

January 31, 2019

Project No.: 3497-354-01

ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

HRP HUDSON, LLC

Former Hudson Generating Station

Van Keuren Avenue

Jersey City, New Jersey 07306

PREPARED BY



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1 INTRODUCTION

On behalf of HRP Hudson, 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 Hudson Generating Station located on Van Keuren Avenue in Jersey City, New Jersey (the Property). Effective December 21, 2018 the ownership of this property has been transferred from PSEG Fossil LLC to HRP Hudson, 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 three 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 three inactive CCR units are located on the Property (refer to **Figure 1 – Site Location Map with CCR Unit Locations**):

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

These units ceased receiving CCR prior to October 19, 2015 and as described in a December 8, 2017 memorandum prepared by GEI Consultants, Inc. (GEI), CCR removal from the units was completed on November 16, 2017 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 presents the information required by 40 CFR 257.90(e) for submission of an Annual Groundwater Monitoring and Corrective Action Report.

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

2 FIGURE DEPICTING CCR UNITS

A figure depicting the three CCR units and the nine 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, nine 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). Eight of the wells (MW-1 through MW-8) 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-9 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 nine monitoring wells on April 27, 2018 and the monitoring wells were installed by Joel D Bernstein of Subsurface Environmental Technologies, LLC between May 31 and June 6, 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 ten (10) and thirty-five (35) 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 risers at MW-1, MW-2, and MW-4 were cut flush with the ground surface and covered with flush-mounted protective steel covers and concrete pads. The remaining wells risers were cut approximately two feet above the ground surface and covered with protective steel covers and concrete pads. The monitoring well installation forms 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

monitoring well MW-1 was continually pumped dry due to a low recharge rate; therefore, a low volume of water was purged from this well during development.

Following installation and development, the monitoring wells were surveyed by Dennis W. Sklar, Inc. (DWS) on July 31, 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 2.81 feet above msl in MW-5 to 4.62 feet above msl in MW-8 indicating groundwater flow direction to the east-southeast towards Penhorn Creek. The groundwater elevations surrounding the Bottom Ash Pond ranged from -4.22 feet above msl in MW-1 to 3.12 feet above msl in MW-3 indicating a groundwater flow direction to the south-southeast towards the Hackensack River.

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

- Event 1: July 30 to August 1, 2018;
- Event 2: September 5 to 6, 2018;
- Event 3: October 1 to 2, 2018;
- Event 4: October 31 to November 1, 2018; and
- Event 5: December 3 to 4, 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,

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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 barium, cobalt, and/or lithium were detected above USEPA MCLs during the five sampling events in the monitoring wells surrounding the CCR Units. In addition, Radium-226 was detected above the USEPA MCL in five of the eight wells surrounding the CCR Units during Event 3. No Appendix III and Appendix IV constituents were detected above USEPA MCLs from the background well location MW-9.

5 MONITORING PROGRAM

In support of closing the three 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 Hudson LLC's CCR Rule Compliance Data and Information web site.

6 CERTIFICATION

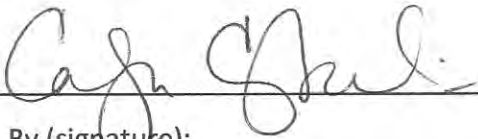
In accordance with 40 CFR 257.91(f), I certify that, based on my review of the work completed to date, the groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR 257.91. Given that the CCR was physically removed from the CCR units prior to monitoring well installation 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 Hackensack River, groundwater flow direction was presumed to be towards the river and generally consistent with surface topography; however, upon review of the groundwater elevations from the five events in 2018, groundwater flow direction has been determined to be to the east-southeast towards Penhorn Creek in the vicinity of the North and South Fly Ash Ponds and to the south-southeast towards the Hackensack River in the vicinity of the Bottom Ash Pond. 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:



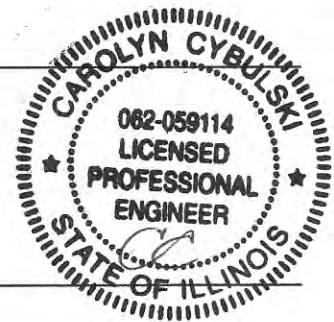
By (signature):

11-30-2019

Expiration Date:

1-31-19

Date:



Weaver Consultants Group North Central, LLC

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TABLES

Table 1
Monitoring Well Survey Data
Former Hudson Generating Station
Jersey City, 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	7.31	9.88	10.20	698614.16	610025.92	40	45	2.057	74	4	27.958
MW-2	8.37	7.97	8.74	698630.02	609706.62	40	45	2.229	74	4	32.106
MW-3	8.42	11.29	11.60	699006.60	609438.39	40	45	5.963	74	4	35.568
MW-4	5.57	8.40	8.71	698889.68	609866.21	40	45	4.787	74	4	30.016
MW-5	4.89	6.88	7.50	700178.41	609252.10	40	45	17.551	74	4	37.915
MW-6	4.31	6.51	6.89	699783.85	608694.67	40	45	13.679	74	4	45.183
MW-7	4.77	7.72	7.90	700220.72	608374.95	40	45	18.011	74	4	49.311
MW-8	5.25	7.58	8.14	700547.94	608786.62	40	45	21.225	74	4	43.941
MW-9	4.41	6.75	7.04	700773.22	609262.37	40	45	23.428	74	4	37.744

Notes:

This survey was completed on July 31, 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	
						July 30-August 1, 2018		September 5-6, 2018		October 1-2, 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	30	flushmount	2	20-30	9.88	15.82	-5.94	15.55	-5.67	14.86	-4.98	14.72	-4.84	14.1	-4.22
MW-2	35	flushmount	2	25-35	7.97	13.21	-5.24	12.82	-4.85	12.8	-4.83	12.49	-4.52	11.69	-3.72
MW-3	20	stick-up	2	5-20	11.29	10.50	0.79	10.54	0.75	9.16	2.13	9.25	2.04	8.17	3.12
MW-4	20	flushmount	2	10-20	8.4	6.07	2.33	9.81	-1.41	9.71	-1.31	10.34	-1.94	8.06	0.34
MW-5	15	stick-up	2	5-15	6.88	5.75	1.13	5.81	1.07	4.72	2.16	5.21	1.67	4.07	2.81
MW-6	15	stick-up	2	5-15	6.51	3.29	3.22	3.79	2.72	2.72	3.79	2.65	3.86	2.91	3.6
MW-7	10	stick-up	2	1-10	7.72	4.03	3.69	4.36	3.36	3.61	4.11	3.65	4.07	3.35	4.37
MW-8	11	stick-up	2	1-11	7.58	5.26	2.32	5.12	2.46	3.42	4.16	4.13	3.45	2.96	4.62
MW-9	15	stick-up	2	5-15	6.75	5.08	1.67	5.8	0.95	4.55	2.2	4.62	2.13	4.1	2.65

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 Hudson Generating Station
Jersey City, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Bottom Ash Pond				Fly Ash Ponds				Background
			MW-1 7/30/18	MW-2 7/30/18	MW-3 7/31/18	MW-4 7/31/18	MW-5 7/31/18	MW-6 7/31/18	MW-7 8/1/18	MW-8 8/1/18	
Appendix III Analytes											
Boron	mg/L	---	1.08	0.827	0.518	1.53	0.802	1.04	0.282	0.281	0.382
Calcium	mg/L	---	396.00	442.00	41.60	164.00	185.00	160.00	37.20	34.00	93.90
Chloride	mg/L	---	6750.00	7230.00	349.00	6610.00	2910.00	2740.00	87.10	475.00	676.00
Fluoride	mg/L	4.00	<0.25	<0.25	0.33	<0.25	<0.25	<0.25	0.36	<0.25	0.26
pH	S.U.	---	7.80	7.70	8.00	7.70	7.10	7.30	8.10	727.00	7.40
Sulfate	mg/L	---	15.20	19.00	90.50	864.00	2.00	3.60	20.10	21.20	27.10
Total Dissolved Solids	mg/L	---	10200.00	10400.00	958.00	10400.00	5120.00	4290.00	361.00	916.00	1340.00
Appendix IV Analytes											
Antimony	mg/L	0.006	<0.00041	0.00052	0.0017	0.0009	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
Arsenic	mg/L	0.01	0.0049	0.0059	0.004	0.0018	0.0012	0.0034	0.0036	0.0032	0.0037
Barium	mg/L	2.00	0.693	2.2700	0.0638	0.119	0.184	0.155	0.0586	0.0954	0.731
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	0.00045	0.00054	<0.00015	0.0005	<0.00015	<0.00015	0.0002	0.0018	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	0.0066	<0.0053	<0.0053	<0.0053	0.0055
Cobalt	mg/L	0.006	0.0041	0.0031	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0045	<0.0015
Fluoride	mg/L	4.00	<0.25	<0.25	0.33	<0.25	<0.25	<0.25	0.36	<0.25	0.26
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.1030	0.0891	<0.0110	0.0994	0.0443	0.0371	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0037	0.0041	0.0164	0.0076	0.00038	0.00054	0.0077	0.0061	0.0071
Selenium	mg/L	0.05	<0.021	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210	<0.0210
Thallium	mg/L	0.002	<0.0700	<0.0700	<0.0140	<0.0140	<0.0140	<0.0140	<0.0140	<0.0700	<0.0140
Radium 228	pCi/L	5.00	2.40	4.87	<3.00	<3.00	<3.00	2.54	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	1.42	2.71	<1.00	0.813	1.06	1.76	0.586	0.756	0.396

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 Hudson Generating Station
Jersey City, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Bottom Ash Pond				Fly Ash Ponds				Background
			MW-1 9/6/18	MW-2 9/6/18	MW-3 9/6/18	MW-4 9/6/18	MW-5 9/5/18	MW-6 9/5/18	MW-7 9/5/18	MW-8 9/5/18	MW-9 9/5/18
Appendix III Analytes											
Boron	mg/L	---	1.11	0.912	0.74	1.14	0.471	0.969	0.268	0.337	0.62
Calcium	mg/L	---	380.00	459.00	175.00	97.90	91.80	136.00	39.90	37.50	116.00
Chloride	mg/L	---	6760.00	6970.00	1720.00	3720.00	739.00	929.00	61.50	598.00	947.00
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.37	<0.25	<0.25
pH	S.U.	---	7.70	7.70	8.00	7.50	7.40	7.50	8.30	7.20	7.50
Sulfate	mg/L	---	123.00	15.80	274.00	558.00	3.40	3.30	<1.5	28.70	22.20
Total Dissolved Solids	mg/L	---	11800.00	11600.00	3180.00	7560.00	1670.00	2450.00	350.00	908.00	2200.00
Appendix IV Analytes											
Antimony	mg/L	0.006	<0.00041	<0.00041	0.00048	0.00046	<0.00041	<0.00041	<0.00041	<0.00041	0.00053
Arsenic	mg/L	0.01	0.0023	0.0047	0.0009	<0.00068	0.00086	0.003	0.001	0.0015	0.0022
Barium	mg/L	2.00	0.808	2.24	0.233	0.0815	0.0821	0.108	0.0681	0.101	0.123
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	<0.00015	<0.00015	0.00016	<0.00015	<0.00015	<0.00015	<0.00015	0.00036	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	0.0048	0.0035	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0068	0.0021
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.37	<0.25	<0.25
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.0431	0.0630	0.0148	0.0551	<0.0110	0.0186	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0029	0.0026	0.0073	0.0089	<0.00031	<0.00031	0.0043	0.0039	0.0018
Selenium	mg/L	0.05	<0.0210	<0.105	<0.0210	<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	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	2.27	2.47	<3.00	<3.00	2.59	4.46	<3.00	2.50	<3.00
Radium-226	pCi/L	5.00	1.11	1.65	<1.00	<1.00	0.466	0.881	<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 Hudson Generating Station
Jersey City, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Bottom Ash Pond				Fly Ash Ponds				Background
			MW-1 10/2/18	MW-2 10/2/18	MW-3 10/2/18	MW-4 10/2/18	MW-5 10/1/18	MW-6 10/1/18	MW-7 10/1/18	MW-8 10/1/18	MW-9 10/1/18
Appendix III Analytes											
Boron	mg/L	---	1.09	0.912	0.61	1.38	0.679	0.822	0.197	0.331	0.473
Calcium	mg/L	---	393.00	446.00	53.40	123.00	129.00	110.00	28.90	24.90	101.00
Chloride	mg/L	---	2840.00	3770.00	587.00	1150.00	1100.00	692.00	29.20	409.00	631.00
Fluoride	mg/L	4.00	<0.25	0.40	<0.25	0.34	<0.25	0.42	0.48	<0.25	<0.25
pH	S.U.	---	7.60	7.60	7.80	7.70	7.20	7.30	7.80	7.40	7.30
Sulfate	mg/L	---	116.00	14.20	78.60	493.00	4.00	9.10	9.90	23.30	51.90
Total Dissolved Solids	mg/L	---	17600.00	15100.00	1270.00	6800.00	2940.00	1500.00	223.00	899.00	1270.00
Appendix IV Analytes											
Antimony	mg/L	0.006	0.0013	0.00053	0.0013	0.00072	<0.00041	<0.00041	<0.00041	<0.00041	0.00066
Arsenic	mg/L	0.01	0.0017	0.003	0.0045	<0.00068	0.0011	0.00075	0.00084	0.0016	0.0048
Barium	mg/L	2.00	0.672	2.15	0.0572	0.149	0.116	0.0927	0.0318	0.0657	0.0892
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<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	<0.00015	0.00069	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	0.0044	0.0032	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0090	<0.0015
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.0372	0.043	<0.0110	0.0474	0.019	<0.0110	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0033	0.0027	0.0139	0.0069	0.00037	<0.00031	0.0061	0.0031	0.0058
Selenium	mg/L	0.05	<0.0210	<0.105	<0.0210	<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	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	<3.00	3.81	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	9.90	4.70	2.68	1.92	5.02	7.72	9.21	72.80	1.87

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 Hudson Generating Station
Jersey City, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Bottom Ash Pond				Fly Ash Ponds				Background
			MW-1 11/1/18	MW-2 11/1/18	MW-3 11/1/18	MW-4 11/1/18	MW-5 10/31/18	MW-6 10/31/18	MW-7 10/31/18	MW-8 10/31/18	MW-9 10/31/18
Appendix III Analytes											
Boron	mg/L	---	1.06	0.814	0.507	1.19	0.444	0.595	0.151	0.191	0.274
Calcium	mg/L	---	382.00	419.00	78.60	128.00	101.00	99.90	32.70	28.50	76.20
Chloride	mg/L	---	7540.00	7650.00	703.00	5370.00	849.00	434.00	44.40	349.00	291.00
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.39	<0.25	0.37
pH	S.U.	---	7.40	7.70	7.70	7.50	7.10	7.50	7.50	7.30	7.20
Sulfate	mg/L	---	122.00	15.10	129.00	551.00	8.00	32.20	11.80	17.50	67.10
Total Dissolved Solids	mg/L	---	7140.00	17300.00	2720.00	9560.00	1760.00	1130.00	253.00	828.00	860.00
Appendix IV Analytes											
Antimony	mg/L	0.006	0.0016	0.00066	0.00096	0.00082	<0.00041	<0.00041	<0.00041	<0.00041	0.0017
Arsenic	mg/L	0.01	0.0020	0.0033	0.0026	0.00069	0.00087	0.0015	0.00075	0.0007	0.0058
Barium	mg/L	2.00	0.7150	1.98	0.0749	0.0997	0.0844	0.0707	0.0381	0.0618	0.0549
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091	<0.000091
Cadmium	mg/L	0.005	0.00016	0.00024	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.00069	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	0.0069	0.0047	<0.0015	0.003	<0.0015	<0.0015	<0.0015	0.0037	<0.0015
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.0478	0.0505	0.0138	0.0497	0.015	<0.0110	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0033	0.0036	0.0115	0.0065	<0.00031	0.00032	0.0056	0.0039	0.012
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<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	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	3.49	4.40	2.31	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Radium-226	pCi/L	5.00	2.65	2.28	0.60	1.19	1.66	1.68	1.28	1.56	<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 3e
Groundwater Analytical Summary Event 5
Former Hudson Generating Station
Jersey City, New Jersey

Parameter	Units	USEPA Drinking Water MCL ^a	Bottom Ash Pond				Fly Ash Ponds				Background
			MW-1 12/3/18	MW-2 12/3/18	MW-3 12/3/18	MW-4 12/3/18	MW-5 12/4/18	MW-6 12/4/18	MW-7 12/4/18	MW-8 12/4/18	MW-9 12/4/18
Appendix III Analytes											
Boron	mg/L	---	1.14	0.927	0.206	0.967	0.364	0.481	0.0848	0.247	0.132
Calcium	mg/L	---	390.00	467.00	56.80	81.60	99.50	95.40	19.90	23.10	64.40
Chloride	mg/L	---	7490.00	7660.00	123.00	3360.00	623.00	368.00	17.80	380.00	113.00
Fluoride	mg/L	4.00	<0.25	<0.25	<0.25	<0.25	<0.25	0.43	<0.25	<0.25	<0.25
Sulfate	mg/L	---	117.00	14.10	46.90	221.00	4.70	29.60	6.20	32.30	30.90
pH	S.U.	---	7.20	7.20	7.80	7.30	6.80	7.20	7.50	7.00	7.20
Total Dissolved Solids	mg/L	---	10800.00	10600.00	524.00	3280.00	1640.00	900.00	141.00	722.00	401.00
Appendix IV Analytes											
Antimony	mg/L	0.006	0.00076	<0.00041	0.0013	0.0005	<0.00041	<0.00041	<0.00041	<0.00041	0.0011
Arsenic	mg/L	0.01	0.002	0.0045	0.0036	<0.00068	0.00078	0.00094	<0.00068	0.0023	0.0019
Barium	mg/L	2.00	0.748	2.24	0.0322	0.229	0.087	0.058	0.0185	0.0427	0.0289
Beryllium	mg/L	0.004	<0.000091	<0.000091	<0.000091	<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	<0.00015	0.0015	<0.00015
Chromium	mg/L	0.10	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053
Cobalt	mg/L	0.006	0.0056	0.0041	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0081	<0.0015
Lead	mg/L	0.015	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Lithium	mg/L	0.04	0.239	0.0709	<0.0110	0.076	0.027	0.0155	<0.0110	<0.0110	<0.0110
Mercury	mg/L	0.002	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	mg/L	0.100	0.0027	0.0032	0.0070	0.0063	<0.00031	0.0022	0.0055	0.0025	0.0028
Selenium	mg/L	0.05	<0.0210	<0.0210	<0.0210	<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	<0.0140	<0.0140	<0.0140
Radium 228	pCi/L	5.00	3.26	2.83	<3.00	<3.00	<3.00	1.49	2.91	<3.00	<3.00
Radium-226	pCi/L	5.00	<1.00	2.00	<1.00	0.459	<1.00	<1.00	0.592	2.06	<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

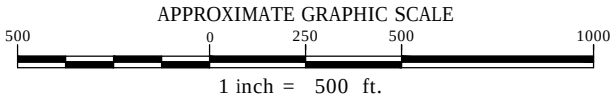
FIGURES



LEGEND

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE CCR UNIT LIMIT



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PREPARED FOR:

HRP HUDSON, LLC

SITE LOCATION MAP WITH COAL
COMBUSTION RESIDUAL (CCR) LOCATIONS
FORMER HUDSON GENERATING STATION
JERSEY CITY, NJ

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REVIEWED BY: AF

DATE: 1/29/2019

FILE: 3497-354-02-01

CAD: SITELOC.dwg

FIGURE 1



LEGEND

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE CCR UNIT LIMIT

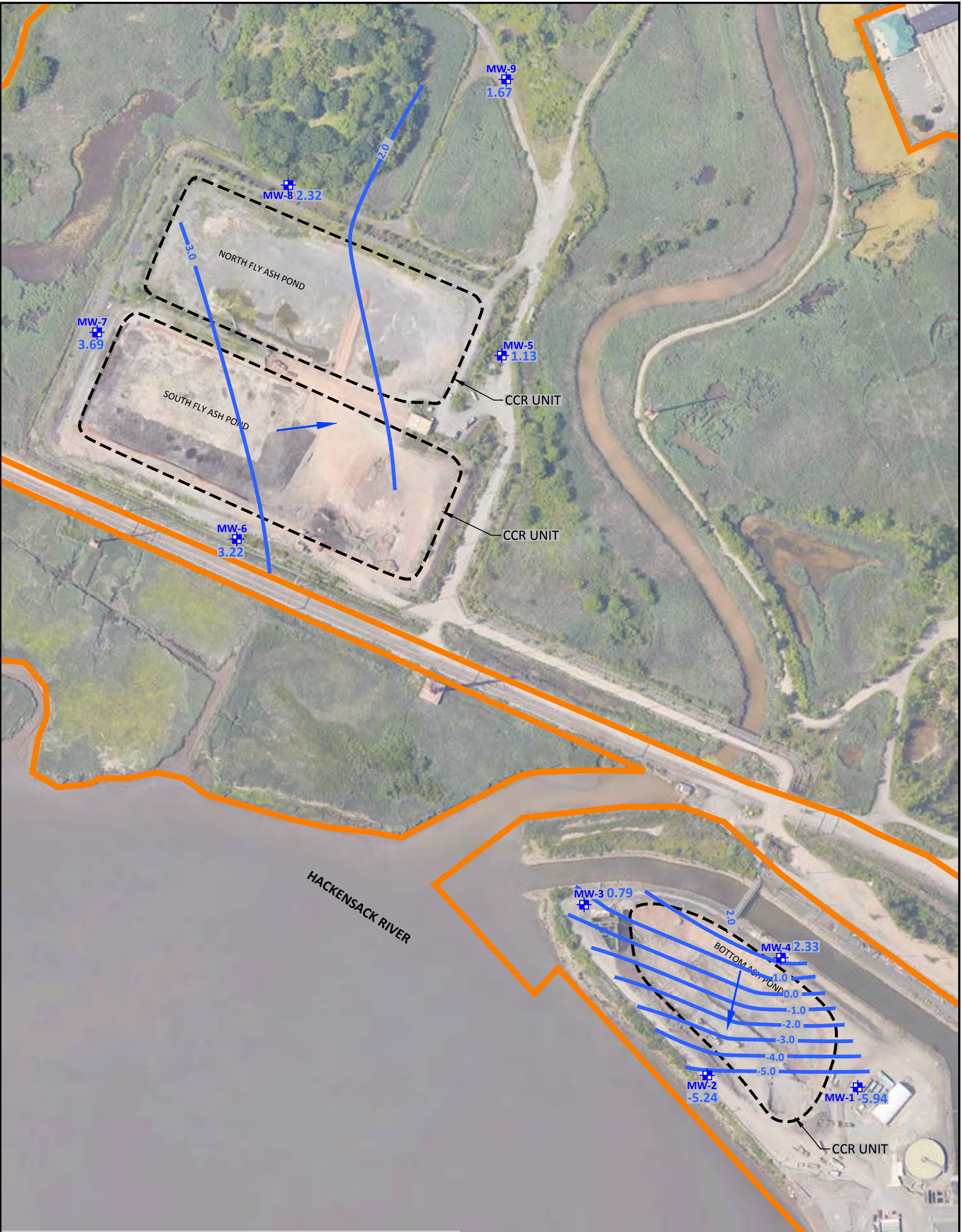
APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)

APPROXIMATE GRAPHIC SCALE

200 0 100 200 400

1 inch = 200 ft.

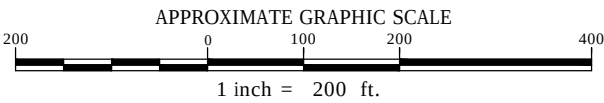
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		JERSEY CITY, NJ		DATE: 1/29/2019
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				FIGURE 2



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 #1 MEASUREMENTS TAKEN JULY 30, 2018 TO AUGUST 1, 2018.



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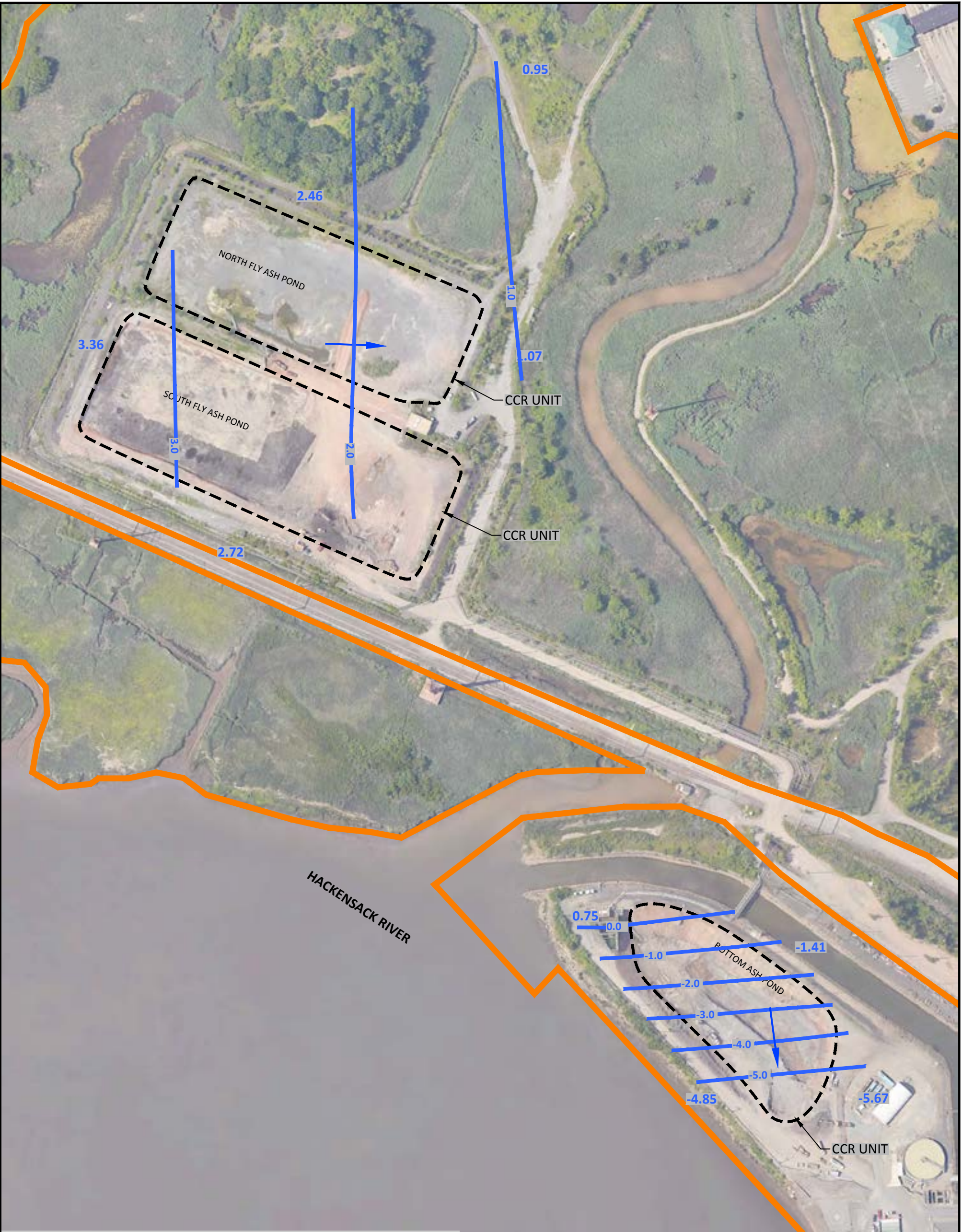
PREPARED FOR:
HRP HUDSON, LLC

GROUNDWATER ELEVATION CONTOUR MAP - EVENT #1 FORMER HUDSON GENERATING STATION JERSEY CITY, NJ
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FIGURE 3a	



LEGEND

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE CCR UNIT LIMIT

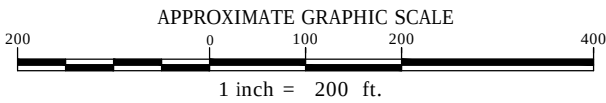
APPROXIMATE MONITORING WELL LOCATION (BY GEI CONSULTANTS, INC.)

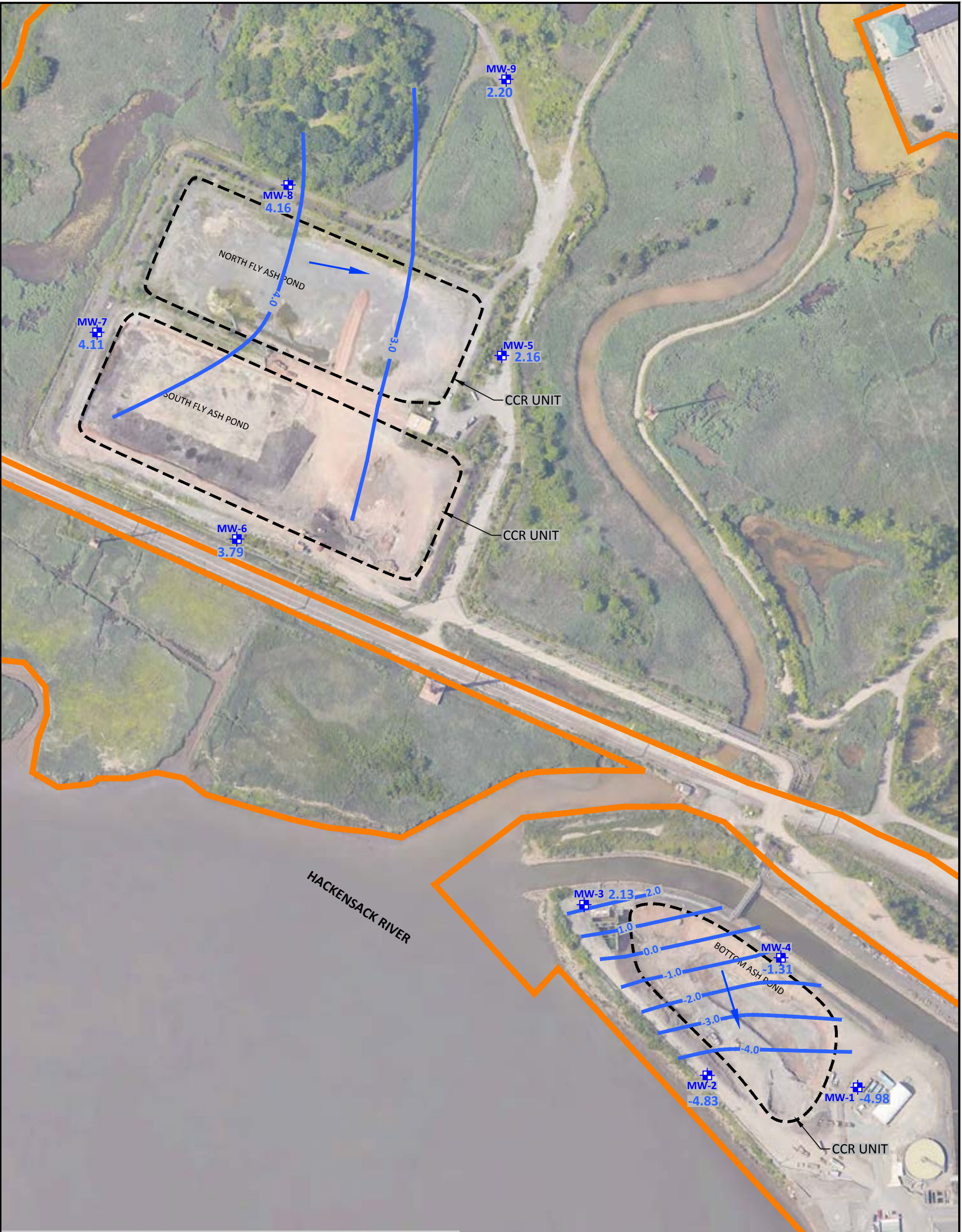
GROUNDWATER CONTOUR

GROUNDWATER ELEVATION

GROUNDWATER FLOW DIRECTION

NOTE:
GROUNDWATER EVENT #2 MEASUREMENTS TAKEN SEPTEMBER 5, 2018 TO SEPTEMBER 6, 2018.

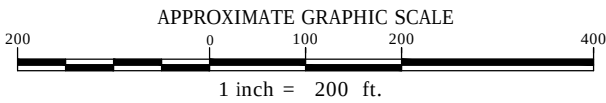




LEGEND

- 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 OCTOBER 1, 2018 TO OCTOBER 2, 2018.



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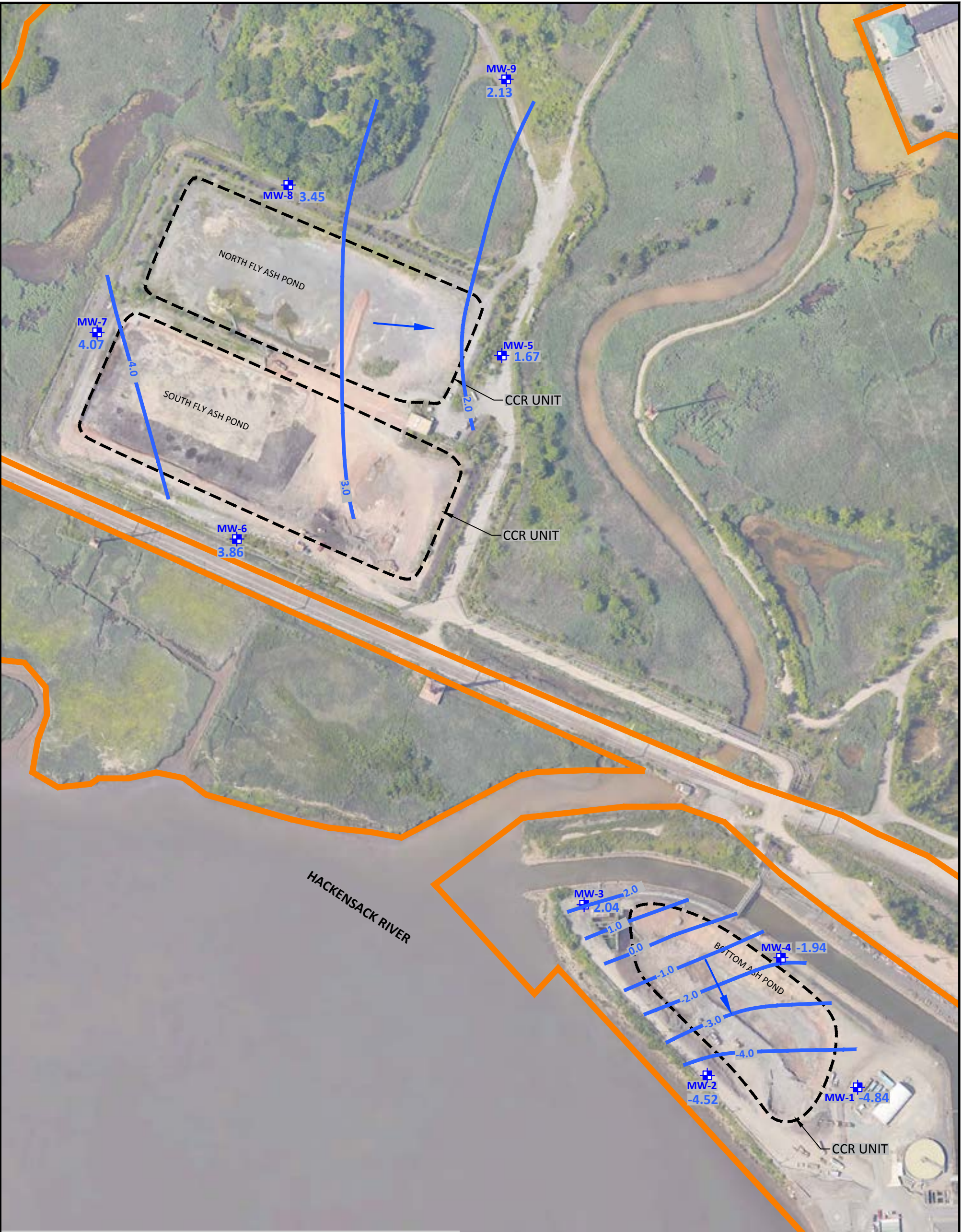
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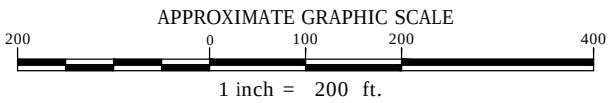
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FILE:	3497-354-02-01
CAD:	SITELOC.dwg
FIGURE 3C	



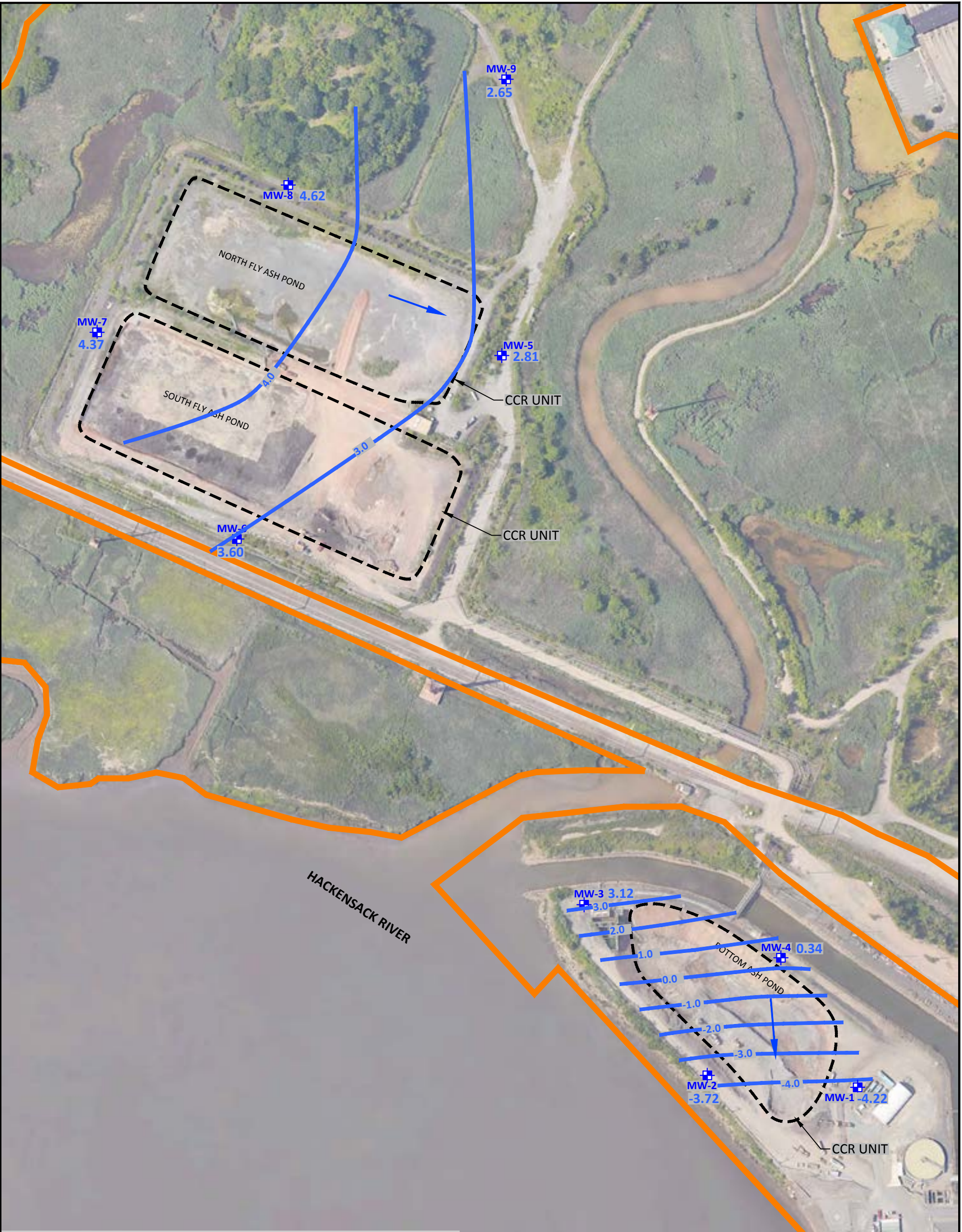
LEGEND

- 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 OCTOBER 31, 2018 TO NOVEMBER 1, 2018.



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		DATE: 1/29/2019		
		FILE: 3497-354-02-01		
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		FIGURE 3d		
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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 #5 MEASUREMENTS TAKEN DECEMBER 3, 2018 TO DECEMBER 9, 2018.

APPROXIMATE GRAPHIC SCALE

200 0 100 200 400

1 inch = 200 ft.

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				REVIEWED BY: AF
				DATE: 1/29/2019
				FILE: 3497-354-02-01
				CAD: SITELOC.dwg
				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: SLBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER, LLC

Organization: PSEGPower, LLC

Address: 80 Park Plaza

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: Hackensack River

County: Hudson

Municipality: Jersey City

Lot: 26

Block: 3101

Easting (X): 610028 **Northing (Y):** 698671

Local ID: MW-1

Coordinate System: NJ State Plane (NAD83) US-HECT

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s):

Diameter (in.): 2

Regulatory Program

Requiring Wells/Borings:

Depth (ft): 45

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
Terry Palawski, 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 # 6024433

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

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: Hackensack Riv Bldg

County: Hudson

Municipality: Jersey City

Lot: 26

Block: 3101

Easting (X): 609610

Northing (Y): 698732

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

Depth (ft): 45

Requiring Wells Borings:

Pump Capacity (gpm): 0

Case ID Number:

Drilling Method: Hollow Stem Augers

Deviation Requested: N

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: SCBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEGPowerLLC

Address: 80 Park Plaza

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: Hackensack Riv Est

County: Hudson

Municipality: Jersey City

Lot: 26

Block: 310

Easting (X): 609411 Northing (Y): 699003

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.): 45

Requiring Wells Borings:

Pump Capacity (gpm): 0

Case ID Number:

Drilling Method: Hollow Stem Augers

Deviation Requested: N

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 085349998

PROPERTY OWNER

Name: PS&G POWER, LLC

Organization: PS&GPowerLLC

Address: 80 Park Plaza

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: Hackensack Riv Etc

County: Hudson

Municipality: Jersey City

Lot: 26

Block: 3101

Easting (X): 609798

Northing (Y): 698912

Local ID: MW-7

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s):

Diameter (in.): 2

Regulatory Program:

Depth (ft): 45

Requiring Wells/Bearings:

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 P. Nowinski, 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 # 6024433

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE, PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEG Power LLC

Address: 80 Park Place

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: New County Road

County: Hudson

Municipality: Secaucus Town

Lot: 3

Block: 7

Easting (X): 609229

Northing (Y): 699932

Local ID: MW-3

Coordinate System: NJ State Plane (NAD83) - USFTT

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in): 20

Regulatory Program

Requiring Wells Borings: _____

Depth (ft.): 2

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: April 27, 2018

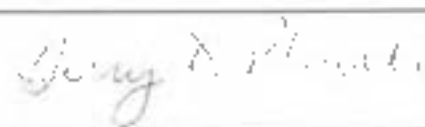
Expiration Date: April 27, 2019

Approved by the authority of:

Catherine R. McCabe

Acting Commissioner

Well Permit - Page 1 of 2


Terry Pitowski, 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 # 6824433

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349398

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEG Power LLC

Address: 80 Park Place

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: New County Road

County: Hudson **Municipality:** Secaucus Town

Lot: 3

Block: 7

Easting (X): 608638 **Northing (Y):** 699858

Local ID: MW-6

Coordinate System: NAD83 - US2121

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s):

Diameter (in.): 20

Regulatory Program

Requiring Wells/Borings:

Depth (ft): 2

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 D. 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 # 0024453

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE. PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER, LLC

Organization: PSEG Power LLC

Address: 80 Park Place

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: New County Road

County: Hudson

Municipality: Succasun Town

Lot: 3

Block: 7

Easting (X): 608409 Northing (Y): 700716

Local ID: MW-7

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 20

Regulatory Program

Requiring Wells/Bearings: _____

Depth (ft.): 2

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

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 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEG Power LLC

Address: 80 Park Place

City: Newark

State: New Jersey

Zip Code: 07101

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: New County Road

County: Hudson

Municipality: Secaucus Town

Lot: 3

Block: 7

Easting (X): 608957

Northing (Y): 700474

Local ID: MW-8

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s):

Diameter (in.): 20

Regulatory Program

Requiring Wells/Barings

Depth (ft.): 2

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 Pilewska

Terry Pilewska, 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 # 0024133

Permit Issued to: SUBSURFACE ENVIRONMENTAL TECHNOLOGIES, LLC

Company Address: 19 BROOKSIDE AVE PENNINGTON, NJ 085349998

PROPERTY OWNER

Name: PSEG POWER LLC

Organization: PSEG Power LLC

Address: 80 Park Place

City: Newark

State: New Jersey

Zip Code: 07102

PROPOSED WELL LOCATION

Facility Name: Hudson Generating Station

Address: New County Road

County: Hudson

Municipality: Secaucus Town

Lot: 3

Block: 7

Easting (X): 699402

Northing (Y): 700550

Local ID: MW-9

Coordinate System: NJ State Plane (NAD83) - USFEET

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 20

Regulatory Program: _____

Requiring Wells/Borings: _____

Depth (ft.): 2

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
Terry Pilawski, 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 2

MW-01

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 30.0
NORTHING (FT): 698613.7 EASTING (FT): 610025.4 DATE STARTED: 6/4/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/4/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 5.5') Gray to tan, medium SAND	
	5					(5.5' - 7.0') Gray CLAY with 10% fine Sand	
						(7.0' - 11.0') Black PEAT; Wet; Organic odor	
	10					(11.0' - 14.5') Dark brown to black SILT with CLAY and organic material; Meadow-Mat	
	15					(14.5' - 18.0') Gray CLAY; Wet	
						(18.0' - 18.5') Dark brown to black SILT with CLAY and organic material; Meadow-Mat	
	20					(18.5' - 30.0') Light gray to reddish tan CLAY; Moist; Dense	
	25						

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



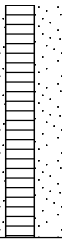
18000 Horizon Way Suite 200
Mount Laurel, NJ 08054
856.608.6860 Fax: 856.608.6864

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

BORING LOG

PAGE
2 of 2

MW-01

ELEV FT.	DEPTH FT.	SAMPLE INFO			STRATA	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
		PEN IN.	REC IN.	PID (ppm)			
	25						
	30						

Bottom of borehole at 30.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-02

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 35.0
NORTHING (FT): 698631.3 EASTING (FT): 609706 DATE STARTED: 6/4/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/5/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 4.5') Fill containing Sand, Bricks, and Concrete Fragments	
	5					(4.5' - 13.0') Black to gray CLAY with Sand	
	10						
	15					(13.0' - 20.0') Dark brown to black SILT and CLAY with organic material; Organic odor: Moist	
	20					(20.0' - 35.0') Reddish brown to gray CLAY; Dense: Moist	
	25						
	30						
	35						

Bottom of borehole at 35.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-03

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 30.0
NORTHING (FT): 699006.9 EASTING (FT): 609437.4 DATE STARTED: 6/5/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/5/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 8.0') FILL, GRAVEL, CONCRETE, AND BRICKS	
	5						
	10					(8.0' - 11.0') Gray to tan CLAY with some fine Sand; Moist at 9'	
	15					(11.0' - 16.0') Tan medium to fine SAND with some Clay; Wet	
	20					(16.0' - 18.0') Gray CLAY with fine Sand	
	25					(18.0' - 26.0') Dark brown to black SILT with Organic Material; Organic odor	
	30					(26.0' - 30.0') Gray to tan CLAY; Dense; Moist	

Bottom of borehole at 30.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-04

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 25.0
NORTHING (FT): 698889.5 EASTING (FT): 609865.1 DATE STARTED: 6/4/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/4/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 8.0') Reddish brown to tan, medium to coarse SAND; Wet at 6'	
	5						
	6					(8.0' - 9.0') Gray coarse SAND with some angular Gravel; Moist	
	10					(9.0' - 15.0') Tan medium SAND; Wet	
	15					(15.0' - 19.0') Black to dark brown SILT with Organic material ; Moist.	
	20					(19.0' - 25.0') Gray to reddish brown CLAY	
	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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-05

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 15.0
NORTHING (FT): 699664.4 EASTING (FT): 608988.9 DATE STARTED: 5/31/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/5/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 5.0') Light tan to gray medium to coarse SAND with some Silt; Moist to wet at 4'	
	5					(5.0' - 7.0') Gray medium SAND with some Silt; Wet; Slight odor	
	10					(7.0' - 14.0') Gray CLAY with 10% fine Sand; Some ash mixed in the top 1'	
	15					(14.0' - 15.0') Dark brown to black SILT with organic material; Organic odor	

Bottom of borehole at 15.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-06

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 15.0
NORTHING (FT): 700259.1 EASTING (FT): 608364.9 DATE STARTED: 6/1/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/5/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 10.0') Tan to red-brown medium to coarse SAND with some Gravel	
	5						
	10					(10.0' - 11.0') Dark brown CLAY with fine Sand (11.0' - 13.5') Dark brown to black SILT with Organic Material; Organic odor	
	15					(13.5' - 15.0') Gray CLAY; Moist	

Bottom of borehole at 15.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-07

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 15.0
NORTHING (FT): 700547 EASTING (FT): 608791.1 DATE STARTED: 5/31/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/1/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 5.0') FILL containing Concrete, Sand, and Gravel	
	5					(5.0' - 10.0') FILL containing Concrete, Bricks, and Sand; Wet	
	10					(10.0' - 13.0') Gray CLAY with fine Sand	
						(13.0' - 14.0') Dark brown to black SILT with Organic Material	
	15					(14.0' - 15.0') Gray CLAY; Dense: Moist	

Bottom of borehole at 15.0 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: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-08

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 11.5
NORTHING (FT): 700179.9 EASTING (FT): 609251.1 DATE STARTED: 5/31/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/6/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 2.5') Brown to gray medium SAND, some Gravel	
						(2.5' - 6.0') Tan to gray SILT, some fine Sand	
	5					(6.0' - 11.5') Green to olive GRAVEL with coarse Sand; Very difficult to drill	
	10						

Bottom of borehole at 11.5 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
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CLIENT: PSEG
PROJECT NAME: PSEG
CITY/STATE: Jersey City, New Jersey
PROJECT NUMBER: 1504710

BORING LOG

PAGE
1 of 1

MW-09

GROUND SURFACE ELEVATION (FT): Not Surveyed TOTAL DEPTH (FT): 15.0
NORTHING (FT): 700775.1 EASTING (FT): 609261.9 DATE STARTED: 6/1/2018
DRILLED BY: S.E.T. / Mike DATE FINISHED: 6/6/2018
LOGGED BY: Steve Peterson BORING DIAMETER: 8.25"
WATER LEVEL DEPTHS (FT): Water Level Not Measured 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' - 8.0') Brown to tan medium to coarse SAND with Gravel; Wet at 7.5'	
	5						
	10					(8.0' - 9.5') Dark gray to gray CLAY; Organic odor; Wet (9.5' - 14.0') Dark brown to black SILT with Organic Material; Organic odor	
	15					(14.0' - 15.0') Dark gray CLAY	

Bottom of borehole at 15.0 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 - Hudson		Project Location: Jersey City									
Weather Conditions: 73°F, Mostly Sunny		Sampling Date: 7/30/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 15.79 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 33.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 23.00 - 33.00 (ft)	h. Depth of Pump: 28.0 (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: 1008	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	1015	200	18.93	6.72	17.56	141.6	4.61	33.5	--	--	15.79
2	1020	200	18.89	6.72	17.46	123.0	4.3	31.9	--	--	16.45
3	1025	200	19.58	6.73	17.68	120.1	4.26	30.6	--	--	16.73
4	1030	200	19.42	6.74	17.65	119.5	4.14	32.9	--	--	16.95
5	1035	200	17.67	6.72	16.93	121.3	3.82	32.8	--	--	17.50
6	1040	200	17.37	6.71	16.80	122.9	3.68	29.7	--	--	18.00
7	1045	200	18.27	6.72	17.10	122.7	3.79	25.1	--	--	18.15
8	1050	200	18.98	6.74	17.38	122.2	3.91	14.9	--	--	18.32
9	1055	200	19.56	6.75	17.59	119.1	4.08	18.0	--	--	18.40
10	1100	200	19.96	6.75	17.74	117.4	4.21	14.1	--	--	18.69
11	1105	200	20.26	6.76	17.84	113.9	4.38	10.8	--	--	18.80
12	1110	200	20.36	6.76	17.89	110.8	4.51	9.5	--	--	18.96
13	1115	200	20.35	6.76	17.88	108.0	4.62	9.1	--	--	19.10
14	1120	200	20.29	6.77	17.86	106.0	4.81	7.3	--	--	19.27
15	1125	200	20.33	6.77	17.86	105.1	4.94	6.8	--	--	19.45
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									--	--	
									--	--	
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-1, 7-30-2018, 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: 1200							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:				Turbidity out of range (cloud cover). Water level out of range (minimal effect).							



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 79°F, Cloudy		Sampling Date: 7/30/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.81 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 34.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 25.00 - 35.00 (ft)	h. Depth of Pump: 30.0 (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: 1241	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	1245	200	19.23	6.72	18.37	135.0	8.10	55.9	--	--	13.25
2	1250	200	19.25	6.71	18.26	119.5	7.77	48.2	--	--	13.50
3	1255	200	19.51	6.70	18.24	111.2	7.74	39.1	--	--	14.00
4	1300	200	19.46	6.70	18.18	113.3	7.78	36.2	--	--	14.41
5	1305	200	19.24	6.69	18.01	123.8	7.84	20.0	--	--	14.80
6	1310	200	19.06	6.68	17.92	132.9	7.86	14.6	--	--	15.30
7	1315	200	18.82	6.67	17.79	144.4	7.87	9.2	--	--	15.74
8	1320	200	18.67	6.68	17.77	152.2	7.91	7.8	--	--	16.00
9	1325	200	18.63	6.68	17.74	157.1	7.89	7.4	--	--	16.32
10	1330	200	18.5	6.68	17.69	160.6	7.87	6.6	--	--	16.75
11	1335	200	18.42	6.67	17.67	162.8	7.76	6.7	--	--	16.80
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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-2, 7-30-2018, 1340					
Sample Start Time: 1340						End Sample Time: 1410					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:						Water level out of range (minimal effect).					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG										
Project Name: PSEG - Hudson		Project Location: Jersey City										
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 7/31/2018										
1. WATER LEVEL DATA (measured from top of inner well casing)												
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water:	10.10 (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:	8.00 - 23.00 (ft)	h. Depth of Pump:	15.5 (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:	0856	End Purge Time:	1005								
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	0900	200	20.64	6.69	2.741	81.9	7.36	160.8	--	--	10.30	
2	0905	200	19.56	6.73	1.767	80.4	6.91	101.2	--	--	10.70	
3	0910	200	19.14	6.73	1.414	95.7	6.66	56.5	--	--	11.00	
4	0915	200							--	--		
5	0920	200							--	--		
6	0925	200	0915 thru 0935 readings not taken, surveyors onsite.							--	--	
7	0930	200							--	--		
8	0935	200							--	--		
9	0940	200	19.85	6.75	1.385	162.9	5.67	-1.4	--	--	11.56	
10	0945	200	19.98	6.76	1.432	168.5	5.61	8.4	--	--	11.69	
11	0950	200	20.00	6.75	1.467	175.0	5.45	-4.3	--	--	11.89	
12	0955	200	20.10	6.75	1.513	182.3	5.34	-6.4	--	--	12.00	
13	1000	200	21.64	6.76	1.578	190.0	5.37	-6.5	--	--	12.11	
14	1005	200	22.53	6.76	1.619	195.4	5.36	-6.1	--	--	12.20	
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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-3, 7-31-2018, 1010						
Sample Start Time: 1010						End Sample Time: 1035						
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured						
ODOR/SHEEN:						None, sample water clear.						
COMMENTS:						Temp, Cond, & ORP 3rd reading out of range (difference minimal).						



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 7/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 6.05 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.03 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 13.00 - 23.00 (ft)	h. Depth of Pump: 18.0 (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: 1110	End Purge Time: 1210									
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	1115	200	23.68	6.59	17.71	95.4	3.06	327.0	--	--	6.00
2	1120	200	23.37	6.57	18.18	97.8	2.69	422.2	--	--	6.00
3	1125	200	23.43	6.58	18.19	99.1	2.59	251.5	--	--	6.00
4	1130	200	23.51	6.60	18.18	102.7	2.52	118.1	--	--	6.00
5	1135	200	23.58	6.60	18.18	100.0	2.46	71.1	--	--	6.00
6	1140	200	23.68	6.60	18.20	94.7	2.41	45.0	--	--	6.00
7	1145	200	23.76	6.58	18.24	88.8	2.38	24.8	--	--	6.00
8	1150	200	23.84	6.59	18.23	84.3	2.36	13.2	--	--	6.00
9	1155	200	23.87	6.58	18.22	79.1	2.33	13.3	--	--	6.00
10	1200	200	23.97	6.57	18.23	77.4	2.26	2.6	--	--	6.00
11	1205	200	23.74	6.56	18.16	74.8	2.23	-1.0	--	--	6.00
12	1210	200	23.78	6.56	18.15	73.1	2.28	-1.5	--	--	6.00
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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, 7-31-2018, 1215					
Sample Start Time: 1215						End Sample Time: 1225					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 7/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 5.82 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.98 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.98 - 16.98 (ft)	h. Depth of Pump: 12.0 (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:	1442	End Purge Time: 1540								
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	1450	200	23.38	6.35	10.12	-77.6	4.25	40.7	--	--	5.98
2	1455	200	23.34	6.34	10.11	-86.1	4.33	20.1	--	--	6.00
3	1500	200	24.11	6.35	10.24	-90.7	4.35	11.7	--	--	6.00
4	1505	200	24.36	6.34	10.23	-94.8	4.35	7.3	--	--	6.00
5	1510	200	24.49	6.34	10.11	-98.2	4.34	14.1	--	--	6.00
6	1515	200	23.35	6.63	9.760	-99.3	4.37	7.8	--	--	6.00
7	1520	200	22.33	6.31	9.333	-99.9	4.22	9.5	--	--	6.00
8	1525	200	21.79	6.30	9.100	-100.3	4.16	22.6	--	--	6.00
9	1530	200	21.84	6.31	8.990	-101.2	4.14	0.5	--	--	6.00
10	1535	200	21.89	6.31	8.930	-102.2	4.12	2.4	--	--	6.00
11	1540	200	21.83	6.31	8.887	-102.7	4.12	2.4	--	--	6.00
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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-5, 7-31-2018, 1545					
Sample Start Time: 1545						End Sample Time: 1600					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Slightly green color.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 7/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 3.45 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 17.05 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.05 - 17.05 (ft)	h. Depth of Pump: 12.1 (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: 1301	End Purge Time: 1405									
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	23.36	6.45	13.55	-99.1	4.70	91.2	--	--	3.40
2	1315	200	22.66	6.46	13.88	-101.8	4.58	107.6	--	--	3.42
3	1320	200	21.53	6.48	12.49	-105.8	4.50	129.2	--	--	3.45
4	1325	200	21.81	6.43	10.60	-105.7	4.59	125.2	--	--	3.42
5	1330	200	22.45	6.40	10.05	-106.1	4.63	101.5	--	--	3.40
6	1335	200	22.95	6.42	9.988	-107.0	4.67	107.4	--	--	3.40
7	1340	200	23.36	6.38	9.968	-106.9	4.65	128.2	--	--	3.40
8	1345	200	23.58	6.37	9.924	-105.7	4.61	77.9	--	--	3.40
9	1350	200	23.36	6.36	9.730	-105.1	4.60	86.1	--	--	3.40
10	1355	200	23.20	6.35	9.424	-104.1	4.58	154.7	--	--	3.40
11	1400	200	22.25	6.29	8.864	-101.4	4.50	127.1	--	--	3.40
12	1405	200	22.05	6.29	8.568	-99.5	4.51	122.1	--	--	3.40
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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-6, 7-31-2018, 1410					
Sample Start Time: 1410						End Sample Time: 1440					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN: No odor/sheen. Slightly turbid with slight, sickly green color.											
COMMENTS: Temp, Cond, Turbidity third reading slightly out of range (effect minimal).											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-7

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Overcast		Sampling Date: 8/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.03 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 11.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 2.99 - 11.99 (ft)	h. Depth of Pump: 8.0 (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: 1137	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	1140	200	25.77	7.02	3.206	-61.2	2.19	290.9	--	--	4.03
2	1145	200	24.98	6.93	3.135	-99.9	0.72	274.3	--	--	4.08
3	1150	200	24.86	6.90	2.661	-106.7	0.46	248.3	--	--	4.10
4	1155	200	25.27	6.84	1.936	-96.5	0.37	157.3	--	--	4.10
5	1200	200	25.51	6.82	1.695	-92.5	0.36	23.8	--	--	4.10
6	1205	200	25.55	6.81	1.455	-92.0	0.34	14.9	--	--	4.10
7	1210	200	26.00	6.82	1.213	-93.1	0.35	25.0	--	--	4.10
8	1215	200	26.38	6.82	1.012	-95.2	0.35	4.4	--	--	4.10
9	1220	200	26.54	6.84	0.851	-97.4	0.34	0.7	--	--	4.10
10	1225	200	27.03	6.85	0.769	-97.0	0.34	-0.9	--	--	4.10
11	1230	200	27.6	6.87	0.720	-99.8	0.36	-3.6	--	--	4.10
12	1235	200	27.99	6.87	0.690	-101.8	0.35	-3.9	--	--	4.10
13	1240	200	28.01	6.87	0.660	-102.5	0.35	-4.9	--	--	4.10
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
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-7, 8-1-2018, 1245					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1245						End Sample Time: 1300					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:						Conductivity out of range at time of sample.					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-8

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 8/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 5.26 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 13.60 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 3.60 - 13.60 (ft)	h. Depth of Pump: 8.6 (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:	1309	End Purge Time: 1435								
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	1315	200	23.72	6.53	0.919	76.3	1.04	1438.0	--	--	5.30
2	1320	200	23.21	6.49	0.925	79.8	0.77	1104.0	--	--	5.30
3	1325	200	23.67	6.51	0.936	81.7	0.69	896.9	--	--	5.30
4	1330	200	23.83	6.51	0.942	83.7	0.66	722.9	--	--	5.30
5	1335	200	23.77	6.50	0.980	87.8	0.59	460.8	--	--	5.30
6	1340	200	23.70	6.50	0.995	89.7	0.58	338.2	--	--	5.30
7	1345	200	23.74	6.49	1.033	92.3	0.54	262.3	--	--	5.30
8	1350	200	23.60	6.49	1.045	93.9	0.53	191.6	--	--	5.30
9	1355	200	23.88	6.49	1.080	95.8	0.51	143.1	--	--	5.30
10	1400	200	24.06	6.48	1.102	97.2	0.50	128.7	--	--	5.30
11	1405	200	24.08	6.49	1.114	98.4	0.51	109.7	--	--	5.30
12	1410	200	23.91	6.48	1.137	99.5	0.48	87.5	--	--	5.30
13	1415	200	23.76	6.49	1.160	100.0	0.45	79.3	--	--	5.30
14	1420	200	23.75	6.49	1.176	100.1	0.44	68.8	--	--	5.30
15	1425	200	23.78	6.49	1.191	100.0	0.42	56.9	--	--	5.30
16	1430	200	24.43	6.49	1.219	100.3	0.43	18.1	--	--	5.30
17	1435	200	25.43	6.50	1.242	99.6	0.48	18.0	--	--	5.30
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-8, 8-1-2018, 1440					
Sample Start Time: 1440						End Sample Time: 1455					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:						Third reading not stabilized for Temp, Cond, and Turbidity (sampled due to time).					



