainty.
- (c) **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].
- (d) The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the **expanded uncertainty** of y .

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

- (e) Estimated limits of detection for photon-emitting impurities are:
 $600 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 12 and 75 keV,
 $150 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 84 and 379 keV, and
 $3 \text{ y} \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 387 and 2700 keV, provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of barium-133.
- (f) The stated uncertainty is the standard uncertainty. See reference [5].
- (g) Relative standard uncertainty of the input quantity x_i .
- (h) The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y / \partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y / \partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- (i) Relative component of combined standard uncertainty of output quantity y , rounded to two decimal places. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y / \partial x_i| \cdot u(x_i)/y = |\partial y / \partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y / \partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

- [j] The response of pressurized ionization chamber A (PIC A) is determined from measurement of the time required to collect a given amount of charge on a stable fixed capacitor. All of the response measurements in the NIST pressurized ionization chambers are made relative to the response of one or more artifact standards. These artifact standards consist of microgram quantities of aged radium-226 in small welded stainless-steel capsules. These capsules are encapsulated in plastic rods whose dimensions are similar to those of the standard NIST ampoule. The artifact standards are called Radium Reference Sources and are designated as RRSx, where x is the nominal mass (in micrograms) of radium-226 in the capsule.
- [k] $|\partial y / \partial x_i| \cdot (x_i / y) = (\text{average background response}) / (\text{average net sample response})$
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y / \partial x_i| \cdot (x_i / y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i) / x_i = 100\%$. $|\partial y / \partial x_i| \cdot (x_i / y) = ((\text{response per Bq of impurity}) / (\text{response per Bq of Ba-133})) \cdot ((\text{Bq of impurity}) / (\text{Bq of Ba-133}))$. Thus $u(y) / y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] Evaluated Nuclear Structure Data File (ENSDF), April 1994.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	0487
Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL
Reference Date:	09/01/1993
Ampoule Mass (g):	5.054 g
Uncertainty:	+/- .26 %
LogBook No:	RC S 035 002

A Solution Material Info		
Isotope:	Barium-133	
Prepared By:	Angela Johnson	
Prep Date:	10/31/2002	
Verification Date:	10/10/2018	
Expiration Date:	10/10/2019	
Primary Code:	0487-A	
Dilution(mL):	100 mL	
Mass of Parent(g):	4.7696 g	
Density(g/mL):	0.9984	Balance ID:

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (bq/g)}) * (\text{conversion dpm to bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (100 \text{ mL}) = 1395394.1760 \text{ dpm/mL}$
$(4.7696 \text{ g}) * (487600 \text{ bq/g}) * (60 \text{ dpm/bq}) / (0.9984 \text{ g/mL}) / (100 \text{ mL}) = 1397609.3930 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
12/18/2015	Gregory Ramsay	15.0062	1000	0487-B	20972.806 dpm/mL	11/18/2016	11/18/2017
01/17/2017	Bethany Fiem	15.1795	1000	0487-C	21215.0117 dpm/mL	01/17/2017	01/17/2018
11/08/2017	Bethany Fiem	15.5573	1000	0487-D	21708.5658 dpm/mL	10/10/2018	10/10/2019

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ba-133 Standard 0487-D

10/11

Instrument	YELLOWI
Analyst	BXP
Verification Prep Date	10/10/13

Standard Information	
Source	Ba-133
Serial Number	10000
Isotope Name	134103-03-D
Reference Date	10/10/13
Ref Act (dpm/mL)	1000000
Amount of Std (mL)	1
Standard Prep Date	10/10/13

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	10/10/13	10000	100000	10000
2	10/10/13	10000	100000	10000
3	10/10/13	10000	100000	10000

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured cpm
1	90000	0.763551	4282.23	4282.23
2	90000	0.763551	4282.24	4282.24
3	90000	0.763551	4282.24	4282.24

Mean Value =	4282.23
Stdev =	62.50624364
Certificate Value*	4548.3
Two sigma =	125.011
10 % of Mean =	428.223
Rule A (Pass/Fail)	Pass
% Recovery	102.031
Rule B (Pass/Fail)	Pass
Expiration Date	10/10/2015

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

* Certificate Value is decay corrected to Count Date.

The analyst prepared three standard verification sources for Ba-133 source 0487-D by transferring 1 mL portions of the standard into glass vials containing 10 mL of Eppendorf vial and some other counts was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 10 mL of Eppendorf vial and some other counts. The standard verification vials and background source were dark coated for at least two hours and counted on LSC YELLOWI for Ba-133 source standard verification. The Ba-133 efficiency calibration which was used for verification calculations was performed on 10/10/2013 using Ba-133 source 1500-A.

Standard results for each verification source was calculated as follows:

$$\text{Source dpm/mL} = (A - B) / C \cdot D$$

where:

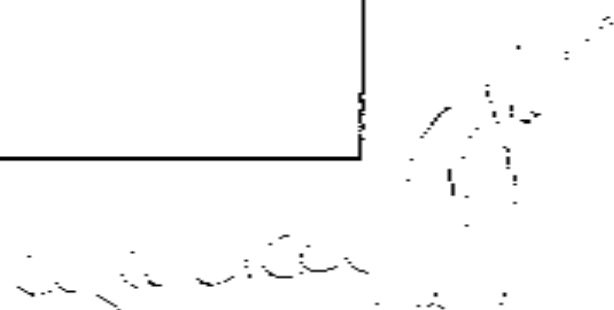
A = Net source cpm

B = BKG cpm

C = System efficiency (cm²/cm²) and

D = volume used for standard verification

RAD-W-001


 BXP



National Institute of Standards & Technology

Certificate

6000117
3/11/17

Standard Reference Material® 4339b

1810

Radium-228 Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive radium-228 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. A unit of SRM 4339b consists of approximately 5 mL of a solution, whose composition is specified in Tables 1 and 2, contained in a flame-sealed borosilicate-glass ampoule [1].

The certified radium-228 massic activity value, at a Reference Time of 1200 EST, 07 October 2010, is:

$$(195 \pm 14) \text{ Bq}\cdot\text{g}^{-1}$$

A NIST certified value, as used within the context of this certificate, is a value for which NIST has the highest confidence in its uncertainty assessment. It is a "measurement result" [2] obtained directly or indirectly from a "primary reference measurement procedure" [3]. The certified value is traceable to the derived SI unit, Becquerel (Bq).

Additional physical, chemical, and radiological properties for this SRM, as well as details on the standardization method, are given in Tables 1 and 2. Uncertainties for the certified quantities are expanded ($k=2$). The uncertainties are calculated according to the ISO and NIST Guides [4,5]. Table 3 contains a specification of the components that comprise the uncertainty analyses.

Expiration of Certification: The certification of SRM 4339b is valid indefinitely, within the measurement uncertainty specified, provided that the SRM is handled and stored properly and that no evaporation or change in composition has occurred. The solution matrix, in an unopened ampoule, is homogeneous and stable within its half-life-dependent useful lifetime provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Handling and Storage"). Periodic recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Radiological and Chemical Hazard: Consult the Safety Data Sheet (SDS), enclosed with the SRM shipment, for radiological and chemical hazard information.

This SRM was prepared in the Physical Measurement Laboratory, Radiation and Biomolecular Physics Division, Radioactivity Group, M.P. Unterwiesing, Group Leader. The overall technical direction and physical measurement leading to certification and photon-emitting impurity analyses were provided by L. Pibida of the NIST Radioactivity Group, with production assistance by J. LaRosa, R. Collé, and L. Laureano-Pérez. Alpha-emitting impurity analyses were provided by J. LaRosa.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Lisa R. Karam, Chief
Radiation and Biomolecular Physics Division

Gaithersburg, Maryland 20899
Certificate Issue Date: 14 November 2012
SRM 4339b

Robert L. Waters, Jr., Director
Office of Reference Materials

Page 1 of 4

Table 1. Certified Massic Activity of SRM 4339b

Radionuclide	Radium-228 ^{1a)}
Reference time	1200 EST, 07 October 2010
Massic activity of the solution	195 Bq g ⁻¹
Relative expanded uncertainty ($k \approx 2$)	7.2 % ^{1b)}

^{1a)} The final ²²⁸Ra purification from the ²³²Th mother solution was performed on 02 September 2010 (0920 EST).

^{1b)} The uncertainties on certified values are expanded uncertainties, $U = k u_c$. The quantity u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides [4,5]. The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ and was chosen to obtain what is assumed to be an approximate 95 % level of confidence.

Table 2. Uncertified Information of SRM 4339b

Source description	Liquid in a flame-sealed 5 mL borosilicate-glass ampoule [1]
Solution composition	1.3 mol L ⁻¹ HNO ₃ with 19.8 µg g ⁻¹ Ba ^{1a)}
Solution density	(1.014 ± 0.002) g mL ⁻¹ at 20.8 °C ^{1a)}
Solution mass	(5.180 ± 0.003) g ^{1a)}
Photon-emitting impurities	²²⁶ Ra: < 0.5 Bq g ^{-1b)}
Alpha-emitting impurities	²³² Th: < 0.08 Bq g ^{-1b)}
Half-lives used	²²⁶ Ra: (5.75 ± 0.04) a ^{1b)} [6] ²²⁶ Ac: (6.15 ± 0.02) h [7] ²²⁶ Ra: (1600 ± 7) s [8] ²³² Th: (14.02 ± 0.06) × 10 ⁹ a [9]
Calibration methods (and instruments)	The certified massic activity for ²²⁶ Ra was obtained by high-resolution gamma-ray spectrometry of three master solution ampoules (eleven separate determinations), as measured on three to five different spectrometers and geometries on each ampoule, and used assumed nuclear data for probabilities per decay for 16 gamma-ray transitions. Confirmatory measurements were performed by 2πα spectrometry of ingrown ²²⁶ Th with a planar, ion-implanted Si detector.

^{1a)} The stated uncertainty is two times the standard uncertainty. See reference 5.

^{1b)} Based on gamma-ray spectrometry of forced-fitted peak at 186.2 keV and assuming a probability per decay of 0.0355 [6].

^{1c)} The maximum ²³²Th activity concentration in ²²⁶Ra.

^{1d)} The stated uncertainty is the standard uncertainty. See reference 5.

Table 3. Uncertainty Evaluation for the Massic Activity of SRM 4339b

Uncertainty component		Assessment Type ^(a)	Relative standard uncertainty contribution on massic activity of ²²⁶ Ra (%)
1	Gamma-ray spectrometry precision; relative standard deviation of the grand mean on the average massic gamma-ray emission rates for 16 measured ²²⁶ Ac gamma-ray transitions. Each mean in the grand mean is based on 11 determinations with three sources in three to five different detectors. The uncertainty in the determination of the massic gamma-ray emission rate for any one transition in a given determination ranged from typically 0.5 % to 1.5 %. The relative standard deviation of the mean for the average of the 16 lines, for any one determination, was typically 1 %; whereas the relative standard deviation of the grand mean for the average of the 16 lines across all 11 determinations is 0.34 % ^(b) . Data passes normality test.	A	11.84
2	Uncertainty due to assumed gamma-ray probabilities per decay for the measured ²²⁶ Ac transitions [7]. The uncertainty on each transition has a shared (correlated) component of 2.5 % (see comments in [7]).	B	3.5
3	Detection efficiencies not embodied within component 1	B	0.4
4	Mass determinations for dilution factors and counting source preparations	B	0.1
5	Decay corrections for ²²⁶ Ra half-life uncertainty of 0.7 % [6]	B	0.003
6	Effect of ²²⁶ Ra and ²²⁶ Ac half-life uncertainties on secular equilibrium ratio	B	0.02
Relative combined standard uncertainty			3.6
Relative expanded uncertainty (<i>k</i> = 2)			7.2

^(a) Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^(b) Average massic gamma-ray emission rates of 11 geometries (R_{γ}) for 16 measured ²²⁶Ac gamma-ray transitions with their respective energy (E_{γ}); assumed gamma-ray probabilities per decay (I_{γ}) and standard deviation of the mean (S_m).

E_{γ} (keV)	Assumed I_{γ} (%) [1]	Mean R_{γ} (s ⁻¹ g ⁻¹) ^(a)	S_m (%) ^(b)
129.065	2.50	1347	0.38
153.967	0.754	421.6	0.40
219.249	3.97	2264	0.55
270.245	3.55	2014	0.53
328.084	5.04	1822	0.43
378.52	11.4	671.2	0.43
409.46	2.02	1185	0.29
465.082	4.45	2645	0.33
755.313	1.03	593.3	0.46
772.291	1.52	899.2	0.53
794.942	4.31	2588	0.35
835.704	1.7	965.3	0.42
911.396	26.2	15609	0.29
964.786	4.99	3067	0.35
968.96	15.9	9582	0.30
1588.2	5.06	1889	0.28

(a) Grand mean for *n* = 11 determinations with three sources in three to five different detectors.

(b) Relative standard deviation of the grand mean on R_{γ} for *n* = 11.

INSTRUCTIONS FOR HANDLING AND STORAGE

Handling: If the ampoule is transported, it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of both the radioactivity and the strong acid. The ampoule should be opened only by persons qualified to handle both radioactive material and alkaline and/or acidic solutions. Appropriate shielding and/or distance should be used to minimize personnel exposure. Refer to SDS for further information.

Storage: SRM 4339b should be stored and used at a temperature between 5 °C and 65 °C. The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material.

REFERENCES

- [1] NIST Physical Measurement Laboratory; *Storage and Handling of Radioactive Standard Reference Materials, Ampoule Specifications and Opening Procedure*, available at <http://www.nist.gov/pml/div682/gsp04/srm.cfm> (accessed Nov 2012). Note: This SRM is contained in a generic borosilicate-glass ampoule and not in the standard NIST ampoule.
- [2] JCGM 200:2012; *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 19 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [3] JCGM 200:2012; *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)* (2008 version with Minor Corrections), 3rd edition, Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France; p. 18 (2012); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf (accessed Nov 2012).
- [4] JCGM 100:2008; *Guide to the Expression of Uncertainty in Measurement*; (ISO GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_1.pdf (accessed Nov 2012).
- [5] Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/> (accessed Nov 2012).
- [6] Luca, A.; June 2009, ^{226}Ra . LNE-LNIB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [7] Pearce, A.; January 2010, ^{228}Ac . LNE-LNIB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ac-228_tables.pdf (accessed Nov 2012).
- [8] Christé, V. and M.M. Bé; December 2006, ^{226}Ra . LNE-LNIB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Ra-226_tables.pdf (accessed Nov 2012).
- [9] Arino, A.; September 2008, ^{232}Th . LNE-LNIB/CEA Table of Radionuclides, available at http://www.nucleide.org/DDEP_WG/Nuclides/Th-232_tables.pdf (accessed Nov 2012).

Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program; telephone (301) 975-2200; fax (301) 948-3710; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.