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-9

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 75°F, Overcast		Sampling Date: 8/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 5.08 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.94 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.94 - 16.94 (ft)	h. Depth of Pump: 11.9 (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:	0947	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	0950	200	23.66	6.30	5.73	-36.1	1.84	55.3	--	--	5.15
2	0955	200	23.03	6.30	8.40	-76.3	0.76	82.0	--	--	5.18
3	1000	200	23.62	6.31	8.61	-87.3	0.67	508.9	--	--	5.20
4	1005	200	23.95	6.33	8.31	-93.7	0.58	717.3	--	--	5.20
5	1010	200	23.94	6.35	7.70	-98.5	0.50	131.3	--	--	6.00
6	1015	200	23.84	6.37	6.895	-100.4	0.41	202.5	--	--	6.00
7	1020	200	23.81	6.39	5.917	-100.4	0.35	183.9	--	--	6.00
8	1025	200	24.49	6.41	5.171	-99.2	0.30	76.2	--	--	6.00
9	1030	200	24.59	6.43	4.841	-99.5	0.28	62.1	--	--	6.00
10	1035	200	25.03	6.44	4.443	-97.4	0.27	41.8	--	--	6.00
11	1040	200	24.72	6.45	4.125	-100.0	0.24	29.1	--	--	6.00
12	1045	200	25.04	6.46	3.974	-98.4	0.23	23.2	--	--	6.00
13	1050	200	25.46	6.47	3.891	-99.3	0.23	0.6	--	--	6.00
14	1055	200	25.55	6.47	3.793	-101.0	0.23	-0.9	--	--	6.00
15	1100	200	25.9	6.48	3.719	-99.0	0.24	4.0	--	--	6.00
									--	--	
									--	--	
									--	--	
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-9, 8-1-2018, 1105							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1105				End Sample Time: 1122							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential Not Measured							
ODOR/SHEEN:				No odor/sheen. Slightly green color.							
COMMENTS:				Conductivity third measurement slightly out of range (difference minimal).							



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 14.90 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 33.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 23.00 - 33.00 (ft)	h. Depth of Pump: 28.0 (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:	905	End Purge Time: 950								
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	200	18.9	7.09	15.97	81.8	3.03	31.3	--	--	14.90
2	5	200	16.23	6.83	14.95	68.9	0.59	9.5	--	--	15.85
3	10	200	16.05	6.84	14.89	67.3	0.31	5.1	--	--	16.62
4	15	200	15.92	6.85	14.85	66.5	0.38	2.2	--	--	18.10
5	20	200	15.82	6.87	14.81	64.9	0.41	1.5	--	--	20.22
6	25	200	15.84	6.87	14.82	64.5	0.18	1.1	--	--	21.78
7	30	200	15.88	6.83	14.82	62.9	0.33	1.2	--	--	23.20
8	35	200	15.99	6.88	14.88	62.9	0.38	1.5	--	--	23.55
9	40	200	15.84	6.86	14.90	60.0	0.39	0.7	--	--	23.61
10	45	200	15.82	6.85	14.92	60.1	0.39	0.6	--	--	23.86
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, 9-6-2018, 0955					
Sample Start Time: 955						End Sample Time: 1040					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 12.80 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 34.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 25.00 - 35.00 (ft)	h. Depth of Pump: 30.0 (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: 910	End Purge Time: 955									
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	17.72	6.70	16.38	3.4	1.90	9.4	--	--	12.80
2	10	200	17.14	6.75	16.18	19.9	0.39	13.7	--	--	12.80
3	15	200	17.34	6.76	16.16	30.0	0.29	10.6	--	--	12.80
4	20	200	17.29	6.76	16.04	32.6	0.34	8.1	--	--	12.80
5	25	200	17.32	6.77	16.03	34.1	0.31	6.7	--	--	12.80
6	30	200	17.24	6.77	15.96	35.7	0.27	5.9	--	--	12.80
7	35	200	17.24	6.76	15.94	37.0	0.29	4.6	--	--	12.80
8	40	200	17.34	6.76	15.91	38.0	0.26	3.7	--	--	12.80
9	45	200	17.4	6.76	15.93	38.8	0.26	3.0	--	--	12.80
3. SAMPLE COLLECTION DATA				Sampling Personnel: Shane Wagner							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-2, 7-30-2018, 1340							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1340				End Sample Time:				1410			
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:				Water level out of range (minimal effect).							

LOW-FLOW GROUNDWATER SAMPLE COLLECTION RECORD

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b.	Depth to Water:	10.14 (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:	8.00 - 23.00 (ft)	h.	Depth of Pump:	15.5 (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:	1105	End Purge Time:	1150							
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	24.07	6.76	5.644	100.5	0.92	0.3	--	--	10.14
2	10	150	23.4	6.70	5.641	68.3	0.78	0.2	--	--	10.14
3	15	150	23.35	6.71	5.755	60.1	0.53	0.3	--	--	10.14
4	20	150	23.36	6.72	5.746	53.1	0.44	0.3	--	--	10.14
5	25	150	23.12	6.73	5.730	49.2	0.35	0.3	--	--	10.14
6	30	150	23.74	6.74	5.776	40.2	0.49	0.6	--	--	10.14
7	35	150	24.4	6.74	5.898	57.3	0.51	1.7	--	--	10.14
8	40	150	24.46	6.74	5.884	55.9	0.50	1.0	--	--	10.14
9	45	150	24.49	6.74	5.895	54.2	0.49	0.7	--	--	10.14
									--	--	
									--	--	
									--	--	
									--	--	
									--	--	
3. SAMPLE COLLECTION DATA				Sampling Personnel: Shane Wagner							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-3, 9-6-2018, 1155							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1155				End SampleTime: 1240							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential Not Measured							
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:											



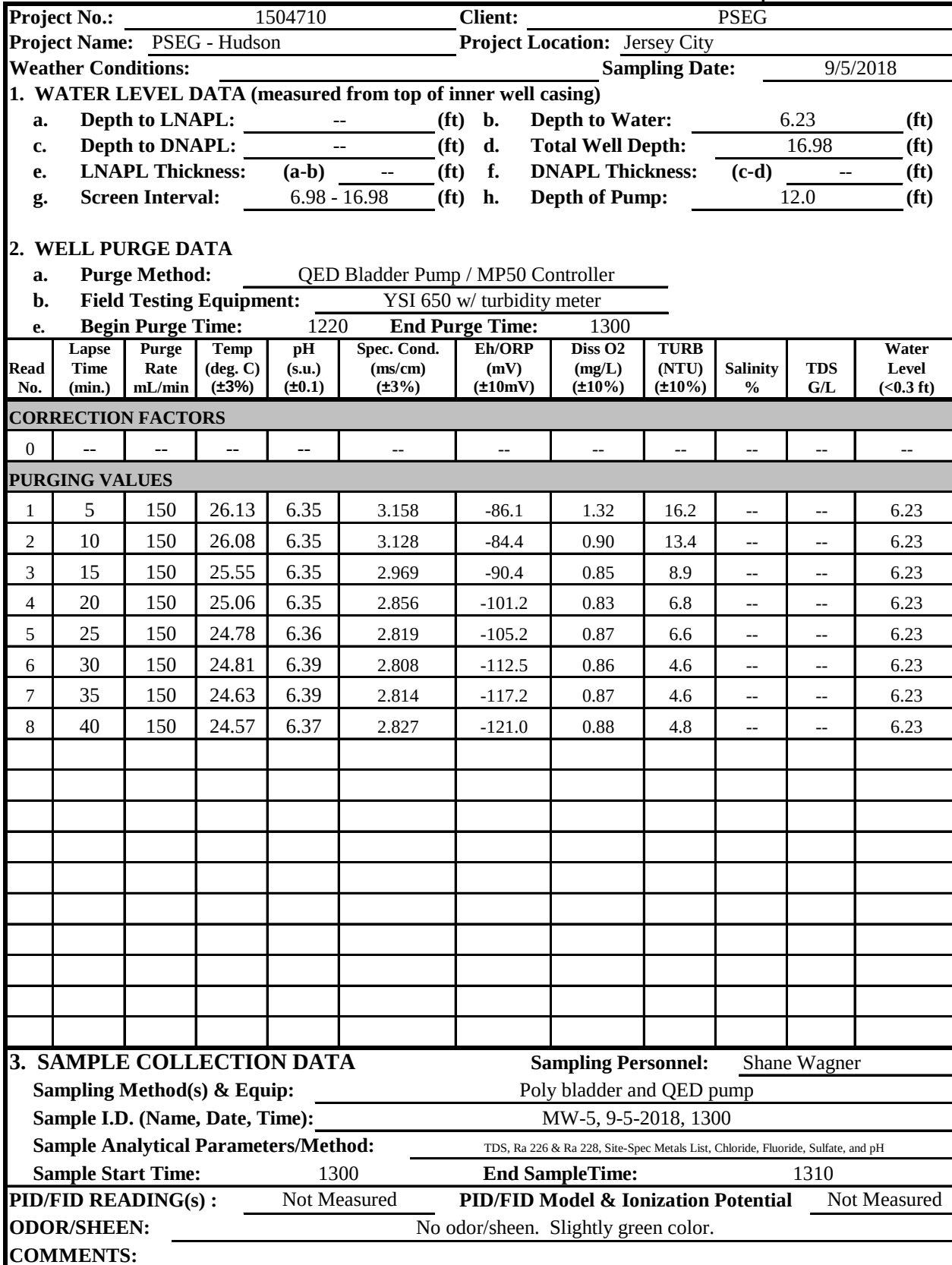
**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/6/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.15 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.03 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 13.00 - 23.00 (ft)	h. Depth of Pump: 18.0 (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: 1110	End Purge Time: 1155									
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	30.70	7.13	7.24	16.7	4.00	30.4	--	--	10.15
2	5	100	25.61	6.83	12.14	45.4	0.97	1.8	--	--	10.15
3	10	100	25.19	6.86	11.90	61.4	1.37	1.2	--	--	10.15
4	15	100	24.84	6.87	11.81	71.9	0.64	3.4	--	--	10.15
5	20	100	24.82	6.88	11.75	15.5	0.61	3.2	--	--	10.16
6	25	100	24.92	6.88	11.72	81.3	1.55	3.3	--	--	10.16
7	30	100	24.96	6.89	11.72	84.9	1.15	2.6	--	--	10.16
8	35	100	25.05	6.89	11.73	86.4	1.13	2.3	--	--	10.17
9	40	100	24.92	6.88	11.67	85.8	1.14	1.5	--	--	10.17
10	45	100	25.21	6.88	11.70	86.7	1.15	1.0	--	--	10.17
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, 9-6-2018, 1200					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1200						End Sample Time: 1210					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											





**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/5/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.00 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 17.05 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.05 - 17.05 (ft)	h. Depth of Pump: 12.1 (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: 1355	End Purge Time: 1435									
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	23.85	6.47	4.220	-57.9	1.13	34.2	--	--	4.00
2	10	150	23.81	6.41	4.212	-58.0	0.87	26.9	--	--	4.00
3	15	150	23.87	6.46	4.199	-57.9	0.79	16.4	--	--	4.00
4	20	150	23.78	6.48	4.179	-57.9	0.60	9.2	--	--	4.00
5	25	150	23.75	6.47	4.172	-57.7	0.56	7.7	--	--	4.00
6	30	150	23.71	6.48	4.161	-57.4	0.59	5.6	--	--	4.00
7	35	150	23.85	6.48	4.165	-57.3	0.57	5.2	--	--	4.00
8	40	150	23.98	6.48	4.174	-56.3	0.56	5.3	--	--	4.00
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Shane Wagner					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-6, 9-5-2018, 1440					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1440						End Sample Time: 1450					
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-7

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/5/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.50 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 11.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 2.99 - 11.99 (ft)	h. Depth of Pump: 8.0 (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: 1240	End Purge Time: 1325									
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	28.02	6.77	5.279	-95.4	2.08	159.8	--	--	4.50
2	5	100	24.97	6.81	4.911	-97.3	0.73	119.1	--	--	4.50
3	10	100	25.84	6.70	2.943	-50.6	0.37	76.5	--	--	4.50
4	15	100	26.10	6.66	2.346	-45.8	0.50	47.4	--	--	4.51
5	20	100	26.40	6.68	1.614	-39.7	0.38	17.9	--	--	4.51
6	25	100	26.51	6.72	1.286	-41.2	0.33	10.4	--	--	4.52
7	30	100	26.60	6.78	1.011	-13.7	0.31	5.8	--	--	4.53
8	35	100	26.63	6.85	0.850	-48.7	0.31	4.2	--	--	4.53
9	40	100	26.67	6.87	0.837	-51.1	0.31	2.6	--	--	4.54
10	45	100	26.69	6.90	0.829	-50.3	0.31	1.6	--	--	4.54
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-7, 9-5-2018, 1330					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1330						End Sample Time: 1340					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:											

LOW-FLOW GROUNDWATER SAMPLE COLLECTION RECORD

WELL NO.:

MW-8

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 81°F, Mostly Cloudy		Sampling Date: 8/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	--	(ft)	b.	Depth to Water:	5.76	(ft)				
c.	Depth to DNAPL:	--	(ft)	d.	Total Well Depth:	13.60	(ft)				
e.	LNAPL Thickness:	(a-b) --	(ft)	f.	DNAPL Thickness:	(c-d) --	(ft)				
g.	Screen Interval:	3.60 - 13.60	(ft)	h.	Depth of Pump:	8.6	(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	5	150	23.76	6.50	1.012	36.2	2.71	2.4	--	--	5.46
2	10	150	23.52	6.37	1.036	36.7	1.34	52.7	--	--	5.46
3	15	150	23.52	6.40	1.275	37.0	1.01	27.0	--	--	5.46
4	20	150	24.38	6.38	1.333	33.8	0.73	24.1	--	--	5.46
5	25	150	24.31	6.36	1.351	34.0	0.81	23.3	--	--	5.46
6	30	150	22.72	6.41	1.452	38.5	0.77	16.8	--	--	5.46
7	35	150	22.42	6.40	1.509	42.1	0.75	16.9	--	--	5.46
8	40	150	22.41	6.40	1.512	43.4	0.76	16.2	--	--	5.46
3. SAMPLE COLLECTION DATA				Sampling Personnel: Shane Wagner							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-8, 9-5-2018, 1130							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1135				End SampleTime: 1145							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				No odor/sheen. Clear water.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-9

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions:		Sampling Date: 9/5/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 5.58 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.94 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f.	DNAPL Thickness: (c-d) -- (ft)								
g.	Screen Interval: 6.94 - 16.94 (ft)	h.	Depth of Pump: 11.9 (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: 1035	End Purge Time: 1135									
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	28.63	6.49	9.056	-84.7	1.77	47.9	--	--	5.58
2	10	150	26.21	6.38	8.547	-96.8	0.36	59.8	--	--	5.59
3	15	150	25.91	6.38	8.140	-98.2	0.51	46.5	--	--	5.59
4	20	150	25.87	6.38	7.792	-86.9	0.14	34.8	--	--	5.59
5	25	150	25.93	6.38	7.353	-92.4	0.19	27.1	--	--	5.59
6	30	150	25.90	6.38	7.001	-87.7	0.18	19.8	--	--	5.60
7	35	150	25.91	6.38	6.426	-94.0	0.16	15.2	--	--	5.60
8	40	150	26.00	6.38	6.177	-95.2	0.16	12.7	--	--	5.60
9	45	150	26.05	6.38	5.793	-96.9	0.15	10.9	--	--	5.60
10	50	150	26.11	6.38	5.439	-91.9	0.18	9.7	--	--	5.60
11	55	150	26.14	6.37	5.386	-86.9	0.16	8.5	--	--	5.61
12	60	150	26.18	6.37	5.374	-85.4	0.16	7.1	--	--	5.61
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-9, 9-5-2018, 1140					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1140						End Sample Time: 1150					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						Little sheen. Pale yellow color					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 69°F, Partly Sunny		Sampling Date: 10/2/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 14.90 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 33.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 23.00 - 33.00 (ft)	h. Depth of Pump: 28.0 (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: 900	End Purge Time: 950									
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	16.70	6.80	15.64	46.3	0.00	64.9	--	--	14.90
2	10	200	16.31	6.80	15.52	39.7	0.65	51.7	--	--	14.90
3	15	200	16.19	6.81	15.43	34.2	0.65	49.6	--	--	14.90
4	20	200	16.41	6.82	15.46	31.7	0.54	46.4	--	--	14.90
5	25	200	16.62	6.82	15.52	28.2	0.43	31.4	--	--	14.90
6	30	200	16.77	6.83	15.55	26.3	0.59	19.3	--	--	14.90
7	35	200	16.77	6.83	15.54	22.1	0.51	9.1	--	--	14.90
8	40	200	16.85	6.83	15.56	19.0	0.48	5.0	--	--	14.90
9	45	200	16.78	6.83	15.52	16.8	0.67	2.8	--	--	14.90
10	50	200	16.79	6.83	15.48	14.4	0.53	8.1	--	--	14.90
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-1, 10-2-2018, 1005							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1005				End Sample Time:				1010			
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 74°F, Partly Cloudy		Sampling Date: 10/2/2018									
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: 34.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 25.00 - 35.00 (ft)	h. Depth of Pump: 30.0 (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: 900	End Purge Time: 950									
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	100	17.22	6.71	15.40	57.0	2.80	42.3	--	--	11.80
2	10	100	15.80	6.73	14.98	40.6	0.94	59.7	--	--	13.00
3	15	100	15.38	6.74	14.84	36.8	0.69	60.6	--	--	14.87
4	20	100	15.26	6.74	14.79	32.8	0.65	54.5	--	--	16.10
5	25	100	15.23	6.74	14.76	31.2	0.63	45.6	--	--	16.80
6	30	100	15.25	6.74	14.75	29.2	0.62	20.9	--	--	18.11
7	35	100	15.26	6.74	14.77	28.2	0.62	15.9	--	--	19.86
8	40	100	15.18	6.75	14.71	26.0	0.62	9.9	--	--	20.03
9	45	100	15.18	6.75	14.72	24.5	0.61	9.6	--	--	20.21
10	50	100	15.16	6.75	14.72	23.4	0.60	7.8	--	--	20.22
3. SAMPLE COLLECTION DATA				Sampling Personnel: Casey Kincaid							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-2, 10-2-2018, 955							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 955				End Sample Time:				1000			
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 78°F, Sunny		Sampling Date: 10/2/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 9.22 (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: 8.00 - 23.00 (ft)	h. Depth of Pump: 15.5 (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: 1050	End Purge Time: 1200									
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	100	22.41	6.80	2.102	132.7	2.47	66.8	--	--	9.36
2	10	100	21.16	6.80	1.832	129.6	1.81	69.6	--	--	9.63
3	15	100	20.93	6.80	1.805	129.7	1.85	65.9	--	--	9.82
4	20	100	20.65	6.80	1.798	130.2	2.04	41.1	--	--	10.02
5	25	100	20.94	6.80	1.827	130.4	2.16	16.4	--	--	10.19
6	30	100	21.11	6.80	1.851	130.9	2.33	49.4	--	--	10.32
7	35	100	21.15	6.81	1.874	131.7	2.50	38.3	--	--	10.48
8	40	100	21.22	6.81	1.896	132.3	2.61	29.5	--	--	10.57
9	45	100	21.32	6.81	1.916	132.7	2.75	20.8	--	--	10.74
10	50	100	21.40	6.82	1.930	132.7	2.84	16.4	--	--	10.83
11	55	100	21.25	6.83	1.930	132.8	2.87	13.2	--	--	10.90
12	60	100	21.35	6.84	1.936	1329.0	2.89	9.8	--	--	10.98
13	65	100	21.35	6.85	1.930	132.8	2.88	7.9	--	--	11.13
14	70	100	21.25	6.86	1.923	132.2	2.82	5.3	--	--	11.20
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-3, 10-2-2018, 1205					
Sample Start Time: 1205						End Sample Time: 1210					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 78°F, Sunny		Sampling Date: 10/2/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 9.05 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.03 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 13.00 - 23.00 (ft)	h. Depth of Pump: 18.0 (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:	1042	End Purge Time: 1137								
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	21.28	6.66	15.80	-40.7	0.18	382.9	--	--	9.05
2	10	200	21.47	6.67	15.44	-58.4	0.37	307.0	--	--	9.05
3	15	200	21.84	6.72	13.79	-49.1	0.40	190.3	--	--	9.05
4	20	200	22.01	6.75	13.00	-15.9	0.31	84.5	--	--	9.05
5	25	200	21.81	6.74	12.80	3.7	0.46	47.1	--	--	9.05
6	30	200	21.89	6.74	12.83	15.8	0.47	27.1	--	--	9.05
7	35	200	22.20	6.73	12.97	26.9	0.46	12.7	--	--	9.05
8	40	200	22.36	6.72	13.04	34.5	0.39	10.0	--	--	9.05
9	45	200	22.42	6.70	13.03	41.2	0.37	5.0	--	--	9.05
10	50	200	22.50	6.69	13.02	45.5	0.37	3.9	--	--	9.05
11	55	200	22.57	6.67	13.03	50.4	0.28	4.2	--	--	9.05
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, 10-2-2018, 1140					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1140						End Sample Time: 1145					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 69°F, Cloudy		Sampling Date: 10/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.79 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.98 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.98 - 16.98 (ft)	h. Depth of Pump: 12.0 (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: 1015	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	5	120	20.59	6.35	5.255	-53.0	1.66	22.0	--	--	4.88
2	10	120	20.60	6.38	5.398	-83.6	0.67	24.5	--	--	4.90
3	15	120	20.81	6.40	5.133	-91.8	0.59	21.0	--	--	4.93
4	20	120	21.01	6.41	4.947	-89.7	0.58	15.6	--	--	4.94
5	25	120	20.99	6.42	4.844	-88.4	0.57	13.4	--	--	4.94
6	30	120	21.16	6.42	4.630	-88.6	0.59	10.5	--	--	4.95
7	35	120	21.18	6.42	4.526	-88.3	0.61	9.0	--	--	4.95
8	40	120	21.38	6.42	4.491	-85.3	0.61	7.8	--	--	4.95
9	45	120	21.65	6.42	4.516	-84.3	0.63	7.4	--	--	4.95
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, 10-1-2018, 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: 1115					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						Possible organic sheen, pale brown color.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 68°F, Cloudy		Sampling Date: 10/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 2.72 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 17.05 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.05 - 17.05 (ft)	h. Depth of Pump: 12.1 (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: 1023	End Purge Time: 1128									
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	19.83	6.52	4.815	-26.5	2.72	108.9	--	--	2.72
2	10	200	19.09	6.52	4.732	-49.2	1.84	127.9	--	--	2.85
3	15	200	19.06	6.55	3.953	-55.6	2.03	165.2	--	--	2.85
4	20	200	19.20	6.56	3.337	-58.2	2.44	160.7	--	--	2.85
5	25	200	19.65	6.56	2.941	-54.9	2.74	214.7	--	--	2.85
6	30	200	19.85	6.55	2.841	-56.1	2.85	228.9	--	--	2.85
7	35	200	20.31	6.55	2.772	-58.4	3.14	47.1	--	--	2.85
8	40	200	20.85	6.55	2.800	-60.8	3.23	36.7	--	--	2.85
9	45	200	21.10	6.56	2.837	-63.1	3.37	23.2	--	--	2.85
10	50	200	20.91	6.55	2.766	-64.0	3.30	37.3	--	--	2.85
11	55	200	21.22	6.55	2.774	-64.7	3.35	9.7	--	--	2.85
12	60	200	21.60	6.55	2.881	-65.8	3.42	8.8	--	--	2.85
13	65	200	21.75	6.54	2.894	-67.0	3.42	8.7	--	--	2.85
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-6, 10-1-2018, 1130					
Sample Start Time: 1130						End Sample Time: 1135					
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-7

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 75°F, Cloudy		Sampling Date: 10/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 3.60 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 11.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 2.99 - 11.99 (ft)	h. Depth of Pump: 8.0 (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: 1346	End Purge Time: 1440									
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	21.71	6.81	3.871	-72.1	1.95	133.2	--	--	3.60
2	10	200	21.45	6.88	3.129	-82.4	2.46	120.3	--	--	3.60
3	15	200	21.19	6.95	1.366	-75.6	3.40	95.7	--	--	3.60
4	20	200	20.97	7.01	0.656	-73.5	2.03	35.5	--	--	3.60
5	25	200	20.99	7.05	0.398	-81.6	1.30	16.1	--	--	3.60
6	30	200	21.03	7.06	0.352	-83.1	1.01	11.5	--	--	3.60
7	35	200	21.16	7.06	0.341	-84.9	0.85	8.7	--	--	3.60
8	40	200	21.49	7.06	0.342	-86.9	0.75	7.1	--	--	3.60
9	45	200	21.71	7.06	0.337	-76.8	0.72	5.0	--	--	3.60
10	50	200	22.01	7.06	0.338	-75.9	0.67	4.8	--	--	3.60
11	55	200	22.04	7.08	0.337	-76.6	0.65	4.7	--	--	3.60
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-7, 10-1-2018, 1440					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1440						End Sample Time: 1445					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-8

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 75°F, Cloudy		Sampling Date: 10/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	-- (ft)	b. Depth to Water:	3.50 (ft)								
c. Depth to DNAPL:	-- (ft)	d. Total Well Depth:	13.60 (ft)								
e. LNAPL Thickness: (a-b)	-- (ft)	f. DNAPL Thickness: (c-d)	-- (ft)								
g. Screen Interval:	3.60 - 13.60 (ft)	h. Depth of Pump:	8.6 (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:	1345	End Purge Time:	1445								
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	20.70	6.50	0.759	-1.7	1.88	414.7	--	--	3.51
2	10	200	20.09	6.38	0.818	16.5	0.49	242.1	--	--	3.52
3	15	200	20.01	6.38	0.891	22.2	0.45	164.1	--	--	3.54
4	20	200	19.87	6.37	0.961	26.6	0.42	80.8	--	--	3.56
5	25	200	19.86	6.38	1.023	30.8	0.41	52.8	--	--	3.56
6	30	200	19.87	6.38	1.090	34.4	0.40	30.4	--	--	3.56
7	35	200	19.97	6.38	1.146	37.1	0.39	21.0	--	--	3.56
8	40	200	20.04	6.38	1.206	40.8	0.39	15.2	--	--	3.56
9	45	200	20.07	6.38	1.233	42.8	0.39	13.7	--	--	3.56
10	50	200	20.16	6.38	1.267	45.7	0.39	9.9	--	--	3.56
11	55	200	20.14	6.38	1.296	48.6	0.39	9.2	--	--	3.56
12	60	200	20.10	6.38	1.297	50.1	0.39	7.6	--	--	3.56
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel:					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-8, 10-1-2018, 1450					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1450						End Sample Time: 1455					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-9

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City									
Weather Conditions: 71°F, Cloudy		Sampling Date: 10/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.26 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.94 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.94 - 16.94 (ft)	h. Depth of Pump: 11.9 (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: 1200	End Purge Time: 1305									
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	25.22	6.29	5.418	-83.0	2.55	16.9	--	--	4.26
2	10	200	22.73	6.14	8.182	-149.1	0.81	18.1	--	--	4.37
3	15	200	22.04	6.19	7.805	-216.1	0.80	15.2	--	--	4.46
4	20	200	22.03	6.22	6.645	-217.9	0.61	21.5	--	--	4.46
5	25	200	22.26	6.24	5.577	-212.6	0.64	35.3	--	--	4.46
6	30	200	22.45	6.26	5.183	-210.4	0.70	41.3	--	--	4.46
7	35	200	22.93	6.27	5.030	-206.8	0.72	40.2	--	--	4.46
8	40	200	23.34	6.31	4.881	-215.0	0.77	38.1	--	--	4.46
9	45	200	23.50	6.31	4.800	-214.9	0.77	40.2	--	--	4.46
10	50	200	23.55	6.33	4.353	-217.5	0.72	37.3	--	--	4.52
11	55	200	21.87	6.36	3.510	-214.1	0.67	25.2	--	--	4.57
12	60	200	21.75	6.38	3.508	-211.8	0.67	22.8	--	--	4.60
13	65	200	21.57	6.40	3.452	-208.1	0.65	22.7	--	--	4.62
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-9, 10-1-2018, 1310					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1310						End Sample Time: 1315					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						Possible organic sheen, pale brown color.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-1

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 58°F, Partly Sunny		Sampling Date: 11/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 15.15 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 33.00 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 23.00 - 33.00 (ft)	h. Depth of Pump: 28.0 (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: 857	End Purge Time: 945									
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	14.64	7.32	0.022	241.3	10.09	23.3	--	--	15.15
2	10	200	14.50	7.16	13.430	73.7	1.77	61.5	--	--	16.00
3	15	200	14.48	7.16	13.490	69.4	1.32	31.6	--	--	17.50
4	20	200	14.48	7.16	13.560	65.2	1.25	17.9	--	--	18.25
5	25	200	14.55	7.16	13.620	61.8	1.19	13.4	--	--	18.70
6	30	200	14.69	7.15	13.680	58.8	1.15	11.1	--	--	18.70
7	35	200	14.76	7.15	13.670	55.7	1.13	9.9	--	--	18.70
8	40	200	14.75	7.15	13.670	51.5	1.11	9.2	--	--	18.70
9	45	200	14.69	7.14	13.630	48.6	1.10	8.4	--	--	18.70
3. SAMPLE COLLECTION DATA				Sampling Personnel: Anthony Shields							
Sampling Method(s) & Equip:				Poly bladder and QED pump							
Sample I.D. (Name, Date, Time):				MW-1, 11-1-2018, 945							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 945				End Sample Time: 955							
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 58°F, Partly Cloudy		Sampling Date: 11/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 11.70 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 34.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 25.00 - 35.00 (ft)	h. Depth of Pump: 30.0 (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: 930	End Purge Time: 1030									
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	100	15.58	6.93	14.060	-3.3	1.80	233.4	--	--	12.26
2	10	100	15.45	6.93	14.000	-10.6	1.21	234.6	--	--	13.02
3	15	100	15.34	6.94	13.950	-19.7	0.88	188.7	--	--	13.63
4	20	100	15.08	6.97	13.870	-28.3	0.70	137.6	--	--	14.01
5	25	100	15.04	6.98	13.890	-32.9	0.66	102.7	--	--	14.32
6	30	100	15.03	7.00	13.850	-36.0	0.63	93.4	--	--	14.61
7	35	100	15.06	7.01	13.900	-39.1	0.63	80.7	--	--	14.94
8	40	100	15.15	7.02	13.880	-40.8	0.65	65.5	--	--	15.23
9	45	100	15.47	7.03	14.070	-45.4	0.62	23.7	--	--	15.72
10	50	100	15.52	7.04	14.060	-47.6	0.60	16.2	--	--	16.39
11	55	100	51.53	7.04	14.050	-48.4	0.61	15.2	--	--	16.52
12	60	100	15.54	7.03	14.050	-48.4	0.61	14.8	--	--	16.63
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Casey Kincaid					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-2, 11-1-2018, 1035					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1035						End Sample Time: 1045					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-3

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 65°F, Partly Cloudy		Sampling Date: 11/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 9.25 (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: 8.00 - 23.00 (ft)	h. Depth of Pump: 15.5 (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: 1110	End Purge Time: 1200									
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	19.09	7.02	2.632	117.3	3.07	668.4	--	--	9.37
2	10	150	18.58	6.84	2.187	92.5	1.42	98.2	--	--	9.78
3	15	150	18.68	6.87	2.127	79.1	1.04	74.2	--	--	10.03
4	20	150	18.75	6.87	2.116	78.1	0.93	48.7	--	--	10.34
5	25	150	18.96	6.88	2.100	76.4	0.80	15.1	--	--	10.55
6	30	150	19.01	6.88	2.082	75.2	0.80	14.9	--	--	10.62
7	35	150	19.00	6.90	2.056	67.0	0.69	14.7	--	--	10.81
8	40	150	18.92	6.93	2.048	64.2	0.63	14.3	--	--	10.92
9	45	150	19.03	6.96	2.047	64.0	0.60	13.9	--	--	10.95
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, 11-1-2018, 1200							
Sample Analytical Parameters/Method:				TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH							
Sample Start Time: 1200				End Sample Time:				1210			
PID/FID READING(s) : Not Measured				PID/FID Model & Ionization Potential				Not Measured			
ODOR/SHEEN:				None, sample water clear.							
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-4

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 62°F, Partly Cloudy		Sampling Date: 11/1/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 10.16 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 23.03 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 13.00 - 23.00 (ft)	h. Depth of Pump: 18.0 (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: 1027	End Purge Time: 1137									
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	14.72	7.15	0.108	47.1	2.42	8.4	--	--	10.16
2	10	200	20.17	7.08	11.760	4.4	2.20	59.8	--	--	10.16
3	15	200	20.66	7.02	11.970	-4.5	1.74	29.0	--	--	10.16
4	20	200	20.46	6.87	11.870	-10.6	1.86	74.3	--	--	10.16
5	25	200	19.81	6.88	11.200	1.2	1.34	54.7	--	--	10.16
6	30	200	19.48	6.94	10.900	20.2	1.26	58.5	--	--	10.16
7	35	200	19.24	6.96	9.684	35.8	1.23	32.8	--	--	10.16
8	40	200	19.22	6.95	9.632	49.0	1.14	21.0	--	--	10.16
9	45	200	19.27	6.88	9.770	60.3	1.05	16.2	--	--	10.16
10	50	200	19.26	6.85	9.978	69.4	1.01	13.8	--	--	10.16
11	55	200	19.47	6.82	10.170	77.8	0.98	11.2	--	--	10.16
12	60	200	19.61	6.79	10.460	86.9	0.95	8.3	--	--	10.16
13	65	200	20.01	6.76	10.730	92.4	0.93	8.5	--	--	10.16
14	70	200	20.05	6.72	10.890	96.9	0.95	6.5	--	--	10.16
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, 11-1-2018, 1140					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1140						End Sample Time: 1150					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						None, sample water clear.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-5

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 52°F, Partly Sunny		Sampling Date: 10/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 5.21 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.98 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.98 - 16.98 (ft)	h. Depth of Pump: 12.0 (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: 1005	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	5	150	16.54	6.39	2.246	-49.5	2.05	31.0	--	--	5.32
2	10	150	17.53	6.39	2.527	-94.7	0.53	28.7	--	--	5.41
3	15	150	17.44	6.38	2.429	-106.3	0.41	23.8	--	--	5.41
4	20	150	17.44	6.38	2.360	-109.6	0.40	25.2	--	--	5.42
5	25	150	17.51	6.37	2.310	-114.7	0.34	26.7	--	--	5.42
6	30	150	17.60	6.36	2.288	-118.0	0.32	27.1	--	--	5.43
7	35	150	17.64	6.35	2.285	-123.4	0.29	27.2	--	--	5.46
8	40	150	17.67	6.33	2.278	-126.0	0.28	27.1	--	--	5.46
9	45	150	17.64	6.33	2.279	-127.1	0.28	27.0	--	--	5.46
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, 10-31-2018, 1050					
Sample Start Time: 1050						End Sample Time: 1100					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						Pale brown to greenish color.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-6

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 64°F, Partly Cloudy		Sampling Date: 10/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 2.65 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 17.05 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 7.05 - 17.05 (ft)	h. Depth of Pump: 12.1 (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: 1320	End Purge Time: 1415									
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	17.06	4.67	1.735	-36.6	3.30	131.9	--	--	2.65
2	10	200	16.89	4.62	1.582	-36.3	2.49	128.9	--	--	2.71
3	15	200	16.89	5.03	1.404	-42.4	1.80	96.9	--	--	2.84
4	20	200	16.57	4.89	1.354	-41.6	1.65	83.7	--	--	2.98
5	25	200	16.47	4.88	1.304	-40.6	1.52	75.8	--	--	3.03
6	30	200	16.45	4.88	1.298	-39.8	1.44	70.0	--	--	3.03
7	35	200	16.43	4.82	1.309	-39.6	1.31	57.8	--	--	3.03
8	40	200	16.41	4.77	1.327	-39.8	1.24	48.5	--	--	3.03
9	45	200	16.41	5.25	1.349	-43.1	1.14	41.2	--	--	3.03
10	50	200	16.39	5.58	1.355	-42.6	1.18	37.2	--	--	3.03
11	55	200	16.33	5.58	1.370	-43.2	1.16	35.5	--	--	3.03
12	60	200	16.28	5.64	1.381	-44.3	1.15	34.8	--	--	3.03
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-6, 10-31-2018, 1420					
Sample Start Time: 1420						End Sample Time: 1430					
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-7

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 62°F, Partly Cloudy		Sampling Date: 10/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 3.65 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 11.99 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 2.99 - 11.99 (ft)	h. Depth of Pump: 8.0 (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: 1142	End Purge Time: 1250									
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	18.63	4.69	1.256	27.0	3.68	29.9	--	--	3.65
2	10	200	17.71	5.23	0.954	-17.7	1.87	324.2	--	--	3.65
3	15	200	19.25	5.06	0.980	-15.9	1.26	269.0	--	--	3.65
4	20	200	18.22	5.01	0.934	-12.9	1.39	286.0	--	--	3.65
5	25	200	17.02	4.95	0.762	-7.1	1.02	177.8	--	--	3.65
6	30	200	16.93	4.93	0.693	-3.7	0.93	132.5	--	--	3.65
7	35	200	17.03	4.93	0.666	-3.7	0.89	117.8	--	--	3.65
8	40	200	17.20	4.91	0.646	-1.9	0.85	103.7	--	--	3.65
9	45	200	17.09	4.96	0.525	-6.4	0.76	52.4	--	--	3.65
10	50	200	16.94	4.95	0.394	-8.4	0.68	34.8	--	--	3.65
11	55	200	16.96	4.94	0.347	-7.8	0.65	30.1	--	--	3.65
12	60	200	17.05	4.92	0.340	-8.2	0.65	30.7	--	--	3.65
13	65	200	16.97	4.92	0.334	-8.2	0.65	29.3	--	--	3.65
14	70	200	16.95	4.92	0.332	-7.5	0.64	27.8	--	--	3.65
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel: Anthony Shields					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-7, 10-31-2018, 1255					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1255						End Sample Time: 1305					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						No odor/sheen. Clear water.					
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-8

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 61°F, Partly Cloudy		Sampling Date: 10/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL:	-- (ft)	b. Depth to Water:	4.13 (ft)								
c. Depth to DNAPL:	-- (ft)	d. Total Well Depth:	13.60 (ft)								
e. LNAPL Thickness: (a-b)	-- (ft)	f. DNAPL Thickness: (c-d)	-- (ft)								
g. Screen Interval:	3.60 - 13.60 (ft)	h. Depth of Pump:	8.6 (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:	1140	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	5	100	18.12	6.72	0.872	41.7	5.12	287.1	--	--	4.11
2	10	101	17.58	6.54	0.381	93.2	4.93	153.1	--	--	4.12
3	15	102	17.49	6.52	0.474	115.4	4.88	145.6	--	--	4.14
4	20	103	17.47	6.52	0.532	123.0	4.82	110.9	--	--	4.16
5	25	104	17.48	6.51	0.603	127.1	4.78	72.1	--	--	4.17
6	30	105	17.54	6.51	0.673	128.7	4.63	56.1	--	--	4.17
7	35	106	17.77	6.51	0.713	130.5	4.73	32.6	--	--	4.19
8	40	107	17.86	6.51	0.760	130.8	4.61	8.6	--	--	4.19
9	45	108	17.88	6.51	0.761	130.4	4.65	7.9	--	--	4.19
10	50	109	17.80	6.50	0.762	130.0	4.52	7.2	--	--	4.19
3. SAMPLE COLLECTION DATA											
Sampling Method(s) & Equip:						Sampling Personnel:					
Poly bladder and QED pump											
Sample I.D. (Name, Date, Time):						MW-8, 10-31-2018, 1235					
Sample Analytical Parameters/Method:						TDS, Ra 226 & Ra 228, Site-Spec Metals List, Chloride, Fluoride, Sulfate, and pH					
Sample Start Time: 1235						End Sample Time: 1245					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN: No odor/sheen. Clear water.											
COMMENTS:											



**LOW-FLOW
GROUNDWATER SAMPLE
COLLECTION RECORD**

WELL NO.:

MW-9

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG - Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 51°F, Cloudy		Sampling Date: 10/31/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a.	Depth to LNAPL:	-- (ft)	b. Depth to Water: 4.62 (ft)								
c.	Depth to DNAPL:	-- (ft)	d. Total Well Depth: 16.94 (ft)								
e.	LNAPL Thickness: (a-b) -- (ft)	f. DNAPL Thickness: (c-d) -- (ft)									
g.	Screen Interval: 6.94 - 16.94 (ft)	h. Depth of Pump: 11.9 (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: 1012	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	5	200	17.28	6.16	1.780	1.9	2.54	21.7	--	--	4.62
2	10	200	17.52	5.97	1.799	-8.0	2.54	25.9	--	--	4.68
3	15	200	17.55	5.83	1.704	-7.3	2.89	30.0	--	--	4.75
4	20	200	17.75	5.73	1.607	-5.2	3.05	31.2	--	--	4.80
5	25	200	17.70	5.61	1.496	0.4	3.27	31.5	--	--	4.80
6	30	200	17.65	5.47	1.381	8.9	3.39	31.2	--	--	4.80
7	35	200	18.24	5.38	1.347	13.0	3.41	31.8	--	--	4.80
8	40	200	18.53	5.27	1.320	18.8	3.46	31.1	--	--	4.80
9	45	200	18.58	5.18	1.281	23.6	3.58	30.0	--	--	4.80
10	50	200	18.67	5.17	1.280	25.1	3.62	29.7	--	--	4.80
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-9, 10-31-2018, 1105					
Sample Start Time: 1105						End Sample Time: 1115					
PID/FID READING(s) : Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:						Possible organic sheen, pale brown color.					
COMMENTS:											



**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:	MW-1
PERMIT NO.:	

Project No.: 1504710	Client: PSEG
Project Name: PSEG Hudson	Project Location: Jersey City, NJ
Weather Conditions: 54F, sunny	Sampling Date: 12/3/2018

- 1. WATER LEVEL DATA (measured from top of inner well casing)**
- | | |
|---------------------------------------|------------------------------------|
| a. Depth to LNAPL: --- (ft) | b. Depth to Water: 14.10 (ft) |
| c. Depth to DNAPL: --- (ft) | d. Total Well Depth: 33.00 (ft) |
| e. LNAPL Thickness: (a-b) --- (ft) | f. DNAPL Thickness: (c-d) --- (ft) |
| g. Length of Water Column: 18.90 (ft) | (a-d) |
| h. Well Volume: 3.08 (gal) | |

- 2. WELL PURGE DATA**
- | | |
|---|-----------------|
| a. Purge Method: Low Flow | |
| b. Field Testing Equipment: YSI 6920, peri pump | |
| e. Begin Purge Time: 10:14 | 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	1020	200	13.86	6.78	16.30	-35.6	0.54	67.3	---	---	14.10
2	1025	200	13.77	6.79	16.27	-29.4	1.09	67.5	---	---	14.10
3	1030	200	13.76	6.80	16.25	-28.2	0.72	47.5	---	---	14.10
4	1035	200	13.72	6.82	16.23	-31.9	1.31	27.8	---	---	14.10
5	1040	200	13.78	6.83	16.26	-34.3	0.41	27.8	---	---	14.10
6	1045	200	13.69	6.83	16.23	-35.5	0.45	16.1	---	---	14.10
7	1050	200	13.72	6.84	16.24	-36.1	0.38	13.7	---	---	14.10
8	1055	200	13.74	6.84	16.26	-36.5	0.47	12.0	---	---	14.10
9	1100	200	13.80	6.84	16.28	-36.6	0.46	11.0	---	---	14.10
10	1105	200	13.76	6.84	16.28	-36.7	0.45	10.6	---	---	14.10
11	1110	200	13.85	6.84	16.31	-36.7	0.40	10.0	---	---	14.10

- 3. SAMPLE COLLECTION DATA**
- | | |
|---|-------------------------------|
| Sampling Method(s) & Equip: Low flow- QED bladder pump, poly bladder, MP50 | Sampling Personnel: AS |
| Sample I.D. (Name, Date, Time): MW-1; 2018-12-03; 11:15 | |
| Sample Analytical Parameters/Method: TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH | |
| Sample Start Time: 11:15 | 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-2

PERMIT NO.:

Project No.: 1504710		Client: PSEG													
Project Name: PSEG Hudson		Project Location: Jersey City, NJ													
Weather Conditions: 53F, partly cloudy		Sampling Date: 12/3/2018													
1. WATER LEVEL DATA (measured from top of inner well casing)															
a.	Depth to LNAPL:	---	(ft)	b.	Depth to Water:	11.69	(ft)								
c.	Depth to DNAPL:	----	(ft)	d.	Total Well Depth:	34.99	(ft)								
e.	LNAPL Thickness:	(a-b) ---	(ft)	f.	DNAPL Thickness:	(c-d) ---	(ft)								
g.	Length of Water Column:	23.30	(ft)	(a-d)											
h.	Well Volume:	3.80	(gal)												
2. WELL PURGE DATA															
a.	Purge Method:	Low Flow													
b.	Field Testing Equipment:	YSI 6920, peri pump													
e.	Begin Purge Time:	12:05	End Purge Time: 13:05												
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	14.78	6.87	16.07	93.4	0.72	16.0	---	---	13.58				
2	10	150	14.8	6.93	16.15	67.6	0.56	14.1	---	---	14.68				
3	15	150	14.87	6.97	16.19	57.6	0.56	12.7	---	---	15.45				
4	20	150	14.76	6.97	16.16	56.7	0.64	8.8	---	---	15.91				
5	25	150	14.69	6.96	16.13	59.3	0.60	6.9	---	---	16.03				
6	30	150	14.62	6.96	16.11	61.4	0.61	6.2	---	---	16.21				
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):				MW-2; 2018-12-03; 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 SampleTime:				13:05			
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-3
PERMIT NO.:	

Project No.: 1504710	Client: PSEG
Project Name: PSEG Hudson	Project Location: Jersey City, NJ
Weather Conditions: 55F, clear	Sampling Date: 12/3/2018

- 1. WATER LEVEL DATA (measured from top of inner well casing)**
- | | |
|---------------------------------------|------------------------------------|
| a. Depth to LNAPL: --- (ft) | b. Depth to Water: 8.17 (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. Length of Water Column: 14.83 (ft) | (a-d) |
| h. Well Volume: 2.42 (gal) | |

- 2. WELL PURGE DATA**
- | | |
|---|-----------------------|
| a. Purge Method: Low Flow | |
| b. Field Testing Equipment: YSI 6920, peri pump | |
| e. Begin Purge Time: 10:20 | End Purge Time: 11:32 |

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

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PURGING VALUES

1	5	150	21.63	7.06	0.372	161.1	8.51	91.9	---	---	8.60
2	10	150	14.97	7.24	0.490	184.9	8.49	101.4	---	---	8.90
3	15	150	14.83	7.20	0.472	178.3	8.43	123.1	---	---	8.96
4	20	150	14.49	7.12	0.490	173.6	8.16	122.8	---	---	9.18
5	25	150	14.39	7.08	0.515	171.6	7.96	87.4	---	---	9.32
6	30	150	14.32	7.04	0.562	169.4	7.36	51.5	---	---	9.50
7	35	150	14.32	7.03	0.593	167.7	6.88	33.7	---	---	9.70
8	40	150	14.43	7.03	0.608	167.2	6.58	26.3	---	---	9.71
9	45	150	14.50	7.03	0.619	166.2	6.26	18.4	---	---	9.82
10	50	150	14.61	7.03	0.628	166.0	6.01	12.6	---	---	9.85
11	55	150	14.73	7.02	0.638	166.2	5.91	9.3	---	---	9.91

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):	MW-3; 2018-12-03; 11:20
Sample Analytical Parameters/Method:	TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH
Sample Start Time: 11:20	End Sample Time: 11:32

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 Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 54F, mostly sunny		Sampling Date: 12/3/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 8.06 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 23.03 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 14.97 (ft)		(a-d)									
h. Well Volume: 2.44 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, peri pump											
e. Begin Purge Time: 11:48		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	1155	200	14.18	6.77	14.27	-76.1	0.94	260.0	---	---	8.06
2	1200	200	14.14	6.79	13.52	-75.9	0.95	223.4	---	---	8.06
3	1205	200	14.05	6.83	11.69	-65.5	1.59	178.0	---	---	8.06
4	1210	200	13.88	6.89	9.172	-51.8	2.25	130.8	---	---	8.06
5	1215	200	13.69	6.92	8.069	-44.3	3.39	69.1	---	---	8.06
6	1220	200	13.54	6.92	7.765	-40.3	4.46	36.6	---	---	8.06
7	1225	200	13.03	6.92	7.651	-37.3	4.54	25.8	---	---	8.06
8	1230	200	12.87	6.88	7.123	-39.5	4.51	22.1	---	---	8.06
9	1235	200	12.80	6.85	8.673	-43.6	4.58	19.9	---	---	8.06
10	1240	200	12.81	6.85	8.972	-46.0	4.53	19.0	---	---	8.06
11	1245	200	12.87	6.85	9.070	-46.8	4.55	16.7	---	---	8.06
12	1250	200	12.86	6.85	9.025	-46.1	4.55	14.4	---	---	8.06
13	1255	200	12.87	6.85	8.951	-45.0	4.53	13.2	---	---	8.06
14	1300	200	12.77	6.85	8.834	-43.4	4.61	13.1	---	---	8.06
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; 2018-12-03; 13:05					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 13:05						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 Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 38F, partly cloudy		Sampling Date: 12/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 4.40 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 15.00 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 10.60 (ft)		(a-d)									
h. Well Volume: 1.73 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, peri pump											
e. Begin Purge Time: 9:05		End Purge Time: 10:20									
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	250	11.48	7.07	0.014	127.9	10.33	6.5	---	---	4.50
2	10	250	11.68	6.48	2.022	-98.7	0.70	7.5	---	---	4.60
3	15	250	11.71	6.49	1.972	-99.0	0.81	7.6	---	---	4.55
4	20	250	11.77	6.49	1.930	-99.0	0.66	6.7	---	---	4.61
5	25	250	11.72	6.49	1.879	-98.8	0.65	5.4	---	---	4.59
6	30	250	12.08	6.50	1.854	-98.8	0.60	5.4	---	---	4.63
7	35	250	12.19	6.50	1.838	-98.9	0.60	5.1	---	---	4.60
8	40	250	12.02	6.50	1.804	-99.6	0.66	7.5	---	---	4.55
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-5; 2018-12-04; 9:55											
Sample Analytical Parameters/Method: TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH											
Sample Start Time: 9:55						End Sample Time: 10:20					
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 Hudson	Project Location: Jersey City, NJ
Weather Conditions: 40F, partly cloudy	Sampling Date: 12/4/2018

- 1. WATER LEVEL DATA (measured from top of inner well casing)**
- | | |
|---------------------------------------|------------------------------------|
| a. Depth to LNAPL: --- (ft) | b. Depth to Water: 2.88 (ft) |
| c. Depth to DNAPL: --- (ft) | d. Total Well Depth: 15 (ft) |
| e. LNAPL Thickness: (a-b) --- (ft) | f. DNAPL Thickness: (c-d) --- (ft) |
| g. Length of Water Column: 12.12 (ft) | (a-d) |
| h. Well Volume: 1.98 (gal) | |

- 2. WELL PURGE DATA**
- | | |
|---|-----------------|
| a. Purge Method: Low Flow | |
| b. Field Testing Equipment: YSI 6920, peri pump | |
| e. Begin Purge Time: 9:10 | 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	915	200	8.86	7.03	1.221	16.9	3.73	211.8	---	---	2.88
2	920	200	9.16	6.94	1.225	16.0	3.04	216.3	---	---	2.88
3	925	200	9.04	6.86	1.242	13.6	3.29	193.2	---	---	2.88
4	930	200	9.18	6.83	1.268	11.8	3.77	164.1	---	---	2.88
5	935	200	9.53	6.91	1.298	10.2	4.01	145.1	---	---	2.88
6	940	200	9.70	6.96	1.315	83.0	4.65	105.7	---	---	2.88
7	945	200	9.15	6.87	1.301	7.7	5.30	89.5	---	---	2.88
8	950	200	9.09	6.92	1.294	7.0	5.97	73.6	---	---	2.88
9	955	200	9.63	6.89	1.314	6.4	6.41	61.8	---	---	2.88
10	1000	200	10.14	6.88	1.328	5.5	7.07	57.4	---	---	2.88
11	1005	200	10.15	6.95	1.331	4.4	7.60	49.5	---	---	2.88
12	1010	200	9.52	6.86	1.308	4.3	7.78	47.7	---	---	2.88
13	1015	200	9.41	6.85	1.298	3.9	8.04	47.3	---	---	2.88
14	1020	200	9.68	6.81	1.269	3.5	8.25	40.8	---	---	2.88
15	1025	200	9.79	6.83	1.271	2.9	8.26	38.3	---	---	2.88
16	1030	200	9.96	6.84	1.274	2.0	8.23	37.1	---	---	2.88

- 3. SAMPLE COLLECTION DATA**
- | | |
|---|-------------------------------|
| Sampling Method(s) & Equip: Low flow- QED bladder pump, poly bladder, MP50 | Sampling Personnel: AS |
| Sample I.D. (Name, Date, Time): MW-6; 2018-12-04; 10:35 | |
| Sample Analytical Parameters/Method: TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH | |
| Sample Start Time: 10:35 | 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-7

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 40F, clear		Sampling Date: 12/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 3.40 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 10.00 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 6.60 (ft)		(a-d)									
h. Well Volume: 1.08 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, peri pump											
e. Begin Purge Time: 12:49		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	1255	200	10.18	6.74	0.687	54.1	1.18	180.9	---	---	3.40
2	1300	200	10.16	6.75	0.657	25.1	0.69	93.9	---	---	3.40
3	1305	200	10.15	6.79	0.569	-9.1	0.58	68.8	---	---	3.40
4	1310	200	10.09	6.86	0.447	-26.9	0.56	72.4	---	---	3.40
5	1315	200	10.17	6.92	0.358	-39.2	0.45	61.7	---	---	3.40
6	1320	200	10.12	6.96	0.286	-47.5	0.42	43.5	---	---	3.40
7	1325	200	10.21	7.01	0.245	-52.8	0.39	31.8	---	---	3.40
8	1330	200	10.08	7.03	0.215	-52.2	0.35	21.5	---	---	3.40
9	1335	200	10.04	7.06	0.194	-54.0	0.29	16.6	---	---	3.40
10	1340	200	10.03	7.09	0.174	-56.9	0.26	10.0	---	---	3.40
11	1345	200	10.05	7.12	0.171	-59.3	0.30	8.8	---	---	3.40
12	1350	200	9.95	7.12	0.169	-60.3	0.28	8.4	---	---	3.40
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-7; 2018-12-04; 13:55					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 13:55						End Sample Time:					
PID/FID READING(s): Not Measured						PID/FID Model & Ionization Potential Not Measured					
ODOR/SHEEN:											
COMMENTS:											



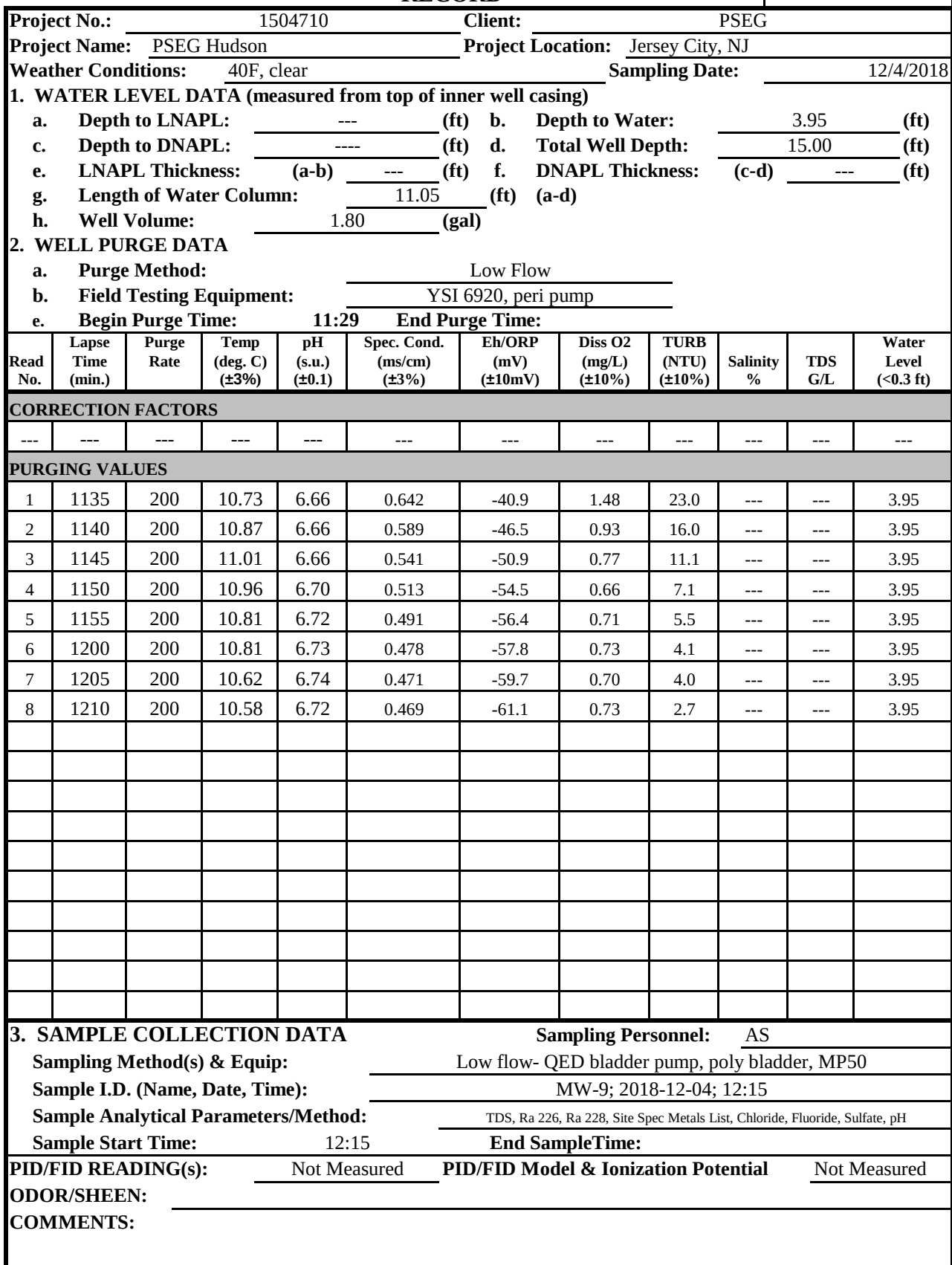
**LOW-FLOW GROUNDWATER
SAMPLE COLLECTION
RECORD**

WELL NO.:

MW-8

PERMIT NO.:

Project No.: 1504710		Client: PSEG									
Project Name: PSEG Hudson		Project Location: Jersey City, NJ									
Weather Conditions: 40F, partly cloudy		Sampling Date: 12/4/2018									
1. WATER LEVEL DATA (measured from top of inner well casing)											
a. Depth to LNAPL: --- (ft)		b. Depth to Water: 3.05 (ft)									
c. Depth to DNAPL: --- (ft)		d. Total Well Depth: 11.00 (ft)									
e. LNAPL Thickness: (a-b) --- (ft)		f. DNAPL Thickness: (c-d) --- (ft)									
g. Length of Water Column: 7.95 (ft)		(a-d)									
h. Well Volume: 1.30 (gal)											
2. WELL PURGE DATA											
a. Purge Method: Low Flow											
b. Field Testing Equipment: YSI 6920, peri pump											
e. Begin Purge Time: 11:25		End Purge Time: 12:50									
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	250	14.14	6.56	2.191	71.8	7.72	1726	---	---	3.10
2	10	250	14.45	6.60	1.787	70.3	5.73	369	---	---	3.10
3	15	250	14.4	6.60	1.705	70.2	5.70	369	---	---	3.10
4	20	250	14.68	6.62	1.174	69.4	5.79	130.9	---	---	3.10
5	25	250	14.69	6.58	1.130	71.4	5.72	70.1	---	---	3.10
6	30	250	14.52	6.54	1.117	73.0	5.70	47.4	---	---	3.10
7	35	250	14.40	6.51	1.106	74.8	5.62	37.1	---	---	3.10
8	40	250	14.26	6.49	1.089	76.3	5.61	30.5	---	---	3.10
9	45	250	14.71	6.50	1.095	77.4	5.44	20.6	---	---	3.10
10	50	250	14.67	6.49	1.088	78.3	5.35	16.0	---	---	3.10
11	55	250	14.60	6.48	1.084	79.1	5.27	15.9	---	---	3.10
12	60	250	14.71	6.46	1.076	80.2	5.13	14.5	---	---	3.10
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-8; 2018-12-04; 12:30					
Sample Analytical Parameters/Method:						TDS, Ra 226, Ra 228, Site Spec Metals List, Chloride, Fluoride, Sulfate, pH					
Sample Start Time: 12:30						End Sample Time: 12:50					
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 07/30/18-08/01/18

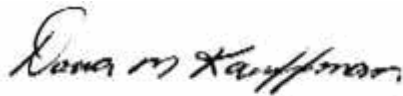
SDG# GEJ45

GROUP	SAMPLE NUMBERS
1972515	9735148-9735157

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: 09/04/2018

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 GEJ45
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
9735148	MW-1	07/30/2018 11:30	08/02/2018 16:20
9735149	MW-2	07/30/2018 13:40	08/02/2018 16:20
9735150	MW-3	07/31/2018 10:10	08/02/2018 16:20
9735151	MW-4	07/31/2018 12:15	08/02/2018 16:20
9735152	MW-5	07/31/2018 15:45	08/02/2018 16:20
9735153	MW-6	07/31/2018 14:10	08/02/2018 16:20
9735154	MW-7	08/01/2018 12:45	08/02/2018 16:20
9735155	MW-8	08/01/2018 14:40	08/02/2018 16:20
9735156	MW-9	08/01/2018 11:05	08/02/2018 16:20
9735157	FB-20180731	07/31/2018 12:00	08/02/2018 16:20

Sample pH Log

SDG: GEJ45

<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>
9735148	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:31:39PM	1532
9735148	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:09:59PM	24788
9735148	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:04:13PM	1532
9735148	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:02:06PM	1532
9735148	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:30:43PM	1532
9735148	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/5/2018 11:24:37PM	24788
9735148	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:31:39PM	1532
9735148	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:30:43PM	1532
9735149	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:32:53PM	1532
9735149	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:10:26PM	24788
9735149	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:02:20PM	1532
9735149	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:06:34PM	1532
9735149	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:31:12PM	1532
9735149	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:33:07PM	1201
9735149	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:32:53PM	1532
9735149	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:31:12PM	1532
9735150	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:33:21PM	1532
9735150	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:10:54PM	24788
9735150	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:04:50PM	1532
9735150	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:04:25PM	1532
9735150	070A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:01PM	1532
9735150	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:41:33PM	1201
9735150	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:33:21PM	1532
9735150	332A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:33:21PM	1532
9735151	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:14PM	1532
9735151	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:08:48PM	24788
9735151	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:14PM	1532
9735151	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:04:38PM	1532
9735151	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:35:43PM	1532
9735151	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/5/2018 11:22:50PM	24788
9735151	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/5/2018 11:11:59PM	24788
9735151	148A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:08:25PM	24788
9735151	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:14PM	1532
9735151	332A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:14PM	1532
9735152	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:55PM	1532
9735152	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:11:24PM	24788
9735152	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:02PM	1532
9735152	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:06:11PM	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
9735152	070A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:35:55PM	1532
9735152	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:30:52PM	1201
9735152	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:55PM	1532
9735152	332A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:34:55PM	1532
9735153	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:38:14PM	1532
9735153	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:11:48PM	24788
9735153	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:25PM	1532
9735153	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:07:40PM	1532
9735153	070A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:36:56PM	1532
9735153	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:27:35PM	1201
9735153	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:38:14PM	1532
9735153	332A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:36:56PM	1532
9735154	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:55:51PM	1532
9735154	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:07:50PM	24788
9735154	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:59PM	1532
9735154	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:07:24PM	1532
9735154	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:38:44PM	1532
9735154	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/5/2018 11:27:30PM	24788
9735154	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:55:51PM	1532
9735154	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:38:44PM	1532
9735155	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:51:54PM	1532
9735155	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:12:24PM	24788
9735155	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:07:54PM	1532
9735155	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:48PM	1532
9735155	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:36:07PM	1532
9735155	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:43:33PM	1201
9735155	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:51:54PM	1532
9735155	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:36:07PM	1532
9735156	004A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:53:05PM	1532
9735156	015A	6	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:09:22PM	24788
9735156	055A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:05:36PM	1532
9735156	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:07:00PM	1532
9735156	070A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:37:47PM	1532
9735156	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:35:38PM	1201
9735156	330A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:53:05PM	1532
9735156	332A	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:37:47PM	1532
9735157	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:52:24PM	1532
9735157	015A		5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 10:12:49PM	24788
9735157	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:06:48PM	1532
9735157	055B	8	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 7:06:23PM	1532
9735157	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:54:42PM	1532
9735157	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/4/2018 11:46:03PM	1201
9735157	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:52:24PM	1532
9735157	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	8/2/2018 6:52:24PM	1532

<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

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) - 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 04, 2018 14:18

Project: PSEG Hudson & Mercer Stations

Account #: 07701
Group Number: 1972515
SDG: GEJ45
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	07/30/2018 11:30	9735148
MW-2 Grab Groundwater	07/30/2018 13:40	9735149
MW-3 Grab Groundwater	07/31/2018 10:10	9735150
MW-4 Grab Groundwater	07/31/2018 12:15	9735151
MW-5 Grab Groundwater	07/31/2018 15:45	9735152
MW-6 Grab Groundwater	07/31/2018 14:10	9735153
MW-7 Grab Groundwater	08/01/2018 12:45	9735154
MW-8 Grab Groundwater	08/01/2018 14:40	9735155
MW-9 Grab Groundwater	08/01/2018 11:05	9735156
FB-20180731 Grab Water	07/31/2018 12:00	9735157

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

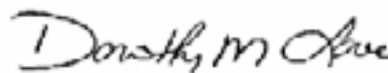
Sampling Date(s): 07/30/18 - 08/01/18

Laboratory Sample ID(s): 9735148-9735157

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?	Yes
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

09/04/2018



Project Name: PSEG Hudson & Mercer Stations
ELLE Group #: 1972515

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: 9735148, 9735149, 9735155

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 #s: 9735148, 9735149, 9735150, 9735151, 9735152, 9735153, 9735154, 9735155, 9735156, 9735157

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.