Standard Traceability Log Rad

Source Material Info	
Parent Code:	1810
Prepared By:	Tim Chandler
Carrier Conc:	1.3M HNO ₃
Reference Date:	10/07/2010
Ampoule Mass (g):	5.18 g
Uncertainty:	+/- 3.6 %
LogBook No:	GL-CED-297-103

A Solution Material Info			
Isotope:	Radium-228 SPIKE		
Prepared By:	Bethany Fiem		
Prep Date:	05/23/2018		
Verification Date:	05/23/2018		
Expiration Date:	05/23/2019		
Primary Code:	1810-A		
Dilution(mL):	200 mL		
Mass of Parent(g):	5.1447 g		
Density(g/mL):	1.0178	Balance ID:	B733529066

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq/g)}) * (\text{conversion dpm to Bq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (200 \text{ mL}) = 300.9650 \text{ dpm/mL}$
$(5.1447 \text{ g}) * (195 \text{ Bq/g}) * (60 \text{ dpm/Bq}) / (1.0178 \text{ g/mL}) / (200 \text{ mL}) = 295.7015 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-228 Standard

1810-A

Jar

4/11/2
RAJF
20 2010

Isotope	Result
Ra-228	pCi/L
Ra-228 N1	29540
Ra-228 N2	28810
Ra-228 N3	29620

Mean Value (Counting) =
Stdev =

107.165

Rule B (Pass/Fail)

Fail

* Exemption from the 10% of the count to 10% of the count value

Certificate Value =
Two sigma =
10 % of Mean =
Rule A (Pass/Fail)

29540
547 0856436
2905 080607
Pass

pCi/L

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value.

29540
547 0856436
2905 080607
Pass

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1830755

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1204178239	MB	JXC9	PIC12A	DEC-27-18 11:38:19	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204178242	MSD	JXC9	PIC12D	DEC-27-18 11:38:28	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204178243	LCS	JXC9	PIC13A	DEC-27-18 11:38:31	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633004	SAMPLE	JXC9	PIC11A	DEC-27-18 11:38:33	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633005	SAMPLE	JXC9	PIC11B	DEC-27-18 11:38:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633006	SAMPLE	JXC9	PIC11C	DEC-27-18 11:38:41	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633007	SAMPLE	JXC9	PIC11D	DEC-27-18 11:38:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630001	SAMPLE	JXC9	PIC1A	DEC-27-18 11:39:15	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630002	SAMPLE	JXC9	PIC1B	DEC-27-18 11:39:18	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630003	SAMPLE	JXC9	PIC1C	DEC-27-18 11:39:20	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630004	SAMPLE	JXC9	PIC1D	DEC-27-18 11:39:23	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630005	SAMPLE	JXC9	PIC2A	DEC-27-18 11:39:25	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630006	SAMPLE	JXC9	PIC2B	DEC-27-18 11:39:28	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630007	SAMPLE	JXC9	PIC2C	DEC-27-18 11:39:31	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630009	SAMPLE	JXC9	PIC4D	DEC-27-18 11:39:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630010	SAMPLE	JXC9	PIC5A	DEC-27-18 11:39:43	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633001	SAMPLE	JXC9	PIC5B	DEC-27-18 11:39:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633002	SAMPLE	JXC9	PIC5C	DEC-27-18 11:39:50	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466633003	SAMPLE	JXC9	PIC5D	DEC-27-18 11:39:51	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204178240	DUP	JXC9	PIC9B	DEC-27-18 13:37:04	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204178241	MS	JXC9	PIC9C	DEC-27-18 13:37:08	DONE	CeF on 25mm Filter	01-JUN-17 00:00
466630008	SAMPLE	JXC9	PIC9A	DEC-27-18 13:37:12	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1830869 Check-list

This check-list was completed on 23-DEC-18 by Lyndsey Pace

This batch was reviewed by Lyndsey Pace on 23-DEC-18 and Elizabeth Krouse on 26-DEC-18.

Batch ID:
1830869

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous?	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences (RPD) between the MS and MSD recoveries within the acceptance limits?		No	
12	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
13	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
14	Are sample-specific MDA/MDC calculated and reported?	Yes		

Radium-226 Queue Sheet

22-DEC-18

GLL Laboratories, Radiochemistry Division

Batch #: 1830869

Analysis: PCW

First Client Due Date: 01/10/2019

Internal Due Date: 01/06/2019

Spike Envelope: Radium-226

Spike Code: 17AN0

Expiration Date: 12/31/2019

End Initial/Degas Date/Time: 12/16/18 09:05

LCS Envelope: Radium-226

LCS Code: 12AN0

Expiration Date: 12/31/2019

End L.N. De-asp Date: 12/16/18

Prep Date: 12/12/18

Bkg Count Time: 30 (Min)

Sample Count Time: 120 (Min)

Start Count Date: 12/12/18

Pipet ID: 1224 (g)

Balance ID: 1850252

Initials: JW

Witness: JW

Sample #	Client Description	Type	Matrix	Min	Client	Position (Label)	Aliquot (Only for QC)	End L.N. De-asp Time	Start Count Time	Cell #	Bkg counts	Total Counts
466626001-1	BR10SW02011	SAMPLE	SURFACE WATER	1 pCi/L	LANC001	1	5.00	12/12/18	12/12/18	160	1.2	171.2
466626002-1	BR10SW02011	SAMPLE	SURFACE WATER	1 pCi/L	LANC001	2	5.00	12/12/18	12/12/18	160	1.2	171.2
466626003-1	BR10SW-40X10	SAMPLE	SURFACE WATER	1 pCi/L	LANC001	3	5.00	12/12/18	12/12/18	160	1.2	171.2
466630001-1	MW-1	SAMPLE	WATER	1 pCi/L	LANC006	4	5.00	12/12/18	12/12/18	160	1.2	171.2
466630002-1	MW-2	SAMPLE	WATER	1 pCi/L	LANC006	5	5.00	12/12/18	12/12/18	160	1.2	171.2
466630003-1	MW-3	SAMPLE	WATER	1 pCi/L	LANC006	6	5.00	12/12/18	12/12/18	160	1.2	171.2
466630004-1	MW-4	SAMPLE	WATER	1 pCi/L	LANC006	7	5.00	12/12/18	12/12/18	160	1.2	171.2
466630005-1	MW-5	SAMPLE	WATER	1 pCi/L	LANC006	8	5.00	12/12/18	12/12/18	160	1.2	171.2
466630006-1	MW-6	SAMPLE	WATER	1 pCi/L	LANC006	9	5.00	12/12/18	12/12/18	160	1.2	171.2
466630007-1	MW-7	SAMPLE	WATER	1 pCi/L	LANC006	10	5.00	12/12/18	12/12/18	160	1.2	171.2
466630008-1	MW-8	SAMPLE	WATER	1 pCi/L	LANC006	11	5.00	12/12/18	12/12/18	160	1.2	171.2
466630009-1	MW-9	SAMPLE	WATER	1 pCi/L	LANC006	12	5.00	12/12/18	12/12/18	160	1.2	171.2
466630010-1	FR-202512018	SAMPLE	WATER	1 pCi/L	LANC006	13	5.00	12/12/18	12/12/18	160	1.2	171.2
466630011-1	MW-1	SAMPLE	WATER	1 pCi/L	LANC006	14	5.00	12/12/18	12/12/18	160	1.2	171.2
466630012-1	MW-2	SAMPLE	WATER	1 pCi/L	LANC006	15	5.00	12/12/18	12/12/18	160	1.2	171.2
466630013-1	MW-3	SAMPLE	WATER	1 pCi/L	LANC006	16	5.00	12/12/18	12/12/18	160	1.2	171.2
466630014-1	MW-4	SAMPLE	WATER	1 pCi/L	LANC006	17	5.00	12/12/18	12/12/18	160	1.2	171.2
466630015-1	MW-5	SAMPLE	WATER	1 pCi/L	LANC006	18	5.00	12/12/18	12/12/18	160	1.2	171.2
466630016-1	MW-6	SAMPLE	WATER	1 pCi/L	LANC006	19	5.00	12/12/18	12/12/18	160	1.2	171.2
466630017-1	FR-202512018	SAMPLE	WATER	1 pCi/L	LANC006	20	5.00	12/12/18	12/12/18	160	1.2	171.2
1204178412-1	NIB for batch 1830869	NIB	SURFACE WATER	1 pCi/L	QC ACCURNT	21	5.00	12/12/18	12/12/18	160	1.2	171.2
1204178413-1	FR-20181206-466630007DC (1)	DUP	WATER	1 pCi/L	QC ACCURNT	22	5.00	12/12/18	12/12/18	160	1.2	171.2
1204178464-1	FR-20181206-466630007MINI	MN	WATER	1 pCi/L	QC ACCURNT	23	5.00	12/12/18	12/12/18	160	1.2	171.2
1204178465-1	FR-20181206-466630007MINI	MN	WATER	1 pCi/L	QC ACCURNT	24	5.00	12/12/18	12/12/18	160	1.2	171.2
1204178466-1	LCS for batch 1830869	LCS	SURFACE WATER	1 pCi/L	QC ACCURNT	25	5.00	12/12/18	12/12/18	160	1.2	171.2

Comments: See file 1830869

Data Reviewed By: [Signature] Page 1 of 1

RA1830869R.xls

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1830869
Analyst : PETE049
Prep Date : 12/12/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Halflife of Ra-226 : 1600 years
Ra-226 Abundance : 1.00
Halflife of Rn-222: 3.8235 days
Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Background Counts	Background CPM	Count Time (min.)	Cell Efficiency (cpm/dpm)
1	466626001.1	0.5000	2.0256E-05	12/5/2018 13:10	106	30	2	0.067	1	0.033	30	2.1070
2	466626002.1	0.5000	2.0256E-05	12/5/2018 13:20	201	30	24	0.800	3	0.100	30	2.0070
3	466627001.1	0.5000	2.0256E-05	12/5/2018 13:25	307	30	17	0.567	1	0.033	30	1.8050
4	466630001.1	0.5000	2.0256E-05	12/3/2018 11:15	408	30	5	0.167	3	0.100	30	1.8510
5	466630002.1	0.5000	2.0256E-05	12/3/2018 12:40	508	30	71	2.367	1	0.033	30	2.1080
6	466630003.1	0.5000	2.0256E-05	12/3/2018 11:20	606	30	4	0.133	3	0.100	30	1.9430
7	466630004.1	0.5000	2.0256E-05	12/3/2018 13:05	705	30	18	0.600	4	0.133	30	1.8350
8	466630005.1	0.5000	2.0256E-05	12/4/2018 9:55	802	30	14	0.467	6	0.200	30	1.6450
9	466630006.1	0.5000	2.0256E-05	12/4/2018 10:35	104	30	4	0.133	2	0.067	30	2.0520
10	466630007.1	0.5000	2.0256E-05	12/4/2018 13:55	203	30	21	0.700	3	0.100	30	1.8290
11	466630008.1	0.5000	2.0256E-05	12/4/2018 12:30	305	30	52	1.733	1	0.033	30	1.4880
12	466630009.1	0.5000	2.0256E-05	12/4/2018 12:15	407	30	2	0.067	4	0.133	30	1.7420
13	466630010.1	0.5000	2.0256E-05	12/3/2018 12:00	504	30	14	0.467	1	0.033	30	1.8310
14	466633001.1	0.5000	2.0256E-05	12/6/2018 10:10	608	30	15	0.500	8	0.267	30	1.9750
15	466633002.1	0.5000	2.0256E-05	12/6/2018 10:10	703	30	11	0.367	4	0.133	30	1.9130
16	466633003.1	0.5000	2.0256E-05	12/6/2018 13:30	803	30	21	0.700	8	0.267	30	1.4750
17	466633004.1	0.5000	2.0256E-05	12/6/2018 11:35	108	30	6	0.200	1	0.033	30	2.0290
18	466633005.1	0.5000	2.0256E-05	12/6/2018 12:40	207	30	25	0.833	2	0.067	30	1.9750
19	466633006.1	0.5000	2.0256E-05	12/6/2018 14:20	308	30	28	0.933	8	0.267	30	1.4570
20	466633007.1	0.5000	2.0256E-05	12/6/2018 12:00	401	30	1	0.033	4	0.133	30	1.9020
21	1204178462.1	0.5000	2.0256E-05	12/12/2018 0:00	503	30	2	0.067	5	0.167	30	1.9410
22	1204178463.1	0.5000	2.0256E-05	12/6/2018 12:00	601	30	5	0.167	2	0.067	30	1.9080
23	1204178464.1	0.1000	1.1370E-05	12/6/2018 12:00	702	30	877	29.233	2	0.067	30	1.7830
24	1204178465.1	0.1000	1.1370E-05	12/6/2018 12:00	804	30	689	22.967	1	0.033	30	1.8590
25	1204178466.1	0.5000	2.0256E-05	12/12/2018 0:00	105	30	791	26.367	3	0.100	30	2.0440

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
Pipet, 0.5 ml Stdev : +/- 0.001000 ml
Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-008
Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
4.700%	5/1/2018	4/30/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
8.300%	8/1/2018	7/31/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
6.300%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
7.000%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
5.200%	6/1/2018	5/31/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
2.400%	7/1/2018	6/30/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
1.800%	11/1/2018	10/31/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
5.600%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:00	12/23/2018 4:00	0.511	0.978	1.002	1.000
7.800%	5/1/2018	4/30/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
9.900%	8/1/2018	7/31/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
2.900%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
6.600%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
9.700%	6/1/2018	5/31/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
9.100%	7/1/2018	6/30/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
6.700%	11/1/2018	10/31/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
2.200%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:25	12/23/2018 4:35	0.513	0.976	1.002	1.000
6.700%	5/1/2018	4/30/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
2.100%	8/1/2018	7/31/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
9.500%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
0.500%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
8.100%	6/1/2018	5/31/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
8.500%	7/1/2018	6/30/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
9.300%	11/1/2018	10/31/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
4.200%	3/1/2018	2/28/2019	12/19/2018 2:15	12/23/2018 1:50	12/23/2018 5:10	0.514	0.975	1.002	1.000
9.300%	5/1/2018	4/30/2019	12/19/2018 2:15	12/23/2018 2:15	12/23/2018 5:40	0.516	0.975	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

* - RPD changed to 0% due to sample & dup activity below MDA

Spike S/N : 1715-D
Spike Exp Date : 12/4/2019
Spike Activity (dpm/ml): 288.41
Spike Volume Added: 0.10