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

Sample #s: 9735148, 9735149, 9735150, 9735151, 9735152, 9735153, 9735154, 9735155, 9735156, 9735157

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

Batch #: 182191404702A (Sample number(s): 9735148-9735157 UNSPK: 9735152 BKG: 9735152)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Arsenic, Cadmium

SM 2540 C-2011, Wet Chemistry

Batch #: 18220921201B (Sample number(s): 9735156 UNSPK: 9735156 BKG: 9735156)

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735148
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submission Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 11:30
SDG#: GEJ45-01

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	
07046	Barium	7440-39-3	0.693	0.0010	0.0100	1
08014	Boron	7440-42-8	1.08	0.0120	0.100	1
01750	Calcium	7440-70-2	396	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0041 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.103	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: Selenium,Thallium.						
07022	Thallium	7440-28-0	N.D.	0.0700	0.300	5
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	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0049	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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00045 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0037 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

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	6,750	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	15.2	1.5	5.0	5
SM 2540 C-2011			mg/l	mg/l	mg/l	

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735148
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 11:30
SDG#: GEJ45-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
00212	Total Dissolved Solids	SM 2540 C-2011 n.a.	mg/l 10,200	mg/l 1,600	mg/l 4,800	10
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.5	Degrees C 0.010	Degrees C 0.010	1
SM 4500-H+ B-2011						
12152	pH	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.

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	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 14:58	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/20/2018 23:33	Xavier Arroyo	5
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:08	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:25	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:25	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:25	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:25	Bradley M Berlot	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735148
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submission Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 11:30
SDG#: GEJ45-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:25	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 12:54	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/13/2018 14:27	Ashlynn M Cornelius	2000
01504	Fluoride	EPA 300.0	1	18215120117A	08/06/2018 17:14	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18215120117A	08/06/2018 17:14	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921201A	08/03/2018 15:47	Angelica Cintron	10
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:22	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:22	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735149
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 13:40
SDG#: GEJ45-02

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	2.27	0.0010	0.0100	1
08014	Boron	7440-42-8	0.827	0.0120	0.100	1
01750	Calcium	7440-70-2	442	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0031 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0891 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: Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0700	0.300	5

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	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	0.00052 J	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0059	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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00054 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0041	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	7,230	1,000	2,000	5000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	19.0	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735149
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 13:40
SDG#: GEJ45-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
00212	Total Dissolved Solids	SM 2540 C-2011 n.a.	mg/l 10,400	mg/l 1,600	mg/l 4,800	10
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.6	Degrees C 0.010	Degrees C 0.010	1
SM 4500-H+ B-2011						
12152	pH	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 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	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:01	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/20/2018 23:41	Xavier Arroyo	5
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:16	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:32	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:32	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:32	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:32	Bradley M Berlot	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735149
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submission Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/30/2018 13:40
SDG#: GEJ45-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:32	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 12:56	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18215120112A	08/03/2018 18:57	Hallie A Burnett	5000
01504	Fluoride	EPA 300.0	1	18215120112A	08/03/2018 18:22	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18215120112A	08/03/2018 18:22	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921201A	08/03/2018 15:47	Angelica Cintron	10
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 12:44	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 12:44	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735150
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 10:10
SDG#: GEJ45-03

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	0.0638	0.0010	0.0100	1
08014	Boron	7440-42-8	0.518	0.0120	0.100	1
01750	Calcium	7440-70-2	41.6	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	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: 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	0.0017 J	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0040	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. K4	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	0.0164	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	349	100	200	500
01504	Fluoride	16984-48-8	0.33 J	0.25	0.50	5
00228	Sulfate	14808-79-8	90.5	3.0	10.0	10
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	958	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-3 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735150
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 10:10
SDG#: GEJ45-03

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 23.6	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 8.0	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.

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	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:09	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:19	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:34	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:34	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:34	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:34	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:34	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 12:58	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735150
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 10:10
SDG#: GEJ45-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/06/2018 20:22	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18218120117A	08/06/2018 20:05	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/09/2018 18:36	Ashlynn M Cornelius	10
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921201A	08/03/2018 15:47	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207B	08/04/2018 12:56	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207B	08/04/2018 12:56	Jeremy L Bolf	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9735151
ELLE Group #: 1972515
Matrix: Groundwater**Project Name:** PSEG Hudson & Mercer Stations**Submittal Date/Time:** 08/02/2018 16:20**Collection Date/Time:** 07/31/2018 12:15**SDG#:** GEJ45-04

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	0.119	0.0010	0.0100	1
08014	Boron	7440-42-8	1.53	0.0120	0.100	1
01750	Calcium	7440-70-2	164	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	0.0994 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: 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	0.00090 J	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0018 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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00050 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0076	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	6,610	1,000	2,000	5000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	864	150	500	500
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	10,400	1,600	4,800	10
	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 - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735151
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 12:15
SDG#: GEJ45-04

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 23.5	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 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	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:12	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:22	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:36	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:36	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:36	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:36	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:36	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 12:46	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735151
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 12:15
SDG#: GEJ45-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/06/2018 21:30	Ashlynn M Cornelius	5000
01504	Fluoride	EPA 300.0	1	18218120117A	08/06/2018 20:56	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/06/2018 21:13	Ashlynn M Cornelius	500
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921202A	08/03/2018 17:02	Angelica Cintron	10
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:16	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:16	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735152
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 15:45
SDG#: GEJ45-05

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	0.184	0.0010	0.0100	1
08014	Boron	7440-42-8	0.802	0.0120	0.100	1
01750	Calcium	7440-70-2	185	0.0330	1.00	1
07051	Chromium	7440-47-3	0.0066 J	0.0053	0.0300	1
07052	Cobalt	7440-48-4	N.D.	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0443 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: 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	0.0012 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. K4	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	0.00038 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	2,910	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	2.0 J	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	5,120	400	1,200	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 - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735152
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 15:45
SDG#: GEJ45-05

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 7.1	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 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	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:15	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 21:51	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:11	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:11	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:11	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:11	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:11	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:01	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735152
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 15:45
SDG#: GEJ45-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/06/2018 22:38	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18218120117A	08/06/2018 21:47	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/06/2018 21:47	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921202A	08/03/2018 17:02	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:47	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:47	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735153
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 14:10
SDG#: GEJ45-06

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	0.155	0.0010	0.0100	1
08014	Boron	7440-42-8	1.04	0.0120	0.100	1
01750	Calcium	7440-70-2	160	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	0.0371 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: 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	0.0034 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. K4	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	0.00054 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	2,740	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	3.6 J	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	4,290	400	1,200	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 - Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9735153
ELLE Group #: 1972515
Matrix: Groundwater**Project Name:** PSEG Hudson & Mercer Stations**Submittal Date/Time:** 08/02/2018 16:20**Collection Date/Time:** 07/31/2018 14:10**SDG#:** GEJ45-06

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 23.7	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	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:17	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:25	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:39	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:39	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:39	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:39	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:39	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:03	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9735153
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 14:10
SDG#: GEJ45-06

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/06/2018 23:30	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18218120117A	08/06/2018 23:12	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/06/2018 23:12	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921202A	08/03/2018 17:02	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:41	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:41	Jeremy L Bolf	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735154
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 12:45
SDG#: GEJ45-07

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	0.0586	0.0010	0.0100	1
08014	Boron	7440-42-8	0.282	0.0120	0.100	1
01750	Calcium	7440-70-2	37.2	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: 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	0.0036 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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00020 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0077	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	87.1	10.0	20.0	50
01504	Fluoride	16984-48-8	0.36 J	0.25	0.50	5
00228	Sulfate	14808-79-8	20.1	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	361	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-7 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735154
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 12:45
SDG#: GEJ45-07

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 23.5	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 8.1	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 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	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:20	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:28	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:41	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:41	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:41	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:41	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:41	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:05	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735154
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 12:45
SDG#: GEJ45-07

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/07/2018 00:21	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18218120117A	08/07/2018 00:04	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/07/2018 00:04	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921201A	08/08/2018 15:05	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:08	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:08	Jeremy L Bolf	1

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735155
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 14:40
SDG#: GEJ45-08

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	0.0954	0.0010	0.0100	1
08014	Boron	7440-42-8	0.281	0.0120	0.100	1
01750	Calcium	7440-70-2	34.0	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0045 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: Selenium, Thallium.

07022	Thallium	7440-28-0	N.D.	0.0700	0.300	5

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	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0032 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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.0018 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0061	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	475	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	21.2	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735155
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 14:40
SDG#: GEJ45-08

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry						
00212	Total Dissolved Solids	SM 2540 C-2011 n.a.	mg/l 916	mg/l 160	mg/l 480	1
Wet Chemistry						
12151	Temperature of pH	SM 2550 B-2010 n.a.	Degrees C 23.7	Degrees C 0.010	Degrees C 0.010	1
SM 4500-H+ B-2011						
12152	pH	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 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	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:23	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/20/2018 23:44	Xavier Arroyo	5
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:31	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:43	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:43	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:43	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:43	Bradley M Berlot	1

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735155
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20

Collection Date/Time: 08/01/2018 14:40

SDG#: GEJ45-08

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:43	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:12	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/07/2018 00:55	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18218120117A	08/07/2018 00:38	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/07/2018 00:38	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921201A	08/08/2018 15:05	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:28	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:28	Jeremy L Bolf	1

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

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735156
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 11:05
SDG#: GEJ45-09

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	0.0731	0.0010	0.0100	1
08014	Boron	7440-42-8	0.382	0.0120	0.100	1
01750	Calcium	7440-70-2	93.9	0.0330	1.00	1
07051	Chromium	7440-47-3	0.0055 J	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: 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	0.0037 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. K4	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	0.0071	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	676	100	200	500
01504	Fluoride	16984-48-8	0.26 J	0.25	0.50	5
00228	Sulfate	14808-79-8	27.1	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,340	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-9 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735156
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 08/01/2018 11:05
SDG#: GEJ45-09

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 24.4	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.4	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 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	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:25	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:33	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:46	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:46	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:46	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:46	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:46	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:14	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735156
ELLE Group #: 1972515
Matrix: Groundwater

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20

Collection Date/Time: 08/01/2018 11:05

SDG#: GEJ45-09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/07/2018 02:20	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18218120117A	08/07/2018 02:03	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18218120117A	08/07/2018 02:03	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18220921201B	08/08/2018 15:06	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18218004207A	08/07/2018 13:57	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18218004207A	08/07/2018 13:57	Jeremy L Bolf	1

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

Sample Description: FB-20180731 Grab Water
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735157
ELLE Group #: 1972515
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 12:00
SDG#: GEJ45-10FB

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	0.151 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: 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	0.00080 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. K4	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00020 J	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
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-20180731 Grab Water
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735157
ELLE Group #: 1972515
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20
Collection Date/Time: 07/31/2018 12:00
SDG#: GEJ45-10FB

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 23.5	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 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	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182181404401	08/08/2018 15:28	Elaine F Stoltzfus	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/30/2018 22:36	Bradley M Berlot	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:48	Bradley M Berlot	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:48	Bradley M Berlot	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:48	Bradley M Berlot	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182191404702A	08/28/2018 01:48	Bradley M Berlot	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182191404702C	08/28/2018 01:48	Bradley M Berlot	1
00259	Mercury	SW-846 7470A	1	182180571307	08/09/2018 13:16	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182181404401	08/08/2018 05:34	James L Mertz	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182191404702	08/08/2018 05:49	James L Mertz	1

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

Sample Description: FB-20180731 Grab Water
PSEG - Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9735157
ELLE Group #: 1972515
Matrix: Water

Project Name: PSEG Hudson & Mercer Stations

Submittal Date/Time: 08/02/2018 16:20

Collection Date/Time: 07/31/2018 12:00

SDG#: GEJ45-10FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
05713	WW SW846 Hg Digest	SW-846 7470A	1	182180571307	08/09/2018 07:05	James L Mertz	1
00224	Chloride	EPA 300.0	1	18218120117A	08/07/2018 02:55	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18218120117A	08/07/2018 02:55	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18218120117A	08/07/2018 02:55	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18215921202A	08/03/2018 17:02	Angelica Cintron	1
12151	Temperature of pH	SM 2550 B-2010	1	18215002207A	08/04/2018 13:12	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18215002207A	08/04/2018 13:12	Jeremy L Bolf	1

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

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/04/2018 14:18

Group Number: 1972515

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: 182180571307	Sample number(s): 9735148-9735157		
Mercury	N.D.	0.000050	0.00020
Batch number: 182181404401	Sample number(s): 9735148-9735157		
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: 182191404702A	Sample number(s): 9735148-9735157		
Antimony	N.D.	0.00041	0.0040
Arsenic	N.D.	0.00068	0.0040
Beryllium	0.00010 J	0.000091	0.0010
Cadmium	N.D.	0.00015	0.0020
Lead	N.D.	0.0011	0.0060
Batch number: 182191404702C	Sample number(s): 9735148-9735157		
Molybdenum	N.D.	0.00031	0.0040
Batch number: 18215120112A	Sample number(s): 9735149		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18215120117A	Sample number(s): 9735148		
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18218120117A	Sample number(s): 9735148,9735150-9735157		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18215921201A	Sample number(s): 9735148-9735150		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18215921202A	Sample number(s): 9735151-9735153,9735157		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18220921201A	Sample number(s): 9735154-9735155		

*- 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: 09/04/2018 14:18

Group Number: 1972515

Method Blank (continued)

Analysis Name	Result	MDL**	LOQ
	mg/l	mg/l	mg/l
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18220921201B	Sample number(s): 9735156		
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: 182180571307	Sample number(s): 9735148-9735157								
Mercury	0.00100	0.000938			94		80-120		
Batch number: 182181404401	Sample number(s): 9735148-9735157								
Barium	2.00	2.09			104		80-120		
Boron	2.00	1.88			94		80-120		
Calcium	4.00	4.19			105		80-120		
Chromium	0.200	0.208			104		80-120		
Cobalt	0.500	0.548			110		80-120		
Lithium	1.00	1.08			108		80-120		
Selenium	0.150	0.156			104		80-120		
Thallium	0.150	0.161			108		80-120		
Batch number: 182191404702A	Sample number(s): 9735148-9735157								
Antimony	0.00600	0.00694			116		80-120		
Arsenic	0.0100	0.0101			101		80-120		
Beryllium	0.00400	0.00428			107		80-120		
Cadmium	0.00500	0.00497			99		84-120		
Lead	0.0150	0.0150			100		90-110		
Batch number: 182191404702C	Sample number(s): 9735148-9735157								
Molybdenum	0.0500	0.0510			102		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18215120112A	Sample number(s): 9735149								
Chloride	3.00	2.93			98		90-110		
Fluoride	0.750	0.680			91		90-110		
Sulfate	7.50	7.55			101		90-110		
Batch number: 18215120117A	Sample number(s): 9735148								
Fluoride	0.750	0.787			105		90-110		
Sulfate	7.50	7.68			102		90-110		
Batch number: 18218120117A	Sample number(s): 9735148,9735150-9735157								

*- 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: 09/04/2018 14:18

Group Number: 1972515

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
Chloride	3.00	2.92			97		90-110		
Fluoride	0.750	0.673			90		90-110		
Sulfate	7.50	7.55			101		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18215921201A	Sample number(s): 9735148-9735150								
Total Dissolved Solids	200	197			99		62-127		
Batch number: 18215921202A	Sample number(s): 9735151-9735153,9735157								
Total Dissolved Solids	200	199			100		62-127		
Batch number: 18220921201A	Sample number(s): 9735154-9735155								
Total Dissolved Solids	200	204			102		62-127		
Batch number: 18220921201B	Sample number(s): 9735156								
Total Dissolved Solids	200	204			102		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18215002207A	Sample number(s): 9735148-9735149,9735151-9735155,9735157								
pH	7.00	6.99			100		95-105		
Batch number: 18215002207B	Sample number(s): 9735150								
pH	7.00	6.99			100		95-105		
Batch number: 18218004207A	Sample number(s): 9735156								
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: 182180571307	Sample number(s): 9735148-9735157 UNSPK: 9735151									
Mercury	N.D.	0.00100	0.000934	0.00100	0.000950	93	95	75-125	2	20
Batch number: 182191404702A	Sample number(s): 9735148-9735157 UNSPK: 9735152									
Antimony	N.D.	0.00600	0.00619	0.00600	0.00721	103	120	75-125	15	20
Arsenic	0.00124	0.0100	0.0126	0.0100	0.0122	114	110	75-125	3	20
Beryllium	N.D.	0.00400	0.00441	0.00400	0.00451	110	113	75-125	2	20
Cadmium	N.D.	0.00500	0.00477	0.00500	0.00446	95	89	75-125	7	20
Lead	N.D.	0.0150	0.0154	0.0150	0.0155	102	103	75-125	1	20

*- 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.

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 09/04/2018 14:18

Group Number: 1972515

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: 182191404702C Molybdenum	Sample number(s): 9735148-9735157 UNSPK: 9735152 0.000379	0.0500	0.0536	0.0500	0.0517	106	103	75-125	4	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18220921201A Total Dissolved Solids	Sample number(s): 9735154-9735155 UNSPK: 9735156 1340	1600	2764			89		62-127		
Batch number: 18220921201B Total Dissolved Solids	Sample number(s): 9735156 UNSPK: 9735156 1340	1600	2764			89		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: 182180571307 Mercury	Sample number(s): 9735148-9735157 BKG: 9735151 N.D.	N.D.	0 (1)	20
Batch number: 182191404702A Antimony	Sample number(s): 9735148-9735157 BKG: 9735152 N.D.	N.D.	0 (1)	20
Arsenic	0.00124	0.00265	73* (1)	20
Beryllium	N.D.	N.D.	0 (1)	20
Cadmium	N.D.	0.000210	200* (1)	20
Lead	N.D.	N.D.	0 (1)	20
Batch number: 182191404702C Molybdenum	Sample number(s): 9735148-9735157 BKG: 9735152 0.000379	0.000385	1 (1)	20
	Degrees C	Degrees C		
Batch number: 18215002207A Temperature of pH	Sample number(s): 9735148-9735149,9735151-9735155,9735157 BKG: 9735149 23.64	23.62	0	5
Batch number: 18215002207B Temperature of pH	Sample number(s): 9735150 BKG: 9735150 23.57	23.54	0	5
	mg/l	mg/l		
Batch number: 18220921201B Total Dissolved Solids	Sample number(s): 9735156 BKG: 9735156 1340	1268	6* (1)	5
	Std. Units	Std. Units		

*- 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: 09/04/2018 14:18

Group Number: 1972515

Laboratory Duplicate (continued)

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

Analysis Name	BKG Conc Std. Units	DUP Conc Std. Units	DUP RPD	DUP RPD Max
Batch number: 18215002207A pH	Sample number(s): 9735148-9735149,9735151-9735155,9735157 BKG: 9735149 7.69	7.70	0	4
Batch number: 18215002207B pH	Sample number(s): 9735150 BKG: 9735150 7.95	7.93	0	4

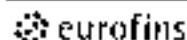
*- Outside of specification

**--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.

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Anal # 1701

For Eurofins Lancaster Laboratories Environmental use only

Client # 1972515

Sample # 0735 08-57

COC # 573912

Client Information				Matrix		Analysis Requested										For Lab Use Only				
Project Name GRI Cementation, Inc.				Matrix ☐ Soil ☐ Tissue ☐ Potable ☐ Ground ☐ Surface ☐ Water ☐ NPDES ☐ Other:		Preservation and Filtration Codes										PAC ... SCN# 228867				
Project Number 15011710																Preservation Codes H-HCl T-Thiosulfate N-HNO ₃ B-NaOH S-H ₂ SO ₄ P-H ₂ PO ₄ F-Field Filtered Q-Other				
Project Manager James Reid																Remarks				
Sample Anthony J. Strubbs																				
Date when sample was collected N/A				Yes ☒ No ☐																
Sample Identification		Collected		Grab	Composite	Soil	Water	Other	Total # of Containers											
		Date	Time																	
MW 1		7-30-18	1130						7											
MW 2		7-30-18	1340						7											
MW 3		7-31-18	1020						7											
MW 4		7-31-18	1205						8											
MW 5		7-31-18	1545						7											
MW 6		7-31-18	1410						7											
MW 7		8-1-18	1340						7											
MW 8		8-1-18	1440						7											
MW 9		8-1-18	1605						7											
FB 20180731		7-31-18	1200						FB 7											
Turnaround Time (TAT) Requested (please circle) Standard Rush				Requested by Bottle Storage		Date 8/1/18	Time 1600	Received by Chris Miller		Date 8/2/18	Time 1600									
Requested TAT in business days				Requested by J. Reid		Date 8/2/18	Time 1330	Received by J. Reid		Date 8/2/18	Time 1330									
E-mail address: JREID@LANCSTERLABS.COM				Requested by J. Reid		Date 8/2/18	Time 1620	Received by J. Reid		Date 8/2/18	Time 1530									
Data Package Options (circle if required) Type I (EPA Level 3) Equivalent/ISO-CLP Type V- (Raw Data Only) Type II (Reduced Ion CLP) ☒ NJ DKOP ☒ TX TRRP 13 NYSDOC Category A or B MA MCP CT RCP				EDD Required? Yes No If yes, format		Site Specific QC (MS/MS/Dup)? Yes No If yes, indicate QC sample and volume for each sample & time		Relinquished by Commercial Carrier UPS FedEx Other		Temperature upon receipt at 0.9-1.8										



Client: GEI Consultants

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>08/02/2018 16:20</u>
Number of Packages:	<u>3</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 17:10 on 08/02/2018

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	1.5	DT	Wet	Y	Bagged	N
2	DT146	1.8	DT	Wet	Y	Bagged	N
3	DT146	0.9	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: GEJ45

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9735148	MW-1	X		
9735149	MW-2	X		
9735150	MW-3	X		
9735151	MW-4	X		
9735152	MW-5	X		
9735153	MW-6	X		
9735154	MW-7	X		
9735155	MW-8	X		
9735156	MW-9	X		
9735157	FB-20180731	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:

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: GEJ45

ICP Metals

Fraction: Metals in Liquid

Sample Duplicate

Batch#: 182191404702A (Sample number(s): 9735148-9735157, UNSPK: 9735152, BKG: 9735152)
The duplicate RPD for the following analyte(s) is outside the acceptance window:
Arsenic, Cadmium

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

(Sample number(s): 9735148-9735157: 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): 9735148-9735157: 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.

(Sample number(s): 9735148-9735149, 9735155: Analysis: 07022)
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.

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

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ45

ICP Metals

Fraction: Metals in Liquid

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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735148
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	4.9			MS
7440-39-3	Barium	693			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1080			P
7440-43-9	Cadmium	0.45	B		MS
7440-70-2	Calcium	396000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.1	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	103			P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.7	B		MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	70.0	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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735149
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.52	B		MS
7440-38-2	Arsenic	5.9			MS
7440-39-3	Barium	2270			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	827			P
7440-43-9	Cadmium	0.54	B		MS
7440-70-2	Calcium	442000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.1	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	89.1	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	4.1			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	70.0	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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735150
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.7	B		MS
7440-38-2	Arsenic	4.0			MS
7440-39-3	Barium	63.8			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	518			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	41600			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	16.4			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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735151, 9735151BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.90	B		MS
7440-38-2	Arsenic	1.8	B		MS
7440-39-3	Barium	119			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1530			P
7440-43-9	Cadmium	0.50	B		MS
7440-70-2	Calcium	164000			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	99.4	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	7.6			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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735152, 9735152BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.2	B		MS
7440-39-3	Barium	184			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	802			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	185000			P
7440-47-3	Chromium	6.6	B		P
7440-48-4	Cobalt	1.5	U		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	44.3	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.38	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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735153
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.4	B		MS
7440-39-3	Barium	155			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1040			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	160000			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	37.1	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.54	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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735154
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.6	B		MS
7440-39-3	Barium	58.6			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	282			P
7440-43-9	Cadmium	0.20	B		MS
7440-70-2	Calcium	37200			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	7.7			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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735155
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.2	B		MS
7440-39-3	Barium	95.4			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	281			P
7440-43-9	Cadmium	1.8	B		MS
7440-70-2	Calcium	34000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.5	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	6.1			MS
7782-49-2	Selenium	21.0	U		P
7440-28-0	Thallium	70.0	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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735156
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.7	B		MS
7440-39-3	Barium	73.1			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	382			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	93900			P
7440-47-3	Chromium	5.5	B		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	7.1			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.: GEJ45

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9735157
Concentration Units: UG/L

% Solids: 0.0
Date Received: 08/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.80	B		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	0.20	B		MS
7440-70-2	Calcium	151	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.: GEJ45

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182181404401	9735148
Boron		9735149
Calcium		9735150
Chromium		9735151
Cobalt		9735152
Lithium		9735153
Selenium		9735154
Thallium		9735155
		9735156
		9735157
		*35952BKG
		P21804AB
		P21804AQ

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.: GEJ45

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182191404702	9735148
Arsenic		9735149
Beryllium		9735150
Cadmium		9735151
Lead		9735152BKG
Molybdenum		9735152MS
		9735152MSD
		9735152DUP
		9735153
		9735154
		9735155
		9735156
		9735157
		P21904BB
		P21904BQ

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.: GEJ45

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182180571307	9735148
		9735149
		9735150
		9735151BKG
		9735151MS
		9735151MSD
		9735151DUP
		9735152
		9735153
		9735154
		9735155
		9735156
		9735157
		P21871GB
		P21871GQ

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.: GEJ45

Method: P

Run Name: 1822006T70

Calibration Date(s): 08/08/2018

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	604.69	100.8	500.0	513.13	102.6	500.0	502.55	100.5
Boron		600.0	567.35	94.6	500.0	484.56	96.9	500.0	477.49	95.5
Calcium		30000.0	29941.35	99.8	25000.0	24976.82	99.9	25000.0	24373.93	97.5
Chromium		600.0	586.41	97.7	500.0	493.11	98.6	500.0	484.72	96.9
Cobalt		600.0	603.41	100.6	500.0	511.72	102.3	500.0	503.42	100.7
Lithium		600.0	604.33	100.7	500.0	507.53	101.5	500.0	514.32	102.9
Selenium		600.0	599.90	100.0	500.0	509.83	102.0	500.0	500.74	100.1
Thallium		600.0	601.83	100.3	500.0	506.27	101.3	500.0	495.58	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.: GEJ45

Method: P
Run Name: 1822006T70
Calibration Date(s): 08/08/2018
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	503.12	100.6	500.0	477.27	95.5
Boron					500.0	484.60	96.9	500.0	456.05	91.2
Calcium					25000.0	24365.43	97.5	25000.0	23113.24	92.5
Chromium					500.0	487.27	97.5	500.0	464.10	92.8
Cobalt					500.0	506.07	101.2	500.0	484.64	96.9
Lithium					500.0	508.53	101.7	500.0	495.60	99.1
Selenium					500.0	502.12	100.4	500.0	493.21	98.6
Thallium					500.0	500.32	100.1	500.0	476.18	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.: GEJ45

Method: P
Run Name: 1823208T70
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)
Barium										
Boron										
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium										
Thallium		600.0	620.60	103.4	500.0	502.52	100.5	500.0	502.97	100.6

(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.: GEJ45

Method: P

Run Name: 1823208T70

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)
Barium										
Boron										
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium										
Thallium					500.0	493.46	98.7	500.0	506.40	101.3

(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.: GEJ45

Method: MS
Run Name: 1824001E03
Calibration Date(s): 08/28/2018
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	522.10	104.4	250.0	250.90	100.4	250.0	264.90	106.0
Beryllium	9	50.0	53.38	106.8	25.0	25.53	102.1	25.0	30.56	122.2*
Cadmium	111	50.0	51.29	102.6	25.0	26.23	104.9	25.0	25.53	102.1
Lead	208	50.0	50.90	101.8	25.0	25.35	101.4	25.0	25.61	102.4
Molybdenum	98	50.0	51.54	103.1	25.0	26.07	104.3	25.0	24.92	99.7

(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.: GEJ45

Method: MS
Run Name: 1824001E03
Calibration Date(s): 08/28/2018
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	256.40	102.6			
Beryllium	9				25.0	29.03	116.1*			
Cadmium	111				25.0	24.98	99.9			
Lead	208				25.0	25.66	102.6			
Molybdenum	98				25.0	25.33	101.3			

(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.: GEJ45

Method: MS

Run Name: 1824211E05

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	52.03	104.1	25.0	26.22	104.9	25.0	26.97	107.9
Arsenic										
Beryllium	9	50.0	52.92	105.8	25.0	25.92	103.7	25.0	26.72	106.9
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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ45

Method: MS
Run Name: 1824211E05
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	25.40	101.6			
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.: GEJ45

Method: CV
Run Name: 1822102M07
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)
Mercury		2.5	2.46	98.4	1.0	0.96	96.0	1.0	0.91	91.0

(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.: GEJ45

Method: CV
Run Name: 1822102M07
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)
Mercury					1.0	0.94	94.0	1.0	0.94	94.0

(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.: GEJ45

Method: CV
Run Name: 1822102M07
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)
Mercury					1.0	0.94	94.0	1.0	0.94	94.0

(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.: GEJ45

Method: CV
Run Name: 1822102M07
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)
Mercury					1.0	0.90	90.0	1.0	0.94	94.0

(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.: GEJ45

Method: CV
Run Name: 1822102M07
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)
Mercury					1.0	0.93	93.0			

(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: 1822006T70
Calibration Date(s): 08/08/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		10.0	10.04	100.4		
Boron		100.0	92.94	92.9		
Calcium		1000.0	1021.63	102.2		
Chromium		30.0	31.23	104.1		
Cobalt		10.0	9.73	97.3		
Lithium		100.0	102.41	102.4		
Selenium		100.0	100.01	100.0		
Thallium		60.0	68.83	114.7		

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.: GEJ45

Method: P

Run Name: 1823208T70

Calibration Date(s): 08/20/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron						
Calcium						
Chromium						
Cobalt						
Lithium						
Selenium						
Thallium		60.0	66.37	110.6		

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.: GEJ45

Method: MS

Run Name: 1824001E03

Calibration Date(s): 08/28/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony						
Arsenic	75	4.0	4.10	102.5		
Beryllium	9	1.0	1.10	110.0		
Cadmium	111	2.0	1.96	98.0		
Lead	208	6.0	5.93	98.8		
Molybdenum	98	4.0	3.68	92.0		

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

Method: MS
Run Name: 1824211E05
Calibration Date(s): 08/30/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	4.0	3.77	94.3		
Arsenic						
Beryllium	9	1.0	0.93	93.0		
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.: GEJ45

Method: CV

Run Name: 1822102M07

Calibration Date(s): 08/09/2018

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.: GEJ45

Method: P
Run Name: 1822006T70
Calibration Date(s): 08/08/2018
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	U182181404401
Boron		8.4	U	8.4	U	8.4	U	8.4	U	12.000	U182181404401
Calcium		33.4	U	33.4	U	33.4	U	33.4	U	33.000	U182181404401
Chromium		0.96	U	0.96	U	1.3	B	0.96	U	5.300	U182181404401
Cobalt		-0.78	B	0.53	U	-0.69	B	0.53	U	1.500	U182181404401
Lithium		9.6	U	9.6	U	9.6	U	9.6	U	11.000	U182181404401
Selenium		8.4	U	8.4	U	8.4	U	8.4	U	21.000	U182181404401
Thallium		6.7	U	6.7	U	6.7	U	6.7	U	14.000	U182181404401

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.: GEJ45

Method: P

Run Name: 1822006T70

Calibration Date(s): 08/08/2018

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				-0.74	B								
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.: GEJ45

Method: P
Run Name: 1823208T70
Calibration Date(s): 08/20/2018

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											
Lithium											
Selenium											
Thallium		6.7U		-10.8B		9.7B		6.7U			

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.: GEJ45

Method: P
Run Name: 1823208T70
Calibration Date(s): 08/20/2018

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											
Lithium											
Selenium											
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



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Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ45

Method: MS

Run Name: 1824001E03

Calibration Date(s): 08/28/2018

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	0.40	U	0.54	B	0.58	B	0.67	B	75	0.680	U182191404702A
Beryllium	9	0.067	U	0.067	U	0.067	U	0.067	B			
Cadmium	111	0.14	B	0.22	B	0.22	B	0.14	U	111	0.150	U182191404702A
Lead	208	0.20	U	0.24	B	0.20	U	0.20	U	208	1.100	U182191404702A
Molybdenum	98	0.25	U	0.75	B	0.25	U	0.25	U	98	0.310	U182191404702A

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.: GEJ45

Method: MS

Run Name: 1824211E05

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	0.52	U	0.52	U	0.52	U	0.52	U	121	0.410	U	182191404702A
Arsenic													
Beryllium	9	0.067	U	0.096	B	0.067	U			9	0.100	B	182191404702A
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.: GEJ45

Method: CV

Run Name: 1822102M07

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	Batch Number
Mercury		0.050	U	0.050	U	0.050	U	0.050	U	182180571307

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.: GEJ45

Method: CV

Run Name: 1822102M07

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	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.: GEJ45

Method: CV
Run Name: 1822102M07
Calibration Date(s): 08/09/2018

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 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ45

Instrument ID: 11016
Run Name: 1822006T70
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		485069	97.0						
Barium	0		1							
Boron	0		-21							
Calcium	500000		504236	100.8						
Chromium	0		0							
Cobalt	0		-1							
Iron	200000		200946	100.5						
Lithium	0		-1							
Magnesium	500000		536335	107.3						
Selenium	0		-5							
Thallium	0		19							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ45

Instrument ID: 11016
Run Name: 1823208T70
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		475510	95.1						
Barium										
Boron										
Calcium	500000		508165	101.6						
Chromium										
Cobalt										
Iron	200000		200298	100.1						
Lithium										
Magnesium	500000		512773	102.6						
Selenium										
Thallium	0		3							

Control Limits: All Metals 80%-120%

Instrument ID: 11332
 Run Name: 1824001E03
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		107700	107.7		
Antimony							
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		315000	105.0		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		282300	112.9		
Lead	208	0		1			
Magnesium	24	100000		103600	103.6		
Molybdenum	98	2000		2367	118.4		
Phosphorus	31	10000		NA			
Potassium	39	100000		114400	114.4		
Sodium	23	250000		252400	101.0		
Sulfur	34	10000		NA			
Titanium	47	2000		2275	113.8		

Control Limits: All Metals 80%-120%

Instrument ID: 19204
 Run Name: 1824211E05
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		96328	96.3		
Antimony	121	0		1			
Arsenic							
Beryllium	9	0		0			
Cadmium							
Calcium	44	300000		281767	93.9		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		251290	100.5		
Lead							
Magnesium	24	100000		99733	99.7		
Molybdenum	98	2000		2063	103.2		
Phosphorus	31	10000		NA			
Potassium	39	100000		96303	96.3		
Sodium	23	250000		238391	95.4		
Sulfur	34	10000		NA			
Titanium	47	2000		2163	108.2		

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ45

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9735151BKG Matrix Spike Lab Sample ID: 9735151MS Matrix Spike Duplicate Lab Sample ID: 9735151MSD

Batch Number(s): 182180571307

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	0.9344		0.9503		1.0000	1.0000	UG/L	93		95		2		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 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ45

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9735152BKG Matrix Spike Lab Sample ID: 9735152MS Matrix Spike Duplicate Lab Sample ID: 9735152MSD
Batch Number(s): 182191404702

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
Antimony	121	0.4060	U	6.1870		7.2050		6.0000	6.0000	UG/L	103		120		15		75 - 125	20	MS
Arsenic	75	1.2380	B	12.6100		12.2000		10.0000	10.0000	UG/L	114		110		3		75 - 125	20	MS
Beryllium	9	0.0910	U	4.4080		4.5120		4.0000	4.0000	UG/L	110		113		2		75 - 125	20	MS
Cadmium	111	0.1510	U	4.7680		4.4550		5.0000	5.0000	UG/L	95		89		7		75 - 125	20	MS
Lead	208	1.0700	U	15.3500		15.4500		15.0000	15.0000	UG/L	102		103		1		75 - 125	20	MS
Molybdenum	98	0.3793	B	53.5800		51.6500		50.0000	50.0000	UG/L	106		103		4		75 - 125	20	MS

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.: GEJ45

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9735151BKG

Duplicate Lab Sample ID: 9735151DUP

Batch Number(s): 182180571307

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ45

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9735152BKG

Duplicate Lab Sample ID: 9735152DUP

Batch Number(s): 182191404702

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		1.2380	B	2.6480	B	73		MS
Beryllium	9		0.0910	U	0.0910	U			MS
Cadmium	111		0.1510	U	0.2098	B	200		MS
Lead	208		1.0700	U	1.0700	U			MS
Molybdenum	98		0.3793	B	0.3850	B	1		MS

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

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182191404702	UG/L	6.000	6.941		80 - 120	116	MS	Yes
Arsenic	75	182191404702	UG/L	10.000	10.080		80 - 120	101	MS	Yes
Barium		182181404401	UG/L	2000.000	2089.950		80 - 120	104	P	Yes
Beryllium	9	182191404702	UG/L	4.000	4.282		80 - 120	107	MS	Yes
Boron		182181404401	UG/L	2000.000	1877.790		80 - 120	94	P	Yes
Cadmium	111	182191404702	UG/L	5.000	4.970		84 - 120	99	MS	Yes
Calcium		182181404401	UG/L	4000.000	4185.040		80 - 120	105	P	Yes
Chromium		182181404401	UG/L	200.000	207.890		80 - 120	104	P	Yes
Cobalt		182181404401	UG/L	500.000	547.870		80 - 120	110	P	Yes
Lead	208	182191404702	UG/L	15.000	15.010		90 - 110	100	MS	Yes
Lithium		182181404401	UG/L	1000.000	1077.490		80 - 120	108	P	Yes
Mercury		182180571307	UG/L	1.000	0.938		80 - 120	94	CV	Yes
Molybdenum	98	182191404702	UG/L	50.000	50.960		80 - 120	102	MS	Yes
Selenium		182181404401	UG/L	150.000	156.320		80 - 120	104	P	Yes
Thallium		182181404401	UG/L	150.000	161.250		80 - 120	108	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.: GEJ45

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *35952BKG

Serial Dilution Lab Sample ID: *35952L

Batch Number(s): 182181404401

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		150.4300		147.5000		2		P
Boron		466.8200		501.4500		7		P
Calcium		129876.9800		125083.2000		4		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		1.5000	U	7.5000	U			P
Lithium		46.6600	B	55.0000	U	100		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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ45

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9735152BKG

Serial Dilution Lab Sample ID: 9735152L

Batch Number(s): 182191404702

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	1.2380	B	4.3655	B	253		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	0.3793	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

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: MS
Instrument ID: 11332
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony			
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: MS
Instrument ID: 19204
Date: 07/2018

Analyte	MASS (amu)	Background	IDL (UG/L)
Antimony	121		0.52
Arsenic			
Beryllium	9		0.067
Cadmium			
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: 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.: GEJ45
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.: GEJ45
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.: GEJ45
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.: GEJ45
Matrix: WATER

Instrument ID: 11332
Date: 08/27/2018

Analyte	Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 5% Peak Height (amu)	%RSD
Lithium	6.000	6.10	0.65	2.7
Magnesium	24.000	24.00	0.65	2.7
Rhodium	103.000	103.00	0.60	2.2
Indium	115.000	115.00	0.60	1.5
Cerium	140.000	140.00	0.60	2.8
Lead	208.000	208.05	0.65	2.8
Uranium	238.000	238.10	0.70	2.0

Comments:

Tune Report

Batch Folder D:\Agilent\ICPMH\1\DATA\~EPATUNEaa.b
 Report Comment ICP-MS #19204 (E05) Daily Tune Check
 Instrument Name G3281A JP12071581

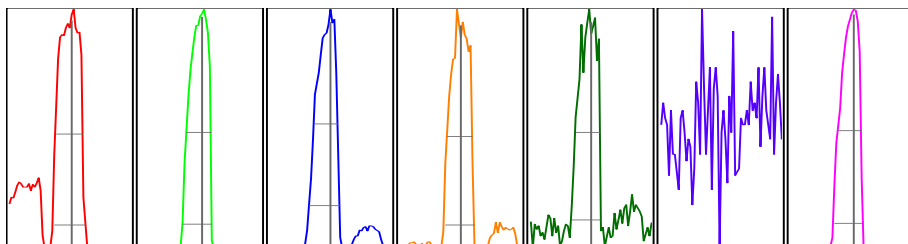
[No Gas]

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		2123	21234.43	2000.00		0.04	-	
89		6062	60623.02	6000.00		0.13	-	
205		2404	24041.52	3000.00		0.05	-	
70		596	5960.56	0.00		0.01	0 - 0.015	
156		169	1692.12	0.00		0.00	0 - 0.03	
220		45	451.03	0.00		0.00	-	
140		47827	478268.34	0.00		1.00	1 - 1	

Mass	RSD% (Actual)	RSD% (Required)	RSD% (Flag)	Background (Actual)	Background (Required)	Background (Flag)
7	2.15	5.00				
89	2.10	5.00				
205	3.14	5.00				
70	6.21					
156	5.45					
220	31.95					
140	2.53					

Mass	Replicate 1 Count	Replicate 2 Count	Replicate 3 Count	Replicate 4 Count	Replicate 5 Count
7	2086	2091	2145	2194	2101
89	5840	6159	6110	6076	6126
205	2339	2393	2366	2389	2534
70	546	572	614	610	639
156	162	182	160	174	169
220	36	37	55	33	66
140	46011	47512	47860	48501	49250

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	325.22	7.05	6.9 - 7.1		0.67	0.773	0.800	
89	1064.93	89.05	88.9 - 89.1		0.60	0.700	0.800	
205	425.90	205.00	204.9 - 205.1		0.56	0.733	0.800	
70	101.33	70.00	-		0.62	0.733		
156	28.28	156.00	-		0.59	0.719		
220	NaN	NaN	-		NaN	NaN		
140	8744.86	140.05	-		0.56	0.720		

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	8.0 V	Deflect	13.2 V
Extract 2	-170.0 V	Cell Entrance	-30 V	Plate Bias	-40 V
Mass	Peak	Axis	Axis	Axis	Axis
	Height	(Actual)	(Required)	(Flag)	
Omega Bias	-90 V	Cell Exit	-50 V		
 ## Cell Parameters ##					
OctP Bias	-8.0 V	He Flow	0.0 mL/min	Energy Discrimination	5.0 V
OctP RF	190 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.: GEJ45

Instrument ID: 11332

Start Date: 08/28/2018

Run Name: 1824001E03

End Date: 08/28/2018

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

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element BI-2-209	Q	Element	Q	Element	Q	Element	Q
S0	00:38	100		100		100							
S	00:40	102		99		103							
ICV	00:43	99		106		111							
ICB	00:45	98		109		114							
LLC	00:47	98		110		117							
ICSA	00:50	92		103		104							
LRS2	00:52	95		99		105							
LRS3	00:54	98		102		109							
CCS	00:56	94		106		109							
CCS	00:59	94		108		113							
CCV	01:01	96		108		114							
CCB	01:04	98		108		112							
P21904BB	01:06	95		107		115							
P21904BQ	01:09	96		104		111							
9735152BKG	01:11	95		98		95							
9735152A	01:13			102		99							
9735152DUP	01:15	106		98		94							
9735152MS	01:18			97		92							
9735152MSD	01:20			100		92							
9735152L	01:23	115		111		106							
9735148	01:25	98		89		80							
CCV	01:27	115		116		117							
CCB	01:30	114		113		113							
9735149	01:32	97		86		79							
9735150	01:34	113		108		104							
9735151	01:36	100		90		81							
9735153	01:39	109		103		95							
9735154	01:41	115		110		110							
9735155	01:43	111		111		107							
9735156	01:46	117		110		106							
9735157	01:48	117		110		114							
ZZZZZZ	01:50												

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.: GEJ45

Instrument ID: 11332

Start Date: 08/28/2018

Run Name: 1824001E03

End Date: 08/28/2018

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

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-1-45	Q	Element IN-2-115	Q	Element BI-2-209	Q	Element	Q	Element	Q	Element	Q
CCV	01:53	116		112		113							
CCB	01:55	102		111		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: 19204

Start Date: 08/30/2018

Run Name: 1824211E05

End Date: 08/30/2018

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

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element IN-1-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
S0	21:11	100		100									
S	21:14	102		101									
ICV	21:17	100		107									
ICB	21:20	103		102									
LLC	21:23	103		103									
ICSA	21:25	96		93									
LRS2	21:28	99		95									
LRS3	21:31	98		99									
CCS	21:34	97		100									
CCS	21:37	97		99									
CCV	21:40	98		95									
CCB	21:43	99		97									
P21904BB	21:45	99		96									
P21904BQ	21:48	102		107									
9735152BKG	21:51			96									
9735152A	21:54	98		95									
9735152DUP	21:57			96									
9735152MS	21:59	100		94									
9735152MSD	22:02	95		89									
9735152L	22:05			97									
9735148	22:08			93									
CCV	22:11	101		102									
CCB	22:14	103		102									
9735149	22:16			92									
9735150	22:19			104									
9735151	22:22			93									
9735153	22:25			96									
9735154	22:28			104									
9735155	22:31			100									
9735156	22:33			102									
9735157	22:36			105									
ZZZZZZ	22:39												

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.: GEJ45

Instrument ID: 19204

Start Date: 08/30/2018

Run Name: 1824211E05

End Date: 08/30/2018

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

Lab Sample ID	Time	Internal Standards %RI For:											
		Element SC-2-45	Q	Element IN-1-115	Q	Element	Q	Element	Q	Element	Q	Element	Q
CCV	22:42	107		100									
CCB	22:45	105		115									

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: 182181404401

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9735148	08/08/2018	50.00	50
9735149	08/08/2018	50.00	50
9735150	08/08/2018	50.00	50
9735151	08/08/2018	50.00	50
9735152	08/08/2018	50.00	50
9735153	08/08/2018	50.00	50
9735154	08/08/2018	50.00	50
9735155	08/08/2018	50.00	50
9735156	08/08/2018	50.00	50
9735157	08/08/2018	50.00	50
*35952BKG	08/08/2018	50.00	50
P21804AB	08/08/2018	50.00	50
P21804AQ	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: 182191404702

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9735148	08/08/2018	50.00	50
9735149	08/08/2018	50.00	50
9735150	08/08/2018	50.00	50
9735151	08/08/2018	25.00	25
9735153	08/08/2018	50.00	50
9735154	08/08/2018	50.00	50
9735155	08/08/2018	50.00	50
9735156	08/08/2018	50.00	50
9735157	08/08/2018	50.00	50
9735152BKG	08/08/2018	25.00	25
9735152DUP	08/08/2018	25.00	25
9735152MSD	08/08/2018	25.00	25
9735152MS	08/08/2018	25.00	25
P21904BB	08/08/2018	50.00	50
P21904BQ	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: 182180571307

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9735148	08/09/2018	40.00	40
9735149	08/09/2018	40.00	40
9735150	08/09/2018	40.00	40
9735152	08/09/2018	40.00	40
9735153	08/09/2018	40.00	40
9735154	08/09/2018	40.00	40
9735155	08/09/2018	40.00	40
9735156	08/09/2018	40.00	40
9735157	08/09/2018	40.00	40
9735151BKG	08/09/2018	40.00	40
9735151DUP	08/09/2018	40.00	40
9735151MSD	08/09/2018	40.00	40
9735151MS	08/09/2018	40.00	40
P21871GB	08/09/2018	40.00	40
P21871GQ	08/09/2018	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.: GEJ45

Method: P

Instrument ID: 11016

Run Name: 1822006T70

Run Start Date: 08/08/2018

Run End Date: 08/08/2018

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	13:56			X		X		X	X	X		X			X	X													
S	1.00	13:59							X																					
S	1.00	14:01			X		X				X	X				X	X													
S	1.00	14:04								X																				
ICV	1.00	14:06			X		X		X	X	X		X			X	X													
ICB	1.00	14:09			X		X		X	X	X		X			X	X													
LLC	1.00	14:11			X		X		X	X	X		X			X	X													
ICSA	1.00	14:14			X		X		X	X	X		X			X	X													
CCV	1.00	14:17			X		X		X	X	X		X			X	X													
CCB	1.00	14:19			X		X		X	X	X		X			X	X													
LRS2	1.00	14:22			X		X		X	X	X		X			X	X													
LRS4	1.00	14:24			X		X		X	X	X		X			X	X													
LRS3	1.00	14:27			X		X		X	X	X		X			X	X													
LRS5	1.00	14:30			X		X		X	X	X		X			X	X													
CCV	1.00	14:32			X		X		X	X	X		X			X	X													
CCB	1.00	14:35			X		X		X	X	X		X			X	X													
P21804AB	1.00	14:37			X		X		X	X	X		X			X	X													
P21804AQ	1.00	14:40			X		X		X	X	X		X			X	X													
*35952BKG	1.00	14:42			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	14:45																												
ZZZZZZ	1.00	14:48																												
ZZZZZZ	1.00	14:50																												
ZZZZZZ	1.00	14:53																												
*35952L	5.00	14:56			X		X		X	X	X		X			X	X													
9735148	1.00	14:58			X		X		X	X	X		X			X														
9735149	1.00	15:01			X		X		X	X	X		X			X														
CCV	1.00	15:04			X		X		X	X	X		X			X	X													
CCB	1.00	15:07			X		X		X	X	X		X			X	X													
9735150	1.00	15:09			X		X		X	X	X		X			X	X													
9735151	1.00	15:12			X		X		X	X	X		X			X	X													
9735152	1.00	15:15			X		X		X	X	X		X			X	X													
9735153	1.00	15:17			X		X		X	X	X		X			X	X													
9735154	1.00	15:20			X		X		X	X	X		X			X	X													
9735155	1.00	15:23			X		X		X	X	X		X			X														
9735156	1.00	15:25			X		X		X	X	X		X			X	X													
9735157	1.00	15:28			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	15:30																												
ZZZZZZ	1.00	15:33																												

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.: GEJ45

Method: P
Instrument ID: 11016
Run Name: 1822006T70

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

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	15:35			X		X		X	X	X		X			X	X													
CCB	1.00	15:38			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.: GEJ45

Method: P

Instrument ID: 11016

Run Name: 1823208T70

Run Start Date: 08/20/2018

Run End Date: 08/20/2018

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											
S0	1.00	22:28															X											
S	1.00	22:31																										
S	1.00	22:33															X											
S	1.00	22:36																										
ICV	1.00	22:39															X											
ICB	1.00	22:41															X											
LLC	1.00	22:44															X											
ICSA	1.00	22:46															X											
CCV	1.00	22:49															X											
CCB	1.00	22:51															X											
LRS2	1.00	22:54															X											
LRS4	1.00	22:57															X											
LRS3	1.00	22:59															X											
LRS5	1.00	23:02															X											
CCV	1.00	23:05															X											
CCB	1.00	23:07															X											
P21804AB	1.00	23:10																										
P21804AB	1.00	23:12																										
P21804AQ	1.00	23:15																										
ZZZZZZ	1.00	23:18																										
ZZZZZZ	1.00	23:20																										
ZZZZZZ	1.00	23:23																										
ZZZZZZ	1.00	23:25																										
ZZZZZZ	1.00	23:28																										
ZZZZZZ	5.00	23:31																										
9735148	5.00	23:33															X											
CCV	1.00	23:36															X											
CCB	1.00	23:38															X											
9735149	5.00	23:41															X											
9735155	5.00	23:44															X											
ZZZZZZ	1.00	23:46																										
ZZZZZZ	1.00	23:49																										
CCV	1.00	23:51															X											
CCB	1.00	23:54															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.: GEJ45

Method: MS

Instrument ID: 11332

Run Name: 1824001E03

Run Start Date: 08/28/2018

Run End Date: 08/28/2018

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	00:38	X		X		X					X			X															
S	1.00	00:40	X		X		X					X			X															
ICV	1.00	00:43	X		X		X					X			X															
ICB	1.00	00:45	X		X		X					X			X															
LLC	1.00	00:47	X		X		X					X			X															
ICSA	1.00	00:50	X		X		X					X			X															
LRS2	1.00	00:52	X		X		X					X			X															
LRS3	1.00	00:54	X		X		X					X			X															
CCS	1.00	00:56	X		X		X					X			X															
CCS	1.00	00:59	X		X		X					X			X															
CCV	1.00	01:01	X		X		X					X			X															
CCB	1.00	01:04	X		X		X					X			X															
P21904BB	1.00	01:06	X				X					X			X															
P21904BQ	1.00	01:09	X				X					X			X															
9735152BKG	1.00	01:11	X		X		X					X			X															
9735152A	1.00	01:13																												
9735152DUP	1.00	01:15	X		X		X					X			X															
9735152MS	1.00	01:18	X				X					X			X															
9735152MSD	1.00	01:20	X				X					X			X															
9735152L	5.00	01:23	X		X		X					X			X															
9735148	1.00	01:25	X		X		X					X			X															
CCV	1.00	01:27	X		X		X					X			X															
CCB	1.00	01:30	X		X		X					X			X															
9735149	1.00	01:32	X		X		X					X			X															
9735150	1.00	01:34	X		X		X					X			X															
9735151	1.00	01:36	X		X		X					X			X															
9735153	1.00	01:39	X		X		X					X			X															
9735154	1.00	01:41	X		X		X					X			X															
9735155	1.00	01:43	X		X		X					X			X															
9735156	1.00	01:46	X		X		X					X			X															
9735157	1.00	01:48	X		X		X					X			X															
ZZZZZZ	1.00	01:50																												
CCV	1.00	01:53	X		X		X					X			X															
CCB	1.00	01:55	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.: GEJ45

Method: MS

Instrument ID: 19204

Run Name: 1824211E05

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													
			B	S	A	E		D	A	R	O	B	I	G	O	E	L													
S0	1.00	21:11	X			X																								
S	1.00	21:14	X			X																								
ICV	1.00	21:17	X			X																								
ICB	1.00	21:20	X			X																								
LLC	1.00	21:23	X			X																								
ICSA	1.00	21:25	X			X																								
LRS2	1.00	21:28	X			X																								
LRS3	1.00	21:31	X			X																								
CCS	1.00	21:34	X			X																								
CCS	1.00	21:37	X			X																								
CCV	1.00	21:40	X			X																								
CCB	1.00	21:43	X			X																								
P21904BB	1.00	21:45	X			X																								
P21904BQ	1.00	21:48	X			X																								
9735152BKG	1.00	21:51	X																											
9735152A	1.00	21:54																												
9735152DUP	1.00	21:57	X																											
9735152MS	1.00	21:59	X			X																								
9735152MSD	1.00	22:02	X			X																								
9735152L	5.00	22:05	X																											
9735148	1.00	22:08	X																											
CCV	1.00	22:11	X			X																								
CCB	1.00	22:14	X			X																								
9735149	1.00	22:16	X																											
9735150	1.00	22:19	X																											
9735151	1.00	22:22	X																											
9735153	1.00	22:25	X																											
9735154	1.00	22:28	X																											
9735155	1.00	22:31	X																											
9735156	1.00	22:33	X																											
9735157	1.00	22:36	X																											
ZZZZZZ	1.00	22:39																												
CCV	1.00	22:42	X																											
CCB	1.00	22:45	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.: GEJ45

Method: CV

Instrument ID: 17384

Run Name: 1822102M07

Run Start Date: 08/09/2018

Run End Date: 08/09/2018

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	06:00												X																
S0.2	1.00	06:02												X																
S0.5	1.00	06:04												X																
S1.0	1.00	06:06												X																
S2.5	1.00	06:08												X																
S5.0	1.00	06:10												X																
ICV	1.00	06:12												X																
ICB	1.00	06:15												X																
CRA	1.00	06:17												X																
CCV	1.00	06:19												X																
CCB	1.00	06:21												X																
CCV	1.00	10:33												X																
CCB	1.00	10:35												X																
ZZZZZZ	1.00	10:44																												
ZZZZZZ	1.00	10:46																												
ZZZZZZ	1.00	10:48																												
ZZZZZZ	1.00	10:50																												
ZZZZZZ	1.00	10:52																												
ZZZZZZ	1.00	10:54																												
ZZZZZZ	1.00	10:56																												
ZZZZZZ	1.00	10:58																												
ZZZZZZ	1.00	11:00																												
ZZZZZZ	1.00	11:02																												
CCV	1.00	11:04												X																
CCB	1.00	11:06												X																
ZZZZZZ	1.00	11:08																												
ZZZZZZ	1.00	11:10																												
ZZZZZZ	1.00	11:12																												
ZZZZZZ	1.00	11:14																												
ZZZZZZ	1.00	11:16																												
ZZZZZZ	1.00	11:18																												
ZZZZZZ	1.00	11:21																												
ZZZZZZ	1.00	11:23																												
ZZZZZZ	1.00	11:25																												
ZZZZZZ	1.00	11:27																												
CCV	1.00	11:29												X																
CCB	1.00	11:31												X																
ZZZZZZ	1.00	11:33																												

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.: GEJ45

Method: CV
Instrument ID: 17384
Run Name: 1822102M07

Run Start Date: 08/09/2018
Run End Date: 08/09/2018

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	11:35																												
ZZZZZZ	1.00	11:37																												
ZZZZZZ	1.00	11:39																												
ZZZZZZ	1.00	11:41																												
ZZZZZZ	1.00	11:43																												
ZZZZZZ	1.00	11:45																												
ZZZZZZ	1.00	11:47																												
ZZZZZZ	1.00	11:49																												
ZZZZZZ	1.00	11:51																												
CCV	1.00	11:53													X															
CCB	1.00	11:55													X															
ZZZZZZ	1.00	11:57																												
ZZZZZZ	1.00	11:59																												
ZZZZZZ	1.00	12:01																												
ZZZZZZ	1.00	12:03																												
ZZZZZZ	1.00	12:05																												
ZZZZZZ	1.00	12:07																												
ZZZZZZ	1.00	12:09																												
ZZZZZZ	1.00	12:11																												
ZZZZZZ	1.00	12:13																												
ZZZZZZ	1.00	12:16																												
CCV	1.00	12:18													X															
CCB	1.00	12:20													X															
ZZZZZZ	1.00	12:22																												
ZZZZZZ	1.00	12:24																												
ZZZZZZ	1.00	12:26																												
ZZZZZZ	1.00	12:28																												
ZZZZZZ	1.00	12:30																												
ZZZZZZ	1.00	12:32																												
ZZZZZZ	1.00	12:34																												
ZZZZZZ	1.00	12:36																												
P21871GB	1.00	12:38													X															
P21871GQ	1.00	12:40													X															
CCV	1.00	12:42													X															
CCB	1.00	12:44													X															
9735151BKG	1.00	12:46													X															
9735151DUP	1.00	12:48													X															
9735151MS	1.00	12:50													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.: GEJ45

Method: CV
Instrument ID: 17384
Run Name: 1822102M07

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	B	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L																		
9735151MSD	1.00	12:52												X																					
9735148	1.00	12:54												X																					
9735149	1.00	12:56												X																					
9735150	1.00	12:58												X																					
9735152	1.00	13:01												X																					
9735153	1.00	13:03												X																					
9735154	1.00	13:05												X																					
CCV	1.00	13:07												X																					
CCB	1.00	13:09												X																					
9735155	1.00	13:12												X																					
9735156	1.00	13:14												X																					
9735157	1.00	13:16												X																					
ZZZZZZ	1.00	13:18																																	
ZZZZZZ	1.00	13:20																																	
ZZZZZZ	1.00	13:22																																	
ZZZZZZ	1.00	13:24																																	
ZZZZZZ	1.00	13:26																																	
ZZZZZZ	1.00	13:28																																	
ZZZZZZ	1.00	13:30																																	
CCV	1.00	13:33												X																					
CCB	1.00	13:35												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: GEJ45

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9735148	MW-1	X		
9735149	MW-2	X		
9735150	MW-3	X		
9735151	MW-4	X		
9735152	MW-5	X		
9735153	MW-6	X		
9735154	MW-7	X		
9735155	MW-8	X		
9735156	MW-9	X		
9735157	FB-20180731	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: GEJ45

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9735148	DF2000	DF5	DF5
9735149	DF5000	DF5	DF5
9735150	DF500	DF5	DF10
9735151	DF5000	DF5	DF500
9735152	DF500	DF5	DF5
9735153	DF500	DF5	DF5
9735154	DF50	DF5	DF5
9735155	DF500	DF5	DF5
9735156	DF500	DF5	DF5
9735157	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: GEJ45

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18215120112A	9735149	08/03/2018 18:22:00		X	X
	9735149	08/03/2018 18:57:00	X		
	P21520LB	08/03/2018 13:44:00	X	X	X
	P21520LQ	08/06/2018 14:57:00	X	X	X
18215120117A	9735148	08/06/2018 17:14:00		X	X
	P21520QB	08/03/2018 09:59:00		X	X
	P21520QQ	08/03/2018 09:42:00		X	X
18218120117A	9735148	08/13/2018 14:27:00	X		
	9735150	08/06/2018 20:05:00		X	
	9735150	08/06/2018 20:22:00	X		
	9735150	08/09/2018 18:36:00			X
	9735151	08/06/2018 20:56:00		X	
	9735151	08/06/2018 21:13:00			X
	9735151	08/06/2018 21:30:00	X		
	9735152	08/06/2018 21:47:00		X	X
	9735152	08/06/2018 22:38:00	X		
	9735153	08/06/2018 23:12:00		X	X
	9735153	08/06/2018 23:30:00	X		
	9735154	08/07/2018 00:04:00		X	X
	9735154	08/07/2018 00:21:00	X		
	9735155	08/07/2018 00:38:00		X	X
	9735155	08/07/2018 00:55:00	X		
	9735156	08/07/2018 02:03:00		X	X
	9735156	08/07/2018 02:20:00	X		
	9735157	08/07/2018 02:55:00	X	X	X
	P21820QB	08/06/2018 14:40:00	X	X	X
	P21820QQ	08/06/2018 14:23:00	X	X	X

Fraction: Instrumental Wet Chemistry

18215120112A / P21520LB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	08/03/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	08/03/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	08/03/18	N.D.	mg/l	0.30	1.0

18215120117A / P21520QB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Fluoride	IC	08/03/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	08/03/18	N.D.	mg/l	0.30	1.0

18218120117A / P21820QB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	08/06/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	08/06/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	08/06/18	N.D.	mg/l	0.30	1.0

SDG: GEJ45
Matrix: LIQUID

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P21520LQ	Batch: 18215120112A (Sample number(s): 9735149)								
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	2.93	NA	98	NA	90-110	NA	NA
Fluoride	IC	0.750	0.680	NA	91	NA	90-110	NA	NA
Sulfate	IC	7.50	7.55	NA	101	NA	90-110	NA	NA

LCS: P21520QQ	Batch: 18215120117A (Sample number(s): 9735148)								
Parameter	ME	Spike Added mg/l	LCS Conc mg/l	LCSD Conc mg/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Fluoride	IC	0.750	0.787	NA	105	NA	90-110	NA	NA
Sulfate	IC	7.50	7.68	NA	102	NA	90-110	NA	NA

LCS: P21820QQ	Batch: 18218120117A (Sample number(s): 9735148, 9735150-9735157)								
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	2.92	NA	97	NA	90-110	NA	NA
Fluoride	IC	0.750	0.673	NA	90	NA	90-110	NA	NA
Sulfate	IC	7.50	7.55	NA	101	NA	90-110	NA	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: GEJ45

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9735148	MW-1	X		
9735149	MW-2	X		
9735150	MW-3	X		
9735151	MW-4	X		
9735152	MW-5	X		
9735153	MW-6	X		
9735154	MW-7	X		
9735155	MW-8	X		
9735156	MW-9	X		
9735157	FB-20180731	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:

Sample Duplicate

Method defined actions are taken for any failed matrix QC.

Batch#: 18220921201B (Sample number(s): 9735156, UNSPK: 9735156, BKG: 9735156)
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: GEJ45

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

Samples	pH	Temperature of pH	Total Dissolved Solids
9735148	DF1	DF1	DF10
9735149	UNSPK, D/ DF1	UNSPK, D/ DF1	DF10
9735150	UNSPK, D/ DF1	UNSPK, D/ DF1	DF1
9735151	DF1	DF1	DF10
9735152	DF1	DF1	DF1
9735153	DF1	DF1	DF1
9735154	DF1	DF1	DF1
9735155	DF1	DF1	DF1
9735156	DF1	DF1	UNSPK, MS, D/ DF1
9735157	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

QC Summary

Wet Chemistry

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ45

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18215921201A	B215871B	08/03/2018 15:47
		L215871Q	08/03/2018 15:47
		9735148	08/03/2018 15:47
		9735149	08/03/2018 15:47
		9735150	08/03/2018 15:47
Total Dissolved Solids	18215921202A	B215872B	08/03/2018 17:02
		L215872Q	08/03/2018 17:02
		9735151	08/03/2018 17:02
		9735152	08/03/2018 17:02
		9735153	08/03/2018 17:02
Total Dissolved Solids	18220921201A	9735157	08/03/2018 17:02
		B220871B	08/08/2018 15:07
		L220871Q	08/08/2018 15:07
		9735154	08/08/2018 15:05
Total Dissolved Solids	18220921201B	9735155	08/08/2018 15:05
		9735156 UNSPK/BKG	08/08/2018 15:06
		9735156 MS,DUP	08/08/2018 15:07

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ45

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18215002207A	9735148	08/04/2018 13:22:00	X	X
	9735149 BKG	08/04/2018 12:44:00	X	X
	9735149 DUP	08/04/2018 12:50:00	X	X
	9735151	08/04/2018 13:16:00	X	X
	9735152	08/04/2018 13:47:00	X	X
	9735153	08/04/2018 13:41:00	X	X
	9735154	08/04/2018 13:08:00	X	X
	9735155	08/04/2018 13:28:00	X	X
	9735157	08/04/2018 13:12:00	X	X
	P002207Q	08/04/2018 12:38:00	X	
18215002207B	9735150 BKG	08/04/2018 12:56:00	X	X
	9735150 DUP	08/04/2018 13:02:00	X	X
18218004207A	9735156	08/07/2018 13:57:00	X	X
	P004207Q	08/07/2018 13:08:00	X	

Fraction: Wet Chemistry

18215921201A / B215871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	08/03/18	N.D.	mg/l	20.0	60.0

18215921202A / B215872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	08/03/18	N.D.	mg/l	20.0	60.0

18220921201A / B220871B 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

UNSPK: 9735156 MS: 9735156	Batch: 18220921201A (Sample number(s): 9735154-9735155)									
	Batch: 18220921201B (Sample number(s): 9735156)									
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	1600	1340.	2764.	NA	89	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: 9735149 DUP: 9735149	Batch: 18215002207A (Sample number(s): 9735148-9735149, 9735151-9735155, 9735157)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	7.69	7.7	0	4

BKG: 9735149 DUP: 9735149	Batch: 18215002207A (Sample number(s): 9735148-9735149, 9735151-9735155, 9735157)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	23.64	23.62	0	5

BKG: 9735150 DUP: 9735150	Batch: 18215002207B (Sample number(s): 9735150)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	7.95	7.93	0	4

BKG: 9735150 DUP: 9735150	Batch: 18215002207B (Sample number(s): 9735150)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	23.57	23.54	0	5

BKG: 9735156 DUP: 9735156	Batch: 18220921201B (Sample number(s): 9735156)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	1340.	1268.	6* (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: GEJ45
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: P002207Q	Batch: 18215002207A (Sample number(s): 9735148-9735149, 9735151-9735155, 9735157)								
	Batch: 18215002207B (Sample number(s): 9735150)								
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: L215871Q	Batch: 18215921201A (Sample number(s): 9735148-9735150)								
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	197	NA	99	NA	62-127	NA	NA

LCS: L215872Q	Batch: 18215921202A (Sample number(s): 9735151-9735153, 9735157)								
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: P004207Q	Batch: 18218004207A (Sample number(s): 9735156)								
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: L220871Q	Batch: 18220921201A (Sample number(s): 9735154-9735155)								
	Batch: 18220921201B (Sample number(s): 9735156)								
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

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: 456680

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: 1972517
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 456680**

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>
456680001	MW-1
456680002	MW-2
456680003	MW-3
456680004	MW-4
456680005	MW-5
456680006	MW-6
456680007	MW-7
456680008	MW-8
456680009	MW-9
456680010	FB-20180731

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.

A handwritten signature in black ink that reads "Julie Robinson". The script is cursive and fluid, with the first letters of each name being capitalized and prominent.

Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation



H56680

Lancaster Laboratories
Environmental

Environmental Analysis Request/Chain of Custody

Acct. # _____ Group # 1972517 Sample # 9735159-68

Subcontractor: GEL		Project Name/ID:		Requestor: Madeline Ratcliff		Sampler: AJS		Phone #: 717-656-2300 Ext 1189		State where samples were collected: NJ		For Compliance: Yes ☐ No ☒		Collection		Turnaround Time Requested (TAT) (please check):		Date results are needed:		Rush results requested by (please check):		E-mail Address: ENVsubcontracting@EurofinsUS.com		Phone: 717-656-2300 Ext 1189		Data Package Options (please check if required)		Type I (Validation/non-CLP)		Type III (Reduced non-CLP)		Type VI (Raw Data Only)		NJ Reduced		EDD Required? Yes ☒ No ☐		If yes, format: HazSite		Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300		7045 0717							
GEL		Site ID #:		P.O. #: NA		PWSID #:		Quote #:		NJ		For Compliance: Yes ☐ No ☒		Collection		Turnaround Time Requested (TAT) (please check):		Date results are needed:		Rush results requested by (please check):		E-mail Address: ENVsubcontracting@EurofinsUS.com		Phone: 717-656-2300 Ext 1189		Data Package Options (please check if required)		Type I (Validation/non-CLP)		Type III (Reduced non-CLP)		Type VI (Raw Data Only)		NJ Reduced		EDD Required? Yes ☒ No ☐		If yes, format: HazSite		Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300		7045 0717							
Requestor: Madeline Ratcliff		P.O. #: NA		PWSID #:		Quote #:		NJ		For Compliance: Yes ☐ No ☒		Collection		Turnaround Time Requested (TAT) (please check):		Date results are needed:		Rush results requested by (please check):		E-mail Address: ENVsubcontracting@EurofinsUS.com		Phone: 717-656-2300 Ext 1189		Data Package Options (please check if required)		Type I (Validation/non-CLP)		Type III (Reduced non-CLP)		Type VI (Raw Data Only)		NJ Reduced		EDD Required? Yes ☒ No ☐		If yes, format: HazSite		Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300		7045 0717									
Sample Identification		MW-1		MW-2		MW-3		MW-4		MW-5		MW-6		MW-7		MW-8		MW-9		FB-20180731		Turnaround Time Requested (TAT) (please check):		Date results are needed:		Rush results requested by (please check):		E-mail Address: ENVsubcontracting@EurofinsUS.com		Phone: 717-656-2300 Ext 1189		Data Package Options (please check if required)		Type I (Validation/non-CLP)		Type III (Reduced non-CLP)		Type VI (Raw Data Only)		NJ Reduced		EDD Required? Yes ☒ No ☐		If yes, format: HazSite		Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300		7045 0717	
Date		7/30/2018		7/30/2018		7/31/2018		7/31/2018		7/31/2018		7/31/2018		8/1/2018		8/1/2018		8/1/2018		7/31/2018		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time					
Time		11:30		13:40		10:10		12:15		15:45		14:10		12:45		14:40		11:05		12:00		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time									
Grab		X		X		X		X		X		X		X		X		X		X		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time									
Composite		X		X		X		X		X		X		X		X		X		X		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time									
Matrix		Soil ☐ Sediment ☐ Tissue ☐		Water ☒ Potable ☐ Ground ☒ Surface ☐		NPDES ☐ Surface ☐		Other: ☐		Total # of Containers		Radium-226 (EPA 903.1 Mod)		Radium-226 (EPA 904.0 Mod)		None		None		None		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time									
Analyses Requested		Preservation and Filtration Codes		SF #:		SCR #:		Preservation Codes		Remarks		9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time											
H = HCl		T = Thiocyanate		N = HNO ₃		B = NaOH		S = H ₂ SO ₄		P = H ₃ PO ₄		F = Field Filtered		O = Other								Date		Time		Date		Time		Date		Time		Date		Time		Date		Time									
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
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9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
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9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
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9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time		Date		Time							
9735159		9735160		9735161		9735162		9735163		9735164		9735165		9735166		9735167		9735168		Date		Time		Date		Time		Date																					

SAMPLE RECEIPT & REVIEW FORM

Client: LANC		SDG/AR/COC/Week Order: 456680	
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): <u>0</u> 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	No	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: <u>see</u> *all temperatures are recorded in Celsius TEMP: above
4 Daily check performed and passed on IR temperature gun?	☒	☒	☐	Temperature Device Serial #: <u>1R3-17</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 ID's and Containers Affected: SEE BELOW If Preservation added, Lot#: <u>1807308P</u>
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 TMC 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 #: 456680**

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>
456680001	MW-1
456680002	MW-2
456680003	MW-3
456680004	MW-4
456680005	MW-5
456680006	MW-6
456680007	MW-7
456680008	MW-8
456680009	MW-9
456680010	FB-20180731
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>
456680001	MW-1
456680002	MW-2
456680003	MW-3
456680004	MW-4
456680005	MW-5
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.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1790829

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
456680006	MW-6

456680007	MW-7
456680008	MW-8
456680009	MW-9
456680010	FB-20180731
1204088201	Method Blank (MB)
1204088202	456680006(MW-6) Sample Duplicate (DUP)
1204088203	456680006(MW-6) Matrix Spike (MS)
1204088204	456680006(MW-6) Matrix Spike Duplicate (MSD)
1204088205	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 degassed and recounted due to low recovery. The recounts are reported.

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204088203 (MW-6MS) and 1204088204 (MW-6MSD), 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: 456680 GEL Work Order: 456680

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

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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:	456680001	Client ID:	LANC006
Matrix:	Water		
Collect Date:	30-JUL-18 11:30		
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		2.40	+/-1.13	1.56	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		1.42	+/-0.414	0.278	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"			75.8	(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

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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:	456680002	Client ID:	LANC006
Matrix:	Water		
Collect Date:	30-JUL-18 13:40		
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		4.87	+/-1.53	1.91	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226 Lucas Cell, Ra226, liquid "As Received"													
Radium-226		2.71	+/-0.592	0.348	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"			75.6	(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

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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-3	Project:	LANC00115
Sample ID:	456680003	Client ID:	LANC006
Matrix:	Water		
Collect Date:	31-JUL-18 10:10		
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	1.62	+/-1.21	1.90	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.384	+/-0.281	0.394	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"			69.3	(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

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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-4	Project:	LANC00115
Sample ID:	456680004	Client ID:	LANC006
Matrix:	Water		
Collect Date:	31-JUL-18 12:15		
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	0.724	+/-1.29	2.25	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		0.813	+/-0.397	0.505	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"			67.1	(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

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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-5	Project:	LANC00115
Sample ID:	456680005	Client ID:	LANC006
Matrix:	Water		
Collect Date:	31-JUL-18 15:45		
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	1.45	+/-0.972	1.48	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		1.06	+/-0.429	0.377	1.00	pCi/L			PCW	08/14/18	1000	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"			83.8	(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

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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:	456680006	Client ID:	LANC006
Matrix:	Water		
Collect Date:	31-JUL-18 14:10		
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		2.54	+/-1.11	1.51	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226 Lucas Cell, Ra226, liquid "As Received"													
Radium-226		1.76	+/-0.523	0.508	1.00	pCi/L			PCW	08/21/18	0835	1790829	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"			84.4	(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

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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-7	Project:	LANC00115
Sample ID:	456680007	Client ID:	LANC006
Matrix:	Water		
Collect Date:	01-AUG-18 12:45		
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	+/-0.742	1.36	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		0.586	+/-0.328	0.320	1.00	pCi/L			PCW	08/21/18	0835	1790829	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"			86.5	(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

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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-8	Project:	LANC00115
Sample ID:	456680008	Client ID:	LANC006
Matrix:	Water		
Collect Date:	01-AUG-18 14:40		
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	0.484	+/-0.782	1.37	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		0.756	+/-0.420	0.534	1.00	pCi/L			PCW	08/21/18	0910	1790829	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"			80.3	(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

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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-9	Project:	LANC00115
Sample ID:	456680009	Client ID:	LANC006
Matrix:	Water		
Collect Date:	01-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	0.296	+/-0.849	1.54	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226		0.396	+/-0.231	0.233	1.00	pCi/L			PCW	08/21/18	0910	1790829	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"			82	(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

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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-20180731
Sample ID: 456680010
Matrix: Water
Collect Date: 31-JUL-18 12:00
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	0.0311	+/-0.690	1.33	3.00	pCi/L			JXC9	08/22/18	1447	1791273	1
Rad Radium-226													
Lucas Cell, Ra226, liquid "As Received"													
Radium-226	U	0.0808	+/-0.274	0.541	1.00	pCi/L			PCW	08/21/18	0910	1790829	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"			82.2	(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

Quality Control Summary

GEL LABORATORIES LLC

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QC Summary

Report Date: September 5, 2018

Page 1 of 3

Eurofins Lancaster Laboratories Environmental, LLC

2425 New Holland Pike
Lancaster, Pennsylvania

Contact: Ms. Madeline Ratcliff

Workorder: 456680

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: 456680

Page 2 of 3

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Ra-226											
Batch	1790829										
QC1204088202	456680006	DUP									
Radium-226		1.76		2.04	pCi/L	14.5		(0% - 100%)	PCW	08/21/18	09:10
	Uncertainty	+/-0.523		+/-0.608							
QC1204088205	LCS										
Radium-226	26.0			21.6	pCi/L		83.3	(75%-125%)		08/21/18	09:40
	Uncertainty			+/-1.68							
QC1204088201	MB										
Radium-226			U	0.173	pCi/L					08/21/18	09:10
	Uncertainty			+/-0.265							
QC1204088203	456680006	MS									
Radium-226	130	1.76		100	pCi/L		75.7	(75%-125%)		08/21/18	09:40
	Uncertainty	+/-0.523		+/-7.55							
QC1204088204	456680006	MSD									
Radium-226	130	1.76		99.4	pCi/L	0.774	75.1	(0%-20%)		08/21/18	09:40
	Uncertainty	+/-0.523		+/-7.77							

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

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QC Summary

Workorder: 456680

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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		

RA1791273r2.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 : 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	Tracer
	Sample	Sample	Sample		Tracer Ref.	Count		Count			
Pos.	ID	Aliquot	StDev.	Sample	Activity	Uncertainty	Activity	Uncertainty	Aliquot	Aliquot	
		L	L	Date/Time	(CPM)	(%)	(CPM)	(%)	(mL)	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						Count	Ac-228	Ac-228				Ac-228	Sample	Sample	
Pos.	Detector	Time	Gross Counts		Beta	Start	Ingrowth	Decay	Ra-228	Ac-228	Ac-228	Count	Recovery	Recovery	
	ID	(min.)	Alpha	Beta	cpm	Date/Time	Date/Time	Date/Time	Decay	Decay	Ingrowth	Correction	%	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

* - RPD changed to 0% due to sample & dup activity below MDA

Spike S/N : 1809-A
Spike Exp Date : 9/15/2018
Spike Activity (dpm/ml): 117.05
Spike Volume Added: 0.10

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 06:10	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	30.380	-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	0.456	0.255	0.413	+5.05
LB4100G2	Above	Beta bkg	22-Aug 04:54	60	3282	0.414	2.180	+11147.44
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	-1.12E+0	4.319	+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	2.113	+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	0.335	-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

Alpha pkg, Alpha ell, Alpha XTalk, Beta pkg, Beta ell, Beta XTalk

Date 5-20-18

Page 2 of 2

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: PCM

First Client Due Date: 08/29/2018

Internal Due Date: 08/27/2018

Spike Isotope: Radium-226

Spike Code: 7152

Expiration Date: 12/14/18

Vol: 5.0

Ecd Initia/Degas Date/Time: 8/16/18

LCS Isotope: Radium-226

LCS Code: 7152

Expiration Date: 12/14/18

Vol: 5.0

End LN De-em Date: 8/16/18

Prep Date: 8/16/18

Paper ID: 2726655

Balance ID: 17, 16, 553

Initials: EIV

Witness: 11/18

Bag Count Time: 5 Min Sample Count Time: 5 Min Start Count Date: 8/16/18

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDL	Client	Position Label	Alignm (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
45677001-1	FB-3019660	SAMPLE		WATER	1 pCi/L	LANC006	1	5.0	8/16/18	8/16/18	105	1	1	106
45677012-1	MW-1	SAMPLE		WATER	1 pCi/L	LANC006	2	5.0	8/16/18	8/16/18	204	1	1	205
45677031-1	MW-2	SAMPLE		WATER	1 pCi/L	LANC006	3	5.0	8/16/18	8/16/18	203	1	1	204
45677041-1	MW-3	SAMPLE		WATER	1 pCi/L	LANC006	4	5.0	8/16/18	8/16/18	202	1	1	203
45678001-1	MW-1	SAMPLE		WATER	1 pCi/L	LANC006	5	5.0	8/16/18	8/16/18	203	1	1	204
45678002-1	MW-2	SAMPLE		WATER	1 pCi/L	LANC006	6	5.0	8/16/18	8/16/18	202	1	1	203
45678003-1	MW-3	SAMPLE		WATER	1 pCi/L	LANC006	7	5.0	8/16/18	8/16/18	203	1	1	204
45678004-1	MW-4	SAMPLE		WATER	1 pCi/L	LANC006	8	5.0	8/16/18	8/16/18	202	1	1	203
45678005-1	MW-5	SAMPLE		WATER	1 pCi/L	LANC006	9	5.0	8/16/18	8/16/18	203	1	1	204
45672001-1	2018021736 MW-3	SAMPLE		WATER	1 pCi/L	DUP007	10	5.0	8/16/18	8/16/18	203	1	1	204
45672002-1	2018021737 MW-4	SAMPLE		WATER	1 pCi/L	DUP007	11	5.0	8/16/18	8/16/18	203	1	1	204
45672003-1	2018021738 MW-5	SAMPLE		WATER	1 pCi/L	DUP007	12	5.0	8/16/18	8/16/18	203	1	1	204
45672004-1	2018021739 MW-6	SAMPLE		WATER	1 pCi/L	DUP007	13	5.0	8/16/18	8/16/18	203	1	1	204
45672005-1	2018021740 MW-6S	SAMPLE		WATER	1 pCi/L	DUP007	14	5.0	8/16/18	8/16/18	203	1	1	204
45672201-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	15	5.0	8/16/18	8/16/18	203	1	1	204
45672202-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	16	5.0	8/16/18	8/16/18	203	1	1	204
45672203-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	17	5.0	8/16/18	8/16/18	203	1	1	204
45672204-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	18	5.0	8/16/18	8/16/18	203	1	1	204
45672205-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	19	5.0	8/16/18	8/16/18	203	1	1	204
45672206-1	2018022335	SAMPLE		SURFACE WA	1 pCi/L	DUP006	20	5.0	8/16/18	8/16/18	203	1	1	204
1204685007-2	MB for back 1790749	MB		SURFACE WA	1 pCi/L	QC ACCOUNT	21	5.0	8/16/18	8/16/18	203	1	1	204
1204685008-1	2018022335 45672202 DUB	DUB		SURFACE WA	1 pCi/L	QC ACCOUNT	22	5.0	8/16/18	8/16/18	203	1	1	204
1204685009-1	2018022335 45672203 DUB	DUB		SURFACE WA	1 pCi/L	QC ACCOUNT	23	5.0	8/16/18	8/16/18	203	1	1	204
1204685010-1	2018022335 45672204 DUB	DUB		SURFACE WA	1 pCi/L	QC ACCOUNT	24	5.0	8/16/18	8/16/18	203	1	1	204
1204685011-1	LCS for back 1790749	LCS		SURFACE WA	1 pCi/L	QC ACCOUNT	25	5.0	8/16/18	8/16/18	203	1	1	204

Consent: _____

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%

Batch 1790829 Check-list

This check-list was completed on 21-AUG-18 by Lyndsey Pace

This batch was reviewed by Lyndsey Pace on 21-AUG-18 and Elizabeth Krouse on 22-AUG-18.

Batch ID:
1790829

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

21-AUG-18

GEL Laboratories, Radiochemistry Division

Batch #: 1790829 Analyst: PCW First Client Due Date: 09/05/2018 Internal Due Date: 09/02/2018
 Spike Isotope: Radium-226 Spike Code: 1790829 Expiration Date: 12/19/18 Vol: 2.1 End Initial/Degas Date/Time: 8/17/18 11:25:00
 LCS Isotope: Radium-226 LCS Code: 1790829 Expiration Date: 12/19/18 Vol: 2.1 End LN De-em Date: 8/17/18
 Prep Date: 8/17/18 Bkg Count Time: 5L Min: Sample Count Time: 30 Min: Start Count Date: 8/17/18
 Pipet ID: 2292-553 Balance ID: 1790829 Initials: JH Witness: JH

Sample #	Client Description	Type	Hazard Code	Matrix	MCN CRDL	Client	Position Label	Aliquot (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
45665001-1	5947 (9-30)	SAMPLE		WATER	1pCiL	LANC002	1	5.00	1790829	1790829	6.0	1	1.0	2.0
45665001-2	594823 (9-1)	SAMPLE		WATER	1pCiL	LANC002	2	5.00	1790829	1790829	6.0	1	1.0	2.0
45665001-3	210	SAMPLE		WATER	1pCiL	LANC001	3	5.00	1790829	1790829	6.0	1	1.0	2.0
45665006-7	MW-4	SAMPLE		WATER	1pCiL	LANC006	4	5.00	1790829	1790829	6.0	1	1.0	2.0
45665007-1	MW-7	SAMPLE		WATER	1pCiL	LANC006	5	5.00	1790829	1790829	6.0	1	1.0	2.0
45665008-2	MW-8	SAMPLE		WATER	1pCiL	LANC006	6	5.00	1790829	1790829	6.0	1	1.0	2.0
45665009-3	MW-9	SAMPLE		WATER	1pCiL	LANC006	7	5.00	1790829	1790829	6.0	1	1.0	2.0
45665013-1	FB-20150712	SAMPLE		WATER	1pCiL	LANC006	8	5.00	1790829	1790829	6.0	1	1.0	2.0
45665001-1	B12	SAMPLE		WATER	1pCiL	LANC001	9	5.00	1790829	1790829	6.0	1	1.0	2.0
45665002-1	B11	SAMPLE		WATER	1pCiL	LANC001	10	5.00	1790829	1790829	6.0	1	1.0	2.0
45665003-1	B13	SAMPLE		WATER	1pCiL	LANC001	11	5.00	1790829	1790829	6.0	1	1.0	2.0
120408201-1	MIS for batch 1790829	MIS		WATER	1pCiL	QC ACCOUNT	12	5.00	1790829	1790829	6.0	1	1.0	2.0
120408202-1	MIS-6-45665006 DLP	DLP		WATER	1pCiL	QC ACCOUNT	13	5.00	1790829	1790829	6.0	1	1.0	2.0
120408203-1	MIS-6-45665006 MIS	MIS		WATER	1pCiL	QC ACCOUNT	14	5.00	1790829	1790829	6.0	1	1.0	2.0
120408204-1	MIS-6-45665006 MSD	MSD		WATER	1pCiL	QC ACCOUNT	15	5.00	1790829	1790829	6.0	1	1.0	2.0
120408205-1	LCS for batch 1790829	LCS		WATER	1pCiL	QC ACCOUNT	16	5.00	1790829	1790829	6.0	1	1.0	2.0

Comments: _____

Data Reviewed By: _____

RA1790829R.xls

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1790829
Analyst : PCW
Prep Date : 8/17/2018
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	Sample		Cell	Counting	Gross	Gross	Background	Background	Count	Cell
Pos.	Sample	Aliquot	Aliquot	Sample	Number	Time	Counts	CPM	Counts	CPM	Time	Efficiency
	ID	L	L	Date/Time		(min.)					(min.)	(cpm/dpm)
1	456554001.1	0.5000	2.0256E-05	8/3/2018 10:00	401	30	9	0.300	3	0.100	30	1.9020
2	456555001.1	0.5000	2.0256E-05	8/6/2018 13:00	504	30	16	0.533	1	0.033	30	1.8310
3	456675001.1	0.5000	2.0256E-05	8/6/2018 8:50	604	30	76	2.533	8	0.267	30	2.0460
4	456680006.1	0.5000	2.0256E-05	7/31/2018 14:10	706	30	64	2.133	8	0.267	30	1.9130
5	456680007.1	0.5000	2.0256E-05	8/1/2018 12:45	808	30	15	0.500	1	0.033	30	1.4380
6	456680008.1	0.5000	2.0256E-05	8/1/2018 14:40	101	30	24	0.800	5	0.167	30	1.5100
7	456680009.1	0.5000	2.0256E-05	8/1/2018 11:05	207	30	14	0.467	1	0.033	30	1.9750
8	456680010.1	0.5000	2.0256E-05	7/31/2018 12:00	305	30	7	0.233	5	0.167	30	1.4880
9	456683001.1	0.5000	2.0256E-05	8/2/2018 11:55	402	30	20	0.667	4	0.133	30	2.0200
10	456683002.1	0.5000	2.0256E-05	8/2/2018 13:20	505	30	40	1.333	4	0.133	30	1.5140
11	456683003.1	0.5000	2.0256E-05	8/2/2018 13:40	602	30	76	2.533	5	0.167	30	2.1000
12	1204088201.1	0.5000	2.0256E-05	8/17/2018 0:00	704	30	14	0.467	8	0.267	30	2.0850
13	1204088202.1	0.5000	2.0256E-05	7/31/2018 14:10	803	30	54	1.800	4	0.133	30	1.4750
14	1204088203.1	0.1000	1.1370E-05	7/31/2018 14:10	104	30	689	22.967	4	0.133	30	2.0520
15	1204088204.1	0.1000	1.1370E-05	7/31/2018 14:10	206	30	638	21.267	3	0.100	30	1.9170
16	1204088205.1	0.5000	2.0256E-05	8/17/2018 0:00	307	30	658	21.933	7	0.233	30	1.8050

RA1790829R.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	
0.500%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:04	8/21/2018 8:35	0.513	0.974	1.002	1.000
9.700%	6/1/2018	5/31/2019	8/17/2018 5:41	8/21/2018 5:04	8/21/2018 8:35	0.513	0.974	1.002	1.000
1.700%	7/1/2018	6/30/2019	8/17/2018 5:41	8/21/2018 5:04	8/21/2018 8:35	0.513	0.974	1.002	1.000
3.000%	11/1/2017	10/31/2018	8/17/2018 5:41	8/21/2018 5:04	8/21/2018 8:35	0.513	0.974	1.002	1.000
8.700%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:04	8/21/2018 8:35	0.513	0.974	1.002	1.000
5.300%	5/1/2018	4/30/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
2.100%	8/1/2018	7/31/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
2.900%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
1.600%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
4.000%	6/1/2018	5/31/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
2.100%	7/1/2018	6/30/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
2.200%	11/1/2017	10/31/2018	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
2.200%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:26	8/21/2018 9:10	0.515	0.972	1.002	1.000
7.800%	5/1/2018	4/30/2019	8/17/2018 5:41	8/21/2018 5:48	8/21/2018 9:40	0.516	0.971	1.002	1.000
6.600%	8/1/2018	7/31/2019	8/17/2018 5:41	8/21/2018 5:48	8/21/2018 9:40	0.516	0.971	1.002	1.000
6.300%	3/1/2018	2/28/2019	8/17/2018 5:41	8/21/2018 5:48	8/21/2018 9:40	0.516	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): 288.45
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	0.1806	0.1275	1	0.3499	0.1898	57.74%	0.2000	0.1155	0.2148	0.2165		SAMPLE				
2	0.1083	0.0765	1	0.2515	0.4929	29.15%	0.5000	0.1374	0.2656	0.2905		SAMPLE				
3	0.2741	0.1935	1	0.4753	1.9998	13.58%	2.2667	0.3055	0.5283	0.6057		SAMPLE				
4	0.2932	0.2070	1	0.5083	1.7614	15.45%	1.8667	0.2828	0.5231	0.5908		SAMPLE				
5	0.1379	0.0973	1	0.3202	0.5858	29.87%	0.4667	0.1333	0.3281	0.3532		SAMPLE				
6	0.2933	0.2071	1	0.5336	0.7564	28.83%	0.6333	0.1795	0.4202	0.4412		SAMPLE				
7	0.1003	0.0708	1	0.2329	0.3957	29.87%	0.4333	0.1291	0.2310	0.2386		SAMPLE				
8	0.2977	0.2102	1	0.5415	0.0808	173.23%	0.0667	0.1155	0.2743	0.2746		SAMPLE				
9	0.1961	0.1385	1	0.3662	0.4761	30.66%	0.5333	0.1633	0.2857	0.2943		SAMPLE				
10	0.2617	0.1847	1	0.4886	1.4294	18.85%	1.2000	0.2211	0.5162	0.5671		SAMPLE				
11	0.2109	0.1489	1	0.3837	2.0324	12.85%	2.3667	0.3000	0.5049	0.5899		SAMPLE				
12	0.2687	0.1897	1	0.4659	0.1730	78.20%	0.2000	0.1563	0.2650	0.2663		MB				
13	0.2686	0.1896	1	0.5015	2.0377	15.39%	1.6667	0.2539	0.6083	0.6814	456680006.1	DUP	14.5%			
14	0.9638	0.6804	1	1.7996	100.1746	8.70%	22.8333	0.8775	7.5455	22.3735	456680006.1	MS			129.9330	75.7%
15	0.8934	0.6308	1	1.7311	99.4022	7.71%	21.1667	0.8439	7.7680	20.7743	456680006.1	MSD	0.8%		129.9330	75.1%
16	0.2899	0.2047	1	0.5091	21.6456	7.44%	21.7000	0.8596	1.6806	4.4420		LCS			25.9861	83.3%

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



Ludlum Alpha Scintillation Counter Checks for 21-AUG-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	07:15	1	1.26E+05	126109	-2.68		
LUCAS2	EFF	07:15	1	1.33E+05	133370	2.13		
LUCAS3	EFF	07:15	1	1.37E+05	137314	-1.75		
LUCAS4	EFF	07:15	1	1.33E+05	133224	1.49		
LUCAS5	EFF	07:15	1	1.33E+05	133393	-0.2		
LUCAS6	EFF	07:15	1	1.34E+05	134013	-0.71		
LUCAS7	EFF	07:15	1	1.43E+05	142992	2.19		
LUCAS8	EFF	07:15	1	1.39E+05	138860	-0.07		

Reviewed by:

Lyndsey Pace

Date: 21-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

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 1790829

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
456554001	SAMPLE	PCW	LUCAS4	AUG-21-18 08:35:00	DONE	Lucas Cell	01-MAR-18 00:00
456555001	SAMPLE	PCW	LUCAS5	AUG-21-18 08:35:00	DONE	Lucas Cell	01-JUN-18 00:00
456675001	SAMPLE	PCW	LUCAS6	AUG-21-18 08:35:00	DONE	Lucas Cell	01-JUL-18 00:00
456680006	SAMPLE	PCW	LUCAS7	AUG-21-18 08:35:00	DONE	Lucas Cell	01-NOV-17 00:00
456680007	SAMPLE	PCW	LUCAS8	AUG-21-18 08:35:00	DONE	Lucas Cell	01-MAR-18 00:00
456680008	SAMPLE	PCW	LUCAS1	AUG-21-18 09:10:00	DONE	Lucas Cell	01-MAY-18 00:00
456680009	SAMPLE	PCW	LUCAS2	AUG-21-18 09:10:00	DONE	Lucas Cell	01-AUG-18 00:00
456680010	SAMPLE	PCW	LUCAS3	AUG-21-18 09:10:00	DONE	Lucas Cell	01-MAR-18 00:00
456683001	SAMPLE	PCW	LUCAS4	AUG-21-18 09:10:00	DONE	Lucas Cell	01-MAR-18 00:00
456683002	SAMPLE	PCW	LUCAS5	AUG-21-18 09:10:00	DONE	Lucas Cell	01-JUN-18 00:00
456683003	SAMPLE	PCW	LUCAS6	AUG-21-18 09:10:00	DONE	Lucas Cell	01-JUL-18 00:00
1204088201	MB	PCW	LUCAS7	AUG-21-18 09:10:00	DONE	Lucas Cell	01-NOV-17 00:00
1204088202	DUP	PCW	LUCAS8	AUG-21-18 09:10:00	DONE	Lucas Cell	01-MAR-18 00:00
1204088203	MS	PCW	LUCAS1	AUG-21-18 09:40:00	DONE	Lucas Cell	01-MAY-18 00:00
1204088204	MSD	PCW	LUCAS2	AUG-21-18 09:40:00	DONE	Lucas Cell	01-AUG-18 00:00
1204088205	LCS	PCW	LUCAS3	AUG-21-18 09:40:00	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 Hudson
Groundwater and Water Samples
Collected on 09/05/18-09/06/18

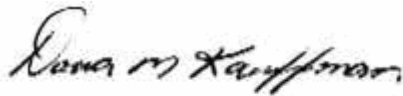
SDG# GEJ51-V.2

GROUP	SAMPLE NUMBERS
1984787	9792190-9792200

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: 10/03/2018

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 GEJ51
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Hudson

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9792190	MW-8	09/05/2018 11:30	09/07/2018 17:00
9792191	MW-9	09/05/2018 11:40	09/07/2018 17:00
9792192	MW-5	09/05/2018 13:00	09/07/2018 17:00
9792193	MW-7	09/05/2018 13:30	09/07/2018 17:00
9792194	MW-6	09/05/2018 14:40	09/07/2018 17:00
9792195	MW-1	09/06/2018 09:55	09/07/2018 17:00
9792196	MW-2	09/06/2018 10:00	09/07/2018 17:00
9792197	MW-3	09/06/2018 11:55	09/07/2018 17:00
9792198	MW-4	09/06/2018 12:00	09/07/2018 17:00
9792199	FB-09052018	09/05/2018 14:00	09/07/2018 17:00
9792200	FB-09062018	09/06/2018 12:30	09/07/2018 17:00

Sample pH Log

SDG: GEJ51

<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>
9792190	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:51:33PM	12190
9792190	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:11:57PM	25804
9792190	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:39:33PM	12665
9792190	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:40:19PM	12665
9792190	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:54:41PM	12190
9792190	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:49:49PM	12644
9792190	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:51:33PM	12190
9792190	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:51:33PM	12190
9792191	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:17:38PM	12190
9792191	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:11:07PM	25804
9792191	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:41:12PM	12665
9792191	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:40:44PM	12665
9792191	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:07:42PM	12190
9792191	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:18:27PM	12644
9792191	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:17:38PM	12190
9792191	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:17:38PM	12190
9792192	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:25:55PM	12190
9792192	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:09:29PM	25804
9792192	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:41:56PM	12665
9792192	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:41:36PM	12665
9792192	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:08:19PM	12190
9792192	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:55:10PM	12644
9792192	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:25:55PM	12190
9792192	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:25:55PM	12190
9792193	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:37:43PM	12190
9792193	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:15:23PM	25804
9792193	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:43:18PM	12665
9792193	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:42:17PM	12665
9792193	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:09:21PM	12190
9792193	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:42:54PM	12644
9792193	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:37:43PM	12190
9792193	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:37:43PM	12190
9792194	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:24:00PM	12190
9792194	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:16:29PM	25804
9792194	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:43:52PM	12665
9792194	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:43:35PM	12665
9792194	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:30:15PM	12190
9792194	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 2:01:39PM	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
9792194	148A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:22:08PM	25804
9792194	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:24:00PM	12190
9792194	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:24:00PM	12190
9792195	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:19:57PM	12190
9792195	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:17:31PM	25804
9792195	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:44:11PM	12665
9792195	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:44:28PM	12665
9792195	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:53:16PM	12190
9792195	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:37:52PM	12644
9792195	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:19:57PM	12190
9792195	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:19:57PM	12190
9792196	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:28:14PM	12190
9792196	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:18:45PM	25804
9792196	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:47:59PM	12665
9792196	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:48:17PM	12665
9792196	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:59:05PM	12190
9792196	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:09:06PM	12644
9792196	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:28:14PM	12190
9792196	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:28:14PM	12190
9792197	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:40:59PM	12190
9792197	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:19:52PM	25804
9792197	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:50:38PM	12665
9792197	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:50:21PM	12665
9792197	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:04:52PM	12190
9792197	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 5:53:47PM	1532
9792197	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:40:59PM	12190
9792197	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:40:59PM	12190
9792198	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:22:05PM	12190
9792198	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:20:26PM	25804
9792198	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:51:13PM	12665
9792198	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:50:55PM	12665
9792198	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:53:53PM	12190
9792198	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 12:15:41PM	12644
9792198	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:22:05PM	12190
9792198	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:22:05PM	12190
9792199	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:03:22PM	12190
9792199	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:18:20PM	25804
9792199	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:51:47PM	12665
9792199	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:51:31PM	12665
9792199	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:03:51PM	12190
9792199	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 5:57:36PM	1532
9792199	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:03:22PM	12190
9792199	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:03:22PM	12190
9792200	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:55:54PM	12190

<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>
9792200	015A	9	5-7	PC	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 3:21:13PM	25804
9792200	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:58:05PM	12665
9792200	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 12:58:22PM	12665
9792200	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 2:59:44PM	12190
9792200	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/10/2018 5:56:02PM	1532
9792200	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:55:54PM	12190
9792200	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	9/8/2018 1:55:54PM	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 16:39

Project: PSEG Hudson

Account #: 07701
Group Number: 1984787
SDG: GEJ51
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 Date/Time</u>	<u>ELLE#</u>
MW-8 Grab Groundwater	09/05/2018 11:30	9792190
MW-9 Grab Groundwater	09/05/2018 11:40	9792191
MW-5 Grab Groundwater	09/05/2018 13:00	9792192
MW-7 Grab Groundwater	09/05/2018 13:30	9792193
MW-6 Grab Groundwater	09/05/2018 14:40	9792194
MW-1 Grab Groundwater	09/06/2018 09:55	9792195
MW-2 Grab Groundwater	09/06/2018 10:00	9792196
MW-3 Grab Groundwater	09/06/2018 11:55	9792197
MW-4 Grab Groundwater	09/06/2018 12:00	9792198
FB-09052018 Grab Water	09/05/2018 14:00	9792199
FB-09062018 Grab Water	09/06/2018 12:30	9792200

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

Sampling Date(s): 09/05/18 - 09/06/18

Laboratory Sample ID(s): 9792190-9792200

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.		



Christiane S. Sweigart
Senior Specialist

09/21/2018



Project Name: PSEG Hudson
ELLE Group #: 1984787

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: 9792190-9792198

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: 9792196**

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.

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 #s: 9792190, 9792191, 9792192, 9792193, 9792194, 9792195, 9792197, 9792198, 9792199, 9792200

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.

Batch #: 182541404402 (Sample number(s): 9792190-9792200 UNSPK: 9792194 BKG: 9792194)

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

SW-846 6020B Rev.2, July 2014, Metals Dissolved**Batch #: 182541404701A (Sample number(s): 9792190-9792200 UNSPK: 9792194 BKG: 9792194)**

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Arsenic

EPA 300.0, Wet Chemistry

Batch #: 18253520206A (Sample number(s): 9792191-9792200 UNSPK: 9792196 BKG: 9792196)

The recovery(ies) for the following analyte(s) in the MS were below the acceptance window: Fluoride

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792190
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:30
SDG#: GEJ51-01

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	0.101	0.0010	0.0100	1
08014	Boron	7440-42-8	0.337	0.0120	0.100	1
01750	Calcium	7440-70-2	37.5	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0068 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	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0015 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00036 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0039 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	598	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	28.7	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	908	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-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792190
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:30
SDG#: GEJ51-01

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 7.2	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 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 12:37	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:37	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:55	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:55	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:55	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:55	Patrick J Engle	1

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792190
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:30
SDG#: GEJ51-01

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 13:55	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 13:55	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:44	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	18253520106A	09/10/2018 18:36	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18253520106A	09/10/2018 18:18	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520106A	09/10/2018 18:18	Ashlynn M Cornelius	5
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 01:18	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:18	Jeremy L Bolf	1

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

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792191
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:40
SDG#: GEJ51-02

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	0.123	0.0010	0.0100	1
08014	Boron	7440-42-8	0.620	0.0120	0.100	1
01750	Calcium	7440-70-2	116	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0021 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	mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	0.00053 J	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.	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	0.0018 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	947	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	22.2	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	2,200	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-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792191
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:40
SDG#: GEJ51-02

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 7.5	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 12:40	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:40	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:03	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:03	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:03	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:03	Patrick J Engle	1

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

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792191
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 11:40
SDG#: GEJ51-02

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 14:03	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:03	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:46	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	18253520206A	09/13/2018 02:47	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 02:13	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 02:13	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	18254006204A	09/12/2018 02:15	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 02:15	Jeremy L Bolf	1

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

Sample Description: MW-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792192
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:00
SDG#: GEJ51-03

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	0.0821	0.0010	0.0100	1
08014	Boron	7440-42-8	0.471	0.0120	0.100	1
01750	Calcium	7440-70-2	91.8	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	0.00086 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	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	739	100	200	500
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.	1,670	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-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792192
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:00
SDG#: GEJ51-03

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 7.4	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 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 12:48	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:48	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:06	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:06	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:06	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:06	Patrick J Engle	1

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

Sample Description: MW-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792192
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:00
SDG#: GEJ51-03

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 14:06	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:06	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:48	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	18253520206A	09/13/2018 03:04	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 02:49	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 02:49	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 02:07	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 02:07	Jeremy L Bolf	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792193
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:30
SDG#: GEJ51-04

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	0.0681	0.0010	0.0100	1
08014	Boron	7440-42-8	0.268	0.0120	0.100	1
01750	Calcium	7440-70-2	39.9	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		mg/l	mg/l	mg/l	
06024	Antimony	7440-36-0	N.D.	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.0010 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	0.0043	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	61.5	10.0	20.0	50
01504	Fluoride	16984-48-8	0.37 J	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.	350	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-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792193
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:30
SDG#: GEJ51-04

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 23.8	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 8.3	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 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 12:51	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:51	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:09	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:09	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:09	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:09	Patrick J Engle	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792193
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 13:30
SDG#: GEJ51-04

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 14:09	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:09	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:50	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	18253520206A	09/11/2018 03:44	Ashlynn M Cornelius	50
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 03:26	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 03:26	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 01:40	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:40	Jeremy L Bolf	1

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

Sample Description: MW-6 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792194
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 14:40
SDG#: GEJ51-05

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	0.108	0.0010	0.0100	1
08014	Boron	7440-42-8	0.969	0.0120	0.100	1
01750	Calcium	7440-70-2	136	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	0.0186 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	0.0030 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	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	929	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	3.3 J	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	2,450	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-6 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792194
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 14:40
SDG#: GEJ51-05

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 7.5	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 12:20	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:20	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:38	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:38	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:38	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 13:38	Patrick J Engle	1

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

Sample Description: MW-6 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792194
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 14:40
SDG#: GEJ51-05

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 13:38	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 13:38	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:32	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	2	18253520206A	09/13/2018 03:21	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 04:02	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 04:02	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 01:52	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:52	Jeremy L Bolf	1

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

Sample Description: MW-1 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792195
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 09:55
SDG#: GEJ51-06

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	0.808	0.0010	0.0100	1
08014	Boron	7440-42-8	1.11	0.0120	0.100	1
01750	Calcium	7440-70-2	380	0.0330	1.00	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0048 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0431 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	0.0023 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	0.0029 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	6,760	500	1,000	2500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	123	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	11,800	1,600	4,800	10
		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 - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792195
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 09:55
SDG#: GEJ51-06

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 23.7	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 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 12:53	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:53	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:11	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:11	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:11	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:11	Patrick J Engle	1

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

Sample Description: MW-1 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792195
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 09:55
SDG#: GEJ51-06

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 14:11	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:11	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:52	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	18253520206A	09/13/2018 03:38	Ashlynn M Cornelius	2500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 05:15	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 05:34	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	10
12151	Temperature of pH	SM 2550 B-2010	1	18254006203A	09/12/2018 00:59	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:59	Jeremy L Bolf	1

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

Sample Description: MW-2 Grab Groundwater
PSEG - Hudson**GEI Consultants, Inc.**
ELLE Sample #: GW 9792196
ELLE Group #: 1984787
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 09/07/2018 17:00**Collection Date/Time:** 09/06/2018 10:00**SDG#:** GEJ51-07

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	
07046	Barium	7440-39-3	2.24	0.0010	0.0100	1
08014	Boron	7440-42-8	0.912	0.0120	0.100	1
01750	Calcium	7440-70-2	459	0.165	5.00	5
07051	Chromium	7440-47-3	N.D.	0.0053	0.0300	1
07052	Cobalt	7440-48-4	0.0035 J	0.0015	0.0100	1
01756	Lithium	7439-93-2	0.0630 J	0.0550	0.500	5
07036	Selenium	7782-49-2	N.D.	0.105	0.500	5
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. 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	0.0047	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	0.0026 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

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	6,970	500	1,000	2500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	15.8	1.5	5.0	5
			SM 2540 C-2011	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	11,600	1,600	4,800	10

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

Sample Description: MW-2 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792196
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 10:00
SDG#: GEJ51-07

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
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 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 12:57	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:57	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/18/2018 22:19	Cindy M Gehman	5
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:57	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:57	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/18/2018 22:19	Cindy M Gehman	5
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/18/2018 22:19	Cindy M Gehman	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 12:57	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:14	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:14	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:14	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:14	Patrick J Engle	1

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

Sample Description: MW-2 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792196
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 10:00
SDG#: GEJ51-07

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 14:14	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:14	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:54	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	18253520206A	09/13/2018 01:55	Ashlynn M Cornelius	2500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 01:18	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 01:18	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	10
12151	Temperature of pH	SM 2550 B-2010	1	18254006203A	09/12/2018 00:37	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:37	Jeremy L Bolf	1

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

Sample Description: MW-3 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792197
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 11:55
SDG#: GEJ51-08

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	0.233	0.0010	0.0100	1
08014	Boron	7440-42-8	0.740	0.0120	0.100	1
01750	Calcium	7440-70-2	175	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	0.0148 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	0.00048 J	0.00041	0.0040	1
06025	Arsenic	7440-38-2	0.00086 J	0.00068	0.0040	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.0010	1
06028	Cadmium	7440-43-9	0.00016 J	0.00015	0.0020	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0060	1
06038	Molybdenum	7439-98-7	0.0073	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	1,720	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	274	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	3,180	400	1,200	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 - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792197
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 11:55
SDG#: GEJ51-08

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 8.0	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 13:00	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:00	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:17	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:17	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:17	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:17	Patrick J Engle	1

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

Sample Description: MW-3 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792197
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 11:55
SDG#: GEJ51-08

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 14:17	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:17	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:56	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	18253520206A	09/13/2018 04:29	Ashlynn M Cornelius	500
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 05:52	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 06:10	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 01:36	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006204A	09/12/2018 01:36	Jeremy L Bolf	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792198
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 12:00
SDG#: GEJ51-09

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	0.0815	0.0010	0.0100	1
08014	Boron	7440-42-8	1.14	0.0120	0.100	1
01750	Calcium	7440-70-2	97.9	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	0.0551 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	0.00046 J	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	0.0089	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	3,720	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	558	15.0	50.0	50
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	7,560	800	2,400	10
		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 - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792198
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 12:00
SDG#: GEJ51-09

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 7.5	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 13:03	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:03	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:20	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:20	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:20	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:20	Patrick J Engle	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792198
ELLE Group #: 1984787
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 12:00
SDG#: GEJ51-09

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 14:20	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:20	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 07:59	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	18253520206A	09/16/2018 06:26	Clinton M Wilson	2000
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 06:28	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 06:47	Ashlynn M Cornelius	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18253921201A	09/10/2018 15:31	Amy L Hankins	10
12151	Temperature of pH	SM 2550 B-2010	1	18254006203A	09/12/2018 00:34	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:34	Jeremy L Bolf	1

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

Sample Description: FB-09052018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792199
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 14:00
SDG#: GEJ51-10FB

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	0.0637 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	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
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	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-09052018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792199
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/05/2018 14:00
SDG#: GEJ51-10FB

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 5.8	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.

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 13:05	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:05	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:23	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:23	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:23	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:23	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:23	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:23	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:05	Damary Valentin	1

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

Analysis Report

Sample Description: FB-09052018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792199
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00

Collection Date/Time: 09/05/2018 14:00

SDG#: GEJ51-10FB

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	18253520206A	09/11/2018 07:05	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 07:05	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 07:05	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 00:45	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:45	Jeremy L Bolf	1

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

Sample Description: FB-09062018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792200
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 12:30
SDG#: GEJ51-11FB

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	0.0534 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		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
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		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-09062018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792200
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00
Collection Date/Time: 09/06/2018 12:30
SDG#: GEJ51-11FB

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 6.1	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 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 13:08	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182541404402	09/17/2018 13:08	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:26	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:26	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:26	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:26	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182541404701A	09/20/2018 14:26	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182541404701C	09/20/2018 14:26	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182540571302	09/12/2018 08:07	Damary Valentin	1

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

Analysis Report

Sample Description: FB-09062018 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9792200
ELLE Group #: 1984787
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 09/07/2018 17:00

Collection Date/Time: 09/06/2018 12:30

SDG#: GEJ51-11FB

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	18253520206A	09/11/2018 07:23	Ashlynn M Cornelius	1
01504	Fluoride	EPA 300.0	1	18253520206A	09/11/2018 07:23	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18253520206A	09/11/2018 07:23	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 00:41	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18254006203A	09/12/2018 00:41	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 16:39

Group Number: 1984787

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): 9792190-9792200		
Mercury	N.D.	0.000050	0.00020
Batch number: 182541404402	Sample number(s): 9792190-9792200		
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): 9792190-9792200		
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): 9792190-9792200		
Molybdenum	N.D.	0.00031	0.0040
Batch number: 18253520106A	Sample number(s): 9792190		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18253520206A	Sample number(s): 9792191-9792200		
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): 9792191-9792198		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18253921202A	Sample number(s): 9792190,9792199-9792200		
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: 09/21/2018 16:39

Group Number: 1984787

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): 9792190-9792200 0.00100	0.000976			98		80-120		
Batch number: 182541404402	Sample number(s): 9792190-9792200								
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): 9792190-9792200								
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 Molybdenum	Sample number(s): 9792190-9792200 0.0500	0.0456			91		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18253520106A	Sample number(s): 9792190								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.725			97		90-110		
Sulfate	7.50	7.50			100		90-110		
Batch number: 18253520206A	Sample number(s): 9792191-9792200								
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 Total Dissolved Solids	Sample number(s): 9792191-9792198 200	208			104		62-127		
Batch number: 18253921202A Total Dissolved Solids	Sample number(s): 9792190,9792199-9792200 200	204			102		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18254006203A pH	Sample number(s): 9792195-9792196,9792198-9792200 7.00	7.01			100		95-105		
Batch number: 18254006204A	Sample number(s): 9792190-9792194,9792197								

*- Outside of specification

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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: 09/21/2018 16:39

Group Number: 1984787

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	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: 182540571302 Mercury	Sample number(s): 9792190-9792200 UNSPK: 9792194 N.D.	0.00100	0.000960	0.00100	0.000950	96	95	75-125	1	20
Batch number: 182541404402 Barium	Sample number(s): 9792190-9792200 UNSPK: 9792194 0.108	2.00	1.97	2.00	2.01	93	95	75-125	2	20
Boron	0.969	2.00	2.89	2.00	2.92	96	98	75-125	1	20
Calcium	136.1	4.00	137.64	4.00	140.86	38 (2)	119 (2)	75-125	2	20
Chromium	N.D.	0.200	0.197	0.200	0.200	98	100	75-125	2	20
Cobalt	N.D.	0.500	0.469	0.500	0.472	94	94	75-125	1	20
Lithium	0.0186	1.00	1.03	1.00	1.05	101	103	75-125	2	20
Selenium	N.D.	0.150	0.111	0.150	0.109	74*	72*	75-125	2	20
Thallium	N.D.	0.150	0.132	0.150	0.131	88	88	75-125	0	20
Batch number: 182541404701A Antimony	Sample number(s): 9792190-9792200 UNSPK: 9792194 N.D.	0.00600	0.00571	0.00600	0.00575	95	96	75-125	1	20
Arsenic	0.00301	0.0100	0.0123	0.0100	0.0116	93	86	75-125	6	20
Beryllium	N.D.	0.00400	0.00408	0.00400	0.00402	102	101	75-125	1	20
Cadmium	N.D.	0.00500	0.00446	0.00500	0.00467	89	93	75-125	5	20
Lead	N.D.	0.0150	0.0151	0.0150	0.0151	101	101	75-125	0	20
Batch number: 182541404701C Molybdenum	Sample number(s): 9792190-9792200 UNSPK: 9792194 N.D.	0.0500	0.0470	0.0500	0.0481	94	96	75-125	2	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18253520206A Chloride	Sample number(s): 9792191-9792200 UNSPK: 9792196 6972.94	5000	12178.03			104		90-110		
Fluoride	N.D.	2.50	1.14			46*		90-110		
Sulfate	15.82	25	41.55			103		90-110		

*- Outside of specification

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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: 09/21/2018 16:39

Group Number: 1984787

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: 182540571302	Sample number(s): 9792190-9792200 BKG: 9792194			
Mercury	N.D.	N.D.	0 (1)	20
Batch number: 182541404402	Sample number(s): 9792190-9792200 BKG: 9792194			
Barium	0.108	0.106	2	20
Boron	0.969	0.948	2	20
Calcium	136.1	134.63	1	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	N.D.	N.D.	0 (1)	20
Lithium	0.0186	0.0218	16 (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20
Batch number: 182541404701A	Sample number(s): 9792190-9792200 BKG: 9792194			
Antimony	N.D.	N.D.	0 (1)	20
Arsenic	0.00301	0.00244	21* (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: 182541404701C	Sample number(s): 9792190-9792200 BKG: 9792194			
Molybdenum	N.D.	N.D.	0 (1)	20
Batch number: 18253520206A	Sample number(s): 9792191-9792200 BKG: 9792196			
Chloride	6972.94	6976.83	0	15
Fluoride	N.D.	N.D.	0 (1)	15
Sulfate	15.82	16.1	2 (1)	15
Batch number: 18254006204A	Sample number(s): 9792190-9792194,9792197 BKG: 9792190			
Temperature of pH	23.8	23.84	0	5
Batch number: 18254006204A	Sample number(s): 9792190-9792194,9792197 BKG: 9792190			
pH	7.19	7.20	0	4

*- Outside of specification

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Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

For Eurofins Lancaster Laboratories Environmental use only

Client # 701 (Group # 15476) Sample # 9792190-200

COC # 579870

Client Information				Matrix		Analysis Requested										For Lab Use Only															
Name <u>GEI Consultants</u>		Address <u>psc 6 Hudson</u>		Matrix ☐ Tissue ☒ Ground ☐ Surface		Preservation and Filtration Codes										PSL	SLR# <u>229123</u>														
Contact <u>Lisa Kohl</u>		Phone <u></u>		Matrix ☐ Polable ☐ NPDES ☐												Preservation Codes															
Email <u>C.Kimball / S.Winger</u>		Fax <u></u>		Matrix ☐ Other: <u></u>												H=HCl Y=Thiosulfate															
Site Address <u>NT</u>		Yes ☐ No ☐		Matrix ☐ Other: <u></u>												N=HNO ₃ B=NaOH															
Sample Identification		Collected		Grab		Composite		Soil ☐ Sediment ☐ Water ☐		Total # of Containers		Metals		Nitrate		Chloride		Fluoride		Sulfate		pH		Total Dissolved Solids		Re. 220		Re. 228		Remarks	
		Date Time																													
MW 8		9/5/18 1130		X				X		7		X		X		X		X		X		X		X		X		X			
MW 9		9/5/18 1140		X				X		7		X		X		X		X		X		X		X		X		X			
MW 5		9/5/18 1200		X				X		7		X		X		X		X		X		X		X		X		X			
MW 7		9/5/18 1230		X				X		7		X		X		X		X		X		X		X		X		X			
MW 16		9/5/18 1440		X				X		7		X		X		X		X		X		X		X		X		X			
MW 1		9/6/18 0955		X				X		7		X		X		X		X		X		X		X		X		X			
MW 2		9/6/18 1001		X				X		7		X		X		X		X		X		X		X		X		X			
MW 3		9/6/18 1155		X				X		7		X		X		X		X		X		X		X		X		X			
MW 4		9/6/18 1205		X				X		7		X		X		X		X		X		X		X		X		X			
PB-69052018		9/6/18 1400		X				X		7		X		X		X		X		X		X		X		X		X			

Turnaround Time (TAT) Requested (please check)		Date		Time		Signature	
Standard		9/3/18		1130		[Signature]	
Rush		9/3/18		1130		[Signature]	
Requested TAT in business days: <u>1</u>		9/3/18		12:00		[Signature]	
Email address: <u>Kimball@geiconsultants.com</u>		9/3/18		1700		[Signature]	
Data Package Options (price if required)		9/3/18		1700		[Signature]	
Type I (EPA Level 3)		Type VI (Raw Data Only)					
Equivalent (non-CLP)							
Type III (Reduced non-G, P)		NJ DKOP		TX TRRP-13			
NYSDEC Category A or B		MA MCP		CT RCP			
BOD Required? Yes No		Yes		No			
Site Specific OC (MS/MSD/Op)? Yes No		Yes		No			
Relinquished by Commercial Carrier		UPS		FedEx		Other	
Temperature upon receipt		57.5°C					

600

For English Learners: Label always in environmental use only

Give it

பித்தரின் த

COC # 1571871

Elanco Laboratories, Inc. • 2125 New Holland Pike • Lancaster, PA 17601 • 717-556-2330 • FOI HELP COMPLETING FORM? CHECK OUT <http://www.elanco.us/foi>

Client: GEL Consultants

Delivery and Receipt Information

Delivery Method	<u>FEDEX Courier</u>	Arrival Timestamp	<u>09/07/2016 17:00</u>
Number of Packages	<u>4</u>	Number of Projects	<u>2</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	Yes	Sample Date/Times match COC	Yes
Custody Seal Intact	Yes	VOA Vial Headspace $\geq$ 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	Yes		

Unpacked by Melvin Sanchez (8943) at 19:30 on 09/07/2016

Samples Chilled Details

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

Cooler #	Thermometer ID	Connects Temp	Insert Type	Ice Type	Ice Present?	Seal Container	Exposed Temp
1	DT146	0.7	DT	Wet	Y	Bagged	N
2	DT146	0.7	DT	Wet	Y	Bagged	N
3	DT146	4.3	DT	Wet	Y	Bagged	N
4	DT146	3.3	DT	Wet	Y	Bagged	N

Container Quantity Discrepancy Details

Sample ID on COC	Container Qty Received	Container Qty on COC	Comments
MW-6	8	7	

General Comments	Received Metals Batch QC for sample MW-0

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: GEJ51

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9792190	MW-8	X		
9792191	MW-9	X		
9792192	MW-5	X		
9792193	MW-7	X		
9792194	MW-6	X		
9792195	MW-1	X		
9792196	MW-2	X		
9792197	MW-3	X		
9792198	MW-4	X		
9792199	FB-09052018	X		Field Blank
9792200	FB-09062018	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

Method defined actions are taken for any failed matrix QC.