LCS S/N : 1715-D
LCS Exp Date : 12/4/2019
LCS Activity (dpm/ml): 288.41
LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.0942	0.0665	1	0.2187	0.0286	173.27%	0.0333	0.0577	0.0970	0.0971		SAMPLE				
2	0.1712	0.1209	1	0.3318	0.6300	26.10%	0.7000	0.1732	0.3055	0.3349		SAMPLE				
3	0.1099	0.0776	1	0.2553	0.5337	27.25%	0.5333	0.1414	0.2774	0.2953		SAMPLE				
4	0.1857	0.1311	1	0.3597	0.0651	141.59%	0.0667	0.0943	0.1803	0.1808		SAMPLE				
5	0.0941	0.0664	1	0.2186	1.9994	13.19%	2.3333	0.2828	0.4750	0.5920		SAMPLE				
6	0.1769	0.1249	1	0.3427	0.0310	264.59%	0.0333	0.0882	0.1607	0.1608		SAMPLE				
7	0.2162	0.1527	1	0.4038	0.4594	33.55%	0.4667	0.1563	0.3017	0.3093		SAMPLE				
8	0.2954	0.2086	1	0.5270	0.2928	56.18%	0.2667	0.1491	0.3208	0.3252		SAMPLE				
9	0.1365	0.0964	1	0.2806	0.0586	122.72%	0.0667	0.0816	0.1406	0.1412		SAMPLE				
10	0.1876	0.1324	1	0.3634	0.5915	28.96%	0.6000	0.1633	0.3155	0.3465		SAMPLE				
11	0.1331	0.0940	1	0.3091	2.0601	14.57%	1.7000	0.2427	0.5764	0.6591		SAMPLE				
12	0.2274	0.1605	1	0.4246	-0.0690	122.65%	-0.0667	0.0816	0.1657	0.1658		SAMPLE				
13	0.1082	0.0764	1	0.2512	0.4268	31.33%	0.4333	0.1291	0.2492	0.2692		SAMPLE				
14	0.2836	0.2003	1	0.4918	0.2130	69.11%	0.2333	0.1599	0.2861	0.2902		SAMPLE				
15	0.2071	0.1462	1	0.3866	0.2199	55.73%	0.2333	0.1291	0.2385	0.2423		SAMPLE				
16	0.3798	0.2681	1	0.6585	0.5297	41.48%	0.4333	0.1795	0.4301	0.4375		SAMPLE				
17	0.0974	0.0688	1	0.2263	0.1479	53.34%	0.1667	0.0882	0.1534	0.1560		SAMPLE				
18	0.1416	0.1000	1	0.2910	0.6988	22.69%	0.7667	0.1732	0.3094	0.3267		SAMPLE				
19	0.3838	0.2710	1	0.6655	0.8236	31.47%	0.6667	0.2000	0.4843	0.5217		SAMPLE				
20	0.2079	0.1468	1	0.3882	-0.0946	74.54%	-0.1000	0.0745	0.1383	0.1383		SAMPLE				
21	0.2278	0.1608	1	0.4144	-0.0927	88.56%	-0.1000	0.0882	0.1603	0.1604		MB				
22	0.1465	0.1035	1	0.3013	0.0943	88.60%	0.1000	0.0882	0.1631	0.1644	466633007.1	DUP	*	0.0%		
23	0.7841	0.5536	1	1.6120	147.2298	9.90%	29.1667	0.9883	9.7777	35.6021	466633007.1	MS			129.9133	113.3%
24	0.5318	0.3754	1	1.2350	111.0320	5.68%	22.9333	0.8756	8.3088	20.2351	466633007.1	MSD	28.0%		129.9133	85.5%
25	0.1671	0.1180	1	0.3239	23.0780	9.96%	26.2667	0.9393	1.6175	5.6044		LCS			25.9825	88.8%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 23-DEC-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	03:00	1	1.29E+05	129499	-0.04		
LUCAS2	EFF	03:00	1	1.33E+05	132679	1.8		
LUCAS3	EFF	03:00	1	1.37E+05	137474	-1.67		
LUCAS4	EFF	03:00	1	1.31E+05	130988	-0.65		
LUCAS5	EFF	03:00	1	1.37E+05	137495	2.52		
LUCAS6	EFF	03:00	1	1.33E+05	132567	-2.21		
LUCAS7	EFF	03:00	1	1.42E+05	142406	0.64		
LUCAS8	EFF	03:00	1	1.46E+05	145500	2.24		

Reviewed by:

Lyndsey Pace

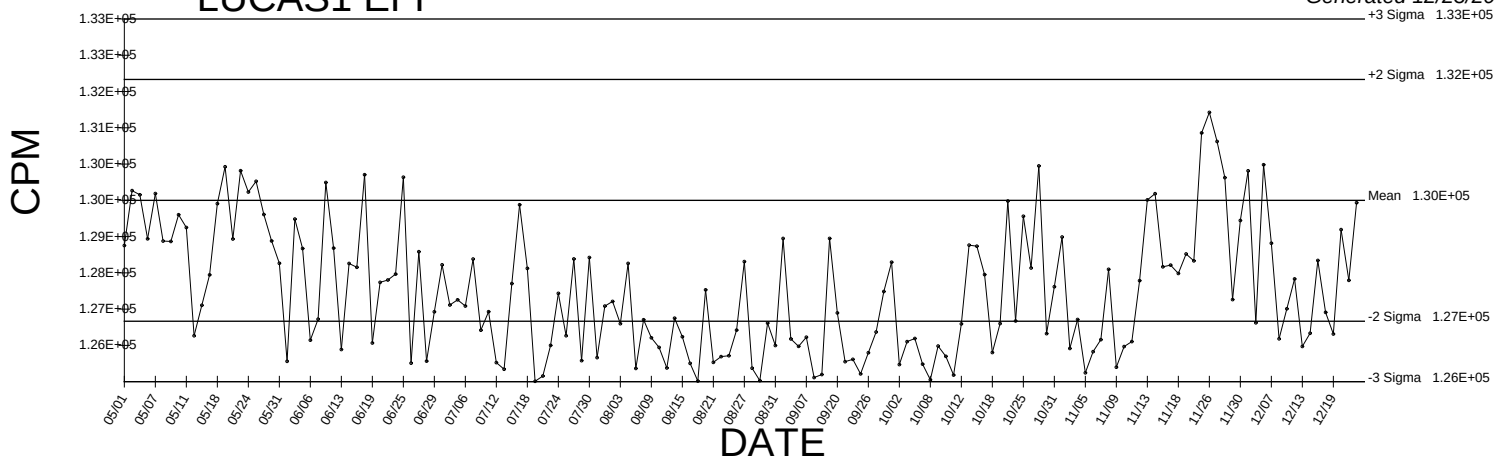
Date: 23-DEC-18

GEL Laboratories LLC

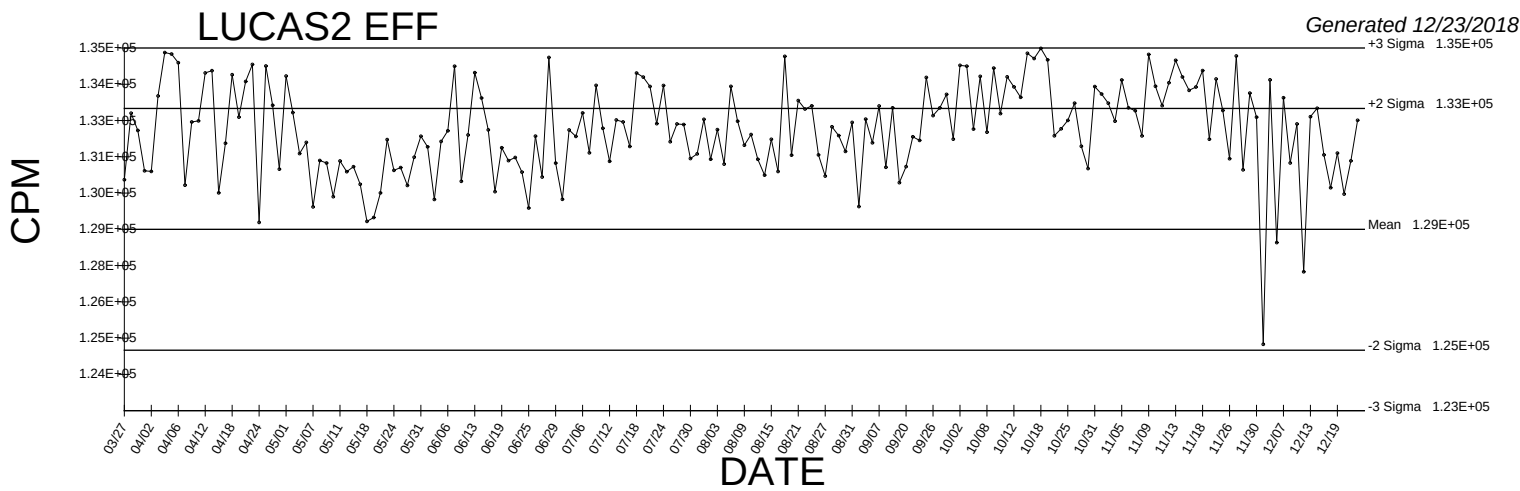
Efficiency Data

LUCAS1 EFF

Generated 12/23/2018



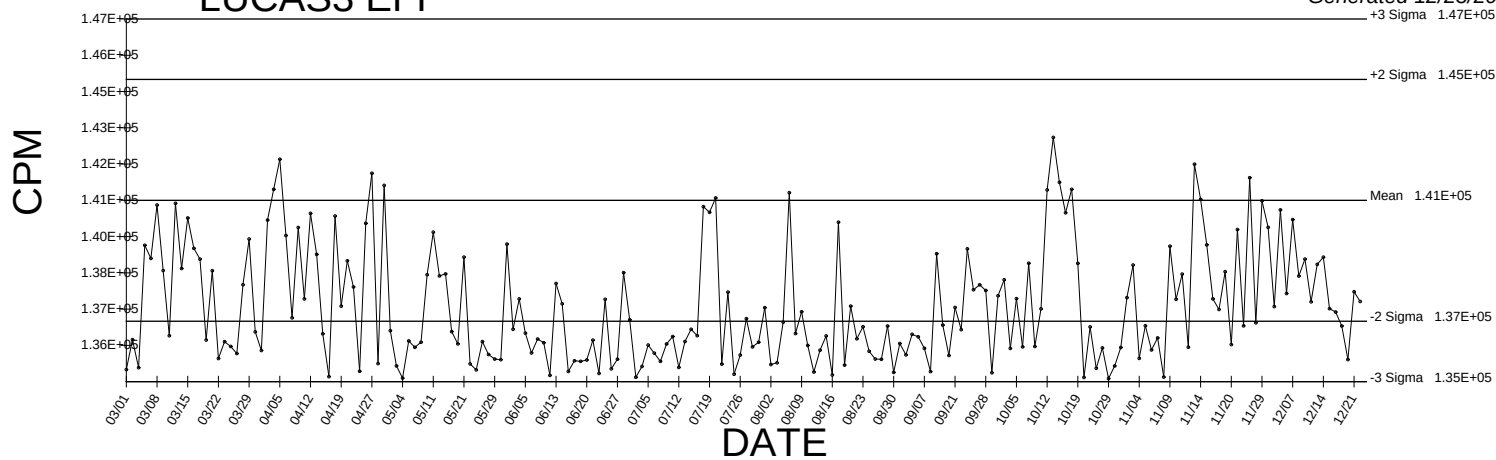
● Denotes Outlier



● Denotes Outlier

LUCAS3 EFF

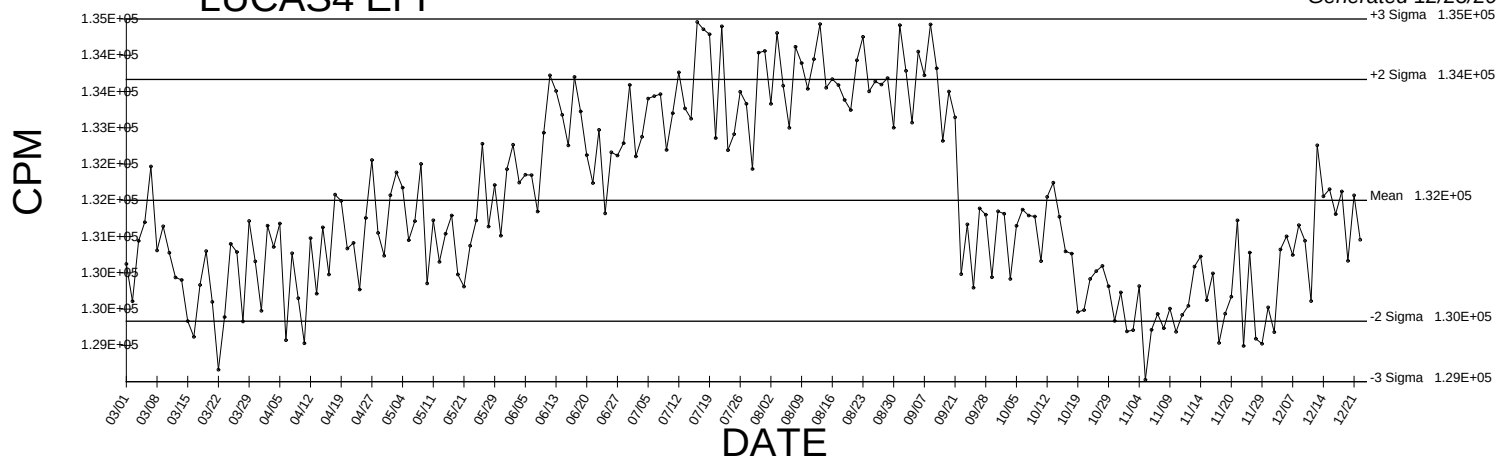
Generated 12/23/2018



● Denotes Outlier

LUCAS4 EFF

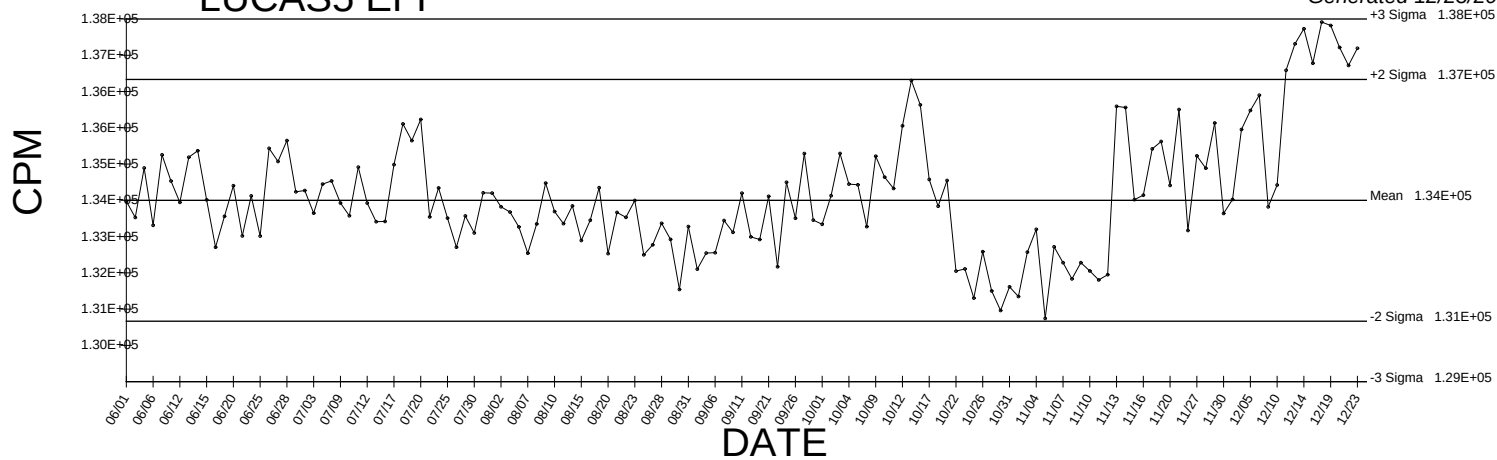
Generated 12/23/2018



● Denotes Outlier

LUCAS5 EFF

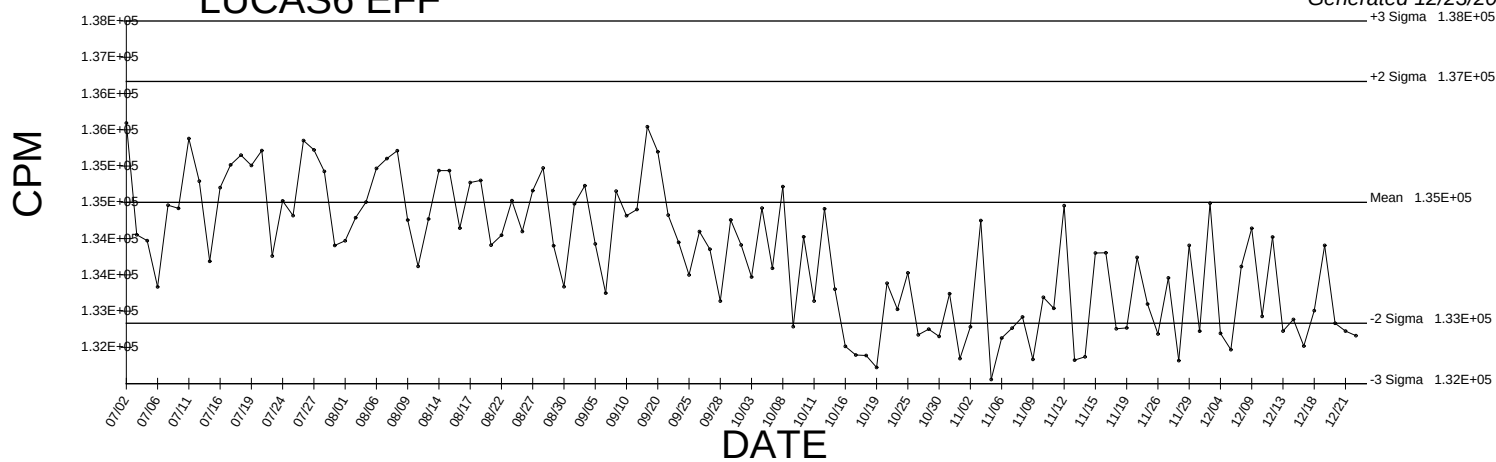
Generated 12/23/2018



● Denotes Outlier

LUCAS6 EFF

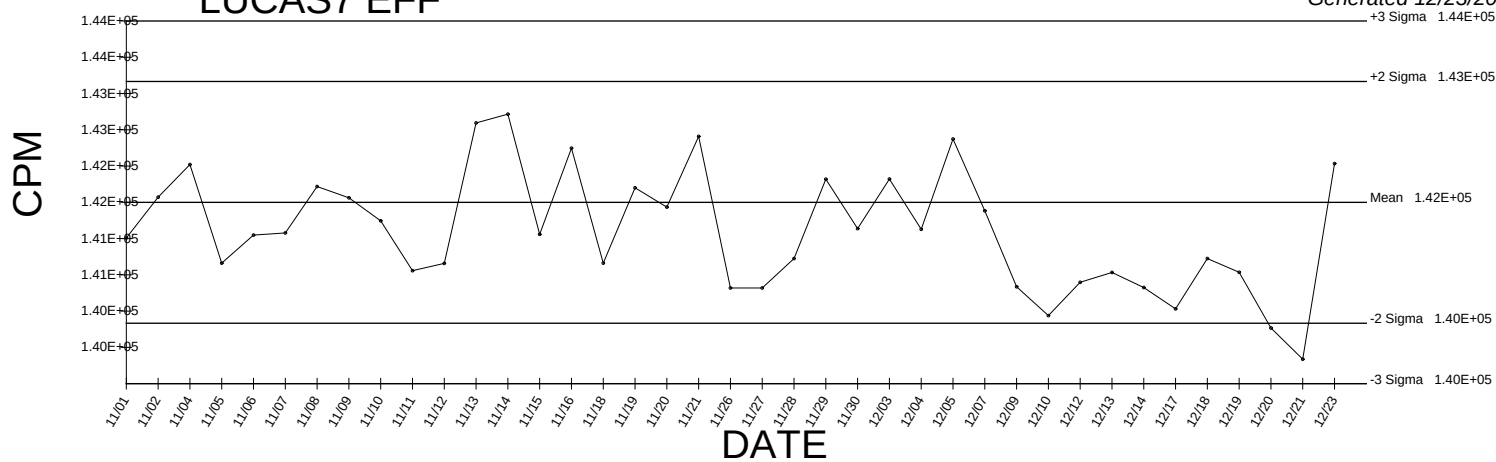
Generated 12/23/2018



● Denotes Outlier

LUCAS7 EFF

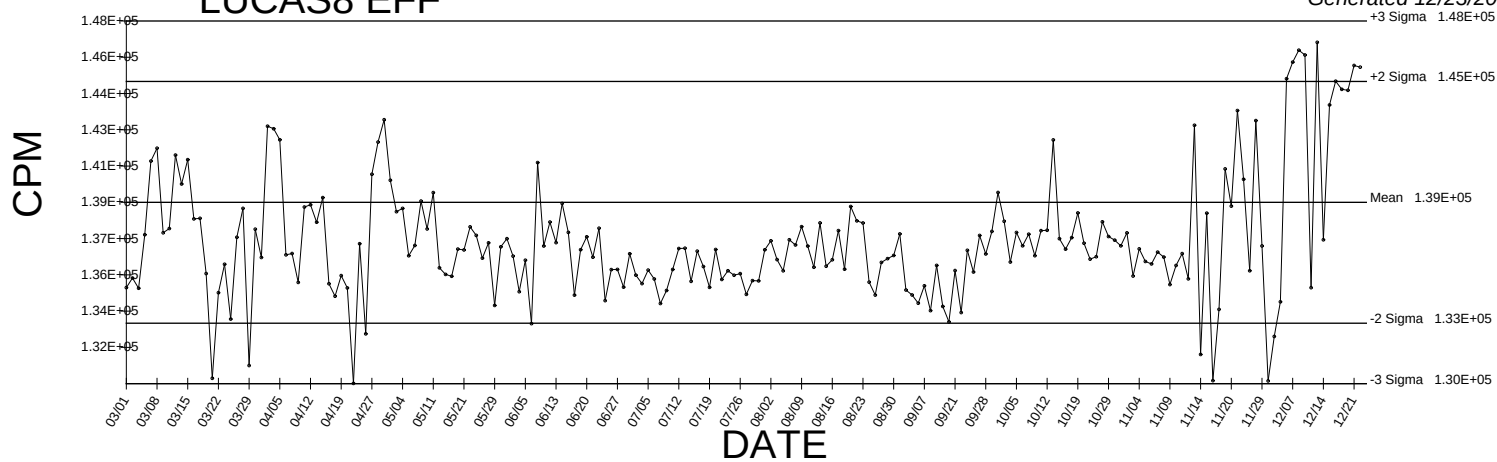
Generated 12/23/2018



● Denotes Outlier

LUCAS8 EFF

Generated 12/23/2018



RAD Standards Traceability



Eckert & Ziegler

Analytics

1100 Peachtree Industrial Blvd.
Atlanta, Georgia 30318
Tel: 404-352-8677
Fax: 404-352-2817
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

1215

98307

Ra-226 5 mL liquid in Flame Sealed Vial

Customer: CGL Laboratories, LLC

P.O. No.: CGL 1409300, Item 7

Product Code: 98307

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked by germanium gamma ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurement Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 2, July 2007, and compliance with ANSI N43.22-1996, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolly Madison Blvd., Ste. 403, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty ^a , %			Reference Date (12:00 PM EST)
			^a _A	^a _B	^a _U	
Ra-226	5.844E+05	3.576E+04	1.0	2.1	4.7	09/09/2014

^aUncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1207, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities (other than decay products) < 0.1%.