Batch#: 182541404402 (Sample number(s): 9792190-9792200, UNSPK: 9792194, BKG: 9792194)
The recovery(ies) for the following analyte(s) in the MS were below the acceptance window: Calcium

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ51

ICP Metals

Fraction: Metals in Liquid

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

Sample Duplicate

Batch#: 182541404701A (Sample number(s): 9792190-9792200, UNSPK: 9792194, BKG: 9792194)
The duplicate RPD for the following analyte(s) is outside the acceptance window: Arsenic

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

(Sample number(s): 9792190-9792195, 9792197-9792200: 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.

(Sample number(s): 9792196: Analysis: 07036)
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.
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.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ51

ICP Metals

Fraction: Metals in Liquid

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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792190
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	1.5	B		MS
7440-39-3	Barium	101			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	337			P
7440-43-9	Cadmium	0.36	B		MS
7440-70-2	Calcium	37500			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	6.8	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	3.9	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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792191
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.53	B		MS
7440-38-2	Arsenic	2.2	B		MS
7440-39-3	Barium	123			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	620			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	116000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	2.1	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	1.8	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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792192
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	0.86	B		MS
7440-39-3	Barium	82.1			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	471			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	91800			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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792193
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	1.0	B		MS
7440-39-3	Barium	68.1			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	268			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	39900			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	4.3			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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792194BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	3.0	B		MS
7440-39-3	Barium	108			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	969			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	136000			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	18.6	B		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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792195
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	2.3	B		MS
7440-39-3	Barium	808			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1110			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	380000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.8	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	43.1	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.9	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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792196
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	4.7			MS
7440-39-3	Barium	2240			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	912			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	459000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.5	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	63.0	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.6	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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792197
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.48	B		MS
7440-38-2	Arsenic	0.86	B		MS
7440-39-3	Barium	233			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	740			P
7440-43-9	Cadmium	0.16	B		MS
7440-70-2	Calcium	175000			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	14.8	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	7.3			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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792198
Concentration Units: UG/L

% Solids: 0.0
Date Received: 09/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.46	B		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	81.5			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1140			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	97900			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	55.1	B		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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792199
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	63.7	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	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.: GEJ51

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9792200
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	53.4	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.: GEJ51

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182541404402	9792190
Boron		9792191
Calcium		9792192
Chromium		9792193
Cobalt		9792194BKG
Lithium		9792194MS
Selenium		9792194MSD
Thallium		9792194DUP
		9792195
		9792196
		9792197
		9792198
		9792199
		9792200
		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.: GEJ51

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182541404701	9792190
Arsenic		9792191
Beryllium		9792192
Cadmium		9792193
Lead		9792194BKG
Molybdenum		9792194MS
		9792194MSD
		9792194DUP
		9792195
		9792196
		9792197
		9792198
		9792199
		9792200
		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.: GEJ51

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182540571302	9792190
		9792191
		9792192
		9792193
		9792194BKG
		9792194MS
		9792194MSD
		9792194DUP
		9792195
		9792196
		9792197
		9792198
		9792199
		9792200
		P25471BB
		P25471BQ

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.: GEJ51

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.: GEJ51

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.: GEJ51

Method: P
Run Name: 1826106T74
Calibration Date(s): 09/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron										
Calcium		30000.0	29502.51	98.3	25000.0	25095.58	100.4	25000.0	25288.37	101.2
Chromium										
Cobalt										
Lithium		600.0	589.04	98.2	500.0	498.32	99.7	500.0	507.57	101.5
Selenium		600.0	582.68	97.1	500.0	499.34	99.9	500.0	505.67	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.: GEJ51

Method: P
Run Name: 1826106T74
Calibration Date(s): 09/18/2018
Concentration Units: UG/L

Analyte	Mass	Initial Calibration			Continuing Calibration					
		True	Found	%R(1)	True	Found	%R(2)	True	Found	%R(2)
Barium										
Boron										
Calcium					25000.0	25548.87	102.2			
Chromium										
Cobalt										
Lithium					500.0	506.17	101.2			
Selenium					500.0	490.78	98.2			
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.: GEJ51

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.: GEJ51

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			
Arsenic	75				250.0	254.45	101.8			
Beryllium	9				25.0	24.35	97.4			
Cadmium	111				25.0	24.74	99.0			
Lead	208				25.0	25.38	101.5			
Molybdenum	98				25.0	23.70	94.8			

(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.: GEJ51

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.: GEJ51

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.: GEJ51

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

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ51

Method: P

Run Name: 1826106T74

Calibration Date(s): 09/18/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron						
Calcium		1000.0	1031.10	103.1		
Chromium						
Cobalt						
Lithium		100.0	105.10	105.1		
Selenium		100.0	103.27	103.3		
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.: GEJ51

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.: GEJ51

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ51

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		7.5	U	7.5	U	7.5	U	7.5	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.: GEJ51

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						
Boron				8.4	U						
Calcium				33.4	U						
Chromium				0.55	U						
Cobalt				0.40	U						
Lithium				7.5	U						
Selenium				-10.4	B						
Thallium				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.: GEJ51

Method: P
Run Name: 1826106T74
Calibration Date(s): 09/18/2018

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											
Boron											
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		
Chromium											
Cobalt											
Lithium		7.5	U	7.5	U	7.5	U	7.5	U		
Selenium		9.2	U	9.2	U	9.2	U	9.2	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.: GEJ51

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	Batch Number
Antimony	121	0.52U	0.52U	0.52U	0.52U	0.52U	121	0.410U	182541404701A
Arsenic	75	0.40U	0.40U	0.40U	0.40U	0.40U	75	0.680U	182541404701A
Beryllium	9	0.067U	0.067U	0.067U	0.067U	0.067U	9	0.091U	182541404701A
Cadmium	111	0.17U	0.17U	0.17U	0.17U	0.17U	111	0.150U	182541404701A
Lead	208	0.21U	0.21U	0.21U	0.21U	0.21U	208	1.100U	182541404701A
Molybdenum	98	0.36U	0.36U	0.36U	0.36U	0.36U	98	0.310U	182541404701A

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.: GEJ51

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ51

Method: CV
Run Name: 1825501M09
Calibration Date(s): 09/12/2018

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 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ51

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%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ51

Instrument ID: 23745
Run Name: 1826106T74
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		478571	95.7						
Barium										
Boron										
Calcium	500000		473994	94.8						
Chromium										
Cobalt										
Iron	200000		191275	95.6						
Lithium	0		-4							
Magnesium	500000		455592	91.1						
Selenium	0		16							
Thallium										

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%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ51

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9792194BKG Matrix Spike Lab Sample ID: 9792194MS Matrix Spike Duplicate Lab Sample ID: 9792194MSD
Batch Number(s): 182541404701, 182541404402, 182540571302

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
Antimony	121	0.4060	U	5.7110		5.7500		6.0000	6.0000	UG/L	95		96		1		75 - 125	20	MS
Arsenic	75	3.0080	B	12.2920		11.5910		10.0000	10.0000	UG/L	93		86		6		75 - 125	20	MS
Barium		108.1000		1974.6400		2006.0300		2000.0000	2000.0000	UG/L	93		95		2		75 - 125	20	P
Beryllium	9	0.0910	U	4.0810		4.0220		4.0000	4.0000	UG/L	102		101		1		75 - 125	20	MS
Boron		968.6800		2887.9800		2921.6600		2000.0000	2000.0000	UG/L	96		98		1		75 - 125	20	P
Cadmium	111	0.1510	U	4.4600		4.6690		5.0000	5.0000	UG/L	89		93		5		75 - 125	20	MS
Calcium		136103.2800		137638.2500		140855.2100		4000.0000	4000.0000	UG/L	38		119		2				P
Chromium		5.3000	U	196.5000		199.8200		200.0000	200.0000	UG/L	98		100		2		75 - 125	20	P
Cobalt		1.5000	U	468.5000		471.9100		500.0000	500.0000	UG/L	94		94		1		75 - 125	20	P
Lead	208	1.0700	U	15.1300		15.1490		15.0000	15.0000	UG/L	101		101		0		75 - 125	20	MS
Lithium		18.5800	B	1026.8200		1046.4400		1000.0000	1000.0000	UG/L	101		103		2		75 - 125	20	P
Mercury		0.0500	U	0.9601		0.9496		1.0000	1.0000	UG/L	96		95		1		75 - 125	20	CV
Molybdenum	98	0.3090	U	47.0010		48.0850		50.0000	50.0000	UG/L	94		96		2		75 - 125	20	MS
Selenium		21.0000	U	111.2900		108.5500		150.0000	150.0000	UG/L	74	N	72	N	2		75 - 125	20	P
Thallium		14.0000	U	132.0300		131.4200		150.0000	150.0000	UG/L	88		88		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:		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	

Background Lab Sample ID: 9792194BKG

Analyte	Mass	Sample Result (SR)	C	Spike Added (SA)	Spiked Sample Result (SSR)	C	SRR %R	Spiked Sample Duplicate (SSD)	C	SSD %R	M
Selenium		21.0000	U	800.0000	740.8000		93	NA	U	NA	P

Comments:

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ51

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9792194BKG

Duplicate Lab Sample ID: 9792194DUP

Batch Number(s): 182541404701, 182541404402, 182540571302

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		3.0080	B	2.4380	B	21		MS
Barium			108.1000		105.9400		2		P
Beryllium	9		0.0910	U	0.0910	U			MS
Boron			968.6800		948.4300		2		P
Cadmium	111		0.1510	U	0.1510	U			MS
Calcium			136103.2800		134634.9000		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			18.5800	B	21.8400	B	16		P
Mercury			0.0500	U	0.0500	U			CV
Molybdenum	98		0.3090	U	0.3090	U			MS
Selenium			-39.0500	B	-32.7600	B	-18		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

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ51

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9792194BKG Serial Dilution Lab Sample ID: 9792194L

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: P
Instrument ID: 23745
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron			
Calcium	317.93		33.4
Chromium			
Cobalt			
Lithium	670.78		7.5
Selenium	196.09		6.0
Thallium			

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.: GEJ51
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.: GEJ51
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.: GEJ51
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.: GEJ51
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.: GEJ51
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

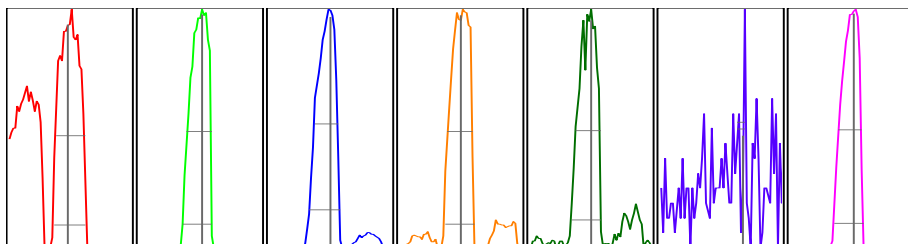
[No Gas]

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 %		

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ51

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					
9792194BKG	13:38	94		99		99		97					
9792194A	13:41	95		104		102		96					
9792194DUP	13:43	95		99		97		96					
9792194MS	13:46	94		102		98		95					
9792194MSD	13:49	94		98		98		95					
9792194L	13:52	103		107		102		105					
9792190	13:55	101		103		103		102					
CCV	13:57	104		111		103		108					
CCB	14:00	106		109		101		104					
9792191	14:03	98		103		101		101					
9792192	14:06	97		101		100		97					
9792193	14:09	105		107		106		106					
9792195	14:11	85		91		91		82					
9792196	14:14	82		89		87		76					
9792197	14:17	85		90		86		80					
9792198	14:20	76		80		79		73					
9792199	14:23	86		95		86		85					
9792200	14:26	87		97		89		86					

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.: GEJ51

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					

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: 182541404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9792190	09/12/2018	50.00	50
9792191	09/12/2018	50.00	50
9792192	09/12/2018	50.00	50
9792193	09/12/2018	50.00	50
9792195	09/12/2018	50.00	50
9792196	09/12/2018	50.00	50
9792197	09/12/2018	50.00	50
9792198	09/12/2018	50.00	50
9792199	09/12/2018	50.00	50
9792200	09/12/2018	50.00	50
9792194BKG	09/12/2018	50.00	50
9792194DUP	09/12/2018	50.00	50
9792194MSD	09/12/2018	50.00	50
9792194MS	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)
9792190	09/12/2018	50.00	50
9792191	09/12/2018	50.00	50
9792192	09/12/2018	50.00	50
9792193	09/12/2018	50.00	50
9792195	09/12/2018	50.00	50
9792196	09/12/2018	50.00	50
9792197	09/12/2018	50.00	50
9792198	09/12/2018	50.00	50
9792199	09/12/2018	50.00	50
9792200	09/12/2018	50.00	50
9792194BKG	09/12/2018	50.00	50
9792194DUP	09/12/2018	50.00	50
9792194MSD	09/12/2018	50.00	50
9792194MS	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



Method: CV
Batch Number: 182540571302

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9792190	09/11/2018	40.00	40
9792191	09/11/2018	40.00	40
9792192	09/11/2018	40.00	40
9792193	09/11/2018	40.00	40
9792195	09/11/2018	40.00	40
9792196	09/11/2018	40.00	40
9792197	09/11/2018	40.00	40
9792198	09/11/2018	40.00	40
9792199	09/11/2018	40.00	40
9792200	09/11/2018	40.00	40
9792194BKG	09/11/2018	40.00	40
9792194DUP	09/11/2018	40.00	40
9792194MSD	09/11/2018	40.00	40
9792194MS	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.: GEJ51

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	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	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													
9792194BKG	1.00	12:20			X		X		X	X	X		X			X	X													
9792194A	1.00	12:23														X														
9792194DUP	1.00	12:26			X		X		X	X	X		X			X	X													
9792194MS	1.00	12:29			X		X		X	X	X		X			X	X													
9792194MSD	1.00	12:32			X		X		X	X	X		X			X	X													
9792194L	5.00	12:34			X		X		X	X	X		X			X	X													
9792190	1.00	12:37			X		X		X	X	X		X			X	X													
9792191	1.00	12:40			X		X		X	X	X		X			X	X													
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													
9792192	1.00	12:48			X		X		X	X	X		X			X	X													
9792193	1.00	12:51			X		X		X	X	X		X			X	X													
9792195	1.00	12:53			X		X		X	X	X		X			X	X													
9792196	1.00	12:57			X		X			X	X						X													
9792197	1.00	13:00			X		X		X	X	X		X			X	X													
9792198	1.00	13:03			X		X		X	X	X		X			X	X													
9792199	1.00	13:05			X		X		X	X	X		X			X	X													
9792200	1.00	13:08			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	13:11																												
ZZZZZZ	1.00	13:14																												

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.: GEJ51

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	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													

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.: GEJ51

Method: P
Instrument ID: 23745
Run Name: 1826106T74

Run Start Date: 09/18/2018
Run End Date: 09/18/2018

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	21:16							X				X			X														
S	1.00	21:19							X																					
S	1.00	21:22											X			X														
S	1.00	21:25																												
ICV	1.00	21:27							X				X			X														
ICB	1.00	21:30							X				X			X														
LLC	1.00	21:33							X				X			X														
ICSA	1.00	21:36							X				X			X														
CCV	1.00	21:39							X				X			X														
CCB	1.00	21:41							X				X			X														
LRS2	1.00	21:44							X				X			X														
LRS4	1.00	21:48							X				X			X														
LRS3	1.00	21:51							X				X			X														
LRS5	1.00	21:54							X				X			X														
CCV	1.00	21:57							X				X			X														
CCB	1.00	21:59							X				X			X														
ZZZZZZ	5.00	22:02																												
ZZZZZZ	5.00	22:05																												
ZZZZZZ	5.00	22:08																												
ZZZZZZ	5.00	22:10																												
ZZZZZZ	5.00	22:13																												
ZZZZZZ	25.00	22:16																												
9792196	5.00	22:19							X				X			X														
9792196	10.00	22:22																												
CCV	1.00	22:25							X				X			X														
CCB	1.00	22:28							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.: GEJ51

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													
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															
9792194BKG	1.00	13:38	X	X		X		X				X			X															
9792194A	1.00	13:41																												
9792194DUP	1.00	13:43	X	X		X		X				X			X															
9792194MS	1.00	13:46	X	X		X		X				X			X															
9792194MSD	1.00	13:49	X	X		X		X				X			X															
9792194L	5.00	13:52	X	X		X		X				X			X															
9792190	1.00	13:55	X	X		X		X				X			X															
CCV	1.00	13:57	X	X		X		X				X			X															
CCB	1.00	14:00	X	X		X		X				X			X															
9792191	1.00	14:03	X	X		X		X				X			X															
9792192	1.00	14:06	X	X		X		X				X			X															
9792193	1.00	14:09	X	X		X		X				X			X															
9792195	1.00	14:11	X	X		X		X				X			X															
9792196	1.00	14:14	X	X		X		X				X			X															
9792197	1.00	14:17	X	X		X		X				X			X															
9792198	1.00	14:20	X	X		X		X				X			X															
9792199	1.00	14:23	X	X		X		X				X			X															
9792200	1.00	14:26	X	X		X		X				X			X															
CCV	1.00	14:28	X	X		X		X				X			X															
CCB	1.00	14:31	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.: GEJ51

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ51

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	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

METHODS:

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MS = Matrix Spike
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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: GEJ51

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9792190	MW-8	X		
9792191	MW-9	X		
9792192	MW-5	X		
9792193	MW-7	X		
9792194	MW-6	X		
9792195	MW-1	X		
9792196	MW-2	X		
9792197	MW-3	X		
9792198	MW-4	X		
9792199	FB-09052018	X		Field Blank
9792200	FB-09062018	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

Method defined actions are taken for any failed matrix QC.

Batch#: 18253520206A (Sample number(s): 9792191-9792200, UNSPK: 9792196, BKG: 9792196)
The recovery(ies) for the following analyte(s) in the MS were below the acceptance window: Fluoride

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ51

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9792190	DF500	DF5	DF5
9792191	DF500	DF5	DF5
9792192	DF500	DF5	DF5
9792193	DF50	DF5	DF5
9792194	DF500	DF5	DF5
9792195	DF2500	DF5	DF50
9792196	UNSPK, MS, D/ DF2500	UNSPK, MS, D/ DF5	UNSPK, MS, D/ DF5
9792197	DF500	DF5	DF50
9792198	DF2000	DF5	DF50
9792199	DF1	DF1	DF1
9792200	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: GEJ51

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18253520106A	9792190	09/10/2018 18:18:00		X	X
	9792190	09/10/2018 18:36:00	X		
	P25320FB	09/10/2018 13:26:00	X	X	X
	P25320FQ	09/10/2018 13:08:00	X	X	X
18253520206A	9792191	09/11/2018 02:13:00		X	X
	9792191	09/13/2018 02:47:00	X		
	9792192	09/11/2018 02:49:00		X	X
	9792192	09/13/2018 03:04:00	X		
	9792193	09/11/2018 03:26:00		X	X
	9792193	09/11/2018 03:44:00	X		
	9792194	09/11/2018 04:02:00		X	X
	9792194	09/13/2018 03:21:00	X		
	9792195	09/11/2018 05:15:00		X	
	9792195	09/11/2018 05:34:00			X
	9792195	09/13/2018 03:38:00	X		
	9792196 BKG	09/11/2018 01:18:00		X	X
	9792196 DUP	09/11/2018 01:36:00		X	X
	9792196 MS	09/11/2018 01:55:00		X	X
	9792196 BKG	09/13/2018 01:55:00	X		
	9792196 DUP	09/13/2018 02:12:00	X		
	9792196 MS	09/13/2018 02:29:00	X		
	9792197	09/11/2018 05:52:00		X	
	9792197	09/11/2018 06:10:00			X
	9792197	09/13/2018 04:29:00	X		
	9792198	09/11/2018 06:28:00		X	
	9792198	09/11/2018 06:47:00			X
	9792198	09/16/2018 06:26:00	X		
	9792199	09/11/2018 07:05:00	X	X	X
	9792200	09/11/2018 07:23:00	X	X	X
	P25320FB	09/10/2018 14:03:00	X	X	X
	P25320FQ	09/10/2018 13:44:00	X	X	X

Fraction: Instrumental Wet Chemistry

18253520106A / 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

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

UNSPK: 9792196 MS: 9792196	Batch: 18253520206A (Sample number(s): 9792191-9792200)									
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
Chloride	IC	5000	6972.94	12178.03	NA	104	NA	90-110	NA	NA
Fluoride	IC	2.50	N.D.	1.14	NA	46 *	NA	90-110	NA	NA
Sulfate	IC	25	15.82	41.55	NA	103	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: 9792196 DUP: 9792196	Batch: 18253520206A (Sample number(s): 9792191-9792200)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Chloride	IC	6972.94	6976.83	0	15
Fluoride	IC	N.D.	N.D.	0 (1)	15
Sulfate	IC	15.82	16.1	2 (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.

SDG: GEJ51
Matrix: LIQUID

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P25320FQ	Batch: 18253520106A (Sample number(s): 9792190)								
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	0.725	NA	97	NA	90-110	NA	NA
Sulfate	IC	7.50	7.50	NA	100	NA	90-110	NA	NA

LCS: P25320FQ	Batch: 18253520206A (Sample number(s): 9792191-9792200)								
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: GEJ51

Instrument ID: 10913
Calibration Date: 08/20/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.475342	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

Concentration units: mg/L

Batch Numbers: 18253520106A, 18253520206A
Run Start Dates: 09/10/2018
Run Names: 1825301D06

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	2.9655	99	7.5	7.4715	100	0.75	0.7169	96
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9999	100	7.5	7.4232	99	0.75	0.7282	97
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0029	100	7.5	7.4093	99	0.75	0.7374	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

* = Out of Specifications



Lancaster Laboratories
Environmental

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

SDG: GEJ51

Instrument ID: 24811
Calibration Date: 08/23/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.722817	1.441954	3.472742	6.607293	9.556303	1.0000	1.0000

Acceptance Range:

ICV/CCV: 90%-110%

ICB/CCB: < MDL

Concentration units: mg/L

Batch Numbers: 18253520206A

Run Start Dates: 09/12/2018, 09/15/2018

Run Names: 1825501D17, 1825801D17

Sample	Chloride		
	True	Result	%Rec
ICV	3	2.9217	97
ICB	0	ND	NA
CCV2	3	2.7905	93
CCB	0	ND	NA
CCV2	3	2.7868	93
CCB	0	ND	NA
CCV2	3	2.7826	93
CCB	0	ND	NA
Low Chk	1.5	1.3790	92
High Chk	4.5	4.5017	100
CCV2	3	2.8528	95
CCB	0	ND	NA
CCV2	3	2.8548	95
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: GEJ51

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9792190	MW-8	X		
9792191	MW-9	X		
9792192	MW-5	X		
9792193	MW-7	X		
9792194	MW-6	X		
9792195	MW-1	X		
9792196	MW-2	X		
9792197	MW-3	X		
9792198	MW-4	X		
9792199	FB-09052018	X		Field Blank
9792200	FB-09062018	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: GEJ51

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

Samples	pH	Temperature of pH	Total Dissolved Solids
9792190	UNSPK,D/ DF1	UNSPK,D/ DF1	DF1
9792191	DF1	DF1	DF1
9792192	DF1	DF1	DF1
9792193	DF1	DF1	DF1
9792194	DF1	DF1	DF1
9792195	DF1	DF1	DF10
9792196	DF1	DF1	DF10
9792197	DF1	DF1	DF1
9792198	DF1	DF1	DF10
9792199	DF1	DF1	DF1
9792200	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

QC Summary

Wet Chemistry



Lancaster Laboratories
Environmental

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ51

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
		9792191	09/10/2018 15:31
		9792192	09/10/2018 15:31
		9792193	09/10/2018 15:31
		9792194	09/10/2018 15:31
		9792195	09/10/2018 15:31
		9792196	09/10/2018 15:31
		9792197	09/10/2018 15:31
		9792198	09/10/2018 15:31
Total Dissolved Solids	18253921202A	B253872B	09/10/2018 15:53
		L253872Q	09/10/2018 15:53
		9792190	09/10/2018 15:53
		9792199	09/10/2018 15:53
		9792200	09/10/2018 15:53

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ51

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18254006203A	9792195	09/12/2018 00:59:00	X	X
	9792196	09/12/2018 00:37:00	X	X
	9792198	09/12/2018 00:34:00	X	X
	9792199	09/12/2018 00:45:00	X	X
	9792200	09/12/2018 00:41:00	X	X
	P006203Q	09/11/2018 23:31:00	X	
18254006204A	9792190 BKG	09/12/2018 01:18:00	X	X
	9792190 DUP	09/12/2018 01:21:00	X	X
	9792191	09/12/2018 02:15:00	X	X
	9792192	09/12/2018 02:07:00	X	X
	9792193	09/12/2018 01:40:00	X	X
	9792194	09/12/2018 01:52:00	X	X
	9792197	09/12/2018 01:36:00	X	X
	P006204Q	09/12/2018 01:14:00	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

Water Quality

Fraction: Wet Chemistry

BKG: 9792190 DUP: 9792190	Batch: 18254006204A (Sample number(s): 9792190-9792194, 9792197)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	7.19	7.2	0	4

BKG: 9792190 DUP: 9792190	Batch: 18254006204A (Sample number(s): 9792190-9792194, 9792197)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	23.8	23.84	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: GEJ51
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: L253871Q	Batch: 18253921201A (Sample number(s): 9792191-9792198)								
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): 9792190, 9792199-9792200)								
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: P006203Q	Batch: 18254006203A (Sample number(s): 9792195-9792196, 9792198-9792200)								
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): 9792190-9792194, 9792197)								
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: 459187

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: 1984788
Chain of Custody: 1984788
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 459187**

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>
459187001	MW-8
459187002	MW-9
459187003	MW-5
459187004	MW-7
459187005	MW-6
459187006	MW-1
459187007	MW-2
459187008	MW-3
459187009	MW-4
459187010	FB-09052018
459187011	FB-09062018

Case Narrative:

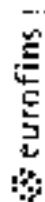
Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

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.

A handwritten signature in black ink, appearing to read 'T Cannon', with a stylized flourish at the end.

Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

Lancaster Laboratories
Lancaster, PA 17602-1598
$$\frac{\mathbb{E}[\text{sum}_{\text{max}}]}{\mathbb{E}[\text{sum}_{\text{min}}]}, |S|$$

Page 2 of 2

[illegible]

SAMPLE RECEIPT & REVIEW FORM

Client: LANC		SUGGESTED WORK ORDER: 459183	
Received By: AA Michelle Stern		Date Received: 9/11/18 K4 711	
Carrier and Tracking Number		Circle Applicable: ☒ FedEx Express ☐ FedEx Ground ☐ UPS ☐ Field Services ☐ Courier ☐ Other	
		5035 4245 0649 5035 4245 0650	
Suggested Hazard Information	☐ Y ☐ N	If No (Counts < 100 ppm) no samples not marked "radioactive", contact the Radiac Safety Group for further investigation.	
Shipped as a DOD Hazardous?	☐ Y ☒ N	Hazard Class Shipped: UNR	
DOCSamples marked or classified as radioactive?	☐ Y ☒ N	Maximum Net Count Observed? (Observed Count - Area Background Counts) 0 CPM / min/Hr Classified as: Rad 1 Rad 2 Rad 3	
Do package, COC, and/or Samples marked HAZ?	☐ Y ☒ N	If yes, select Hazards below, and contact the GEL Safety Group: ☐ PCBs ☐ Flammable ☐ Foreign Soil ☐ RCRA ☐ Asbestos ☐ Mercury ☐ Other	
Sample Receipt Criteria		☐ Y ☐ N ☐ P	Comments (Use Remarks if Required for Non-Conforming Items)
1. Shipping containers received intact and sealed?	☒ Y ☐ N ☐ P		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2. Chain of custody documents included with shipment?	☒ Y ☐ N ☐ P		
3. Samples requiring cold preservation within (0 ± 6 deg. C)?	☒ Y ☐ N ☐ P		Preservation Method: ☒ Wet Ice ☐ Dry Ice ☐ None ☐ Other All temperatures are recorded in Celsius. TEMP: 1°
4. Daily check performed and passed on RH temperature gun?	☒ Y ☐ N ☐ P		Temperature Device Serial #: 7A2-18 Secondary Temperature Device Serial # (if Applicable)
5. Sample containers (MAC) and sealed?	☒ Y ☐ N ☐ P		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6. Samples requiring chemical preservation at proper pH?	☒ Y ☐ N ☐ P		Sample IDs and Containers affected: If Transference of Vol. Lost: If Yes, Are Fixatives or Split Kits present? Yes No If yes, take to VOA Facility 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:
7. Do any samples require Volatile Analysis?	☒ Y ☐ N ☐ P		
8. Samples received within holding time?	☒ Y ☐ N ☐ P		IDs and containers affected:
9. Sample IDs on COC match IDs on bottles?	☒ Y ☐ N ☐ P		Sample IDs and containers affected:
10. Date & time on COC match date & time on bottles?	☒ Y ☐ N ☐ P		Sample IDs affected:
11. Number of containers received match number indicated on COC?	☒ Y ☐ N ☐ P		Sample IDs affected:
12. Are sample containers identifiable as GEL generated?	☒ Y ☐ N ☐ P		
13. COC form is properly signed in requisition/received section?	☒ Y ☐ N ☐ P		
Comments (Use Discrepancy Form if needed):			

PM (or DMA) or your initials **KG**

Date **9/11/18**

Page **1** of **1**

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 #: 459187**

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>
459187001	MW-8
459187002	MW-9
459187003	MW-5
459187004	MW-7
459187005	MW-6
459187006	MW-1
459187007	MW-2
459187008	MW-3
459187009	MW-4
459187010	FB-09052018
459187011	FB-09062018
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>
459187001	MW-8
459187002	MW-9
459187003	MW-5
459187004	MW-7
459187005	MW-6
459187006	MW-1
459187007	MW-2
459187008	MW-3
459187009	MW-4
459187010	FB-09052018
459187011	FB-09062018
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.

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: 459187 GEL Work Order: 459187

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

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: September 28, 2018

Client Sample ID: MW-8
Sample ID: 459187001
Matrix: Ground Water
Collect Date: 05-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		2.50	+/-1.28	1.90	+/-1.45	3.00	pCi/L			JXC9	09/27/18	0925	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.112	+/-0.303	0.573	+/-0.304	1.00	pCi/L			PCW	09/27/18	0920	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	88.7	(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

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-9
Sample ID: 459187002
Matrix: Ground Water
Collect Date: 05-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	1.75	+/-1.22	1.91	+/-1.31	3.00	pCi/L			JXC9	09/27/18	0925	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.184	+/-0.297	0.529	+/-0.298	1.00	pCi/L			PCW	09/27/18	0920	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	92.1	(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
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Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-5
Sample ID: 459187003
Matrix: Ground Water
Collect Date: 05-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		2.59	+/-1.59	2.46	+/-1.74	3.00	pCi/L			JXC9	09/27/18	0925	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.466	+/-0.322	0.406	+/-0.334	1.00	pCi/L			PCW	09/27/18	0920	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	79.4	(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	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
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Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-7
Sample ID: 459187004
Matrix: Ground Water
Collect Date: 05-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	1.25	+/-0.912	1.40	+/-0.973	3.00	pCi/L			JXC9	09/27/18	0911	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.289	+/-0.269	0.396	+/-0.275	1.00	pCi/L			PCW	09/27/18	0920	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	80.6	(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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Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-6
Sample ID: 459187005
Matrix: Ground Water
Collect Date: 05-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		4.46	+/-1.34	1.62	+/-1.80	3.00	pCi/L			JXC9	09/27/18	0911	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.881	+/-0.431	0.514	+/-0.459	1.00	pCi/L			PCW	09/27/18	0920	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	(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: 459187006
Matrix: Ground Water
Collect Date: 06-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		2.27	+/-1.02	1.37	+/-1.19	3.00	pCi/L			JXC9	09/27/18	0911	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.11	+/-0.417	0.344	+/-0.451	1.00	pCi/L			PCW	09/27/18	0920	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	85.4	(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	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

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-2
Sample ID: 459187007
Matrix: Ground Water
Collect Date: 06-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		2.47	+/-0.936	1.14	+/-1.15	3.00	pCi/L			JXC9	09/27/18	0911	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226		1.65	+/-0.521	0.376	+/-0.576	1.00	pCi/L			PCW	09/27/18	0920	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	92.3	(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
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Lancaster, Pennsylvania 17601-5994

Report Date: September 28, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3
Sample ID: 459187008
Matrix: Ground Water
Collect Date: 06-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	0.205	+/-0.846	1.57	+/-0.848	3.00	pCi/L			JXC9	09/27/18	0911	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.224	+/-0.316	0.550	+/-0.318	1.00	pCi/L			PCW	09/27/18	0920	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	81	(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: September 28, 2018

Client Sample ID: MW-4
Sample ID: 459187009
Matrix: Ground Water
Collect Date: 06-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	1.77	+/-1.23	1.91	+/-1.32	3.00	pCi/L			JXC9	09/27/18	0912	1802264	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	-0.109	+/-0.256	0.586	+/-0.256	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	75	(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-09052018

Project: LANC00115

Sample ID: 459187010

Client ID: LANC006

Matrix: Ground Water

Collect Date: 05-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	0.697	+/-0.748	1.24	+/-0.771	3.00	pCi/L			JXC9	09/27/18	0912	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.0411	+/-0.267	0.551	+/-0.267	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	93.8	(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

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: FB-09062018

Project: LANC00115

Sample ID: 459187011

Client ID: LANC006

Matrix: Ground Water

Collect Date: 06-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	-0.378	+/-0.746	1.52	+/-0.747	3.00	pCi/L			JXC9	09/27/18	0913	1802264	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.0835	+/-0.231	0.462	+/-0.232	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	89.2	(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

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: September 28, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 459187

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: 459187

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	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.

** 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	Activity	Uncertainty	Aliquot	Aliquot	
		L	L	Date/Time	(CPM)	(%)	(CPM)	(%)	(mL)	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 Recovery %	Sample Recovery Error %
Counting			Gross Counts		Beta	Count	Ac-228	Ac-228	Ra-228 Decay	Ac-228 Decay	Ac-228 Ingrowth	Ac-228 Count Correction			
Pos.	Detector ID	Time (min.)	Alpha	Beta	cpm	Start Date/Time	Ingrowth Date/Time	Decay Date/Time							
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

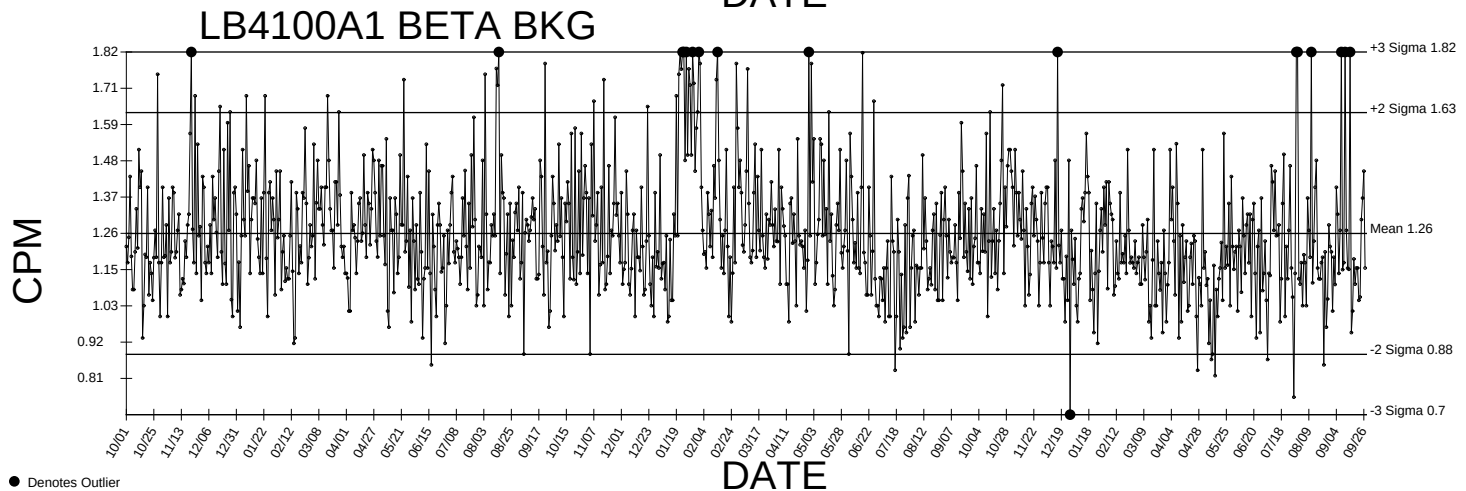
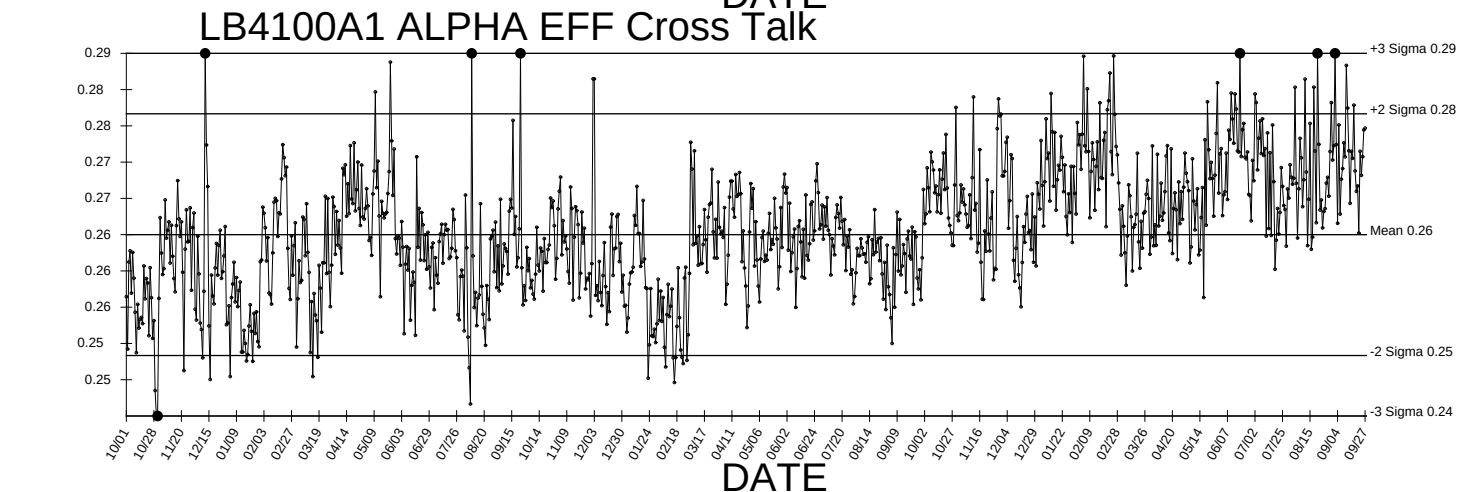
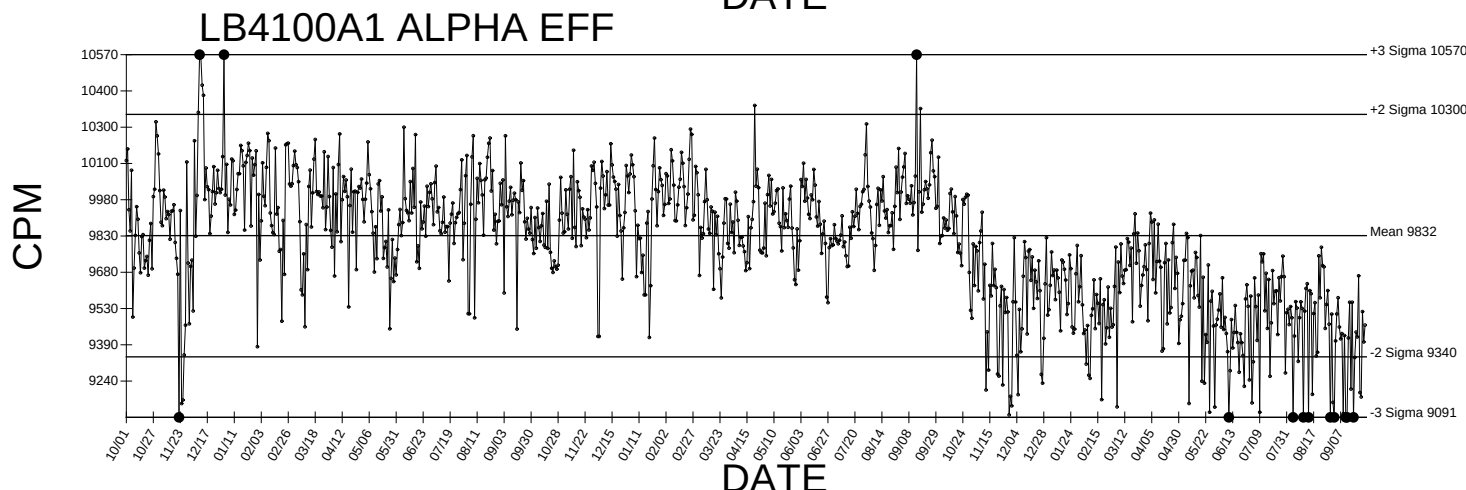
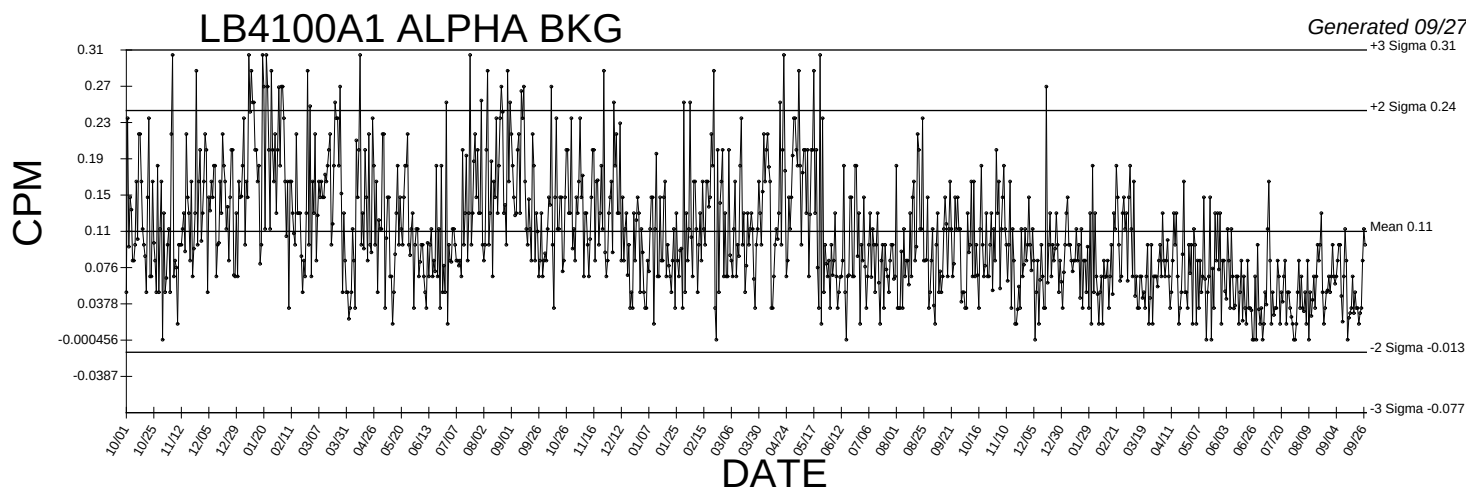
LB4100B3	Alpha bkg, Beta bkg, Beta eff, Beta XTalk
LB4100D1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D2	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100D4	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
PIC3A	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
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PIC13C	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

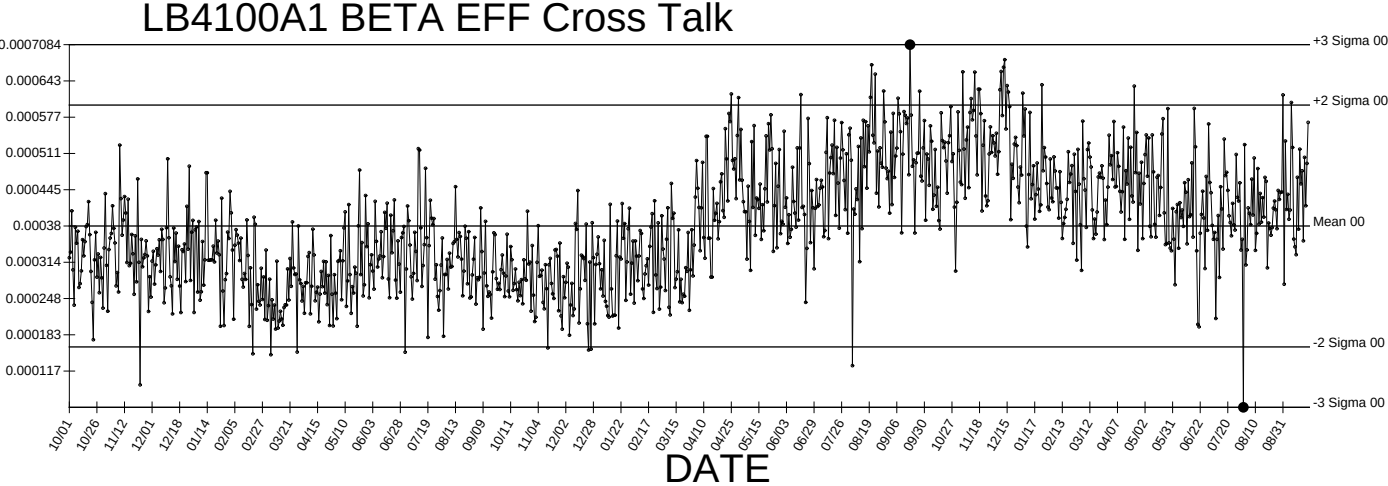
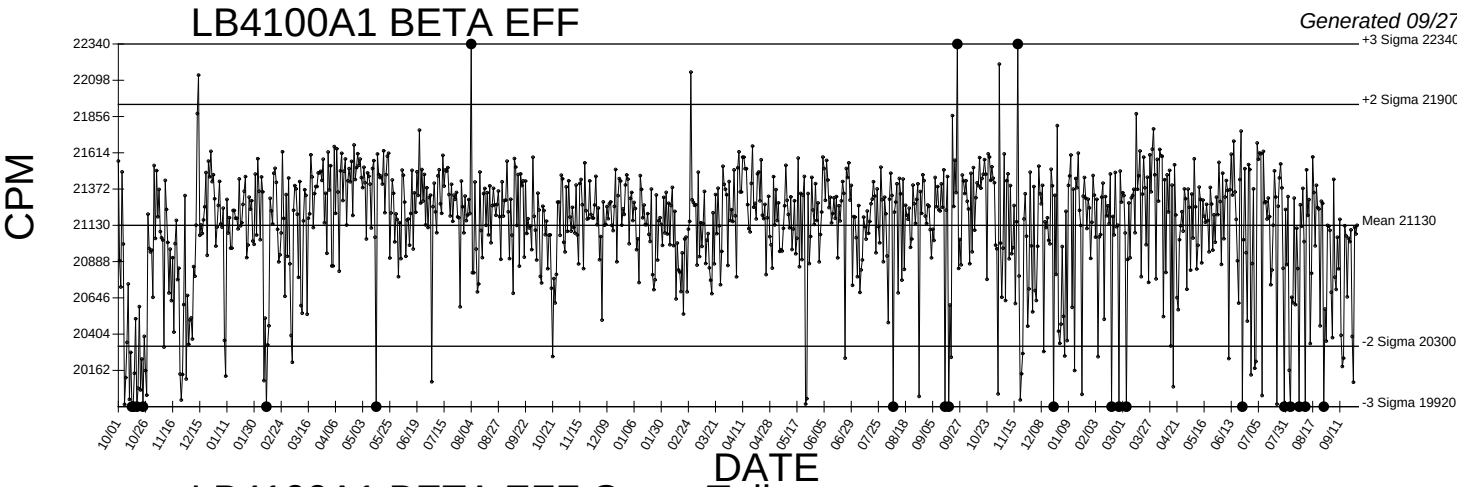
Reviewed by *[Signature]*

Date 9-27-18

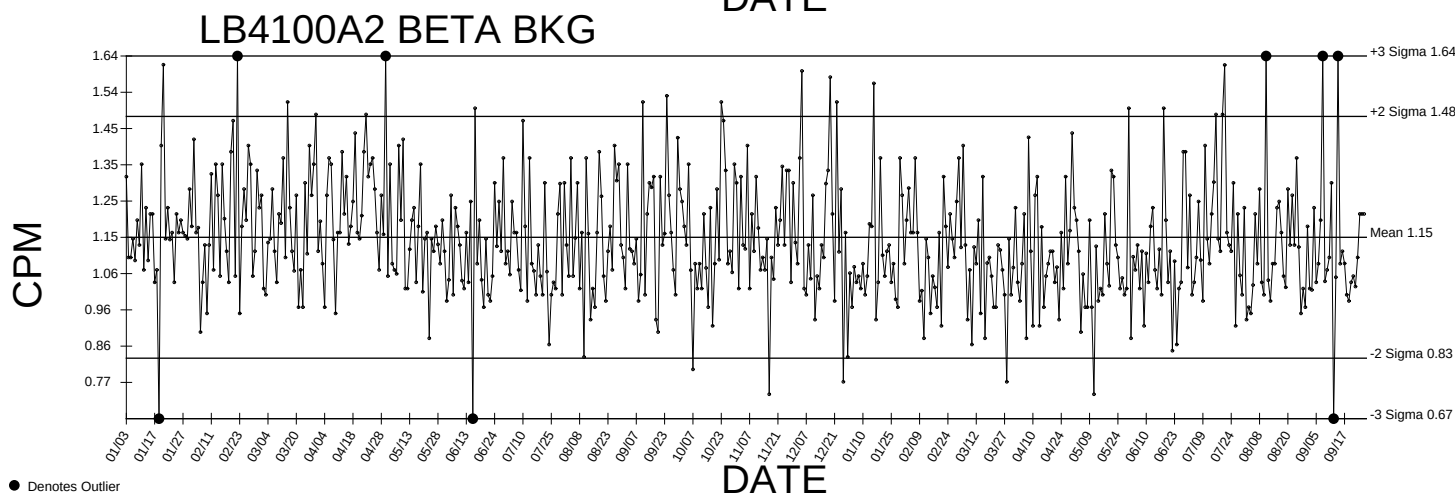
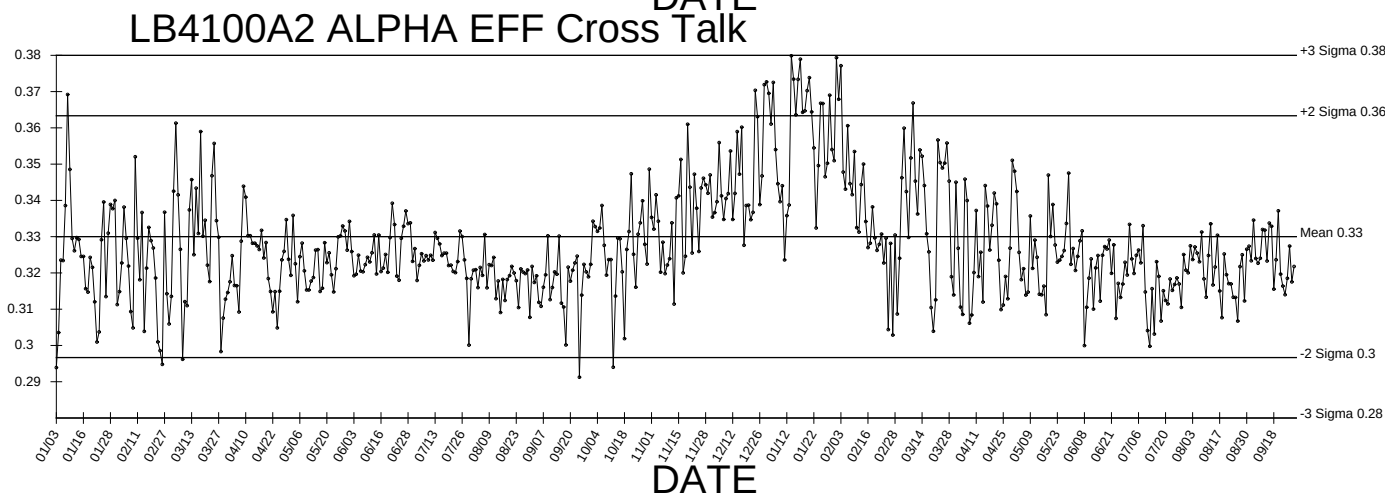
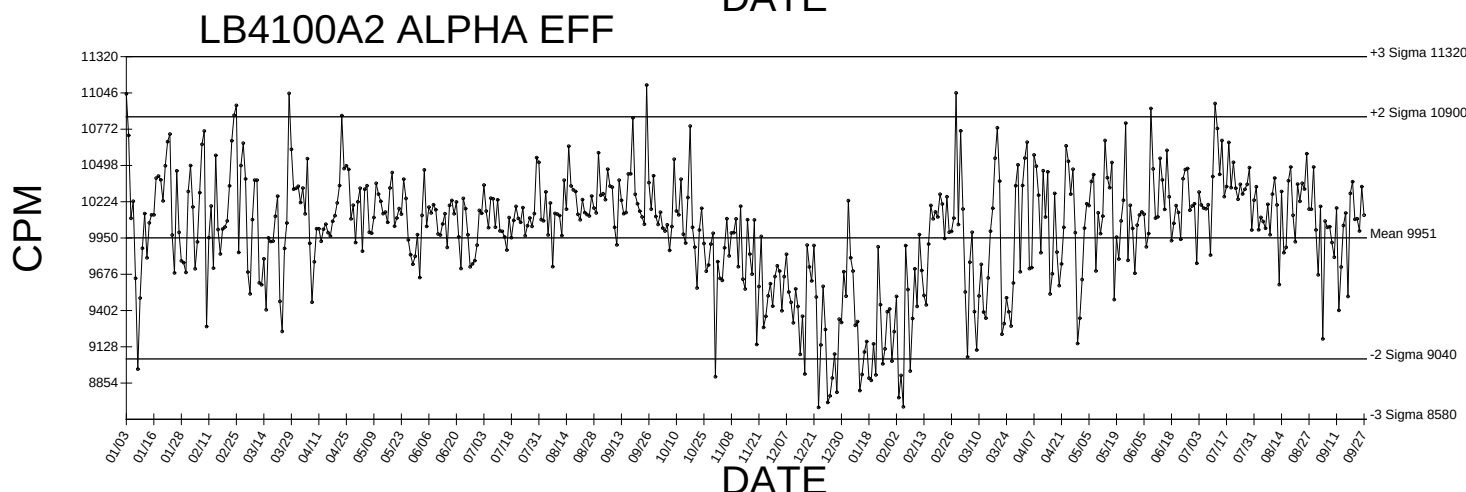
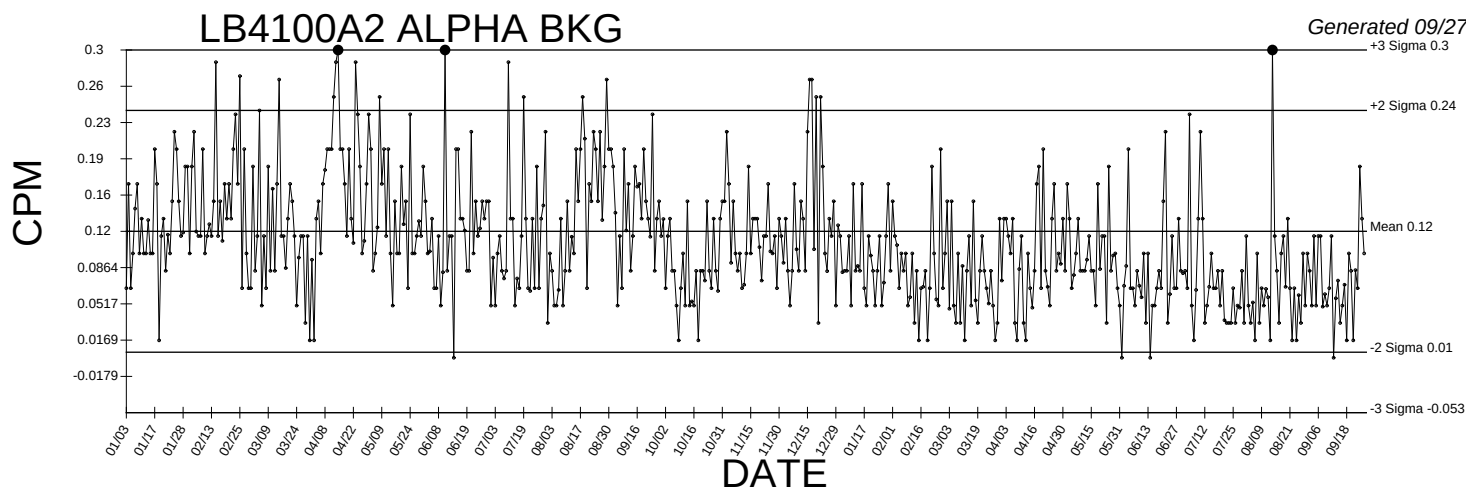
GEL Laboratories LLC

Background and Efficiency Data

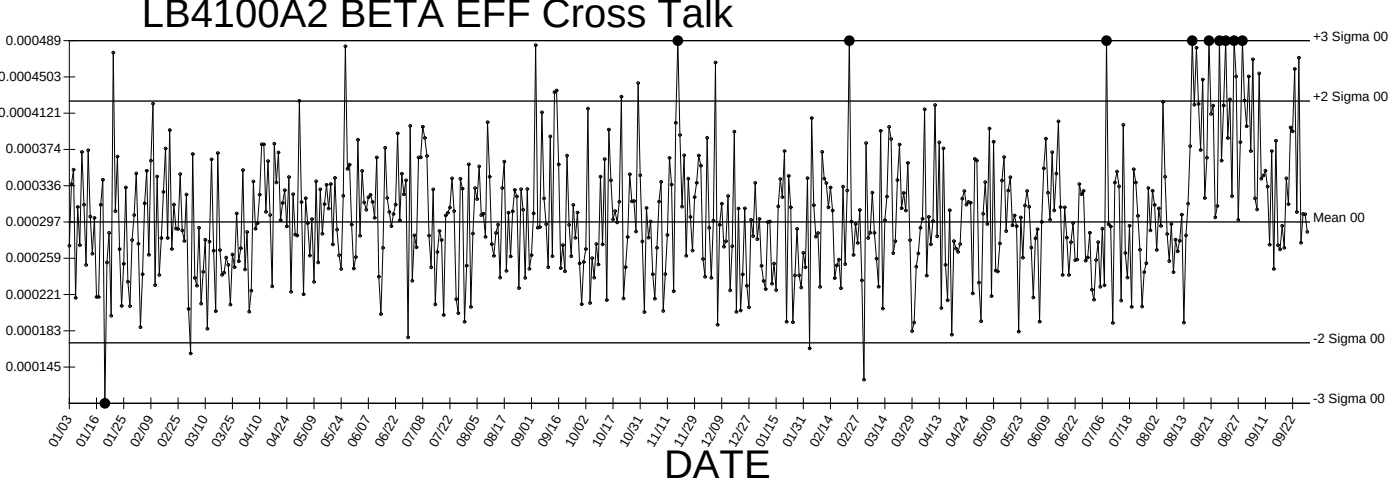
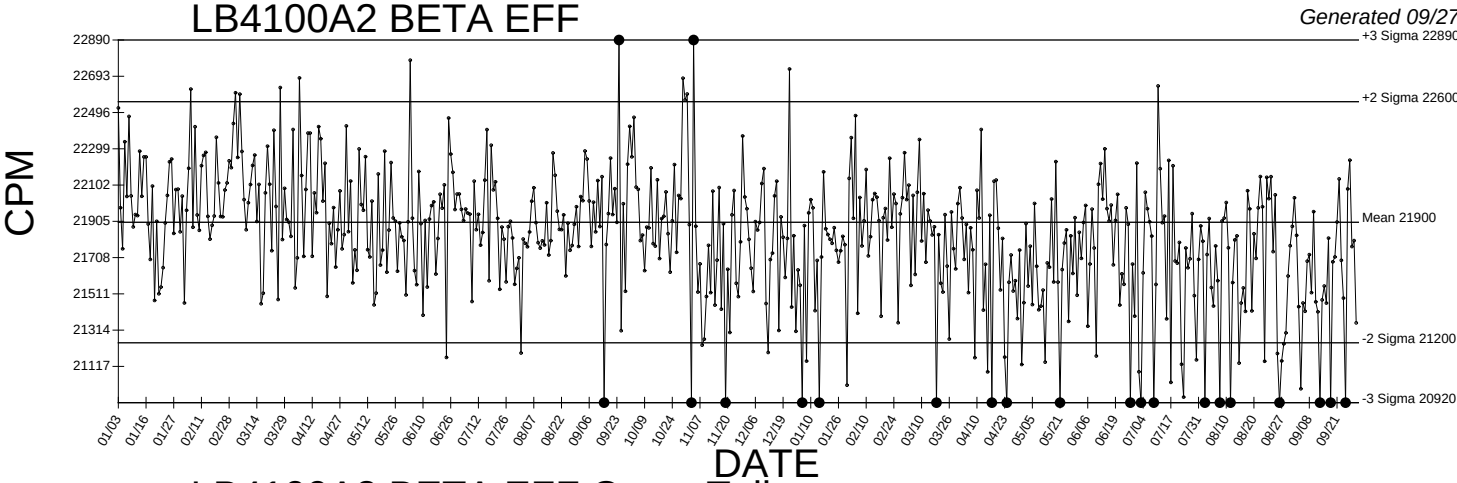




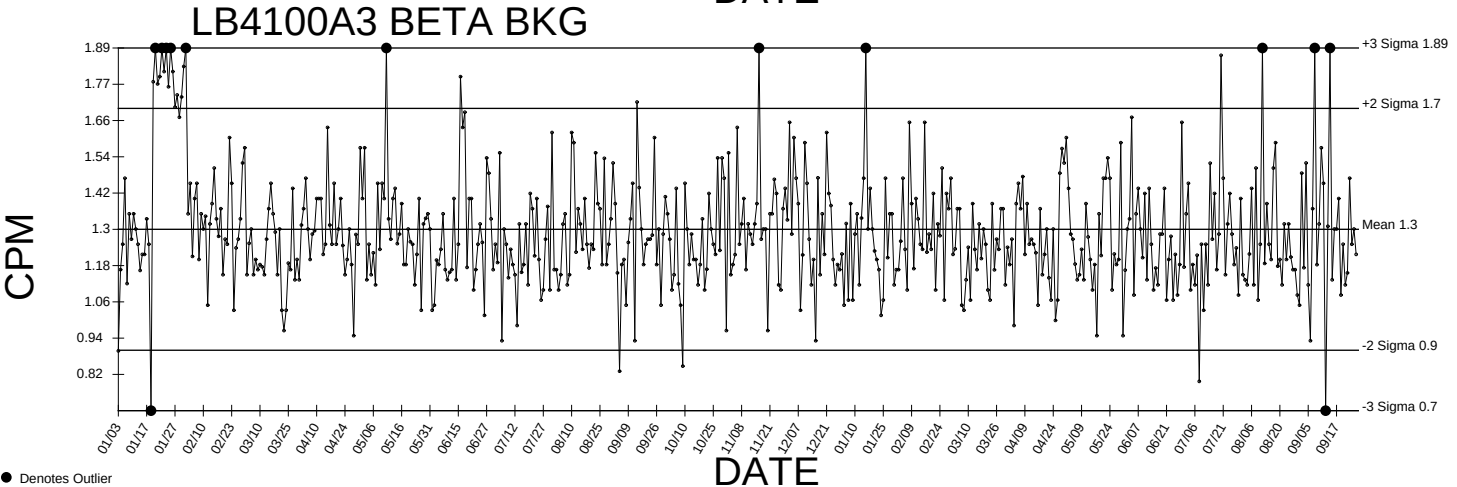
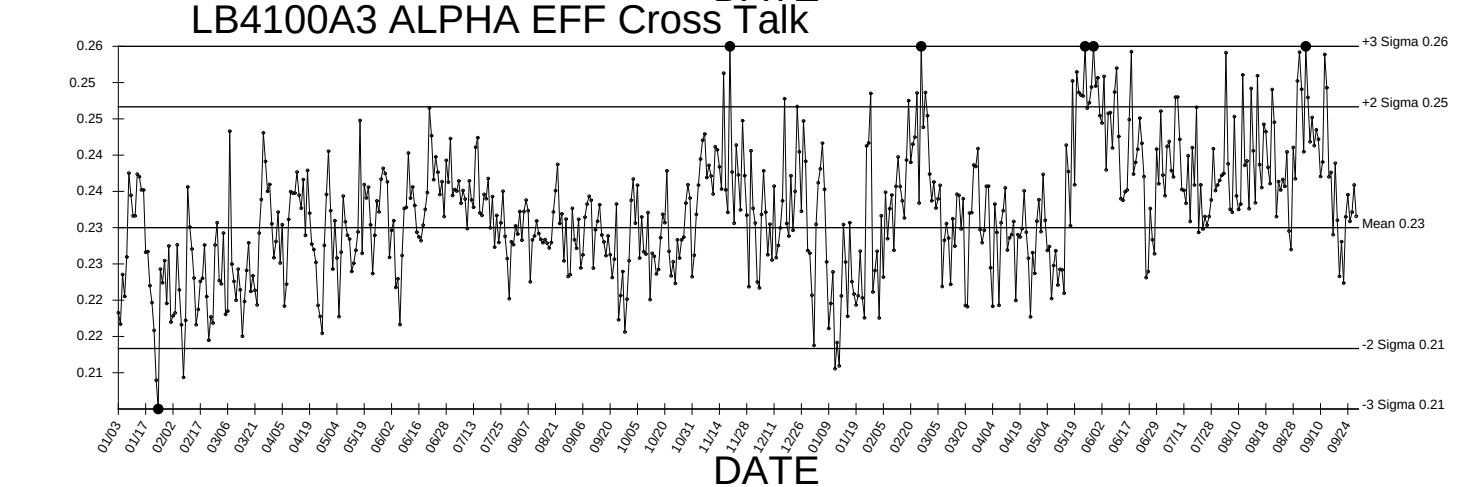
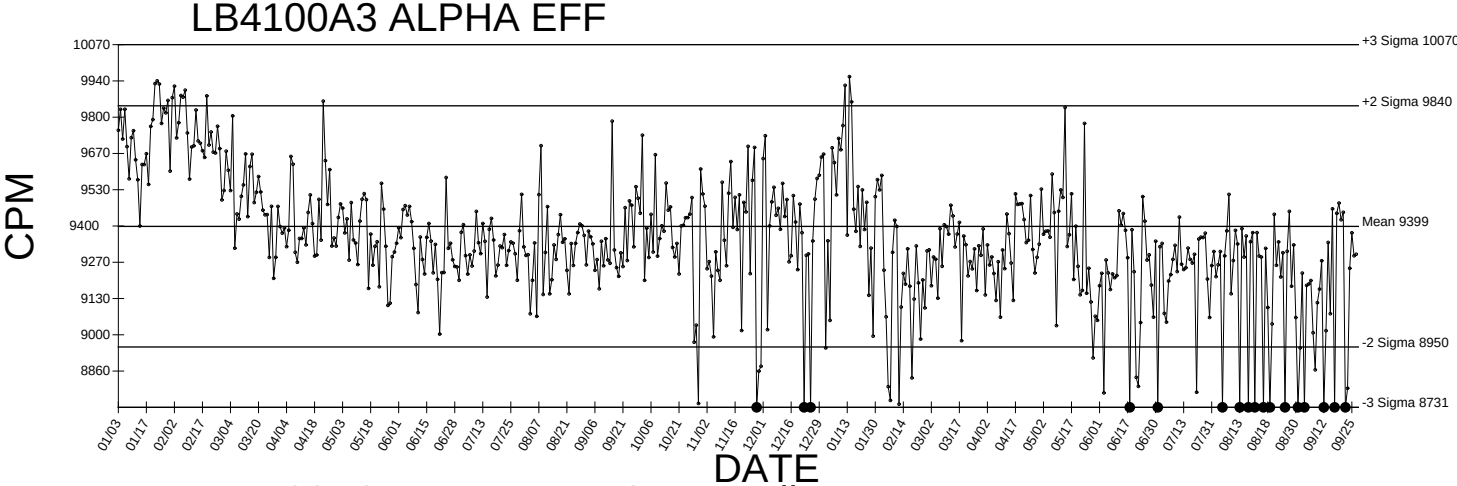
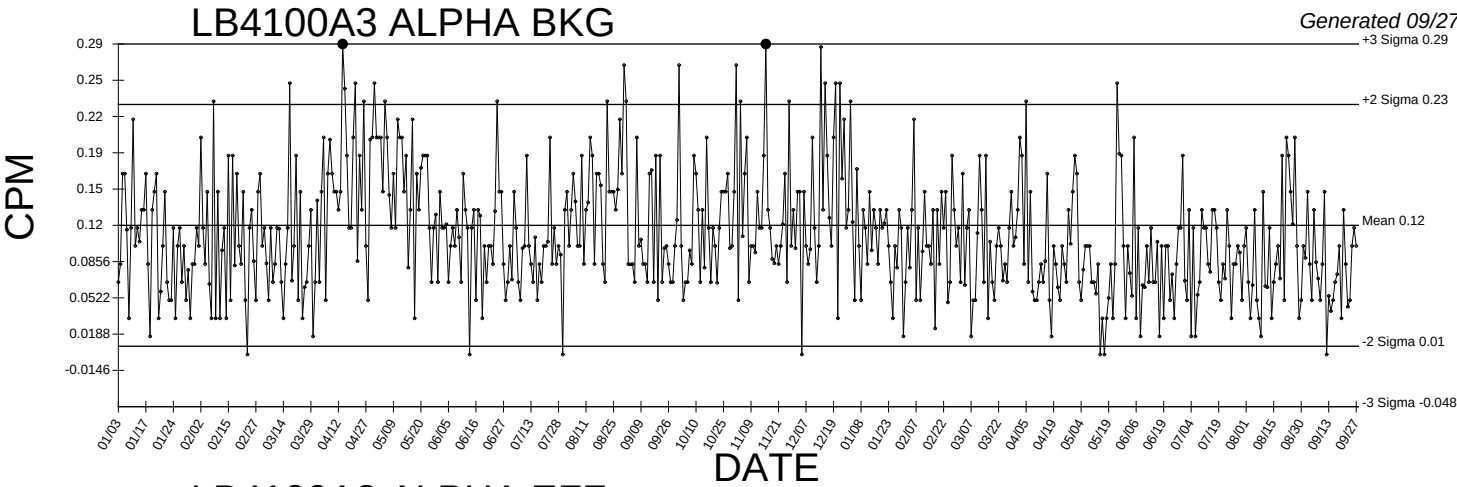
● Denotes Outlier



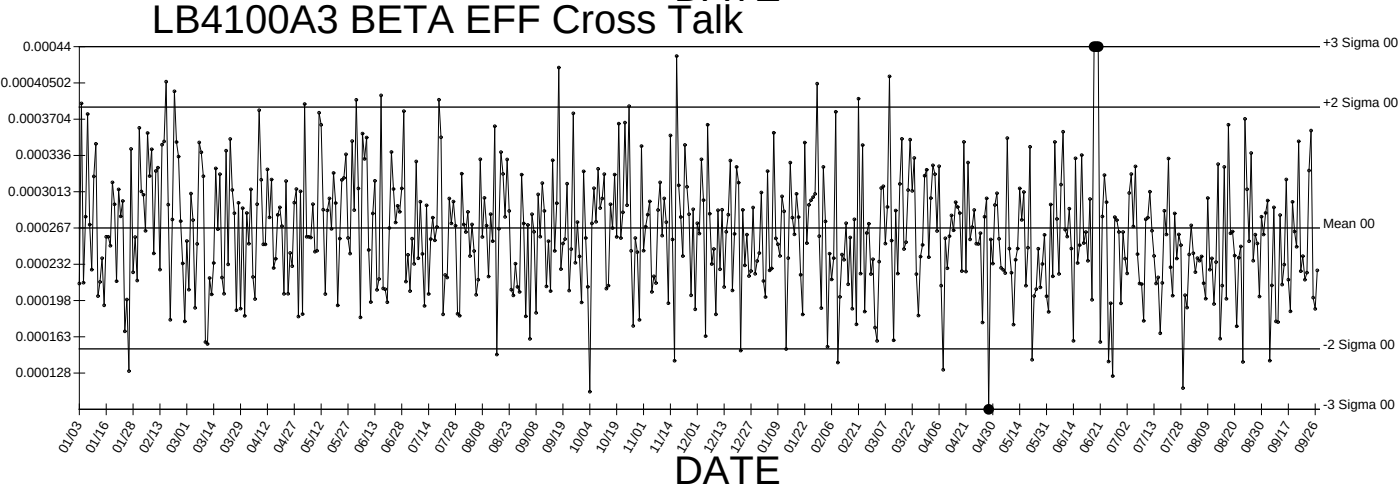
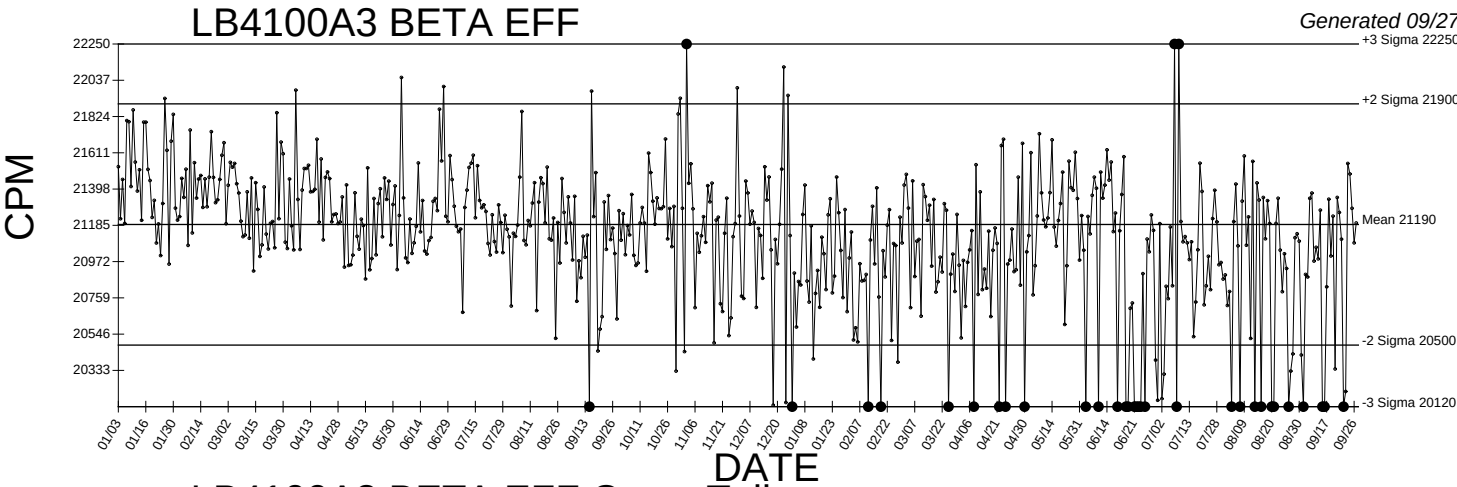
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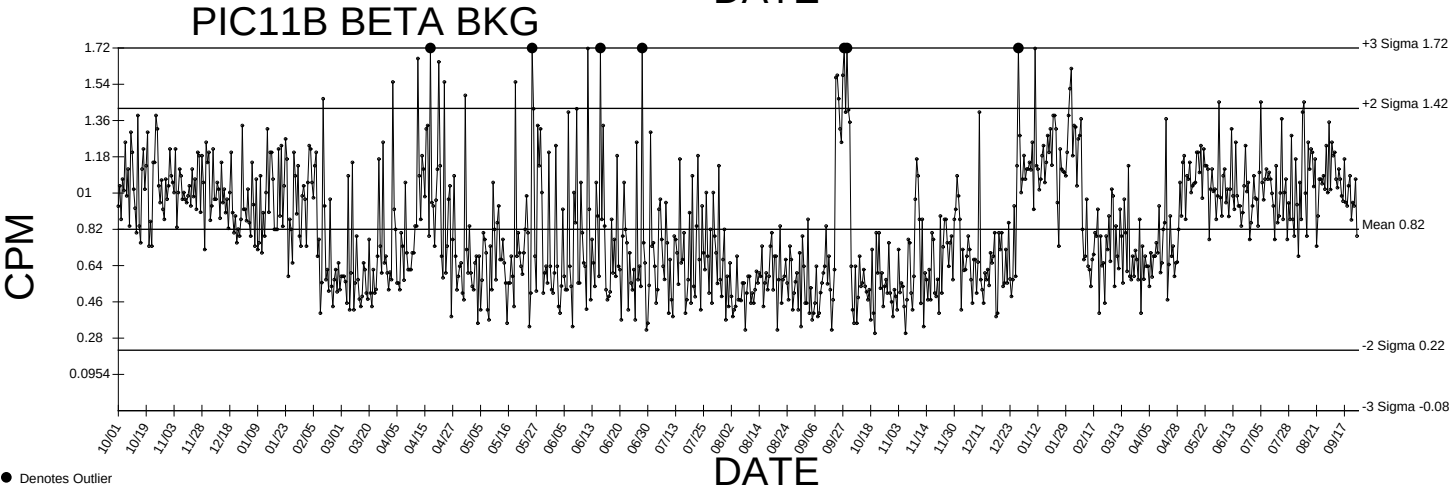
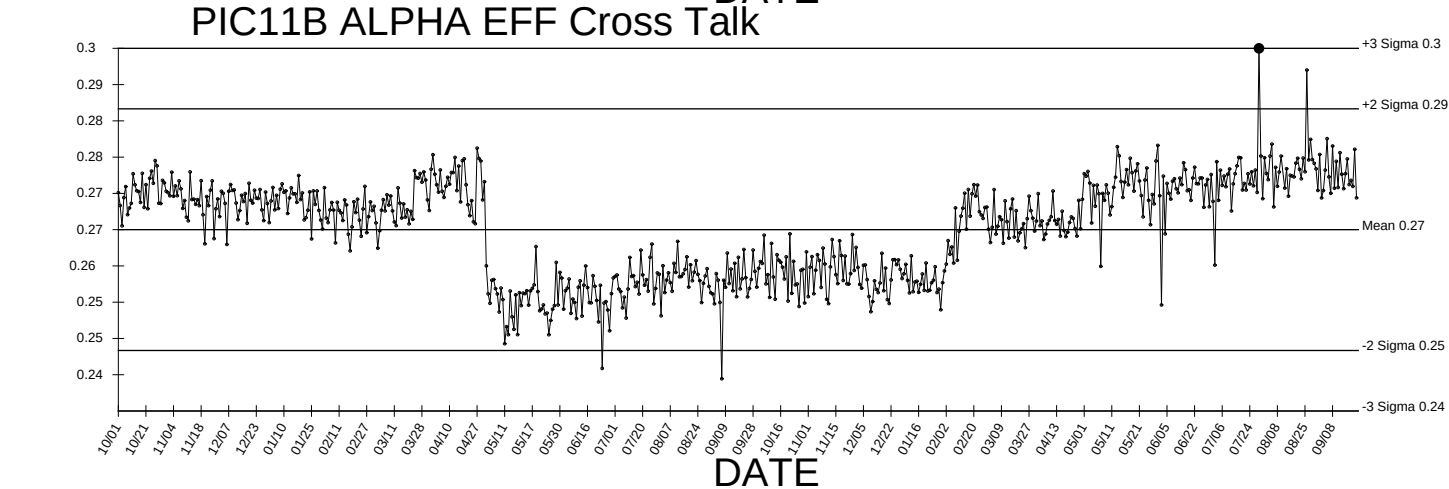
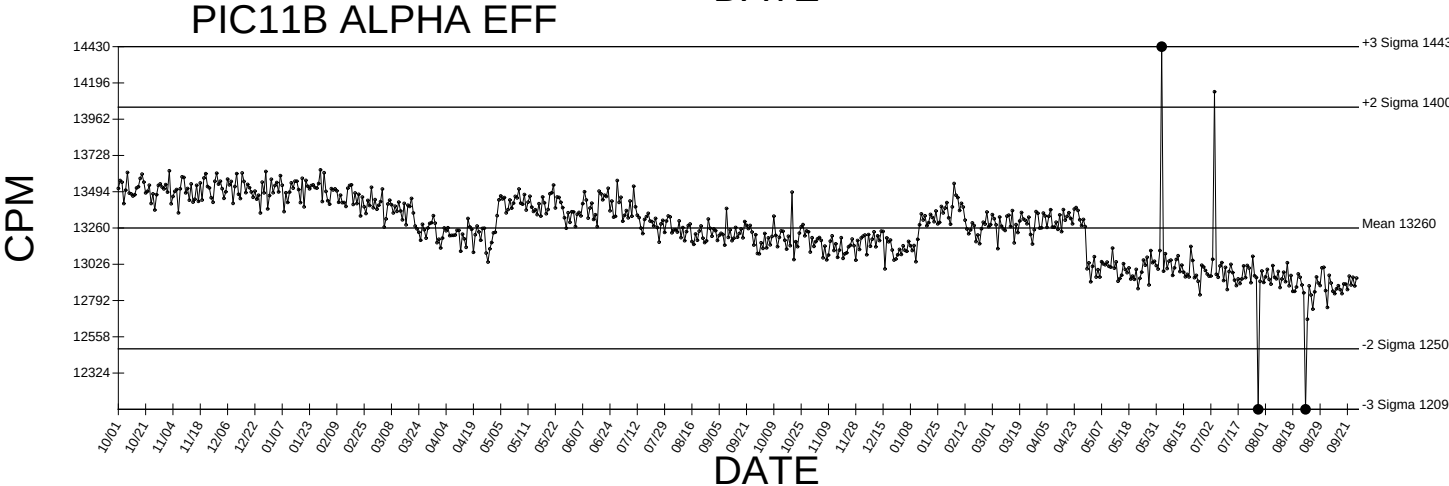
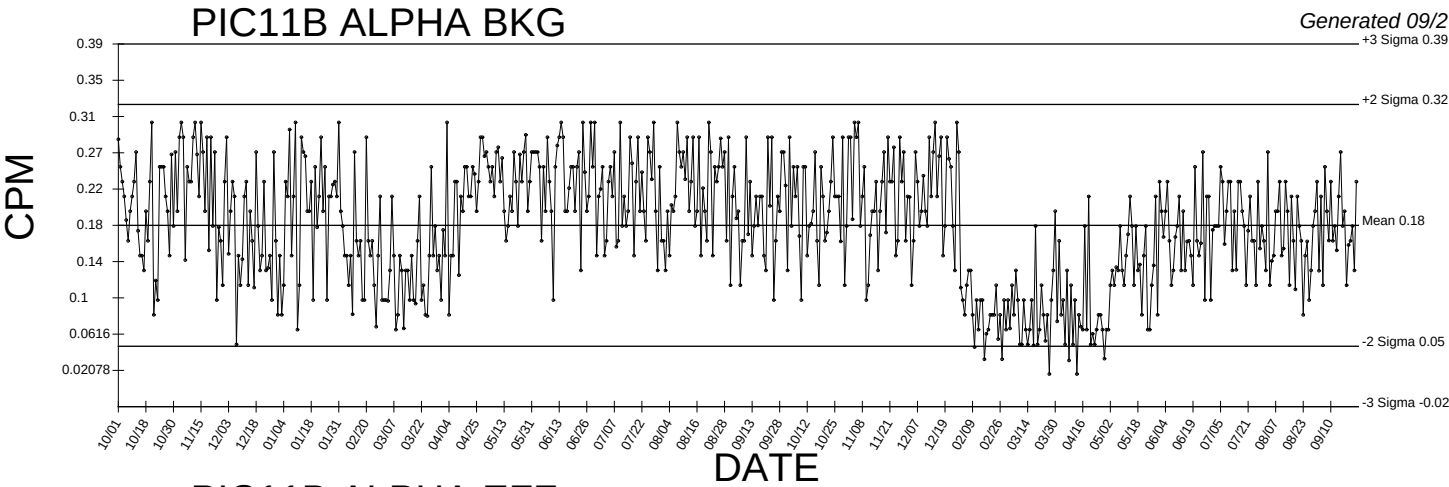
● Denotes Outlier



● Denotes Outlier

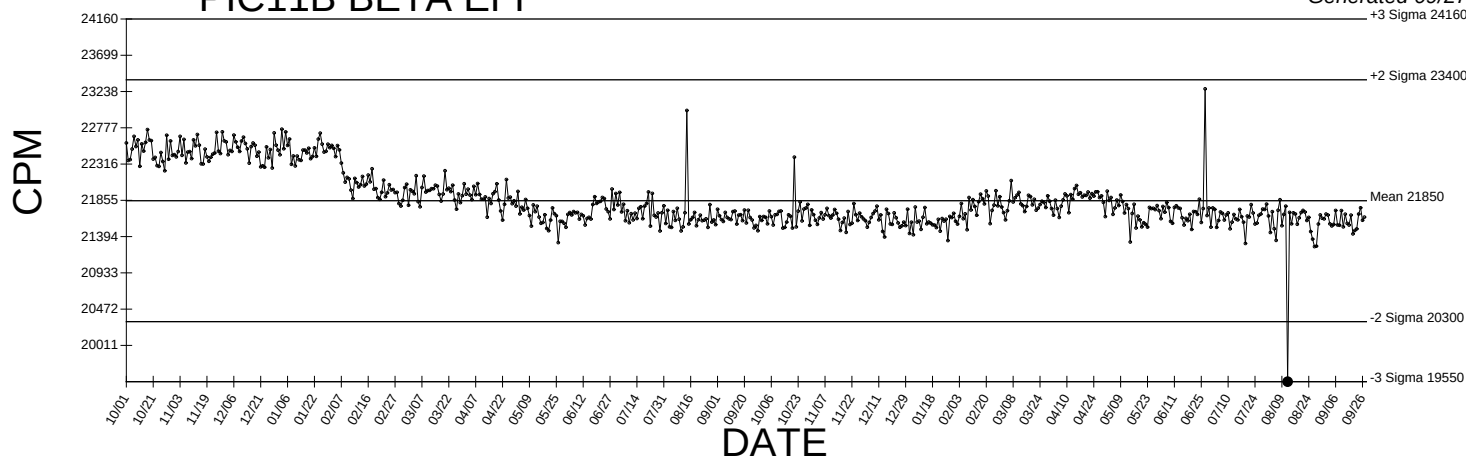


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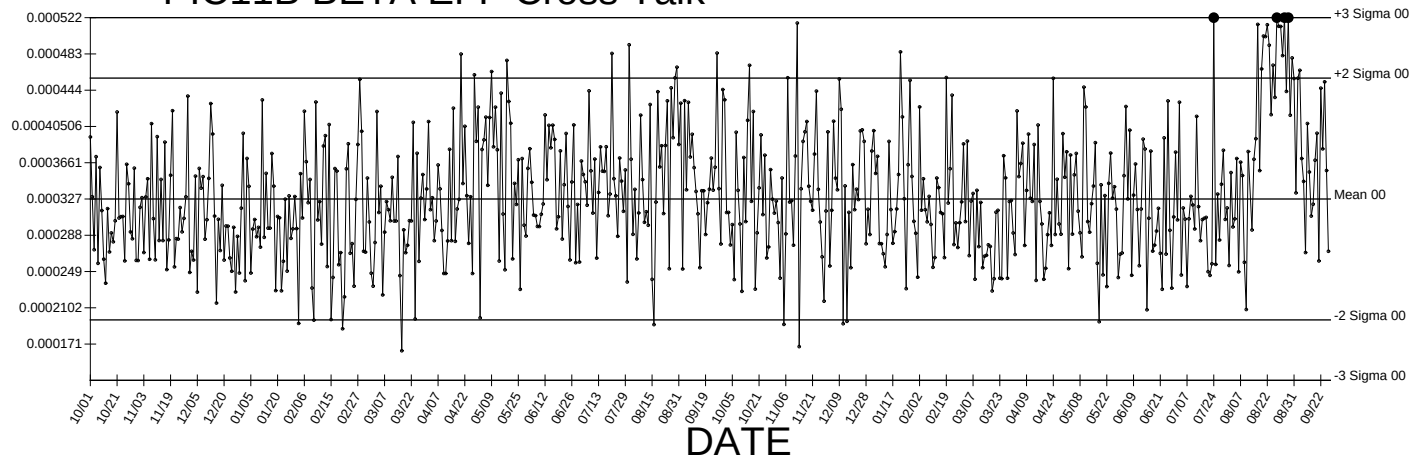


PIC11B BETA EFF

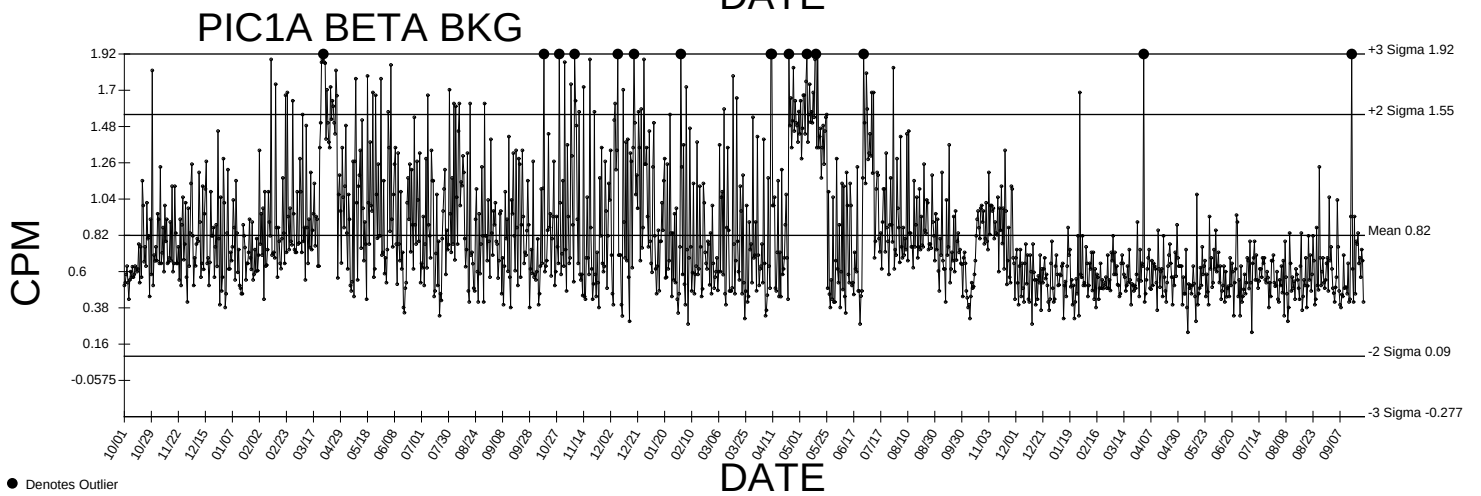
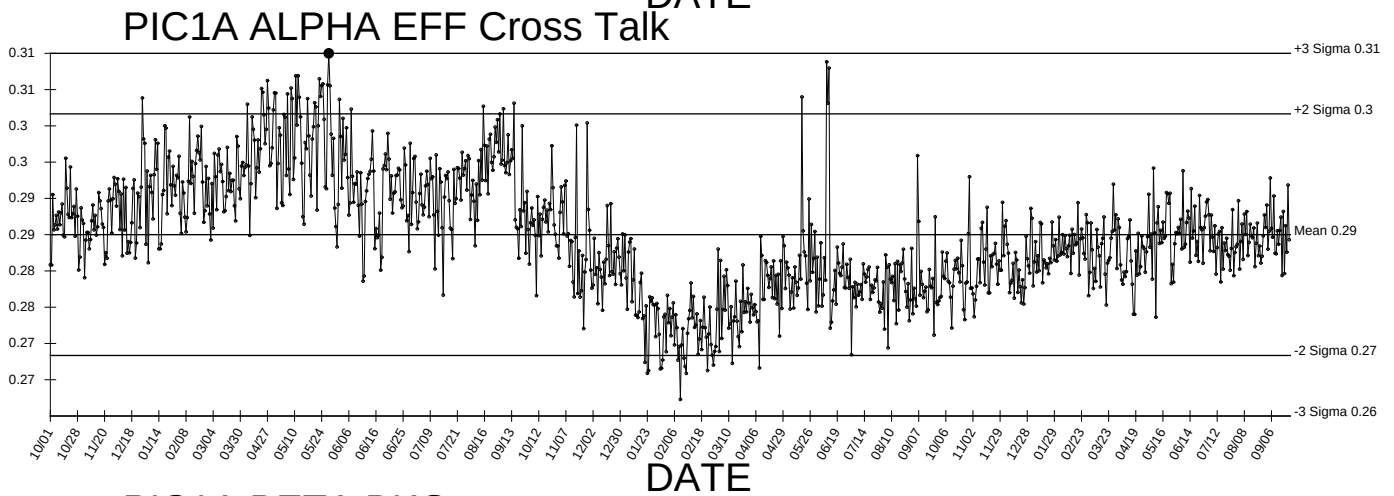
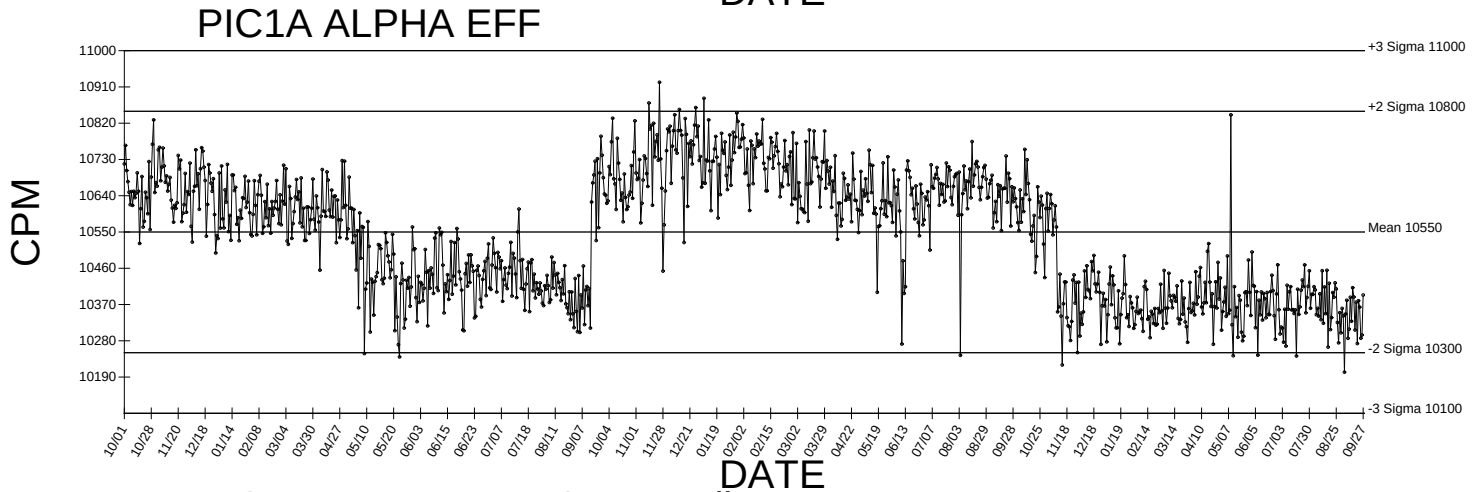
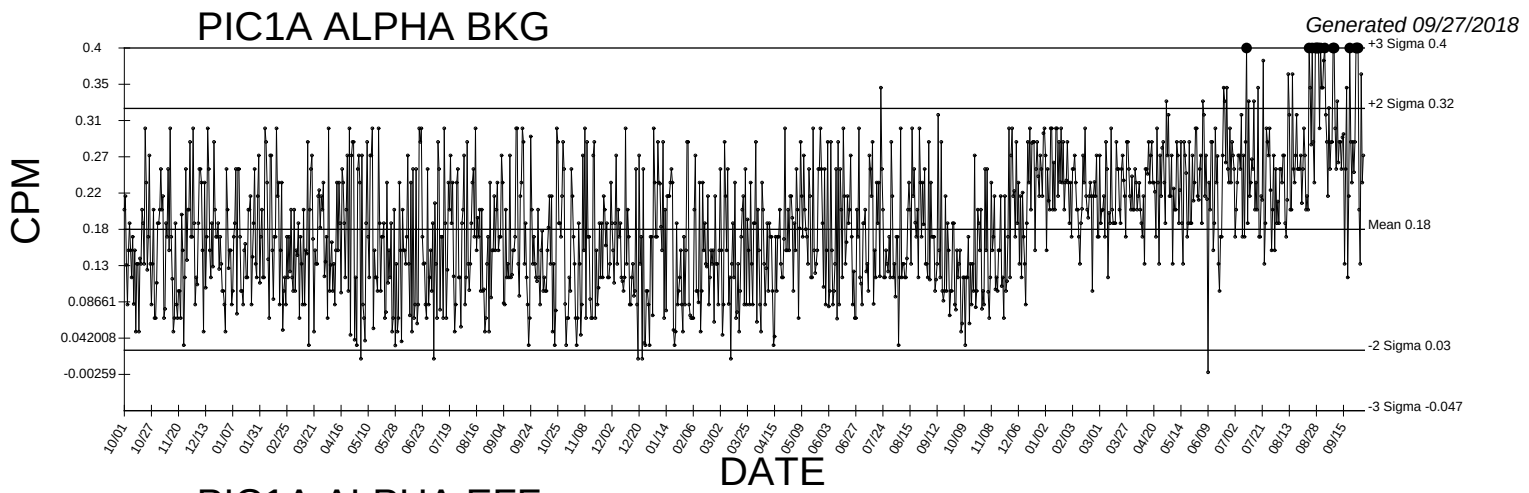
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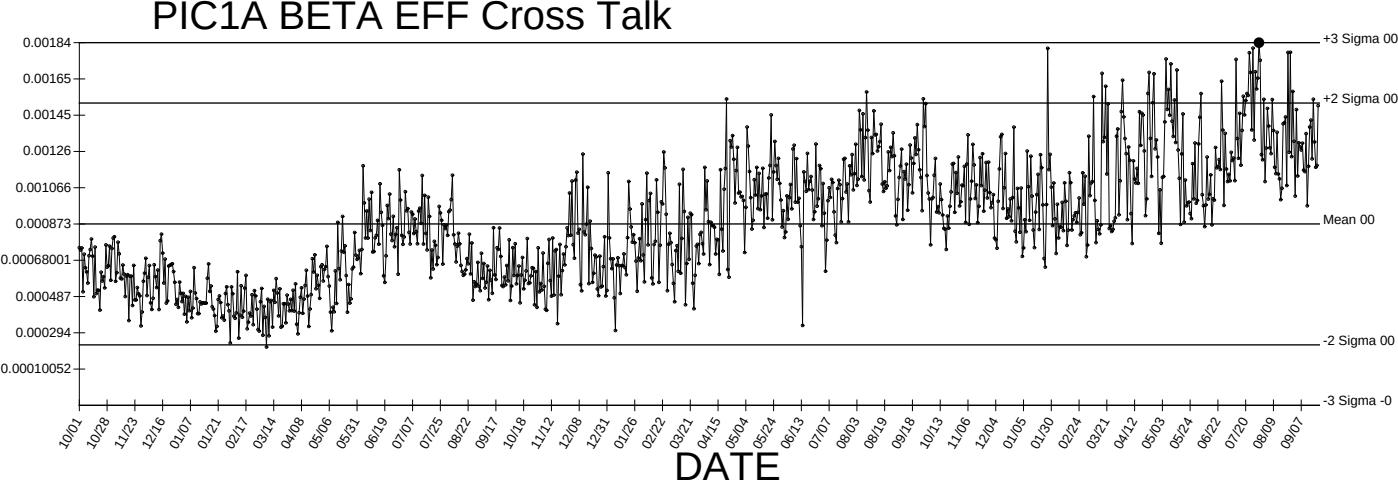
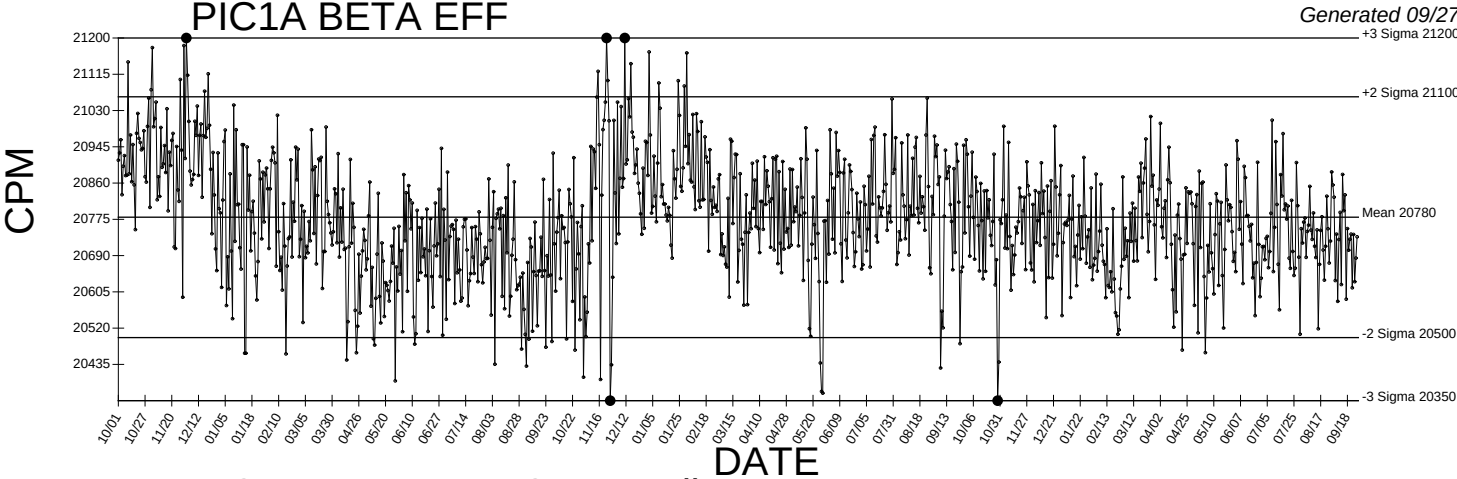


PIC11B BETA EFF Cross Talk

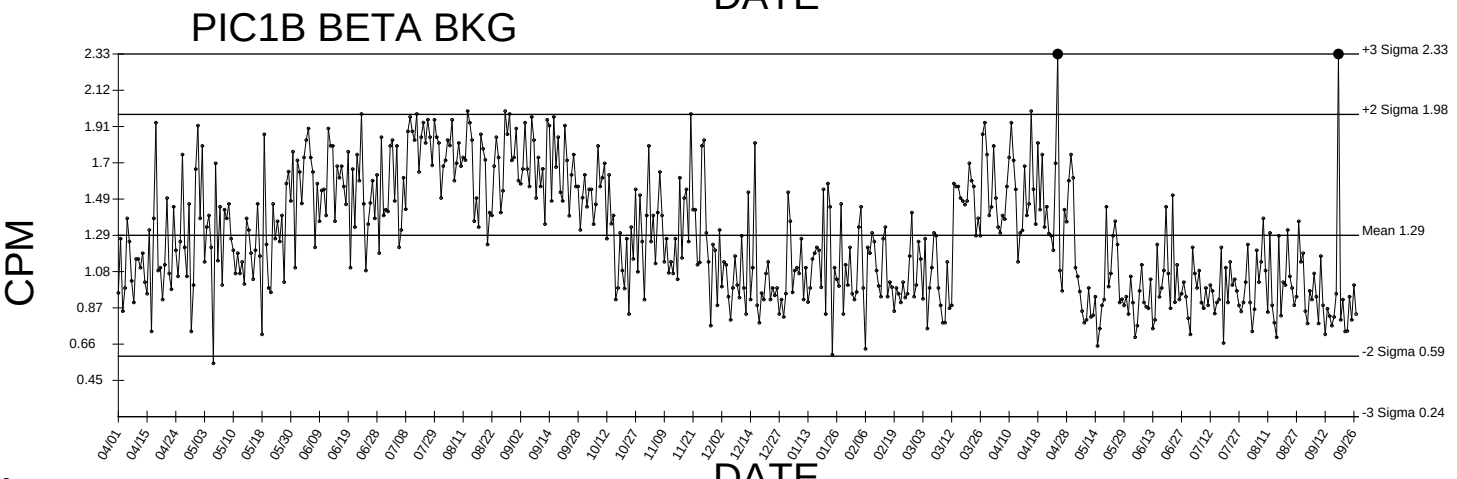
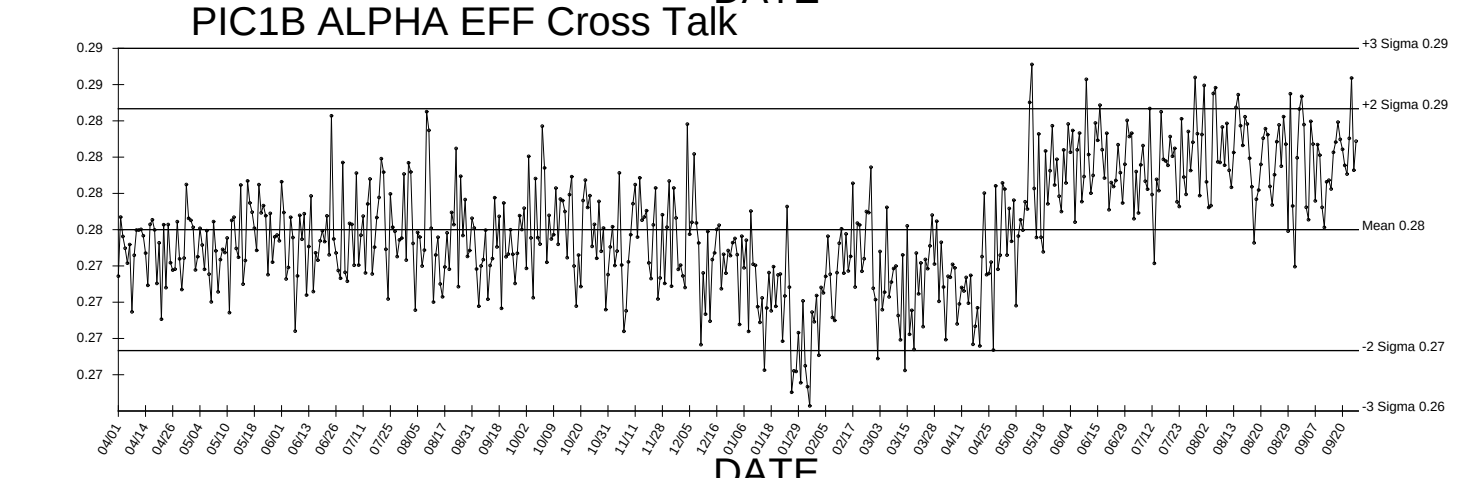
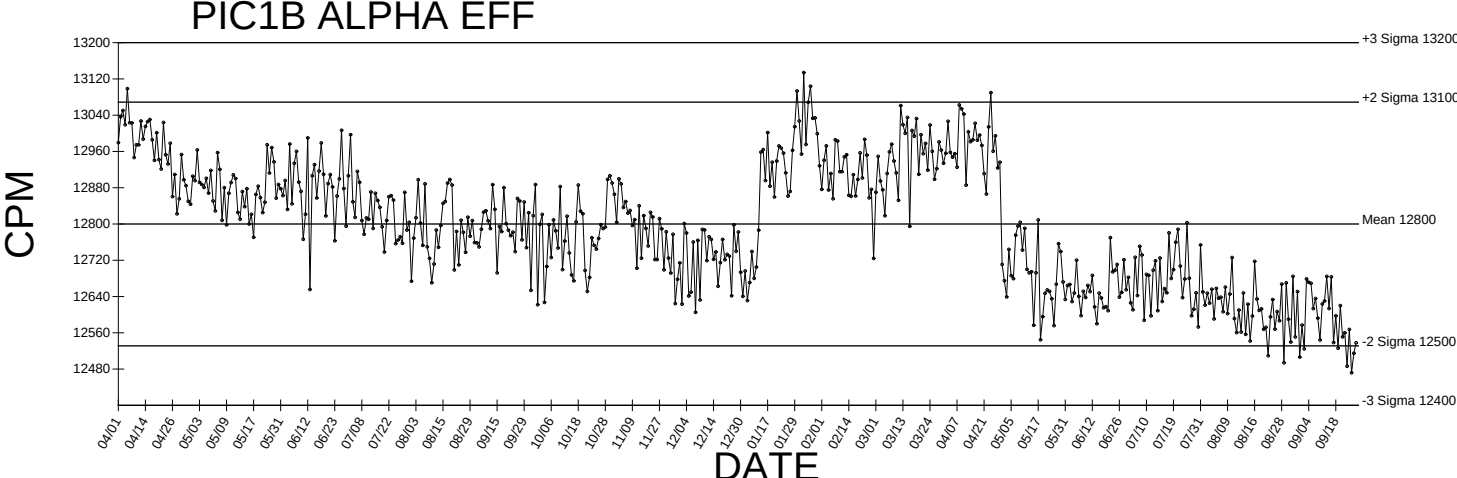
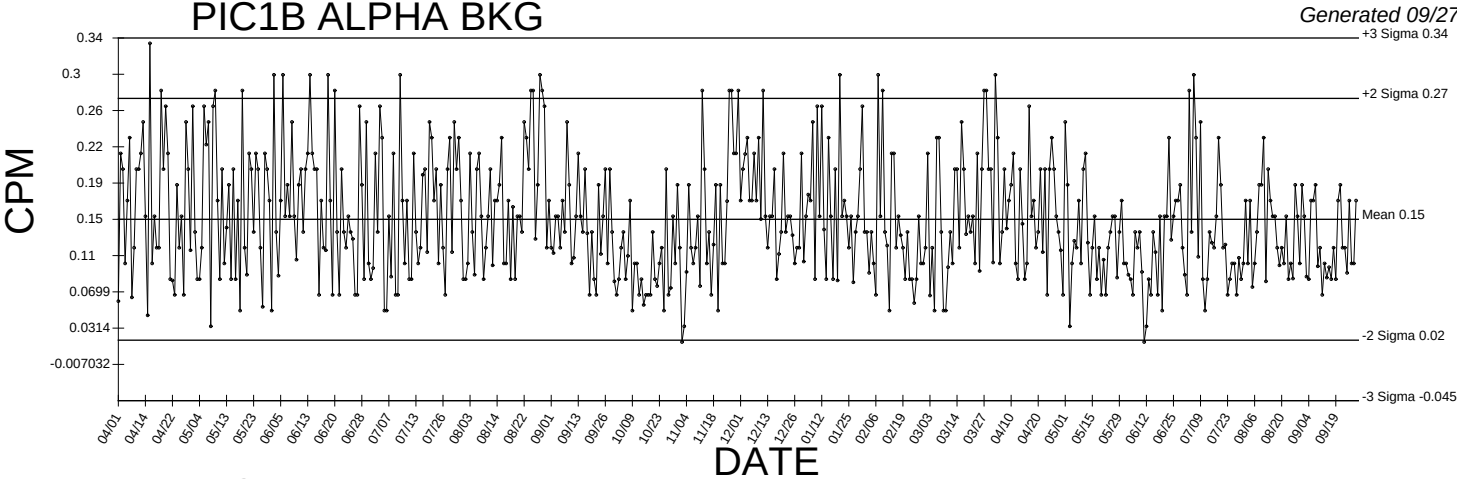


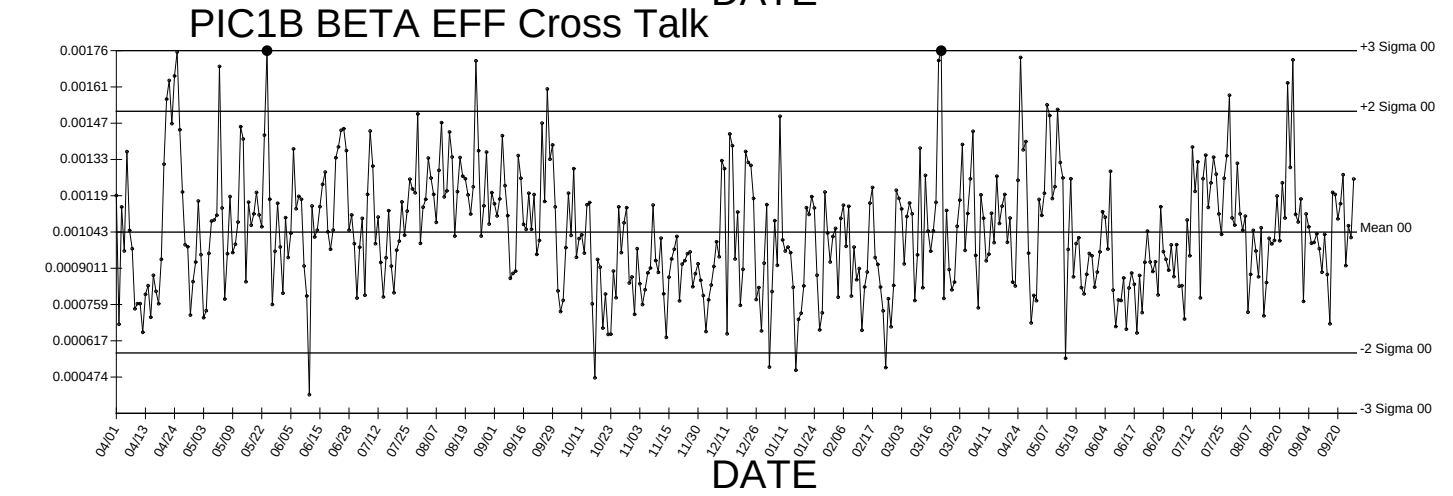
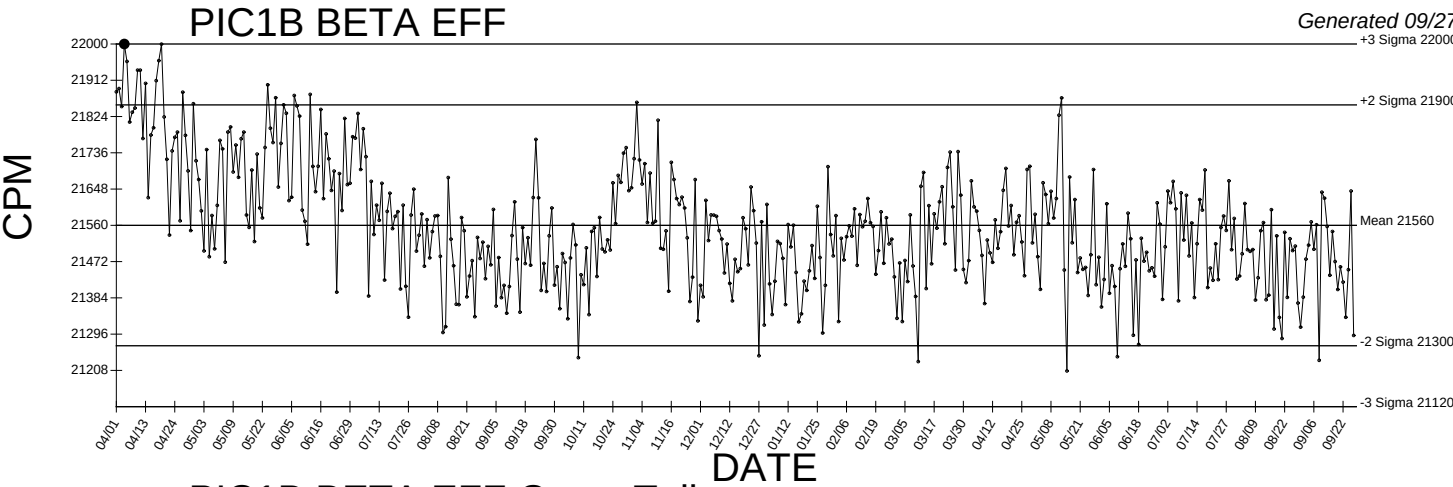
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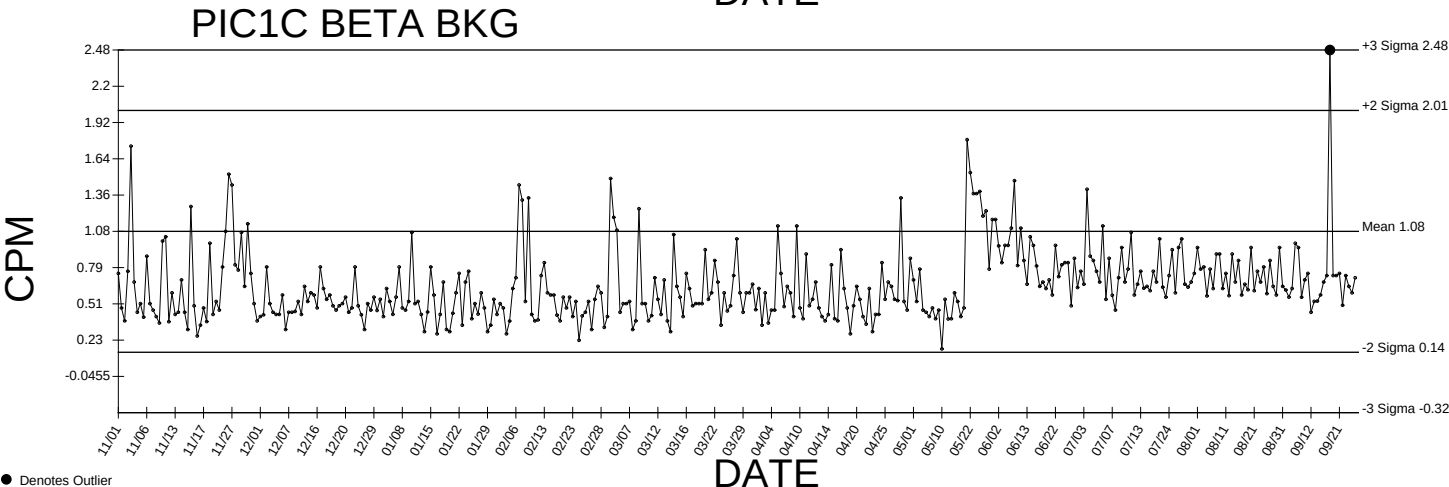
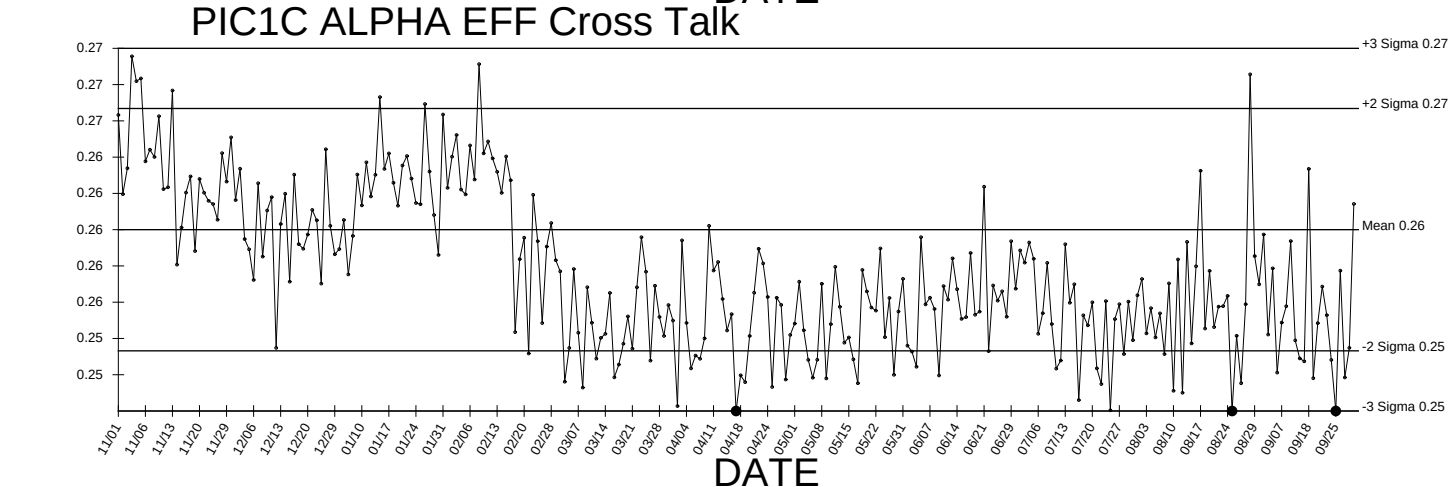
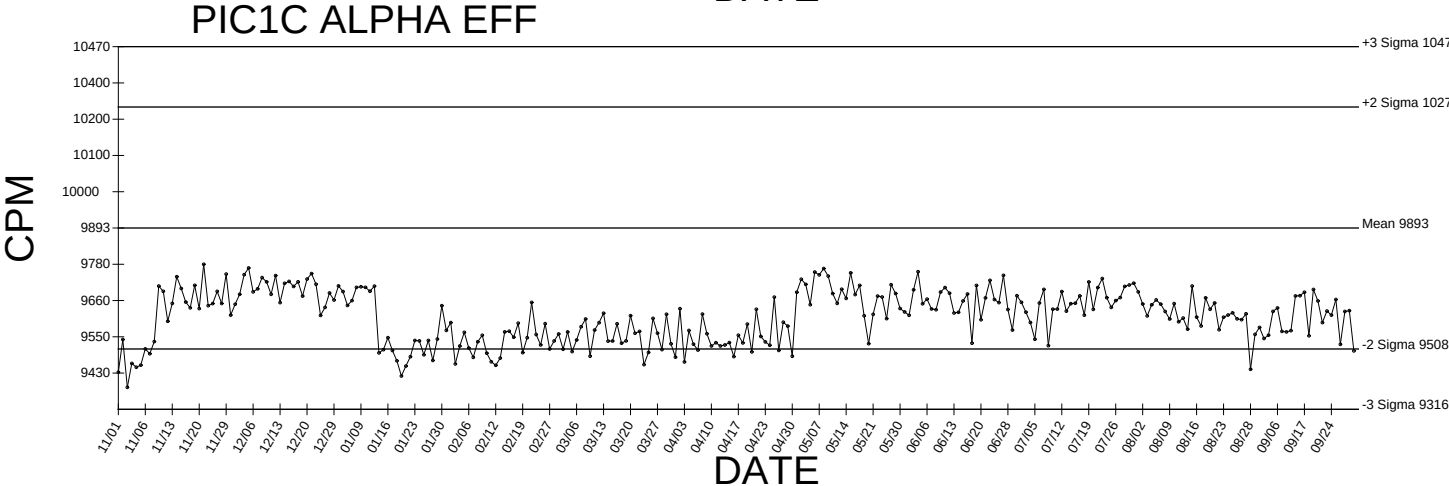
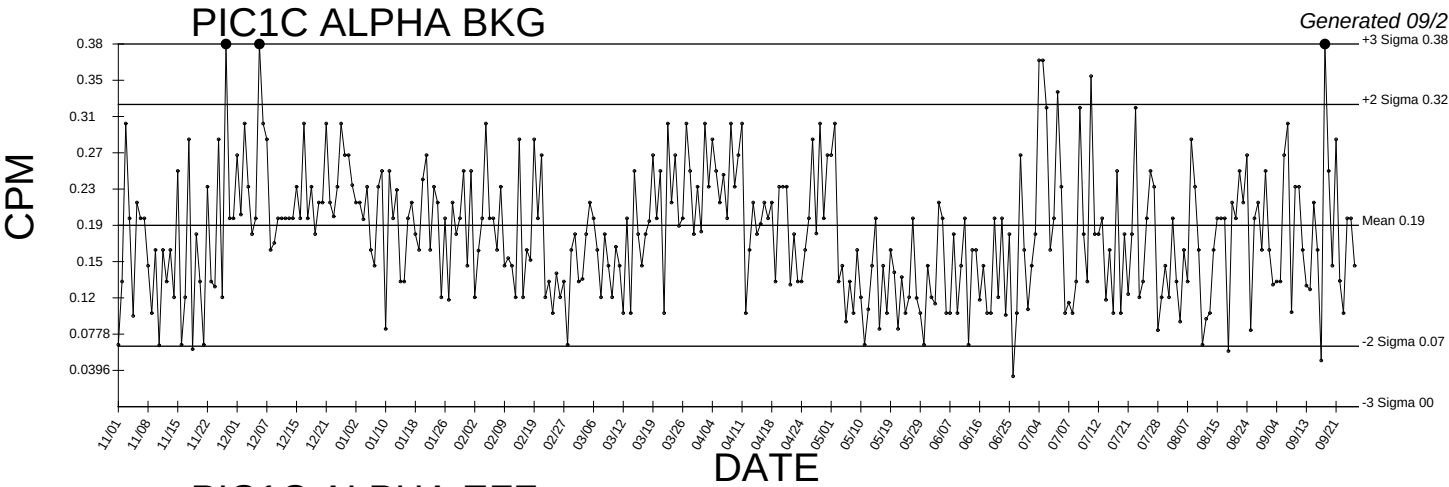