5.02193 g 0.1M HCl solution with approximately 30 μ g/g Ba carrier.

Source Prepared by:

R. Ormsby
R. Ormsby, Radiochemist

QC Approved:

L. Tkavacke
L. Tkavacke, Nuclear Metrologist

Date: 9 Sep 14

11/10/14





Standard Traceability Log Rad

Source Material Info	
Parent Code:	1715
Prepared By:	Gregory Ramsay
Carrier Conc:	0.1M HCl
Reference Date:	09/09/2014
Ampoule Mass (g):	5.02193 g
Uncertainty:	+/- 2.35 %
LogBook No:	GL-CED-297-008

A Solution Material Info			
Isotope:	Radium-226		
Prepared By:	Gregory Ramsay		
Prep Date:	07/06/2016		
Verification Date:	12/04/2018		
Expiration Date:	12/04/2019		
Primary Code:	1715-A		
Dilution(mL):	100 mL		
Mass of Parent(g):	4.9865 g		
Density(g/mL):	0.9967	Balance ID:	C31514

Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (Bq)}) * (\text{conversion dpm to Bq}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21900.3937 \text{ dpm/mL}$
$(4.9865 \text{ g}) * (36760 \text{ Bq}) * (60 \text{ dpm/Bq}) / (0.9967 \text{ g/mL}) / (5.02193 \text{ g} * 100 \text{ mL}) = 21972.4854 \text{ dpm/g}$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
07/06/2016	Gregory Ramsay	2.6261	200	1715-B	288.51 dpm/ml	01/25/2017	11/10/2018
02/08/2017	Gregory Ramsay	21.96	250	1715-C	1930.063 dpm/ml	02/08/2017	02/08/2018
12/19/2017	Gregory Ramsay	2.63	200	1715-D	288.938 dpm/ml	12/04/2018	12/04/2019

GEL Laboratories LLC
Version 1.0 9/18/2000

Verification for Ra-226 Standard 1715-D

1715-D

Instrument	YELLOW
Analyst	XXXX
Verification Prep Date	XXXX

Standard Information	
Isotope	Ra-226
Serial Number	XXXX
Isotope Half-life	1600.43 Y
Reference Date	XXXX
Rn Age (days)	XXXX
Amount of Std (mL)	XXXX
Standard Prep Date	XXXX

Std #	Count Date	Quench Number	Gross cpm	Blkg cpm
1	XXXX	XXXX	XXXX	XXXX
2	XXXX	XXXX	XXXX	XXXX
3	XXXX	XXXX	XXXX	XXXX

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	225.00	0.833318	269.97	269.97
2	232.00	0.833318	277.46	277.46
3	234.50	0.833318	279.73	279.73

Mean Value = 274.52 dpm/mL
 Stdev = 7.14824487
 Certificate Value* = 288.4
 Two sigma = ±2.259
 10 % of Mean = 27.452
 Rule A (Pass/Fail) Pass
 % Recovery 95.15%
 Rule B (Pass/Fail) Pass
 Expiration Date 12/4/2019

Verification Rules

Rule A = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule B = The determined mean value shall be within 5% of the certificate value

* Certificate Value is decay corrected to Count Date.

The analyst prepared three standard verification sources for Ra-226 source 1715-D by transferring 1 mL portions of the standard into three liquid scintillation vials. 10 mL of EcoSolv Ultra liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared as a background using 10 mL of EcoSolv Ultra liquid scintillation cocktail. The standard verification vials and background source were dark adapted for at least two hours and counted on LSC YELLOW for Ra-226 source standard verification. The Ra-226 standard verification which was used for verification calculations was performed on 12/4/2019 as in Ra-226 source 1715-D.

Standard results for each verification source was calculated as follows

$$\text{Source cpm/mL} = (A - B) / C \times D$$

where

A = Net source cpm

B = BKG cpm

C = System efficiency (midpoint), and

D = volume used for standard verification

RA-226-001

XXXX

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1830869

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
466626001	SAMPLE	PCW	LUCAS1	DEC-23-18 04:00:00	DONE	Lucas Cell	01-MAY-18 00:00
466626002	SAMPLE	PCW	LUCAS2	DEC-23-18 04:00:00	DONE	Lucas Cell	01-AUG-18 00:00
466627001	SAMPLE	PCW	LUCAS3	DEC-23-18 04:00:00	DONE	Lucas Cell	01-MAR-18 00:00
466630001	SAMPLE	PCW	LUCAS4	DEC-23-18 04:00:00	DONE	Lucas Cell	01-MAR-18 00:00
466630002	SAMPLE	PCW	LUCAS5	DEC-23-18 04:00:00	DONE	Lucas Cell	01-JUN-18 00:00
466630003	SAMPLE	PCW	LUCAS6	DEC-23-18 04:00:00	DONE	Lucas Cell	01-JUL-18 00:00
466630004	SAMPLE	PCW	LUCAS7	DEC-23-18 04:00:00	DONE	Lucas Cell	01-NOV-18 00:00
466630005	SAMPLE	PCW	LUCAS8	DEC-23-18 04:00:00	DONE	Lucas Cell	01-MAR-18 00:00
466630006	SAMPLE	PCW	LUCAS1	DEC-23-18 04:35:00	DONE	Lucas Cell	01-MAY-18 00:00
466630007	SAMPLE	PCW	LUCAS2	DEC-23-18 04:35:00	DONE	Lucas Cell	01-AUG-18 00:00
466630008	SAMPLE	PCW	LUCAS3	DEC-23-18 04:35:00	DONE	Lucas Cell	01-MAR-18 00:00
466630009	SAMPLE	PCW	LUCAS4	DEC-23-18 04:35:00	DONE	Lucas Cell	01-MAR-18 00:00
466630010	SAMPLE	PCW	LUCAS5	DEC-23-18 04:35:00	DONE	Lucas Cell	01-JUN-18 00:00
466633001	SAMPLE	PCW	LUCAS6	DEC-23-18 04:35:00	DONE	Lucas Cell	01-JUL-18 00:00
466633002	SAMPLE	PCW	LUCAS7	DEC-23-18 04:35:00	DONE	Lucas Cell	01-NOV-18 00:00
466633003	SAMPLE	PCW	LUCAS8	DEC-23-18 04:35:00	DONE	Lucas Cell	01-MAR-18 00:00
466633004	SAMPLE	PCW	LUCAS1	DEC-23-18 05:10:00	DONE	Lucas Cell	01-MAY-18 00:00
466633005	SAMPLE	PCW	LUCAS2	DEC-23-18 05:10:00	DONE	Lucas Cell	01-AUG-18 00:00
466633006	SAMPLE	PCW	LUCAS3	DEC-23-18 05:10:00	DONE	Lucas Cell	01-MAR-18 00:00
466633007	SAMPLE	PCW	LUCAS4	DEC-23-18 05:10:00	DONE	Lucas Cell	01-MAR-18 00:00
1204178462	MB	PCW	LUCAS5	DEC-23-18 05:10:00	DONE	Lucas Cell	01-JUN-18 00:00
1204178463	DUP	PCW	LUCAS6	DEC-23-18 05:10:00	DONE	Lucas Cell	01-JUL-18 00:00
1204178464	MS	PCW	LUCAS7	DEC-23-18 05:10:00	DONE	Lucas Cell	01-NOV-18 00:00
1204178465	MSD	PCW	LUCAS8	DEC-23-18 05:10:00	DONE	Lucas Cell	01-MAR-18 00:00
1204178466	LCS	PCW	LUCAS1	DEC-23-18 05:40:00	DONE	Lucas Cell	01-MAY-18 00:00