● Denotes Outlier





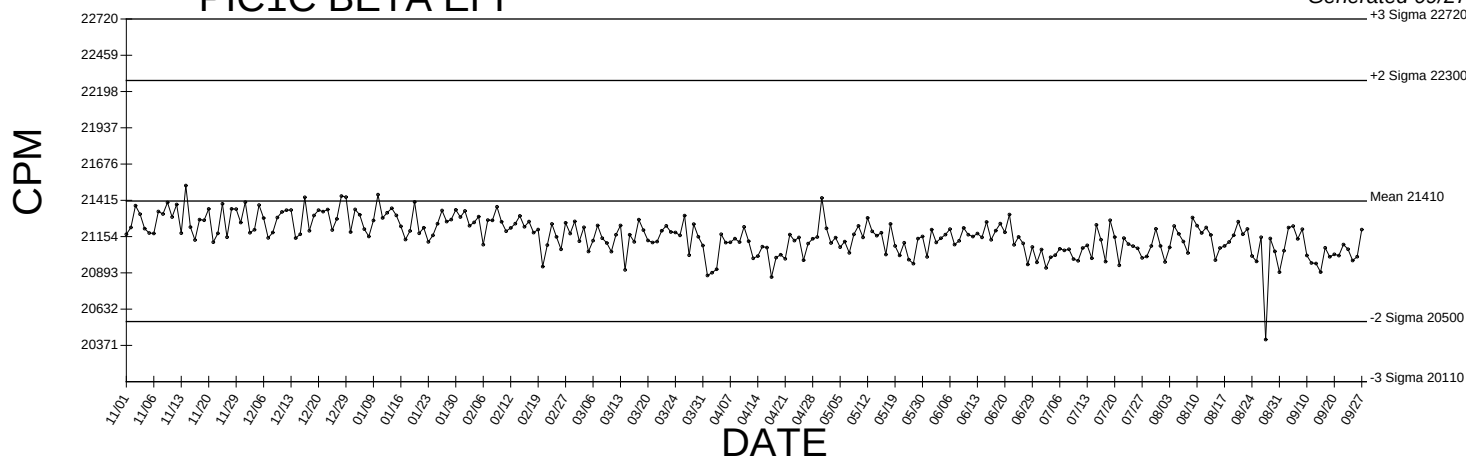
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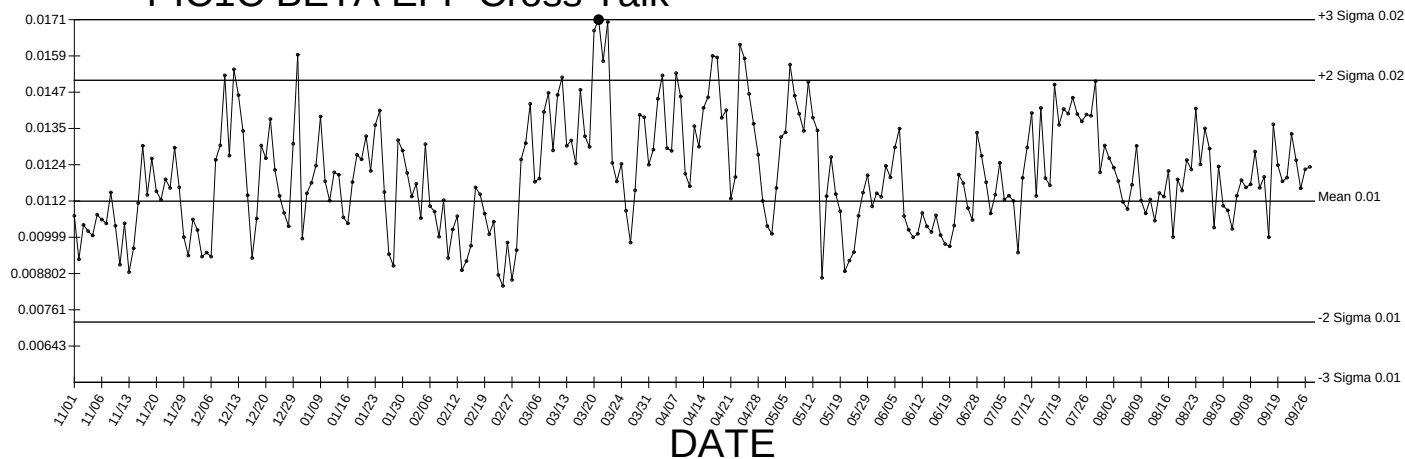
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PIC1C BETA EFF

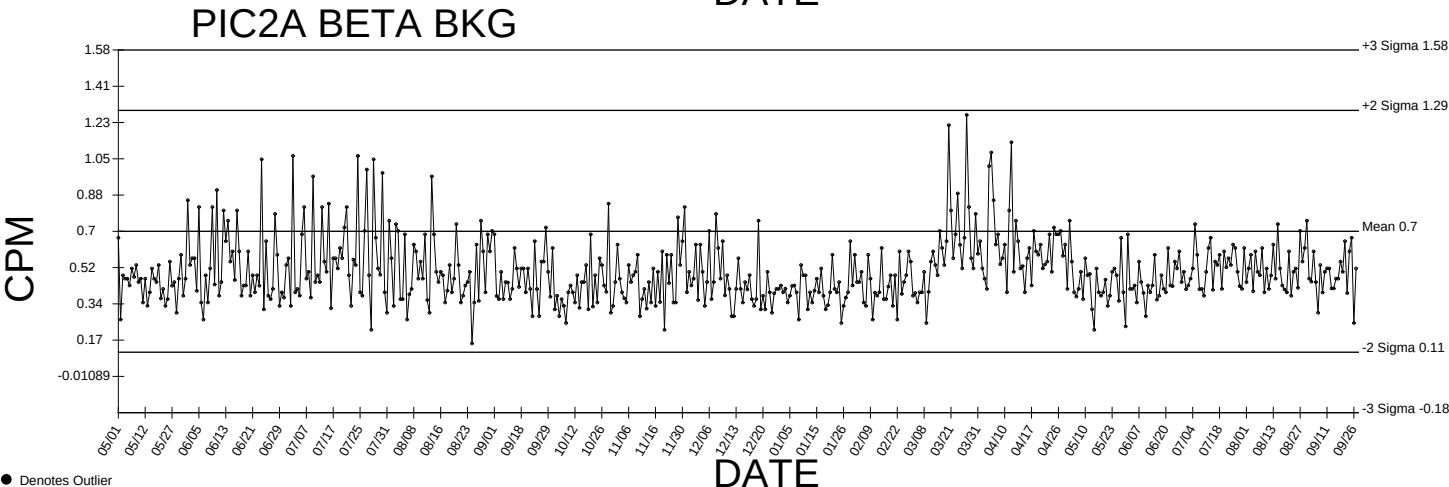
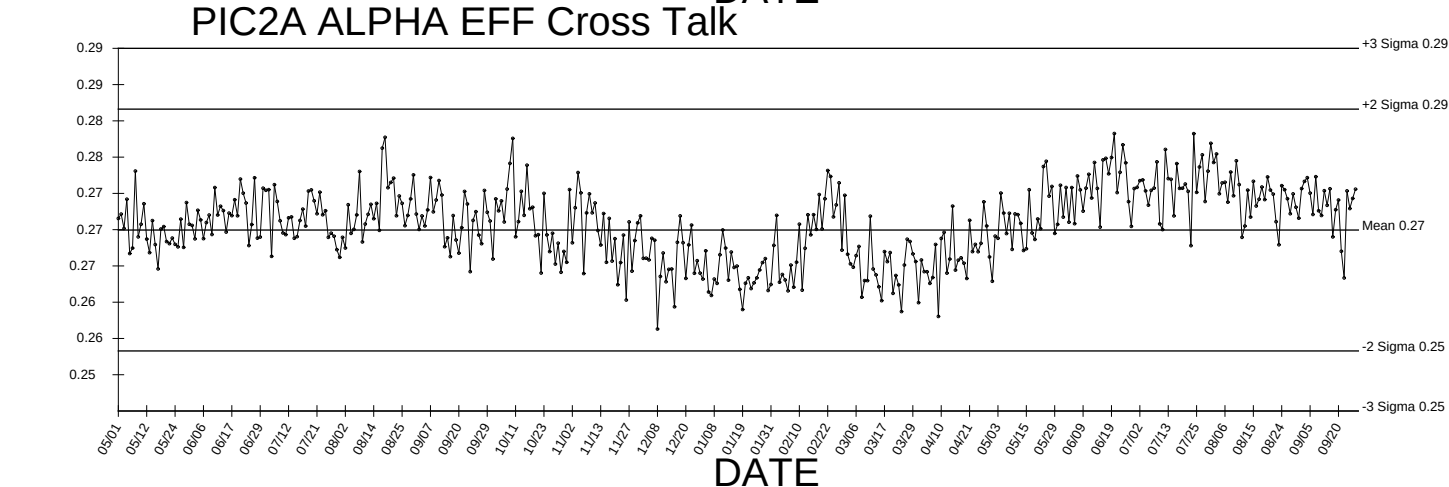
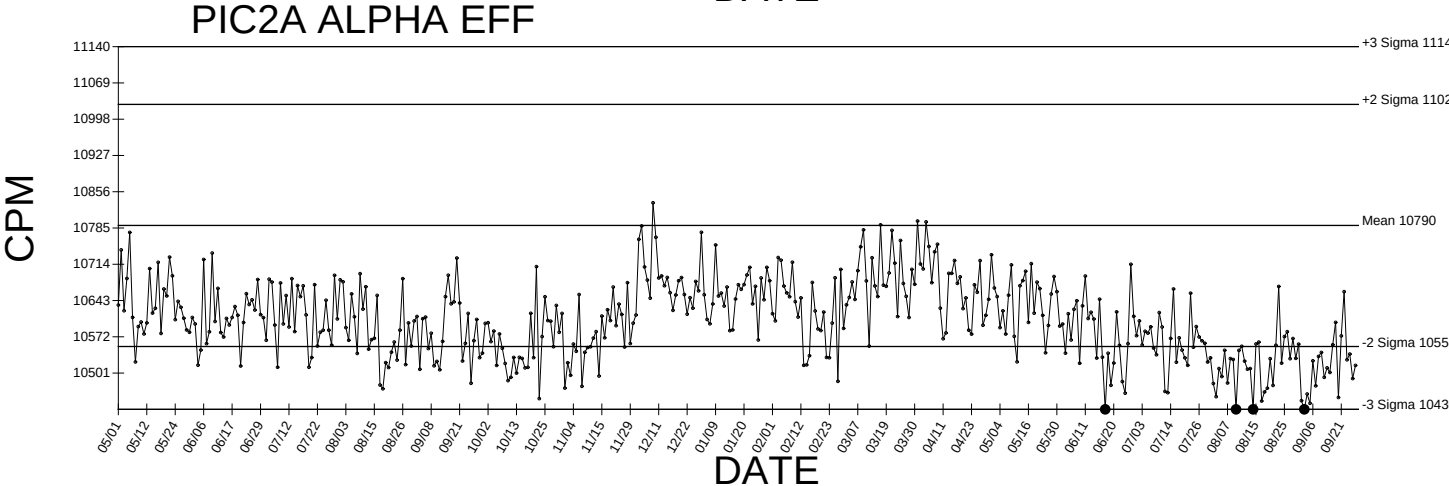
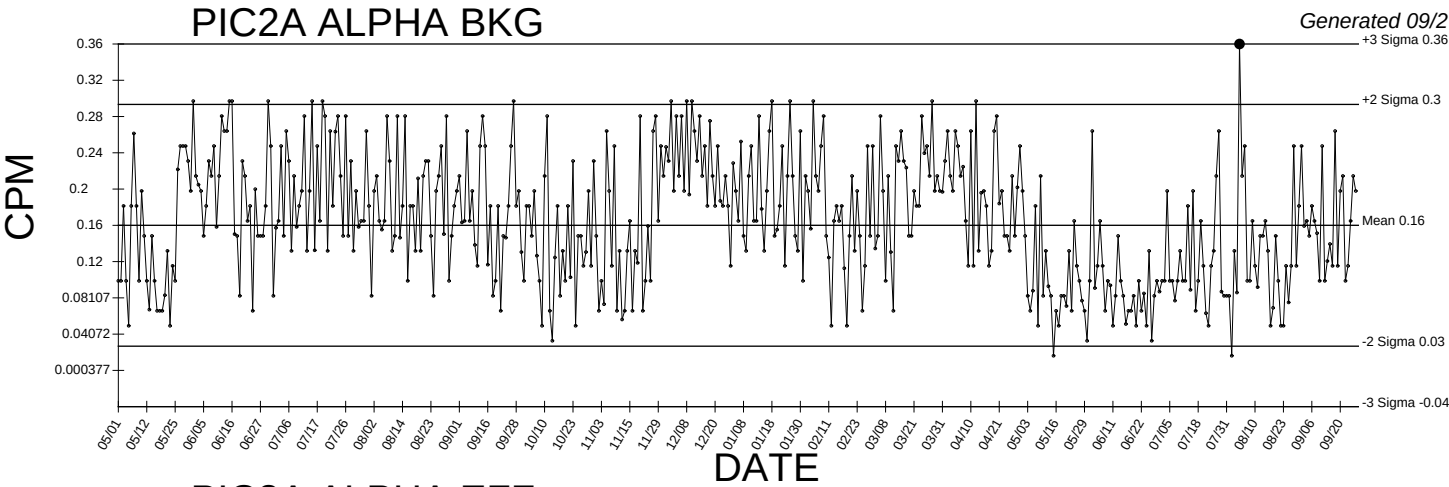
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PIC1C BETA EFF Cross Talk



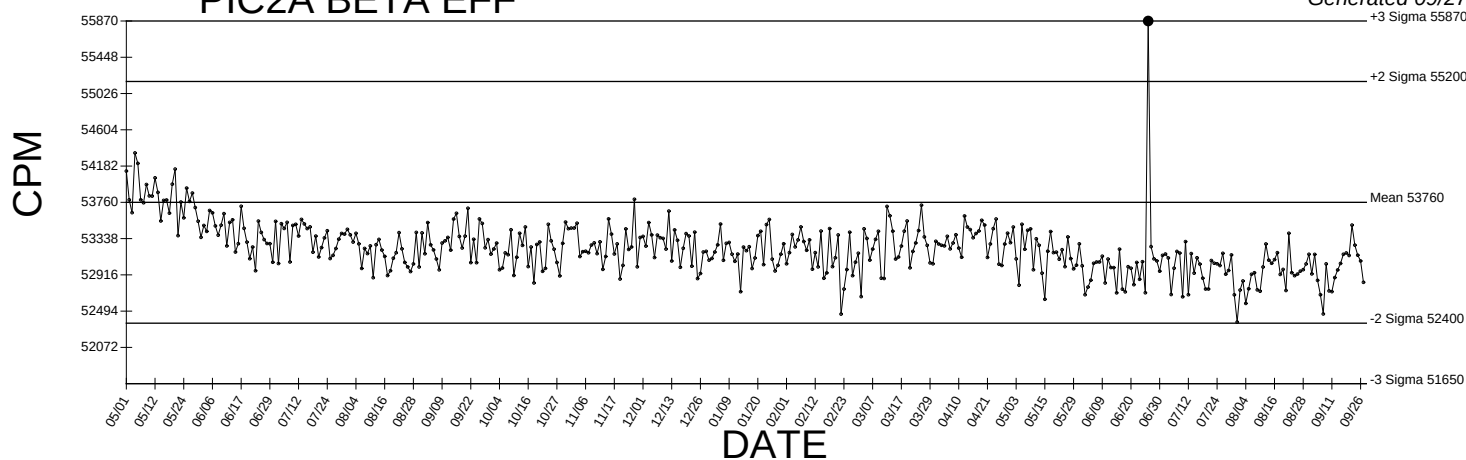
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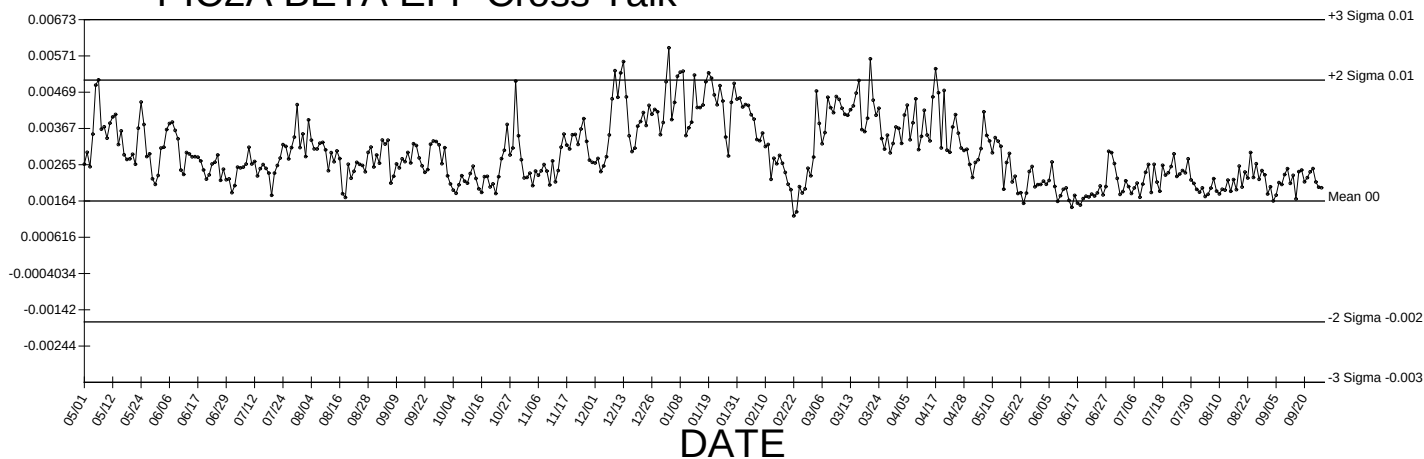
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PIC2A BETA EFF

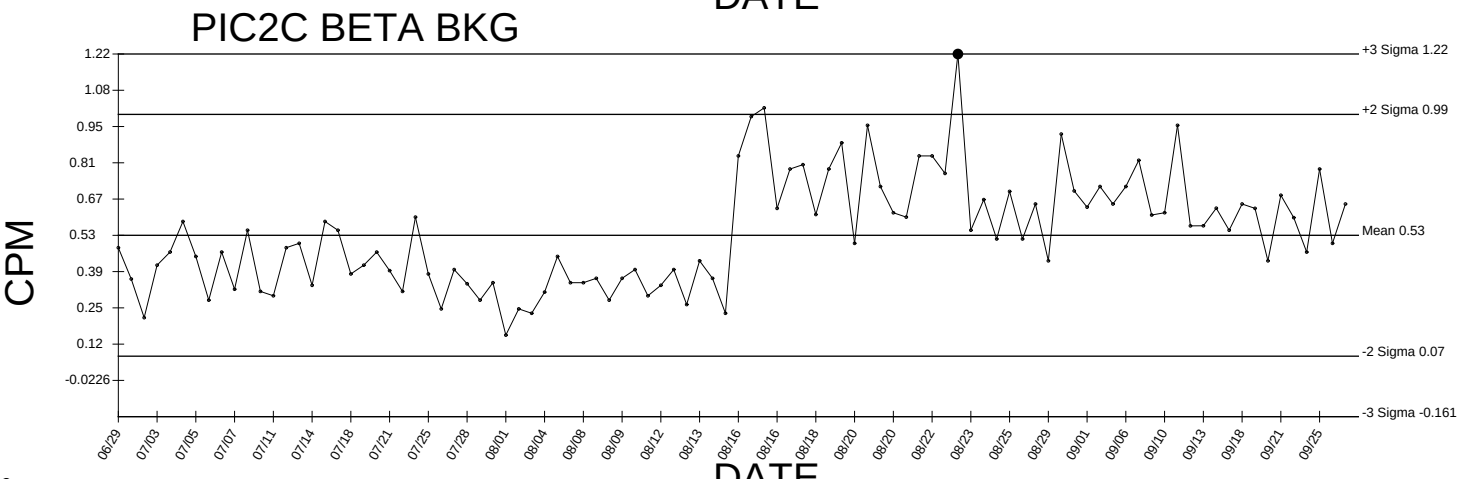
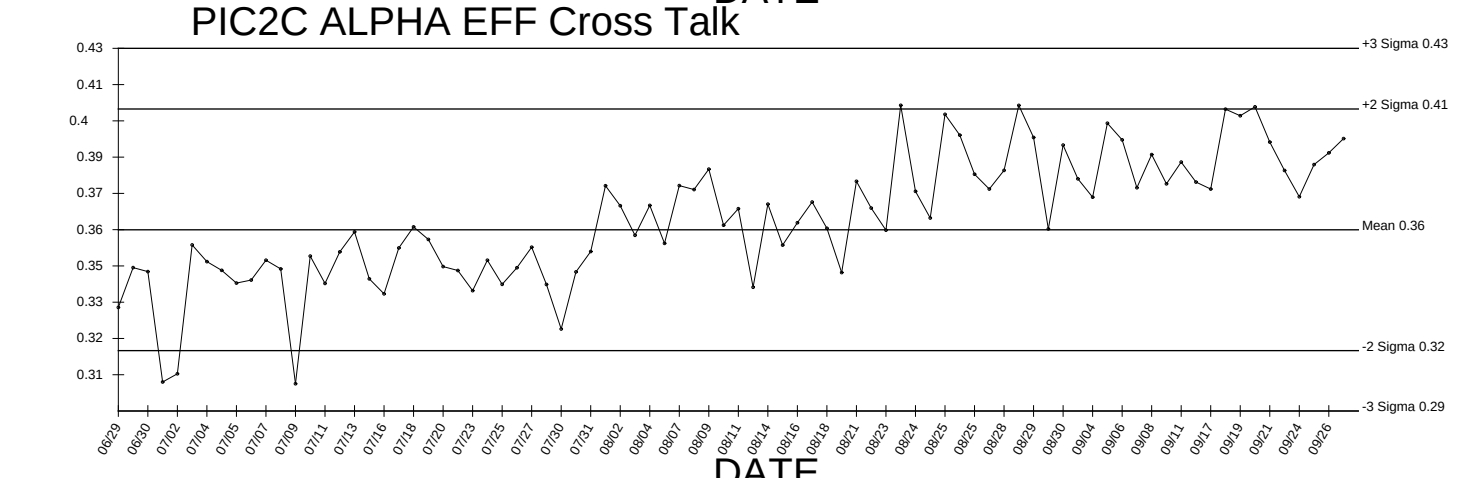
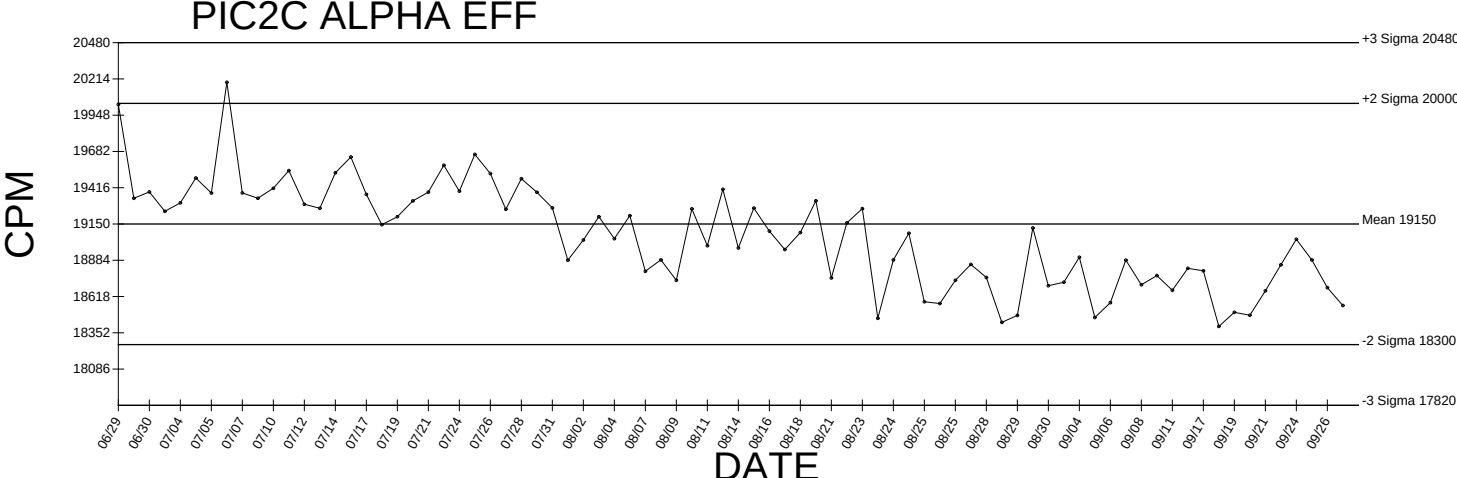
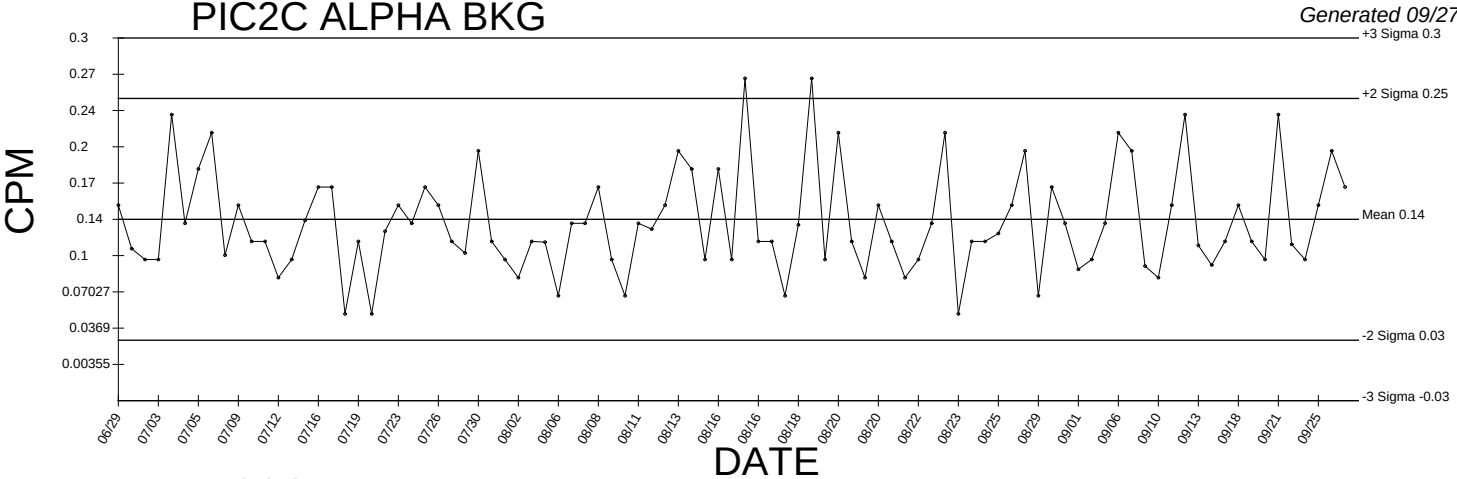
Generated 09/27/2018



PIC2A BETA EFF Cross Talk



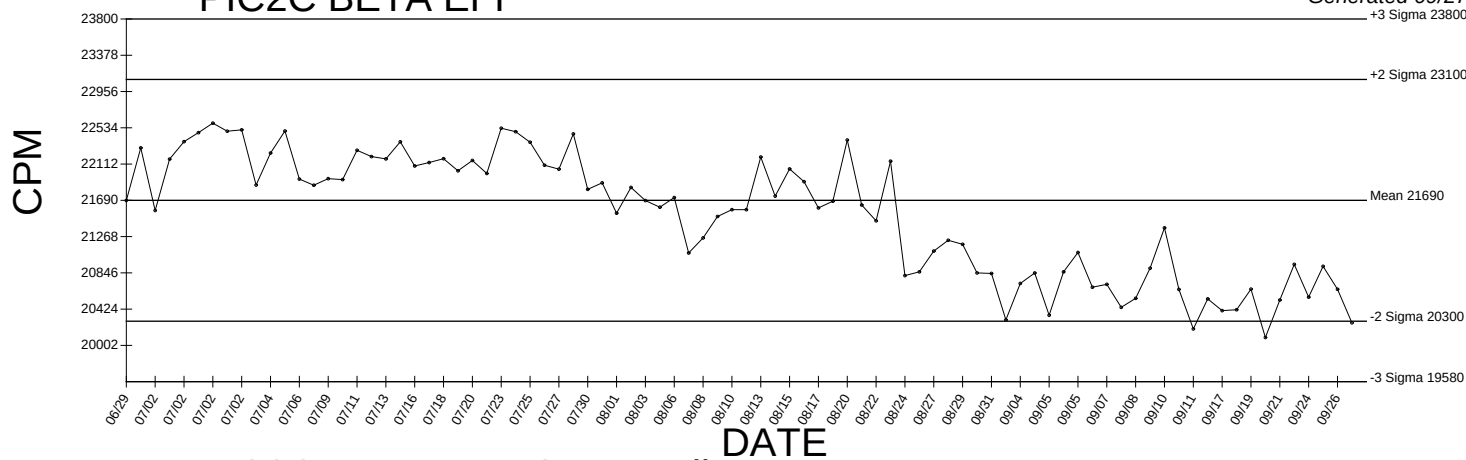
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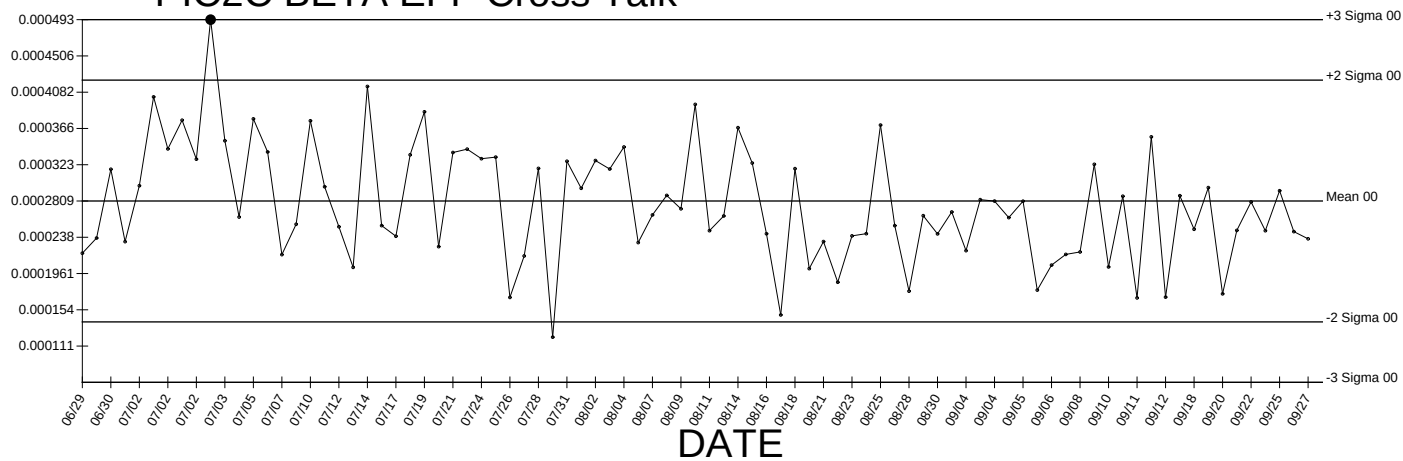
● Denotes Outlier

PIC2C BETA EFF

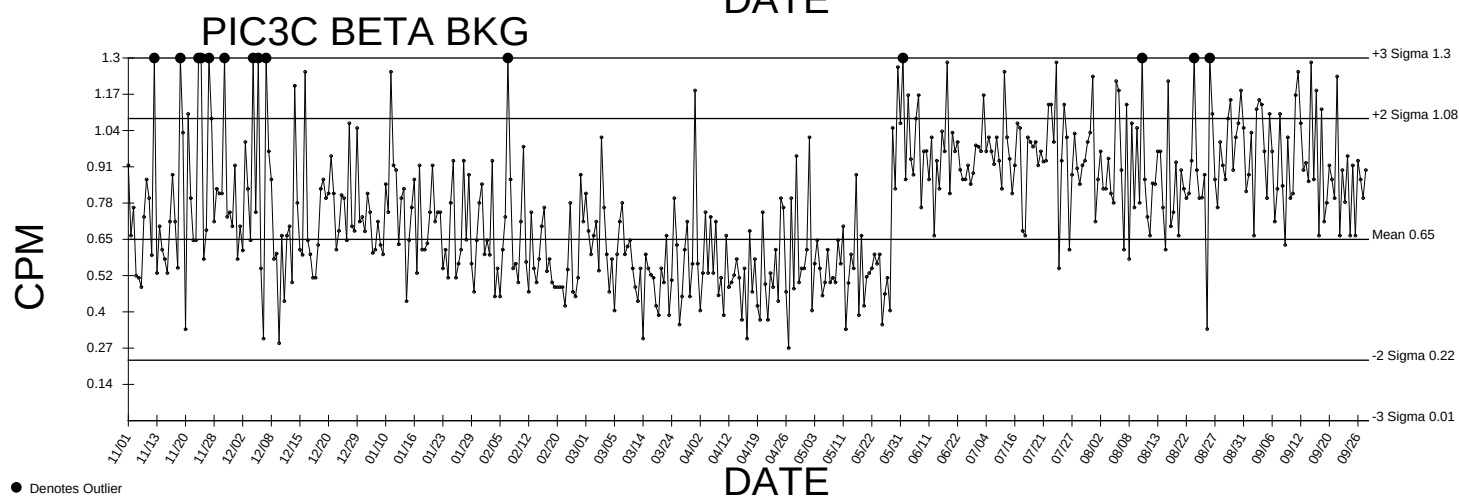
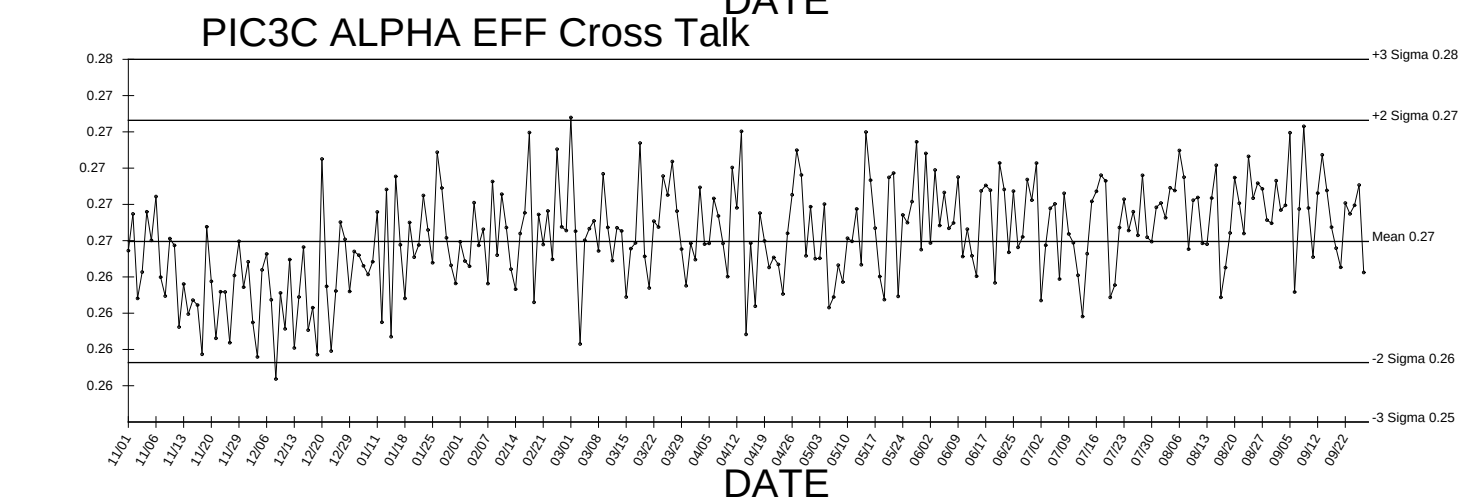
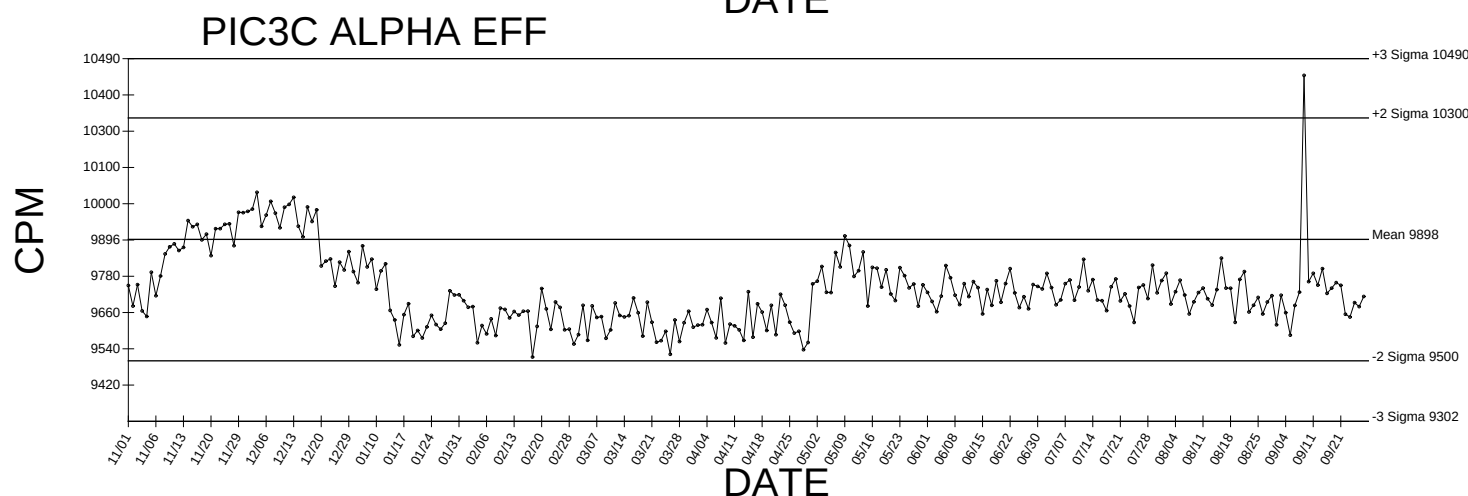
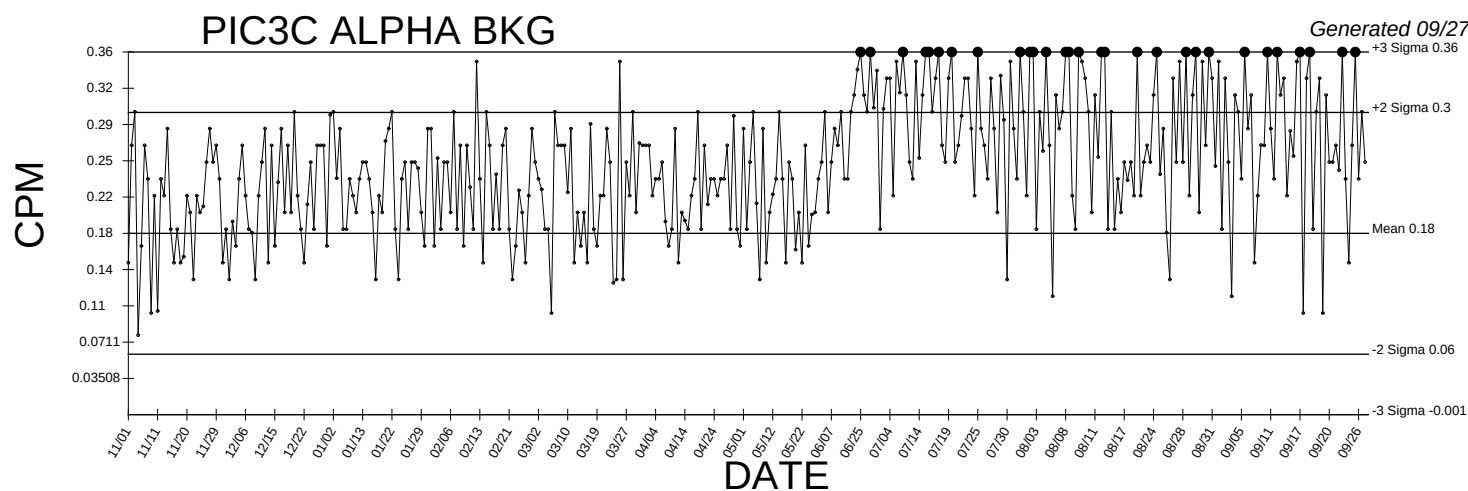
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PIC2C BETA EFF Cross Talk

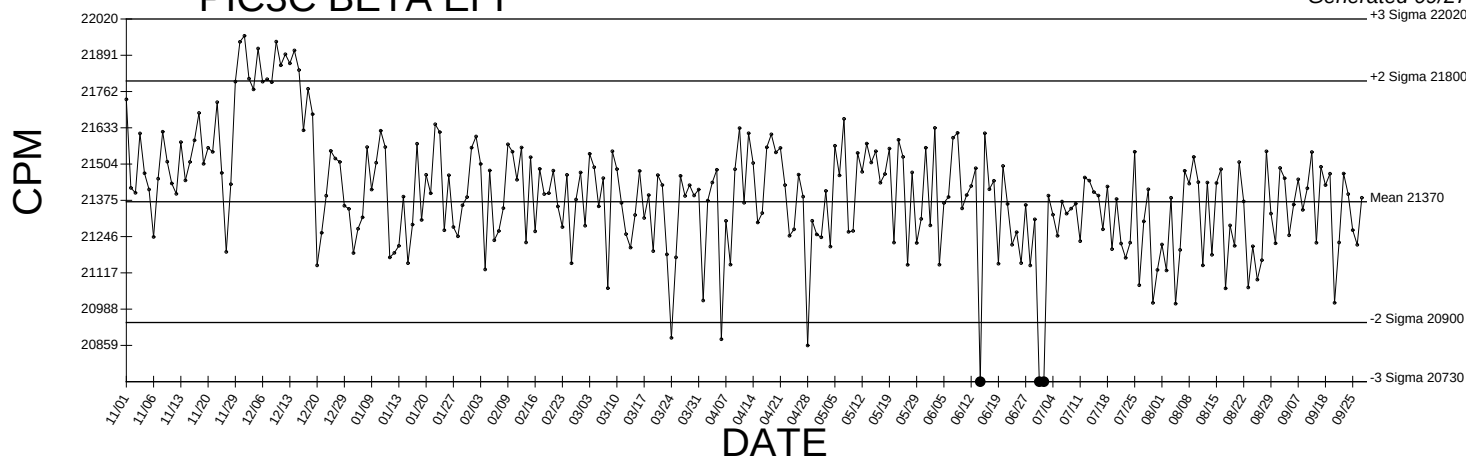


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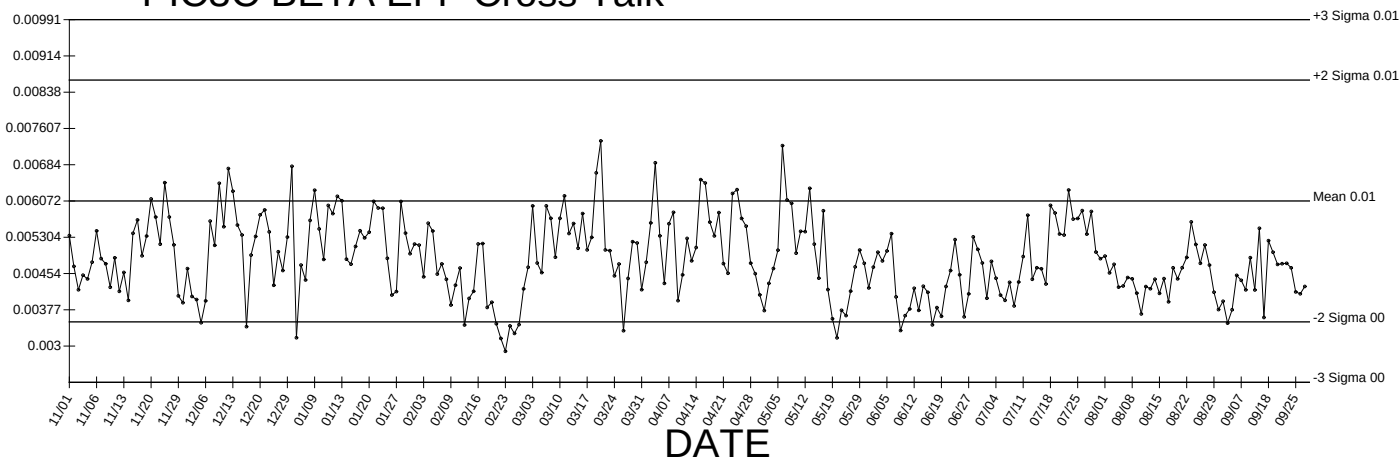


PIC3C BETA EFF

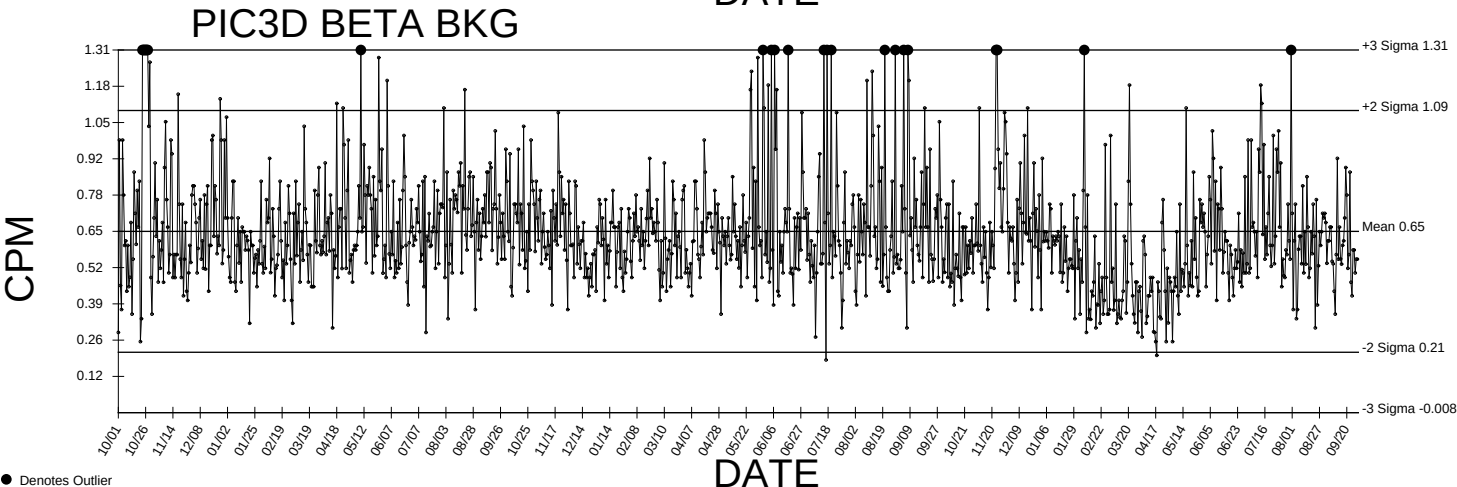
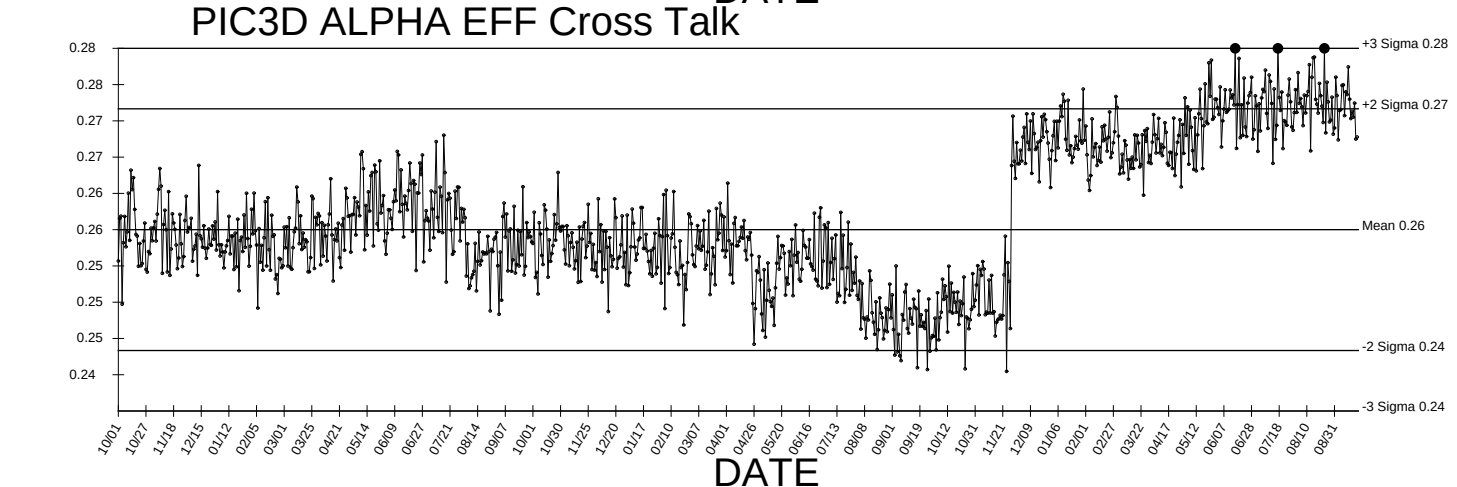
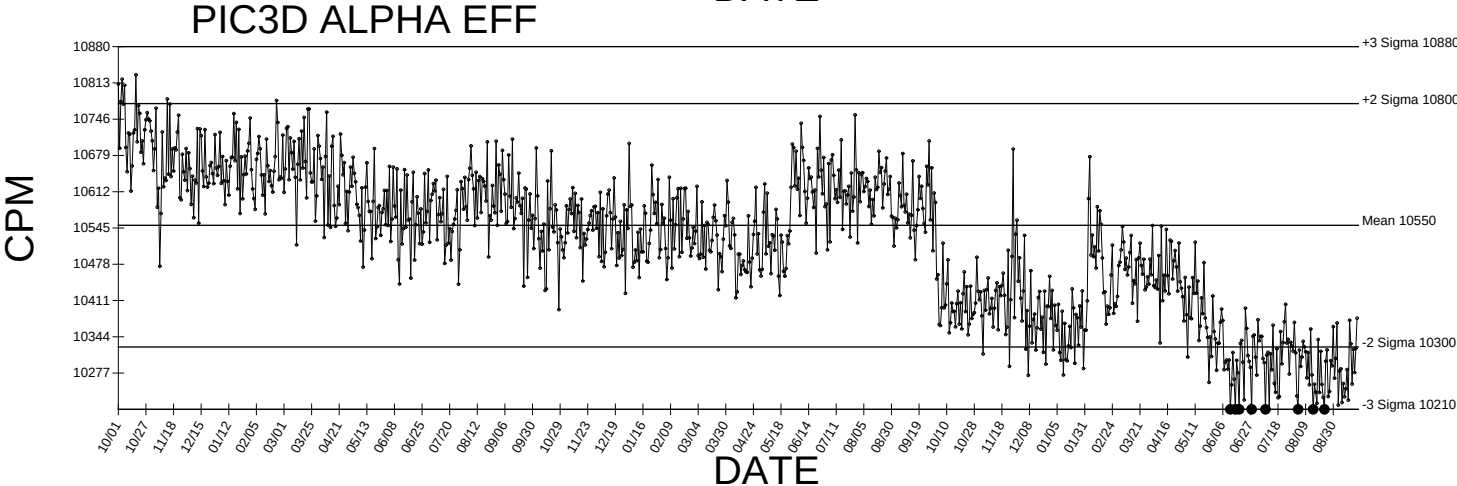
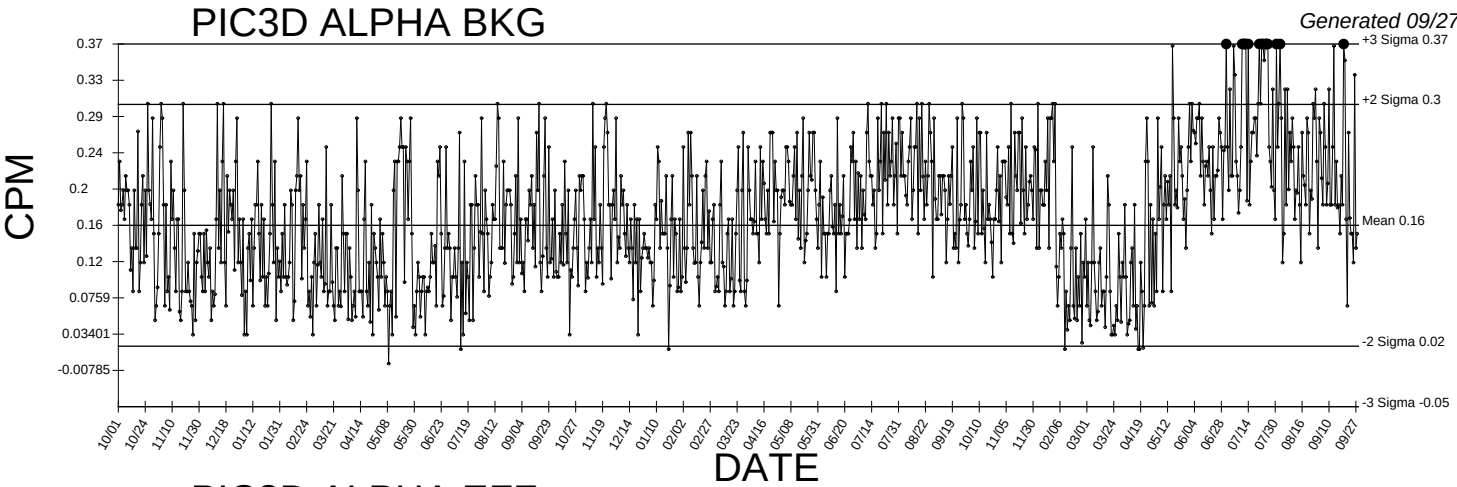
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+3 Sigma 22020



PIC3C BETA EFF Cross Talk



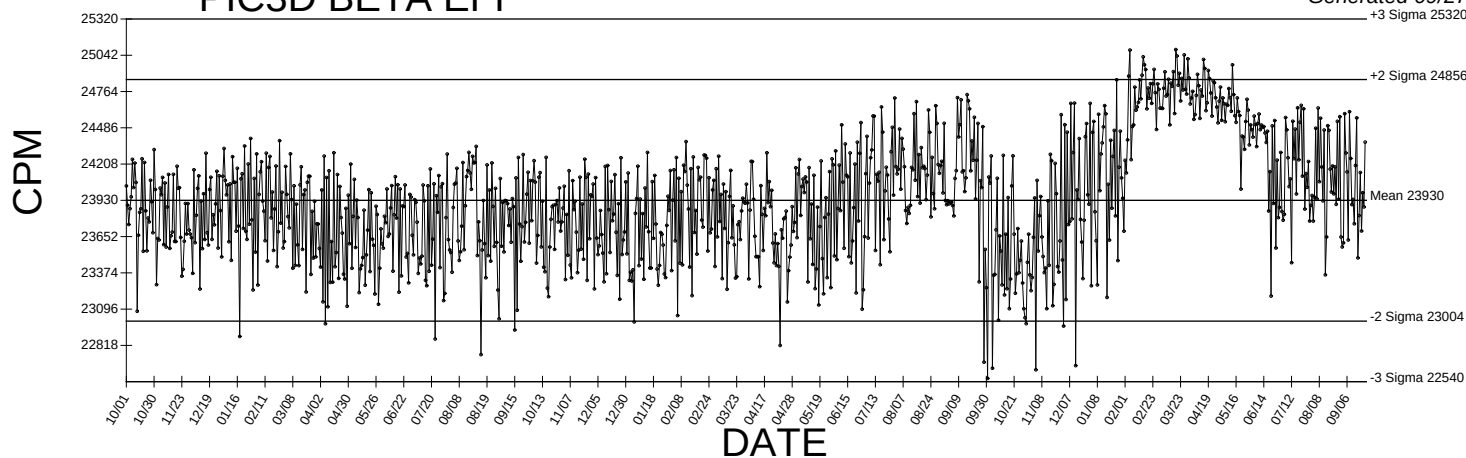
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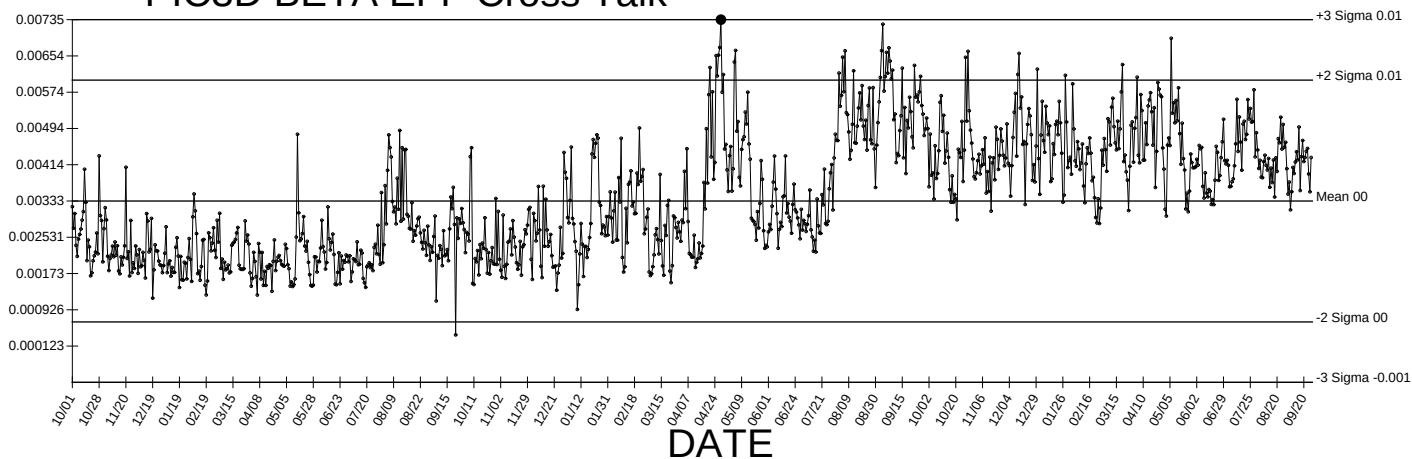
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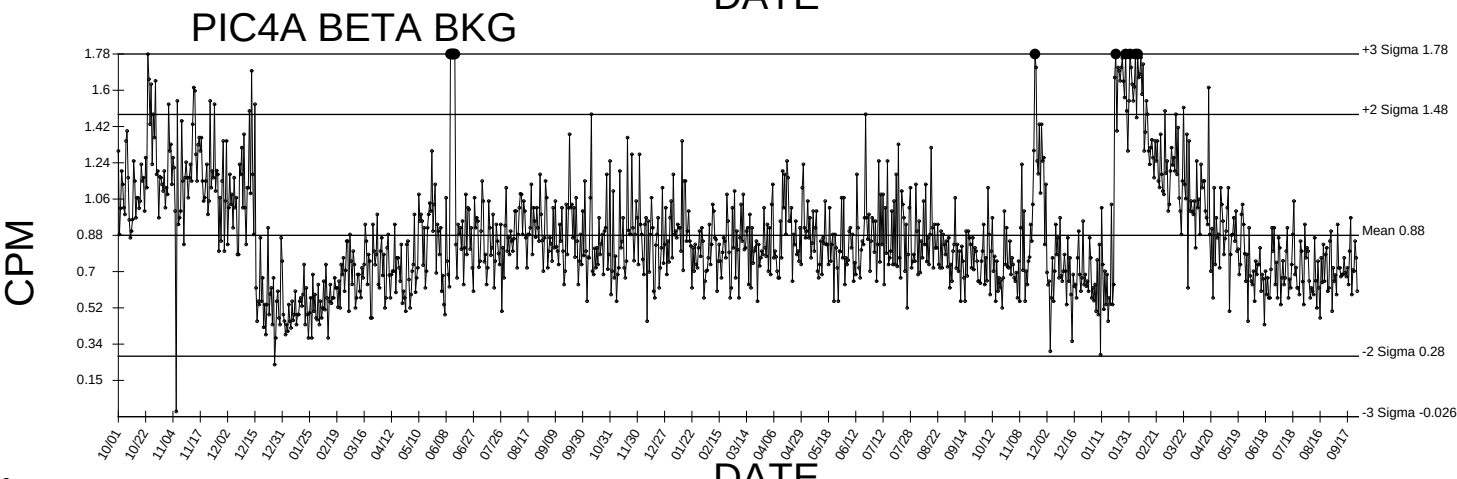
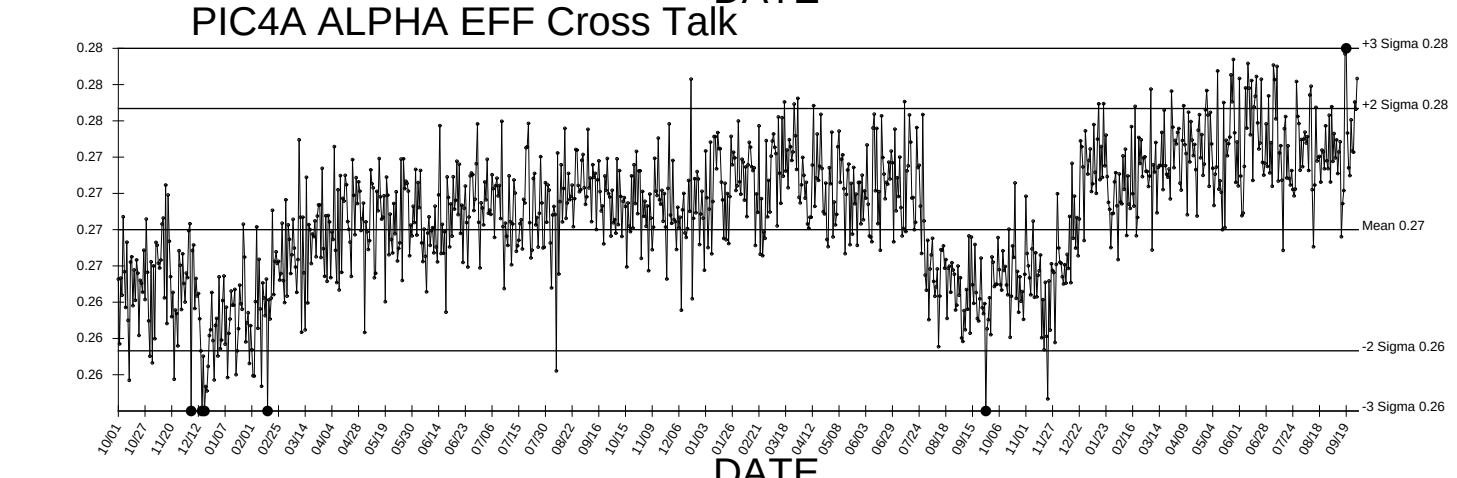
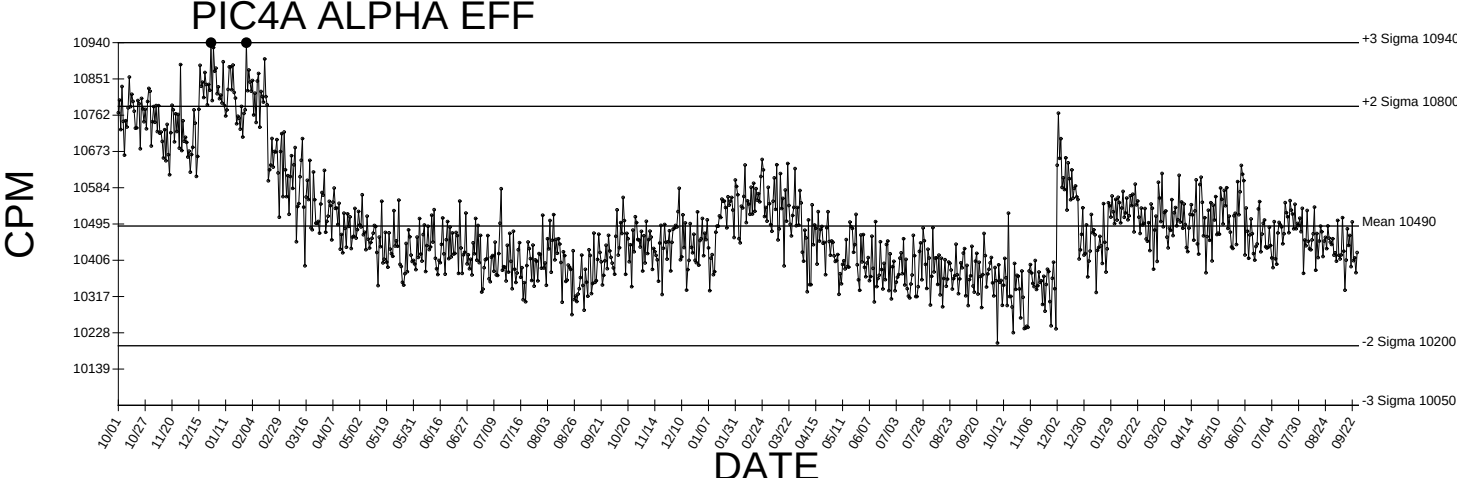
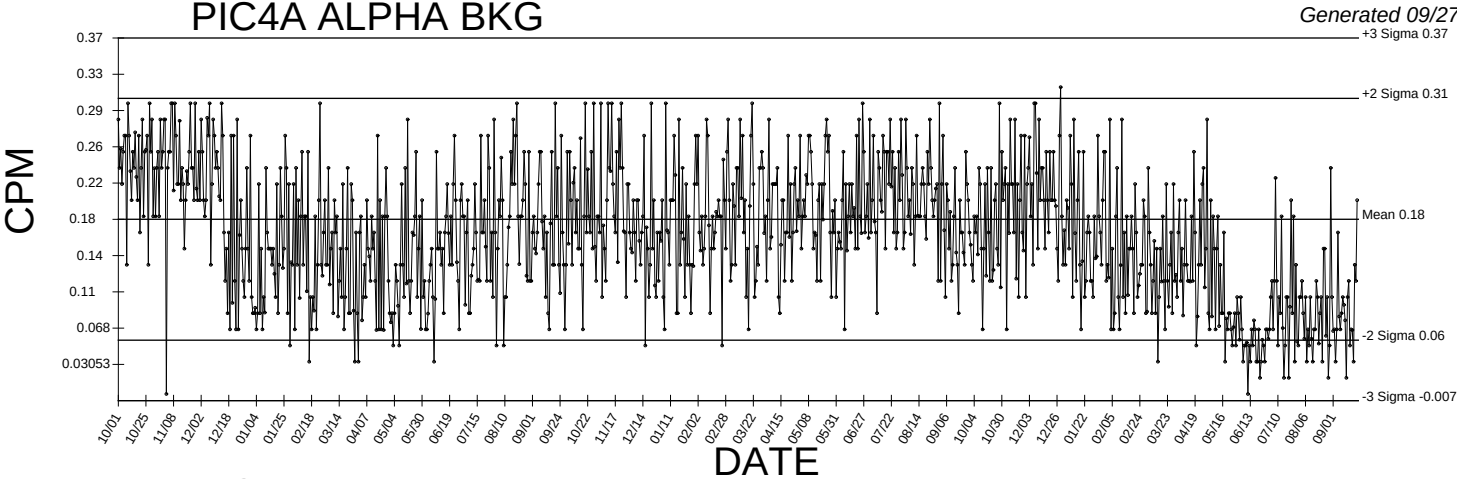
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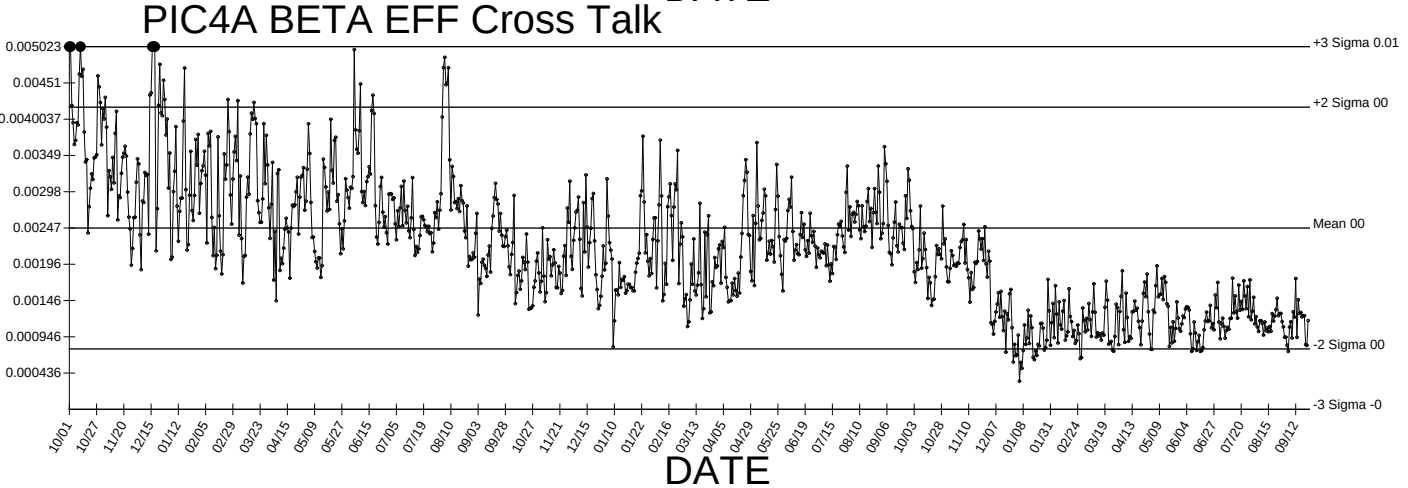
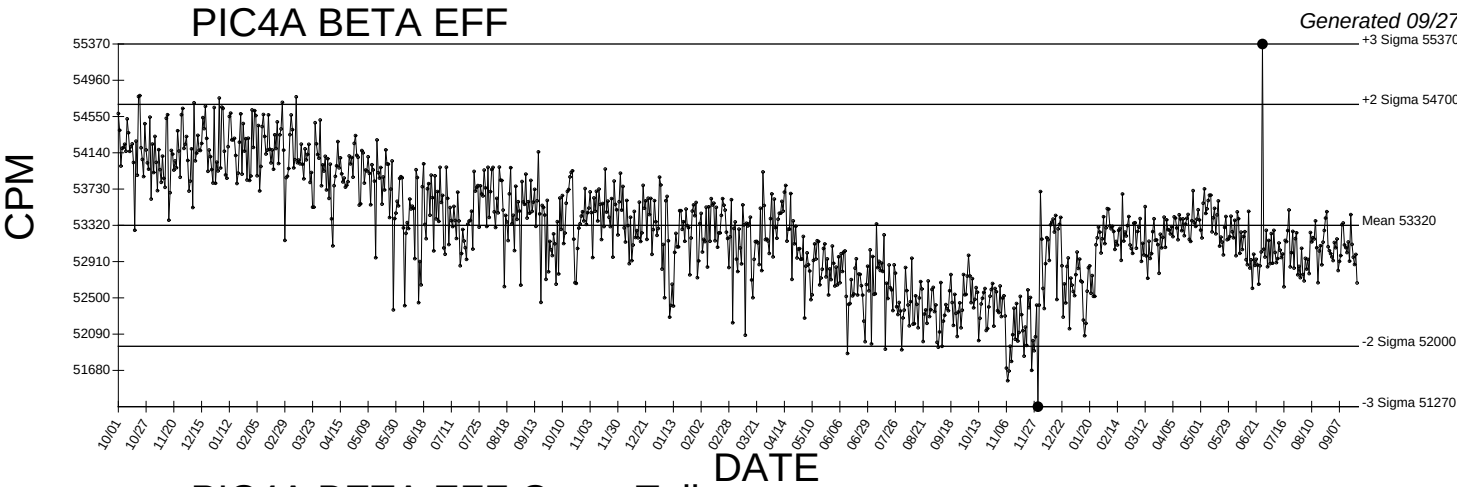
PIC3D BETA EFF Cross Talk



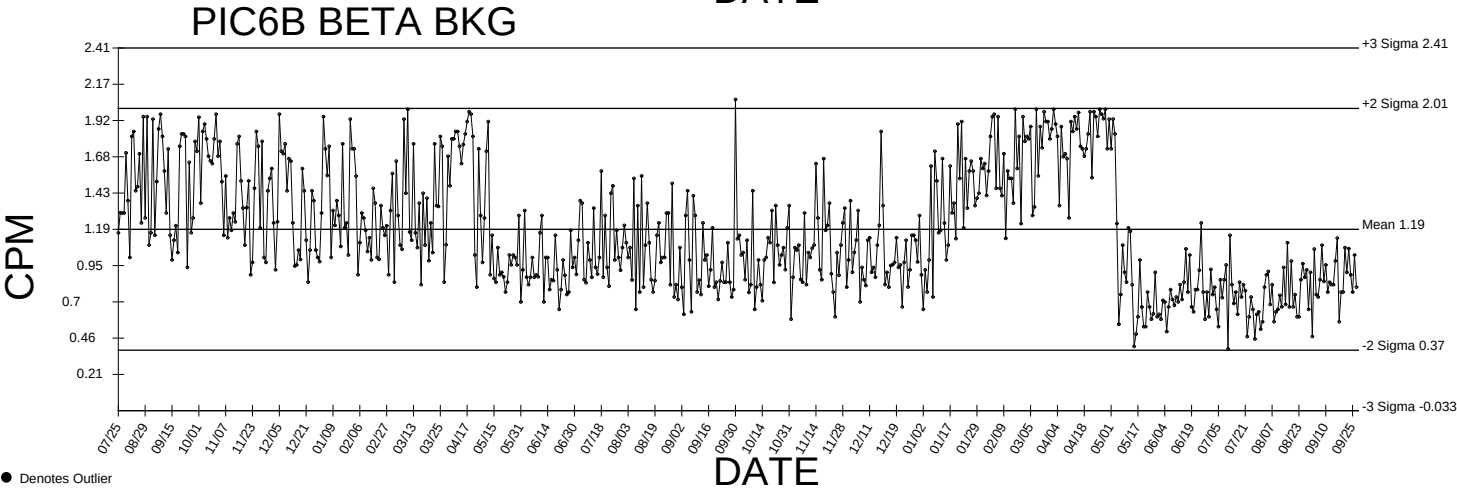
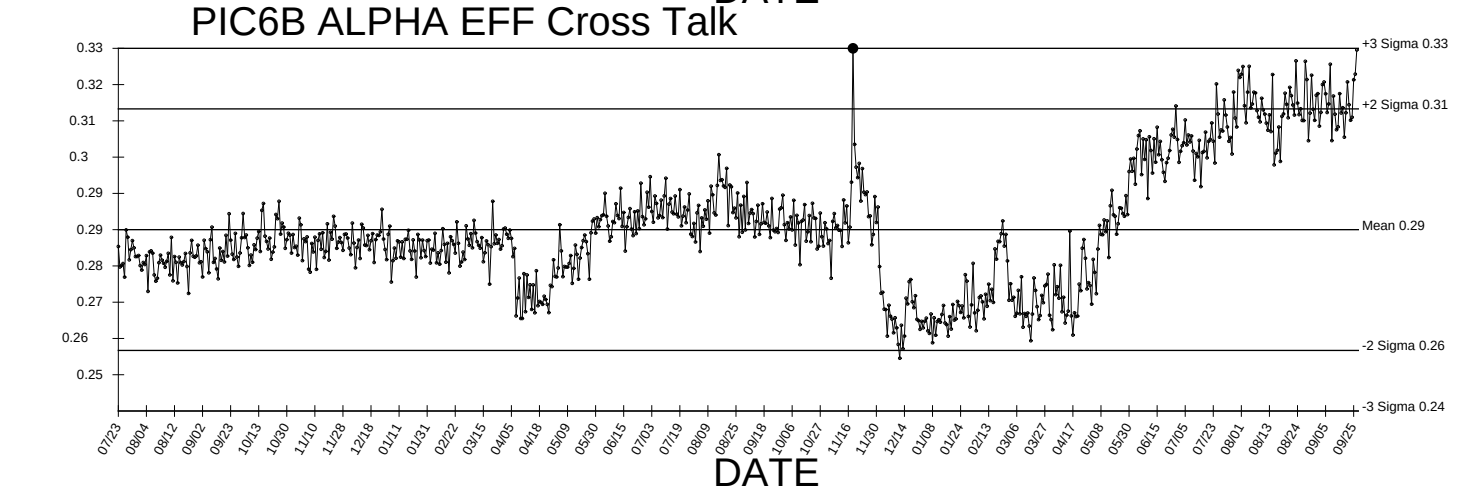
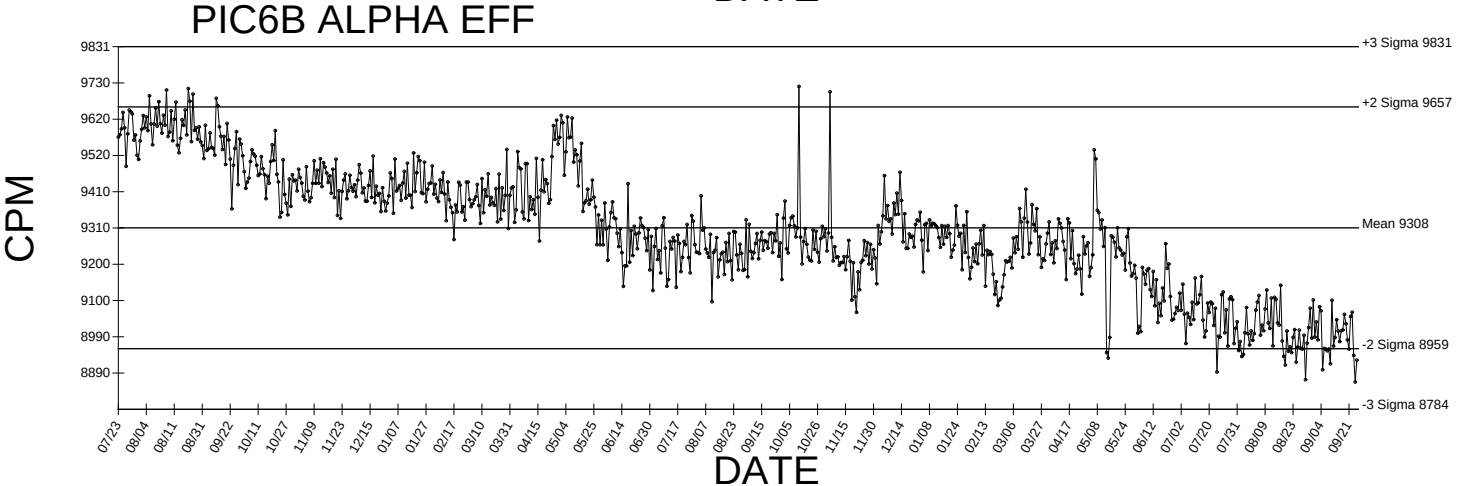
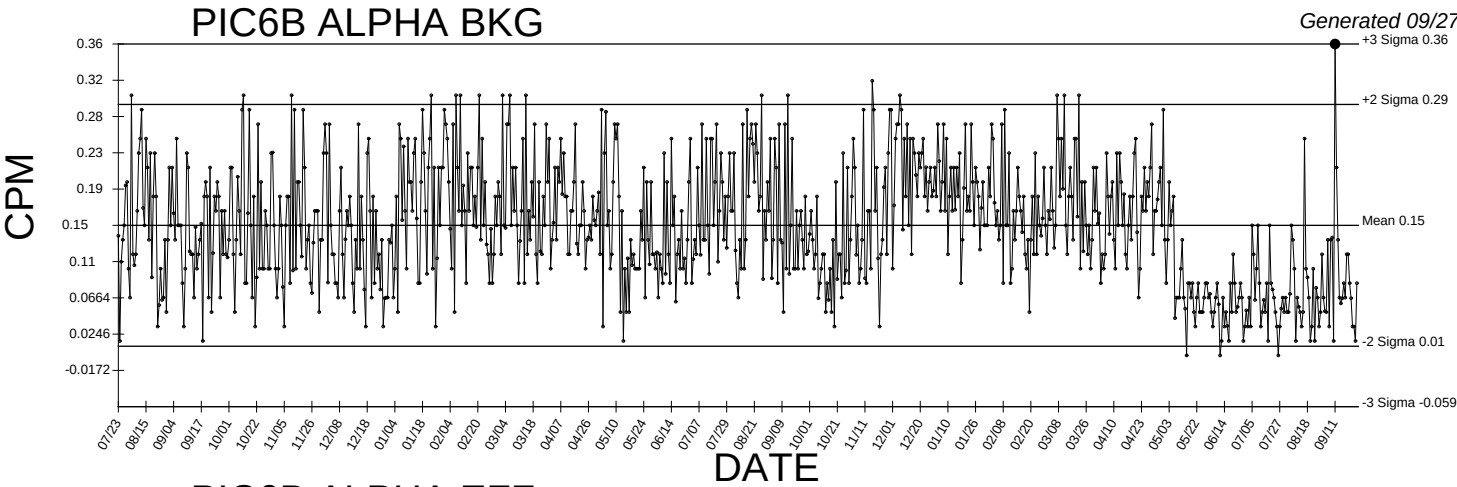
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● Denotes Outlier



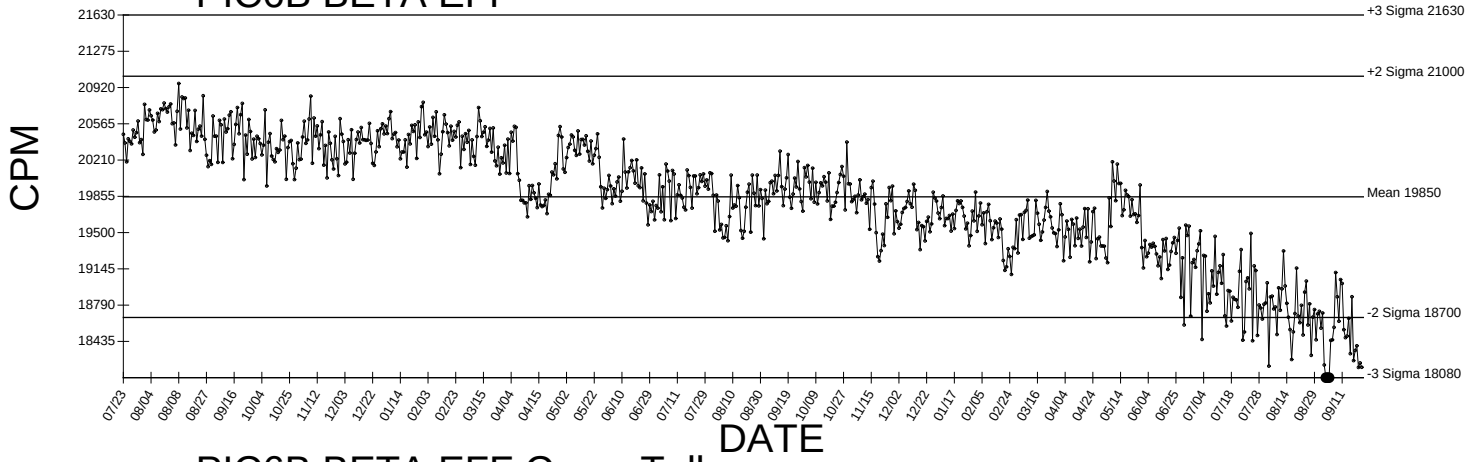
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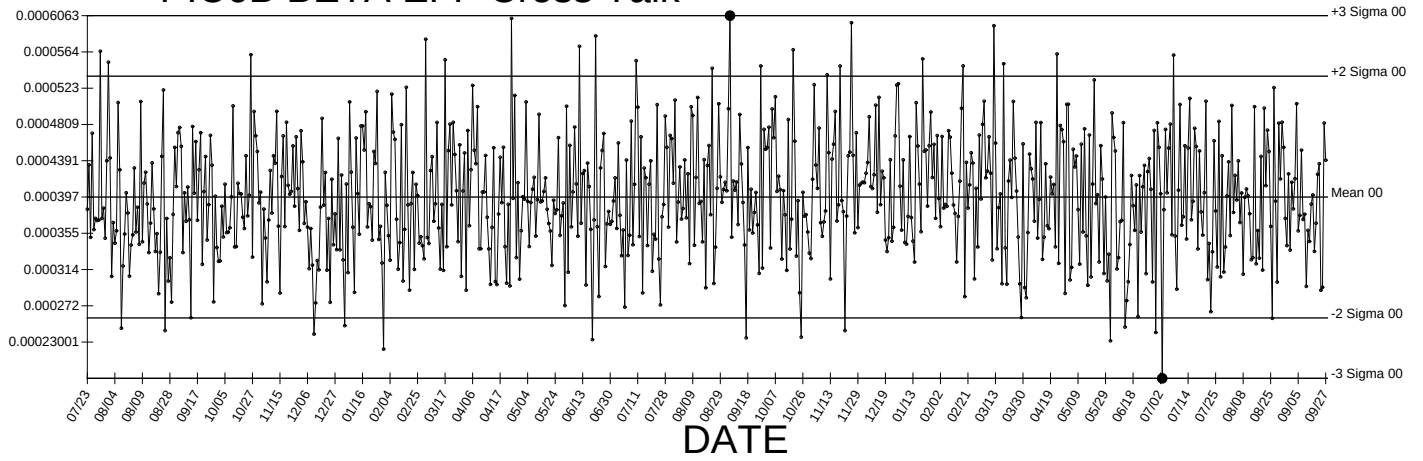
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PIC6B BETA EFF

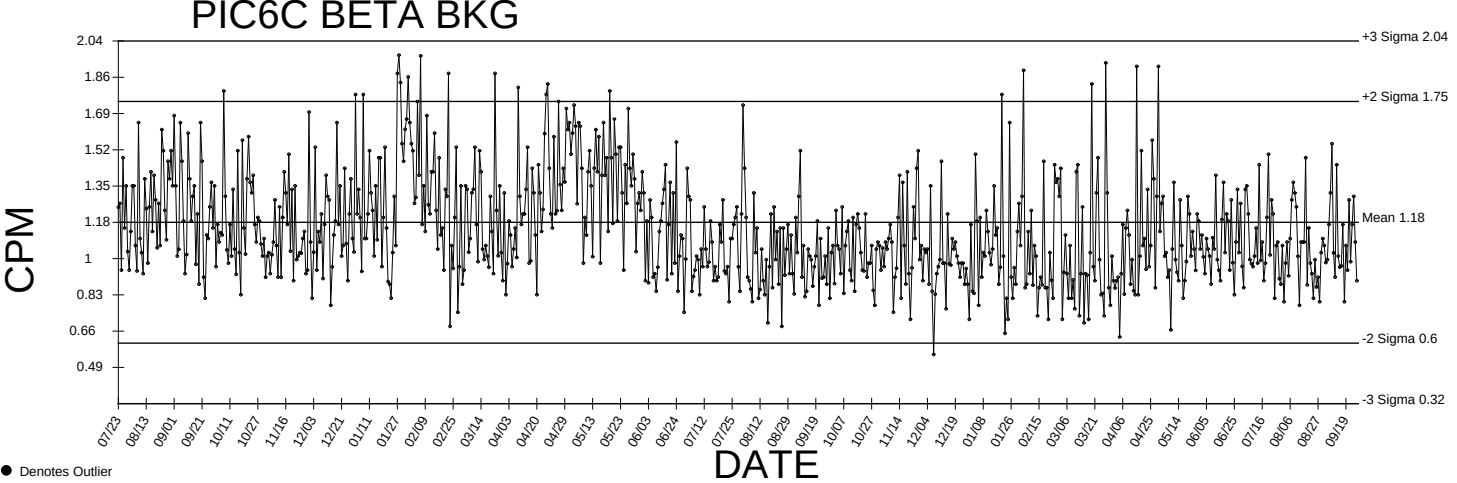
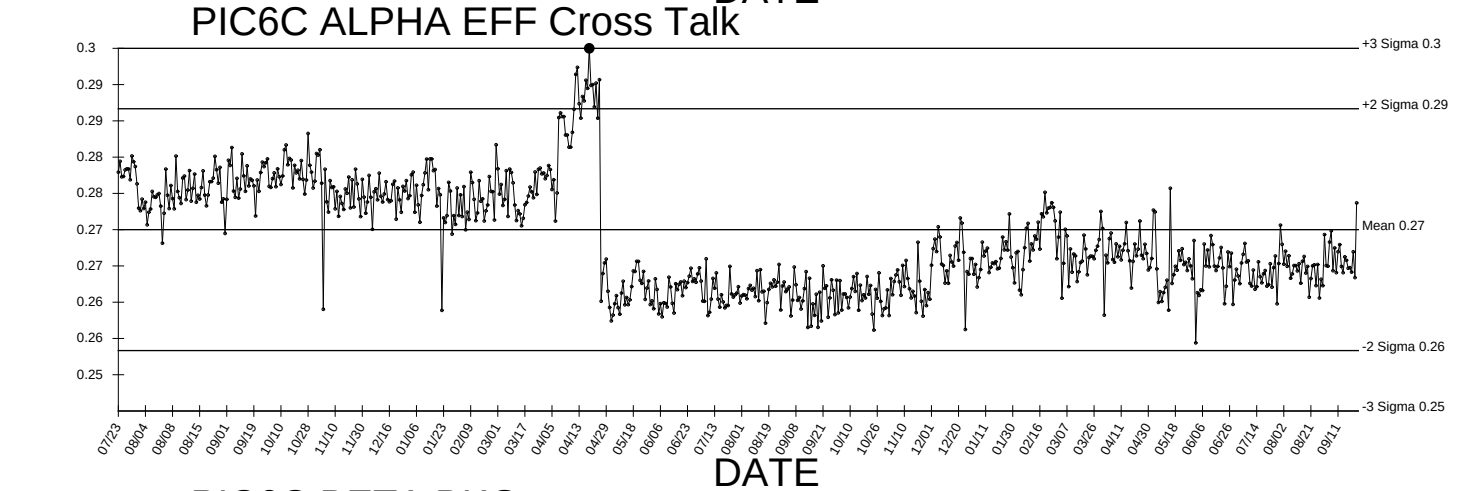
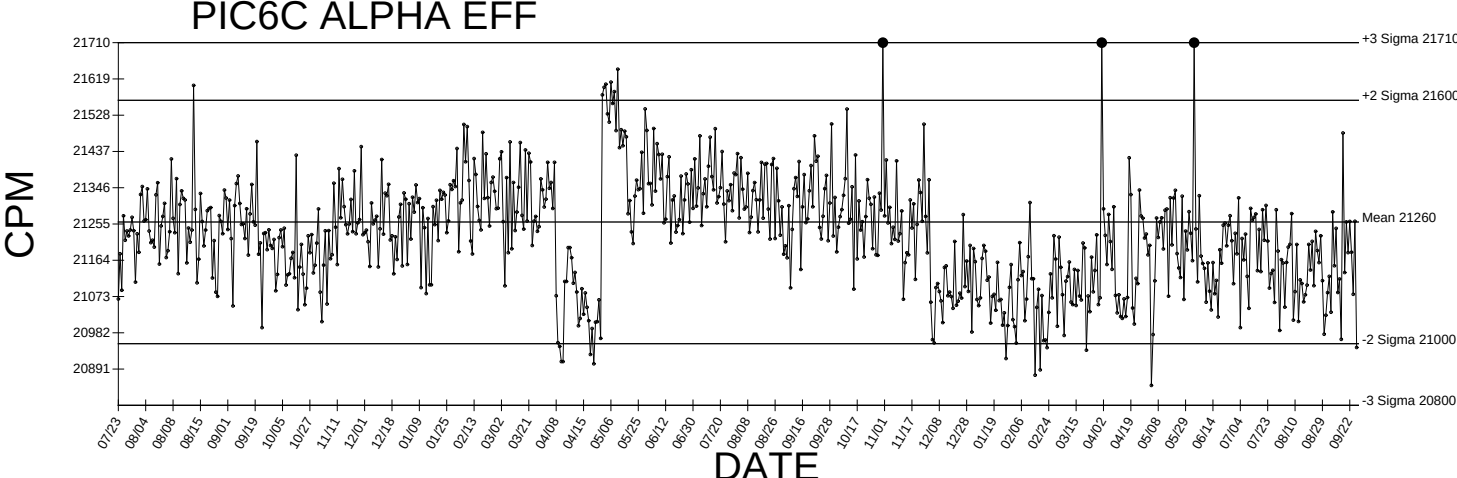
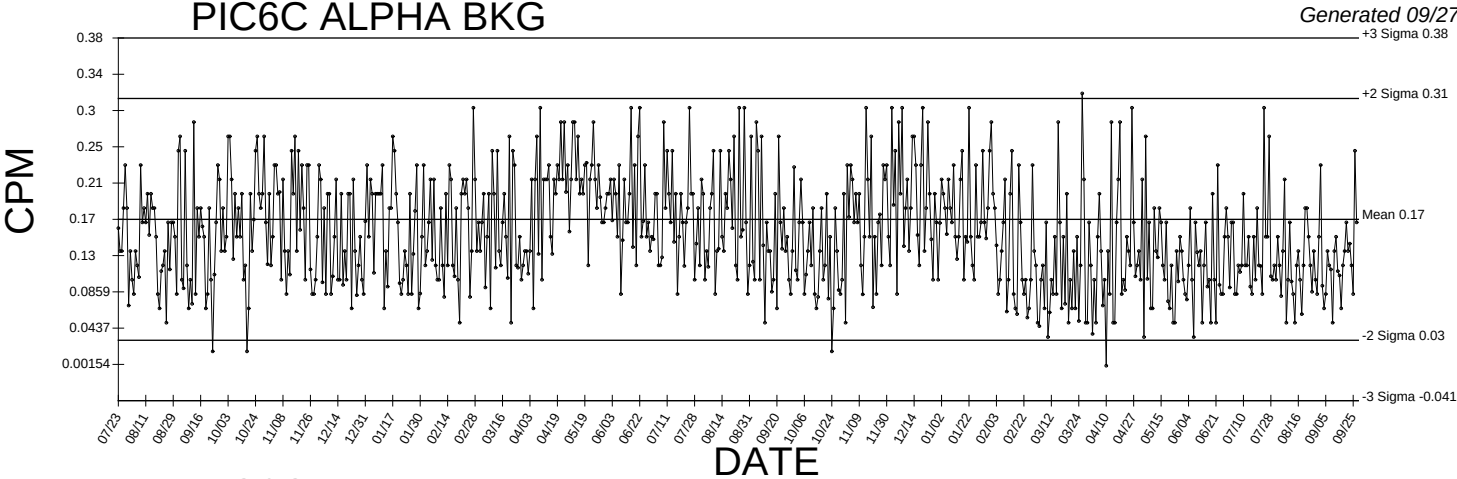
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+3 Sigma 21630



PIC6B BETA EFF Cross Talk



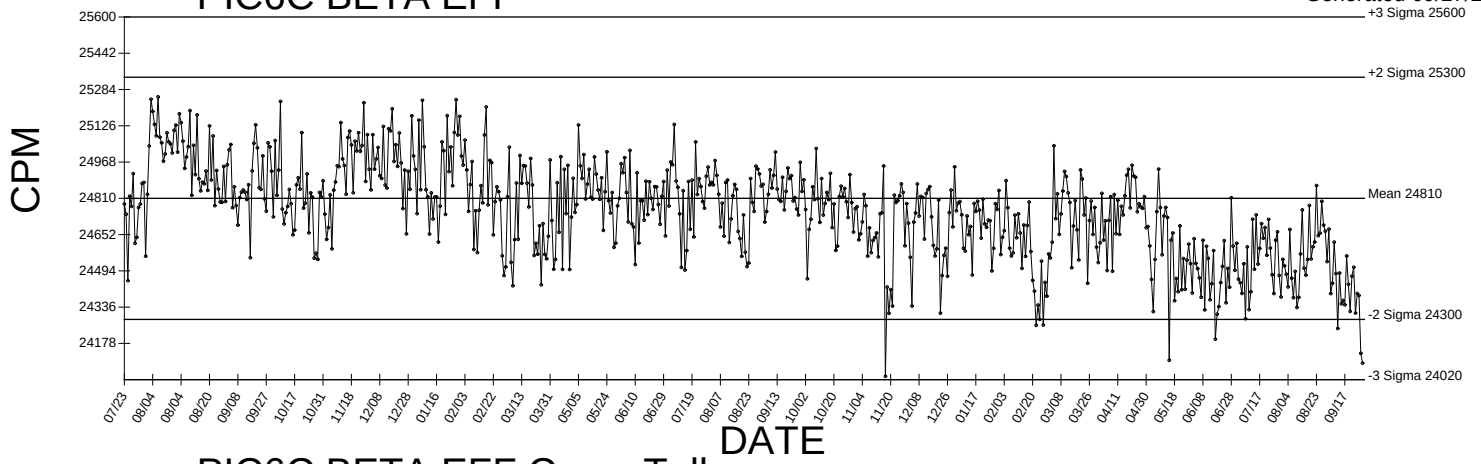
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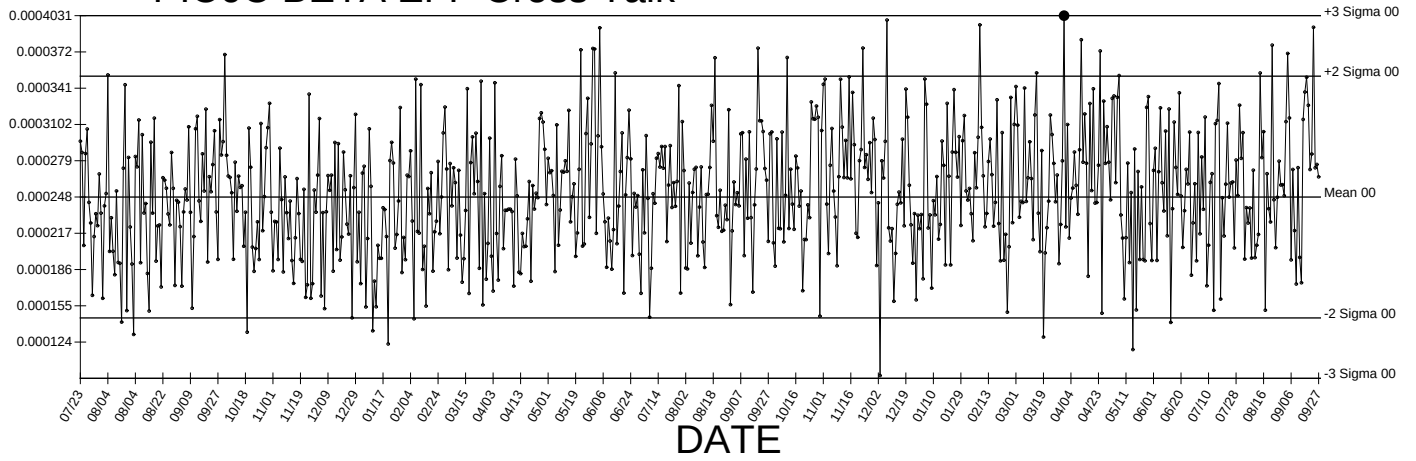
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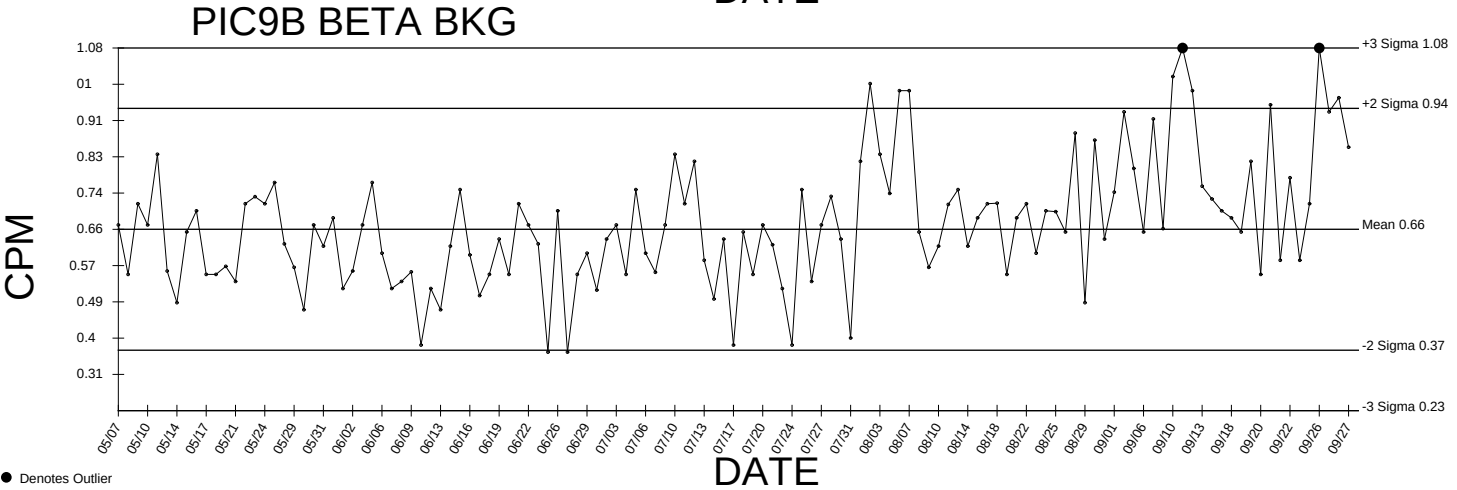
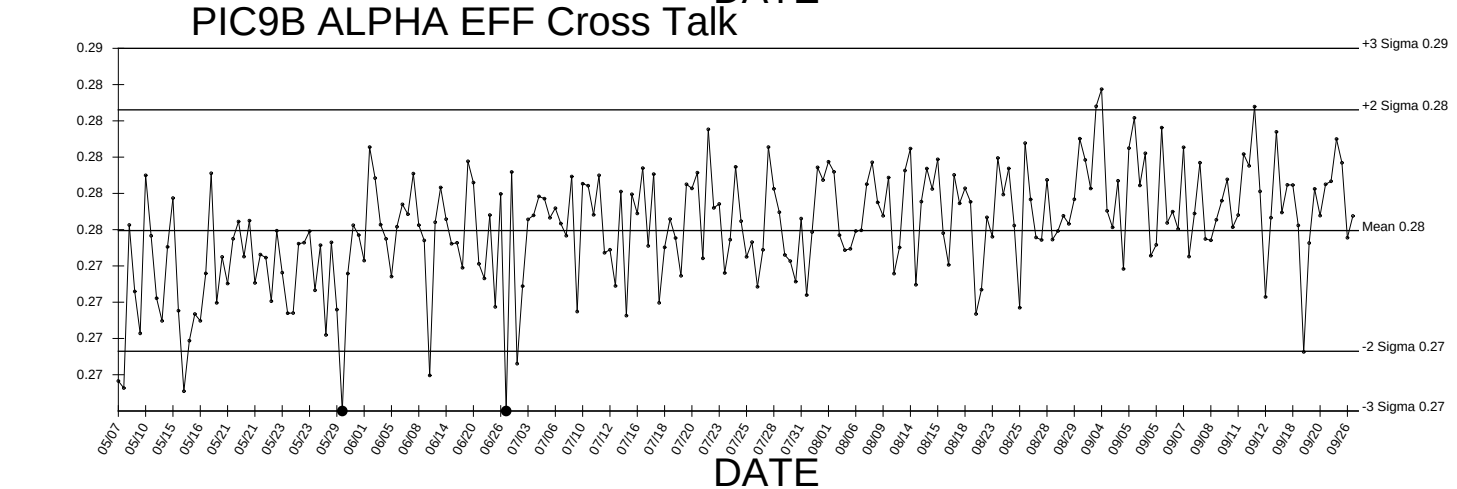
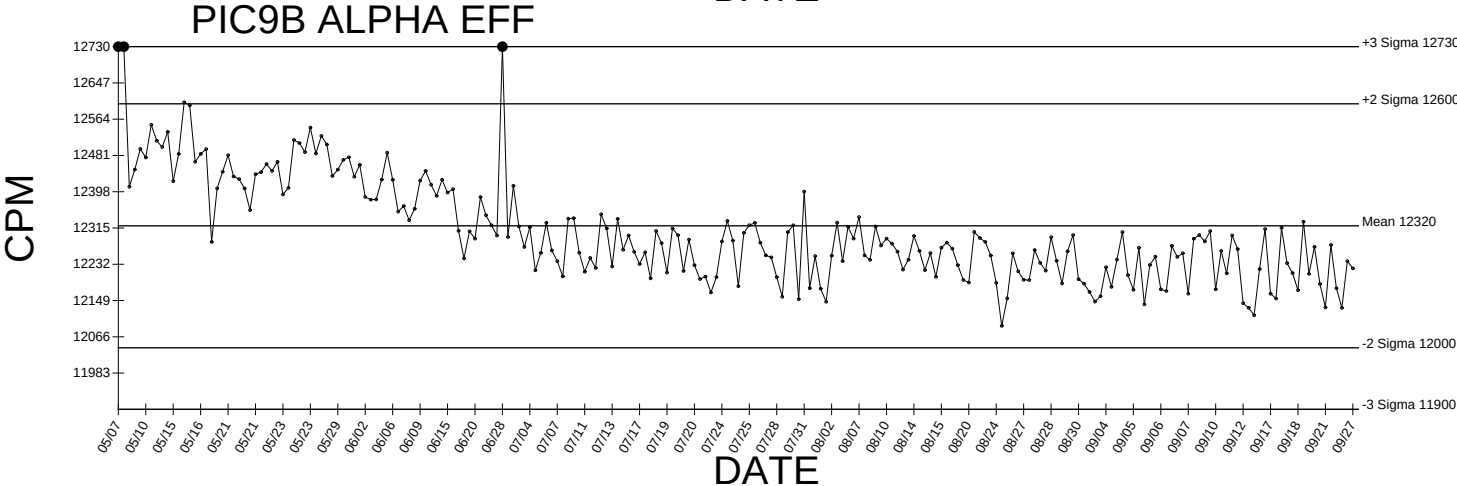
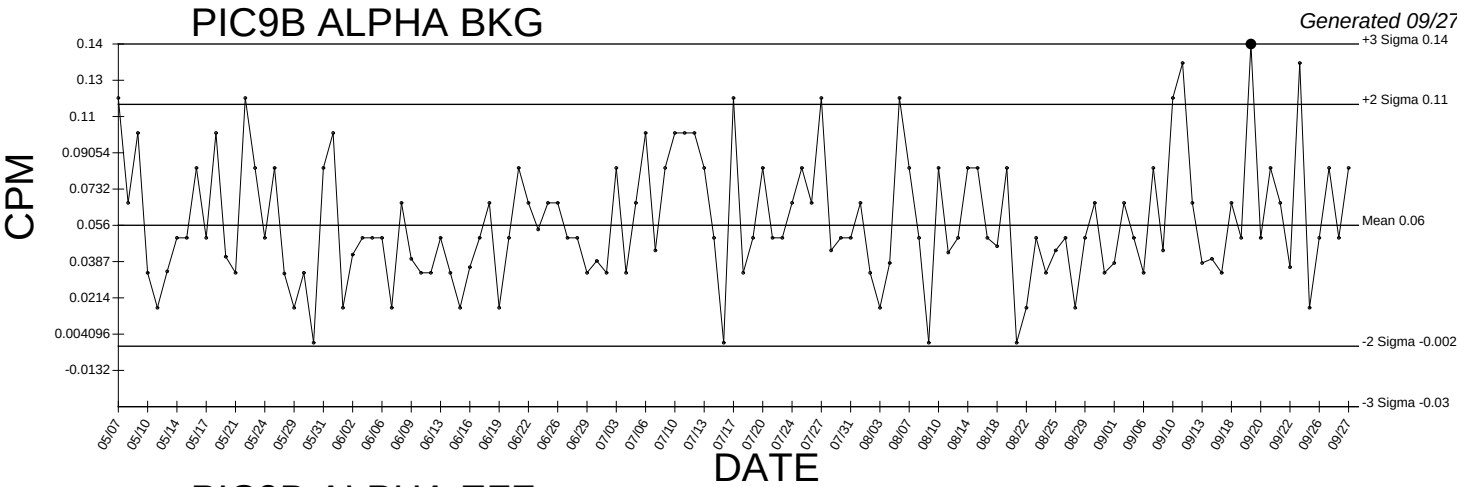
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PIC6C BETA EFF Cross Talk



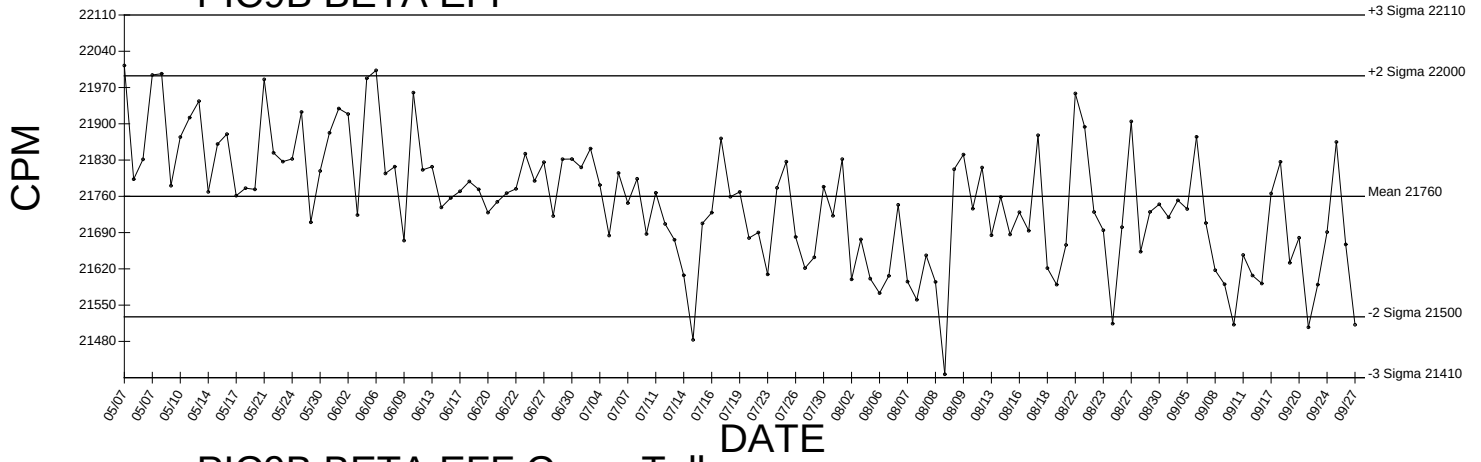
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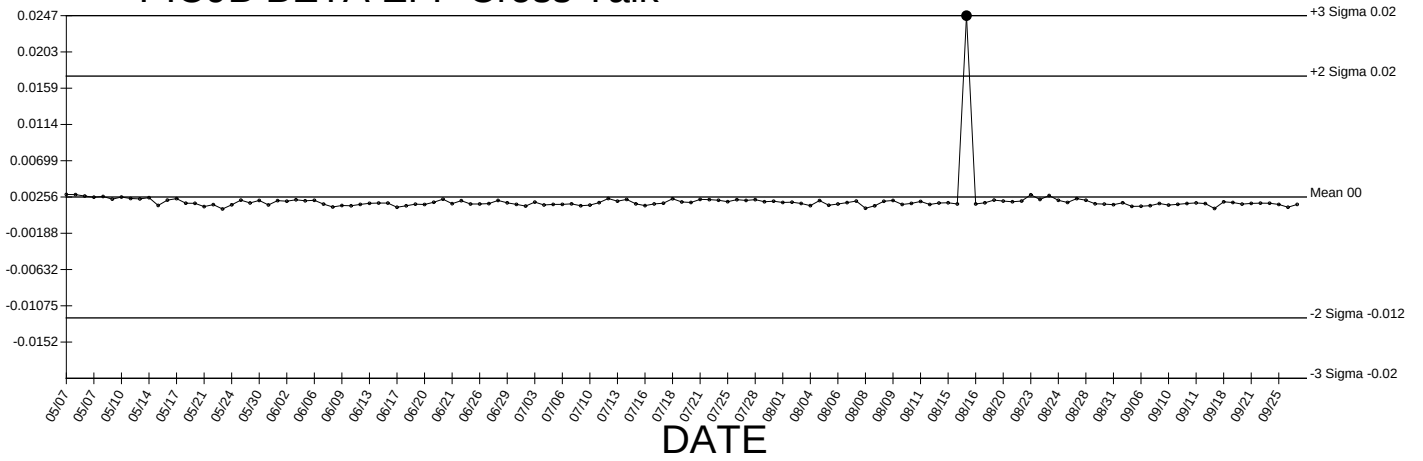
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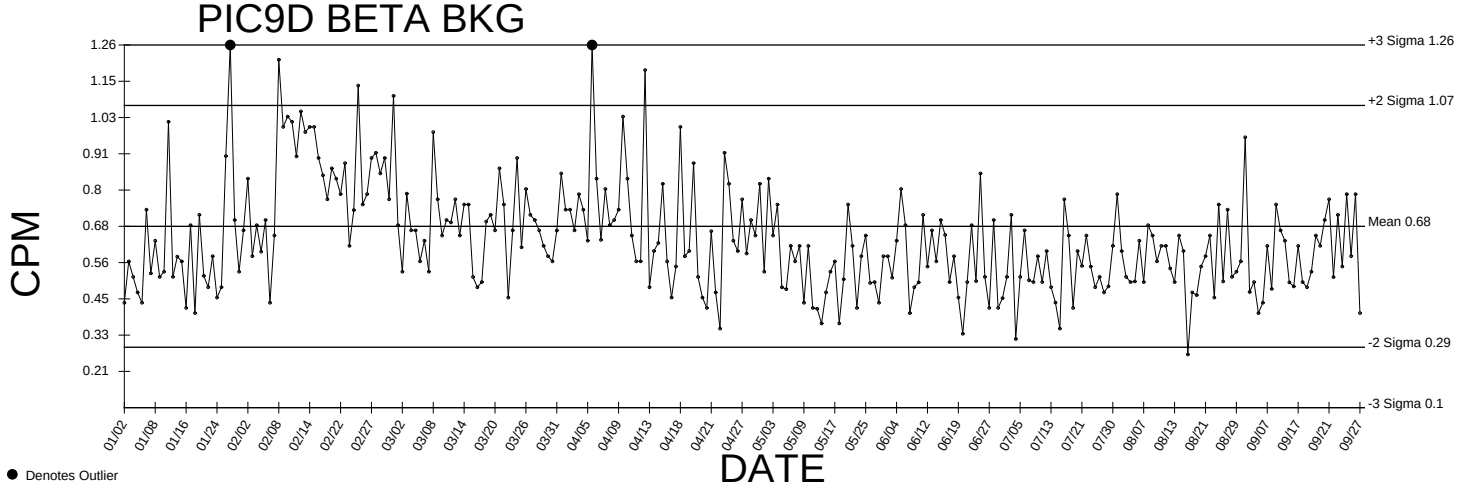
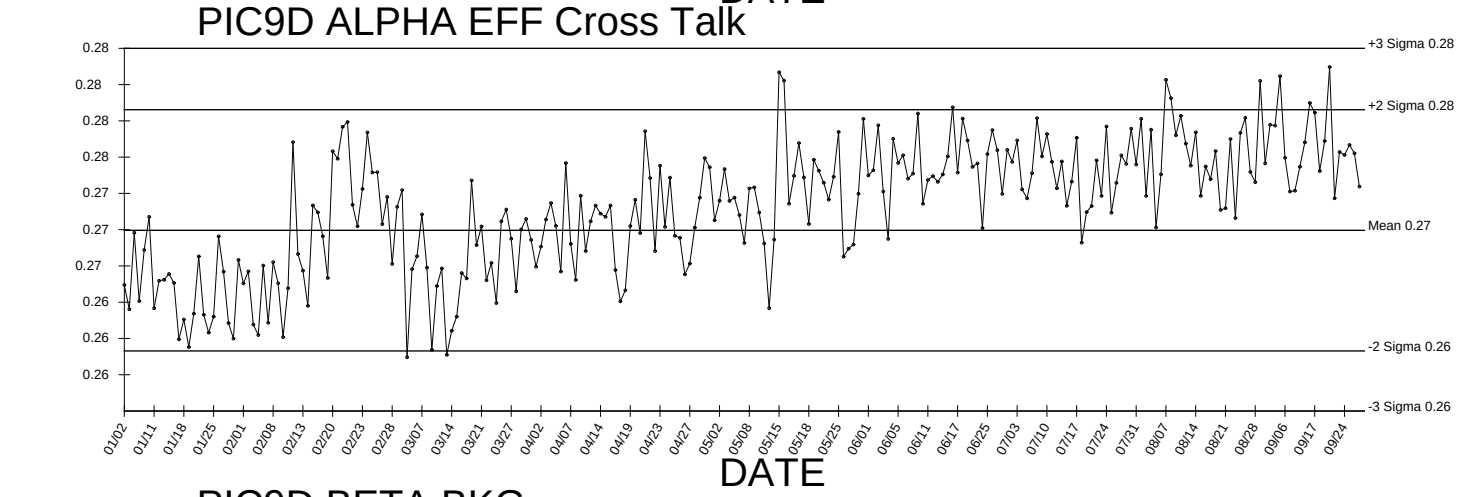
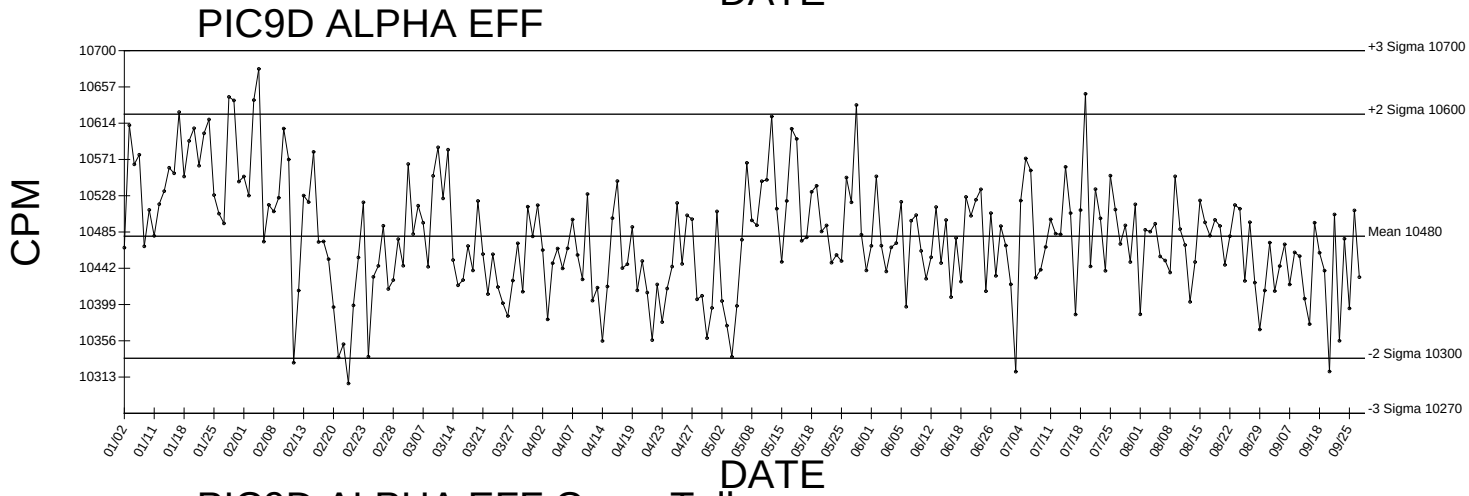
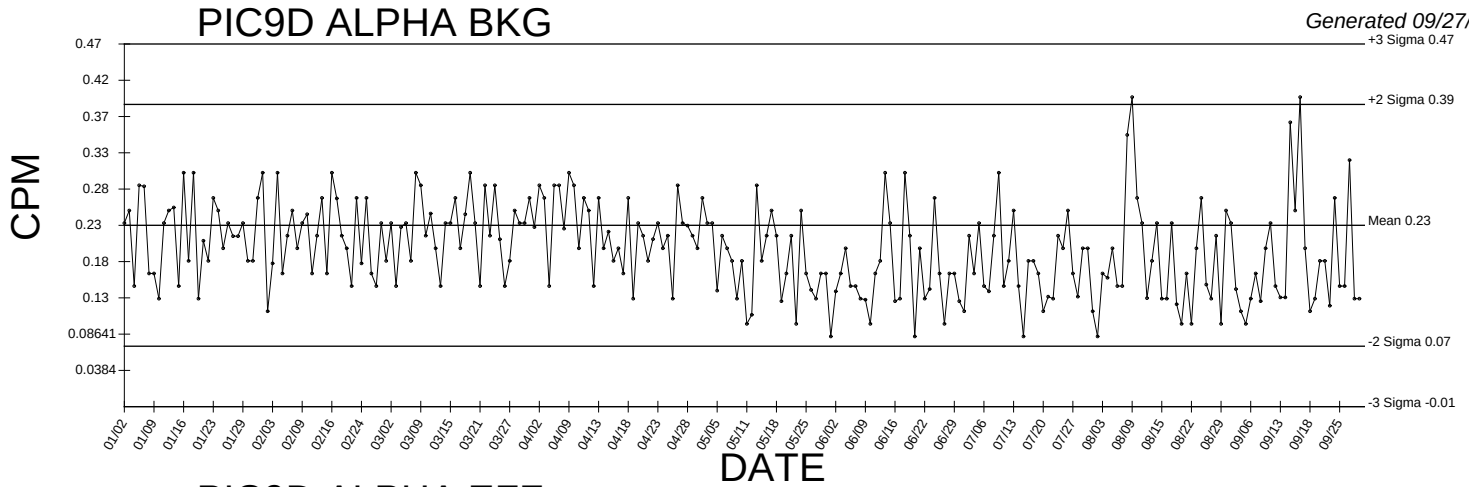
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PIC9B BETA EFF Cross Talk

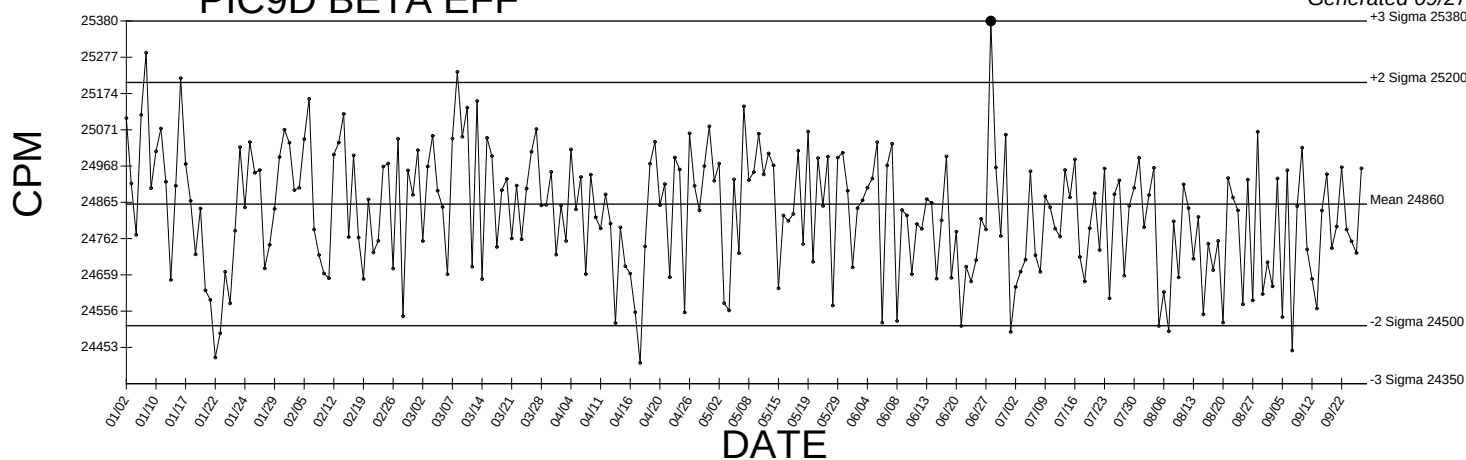


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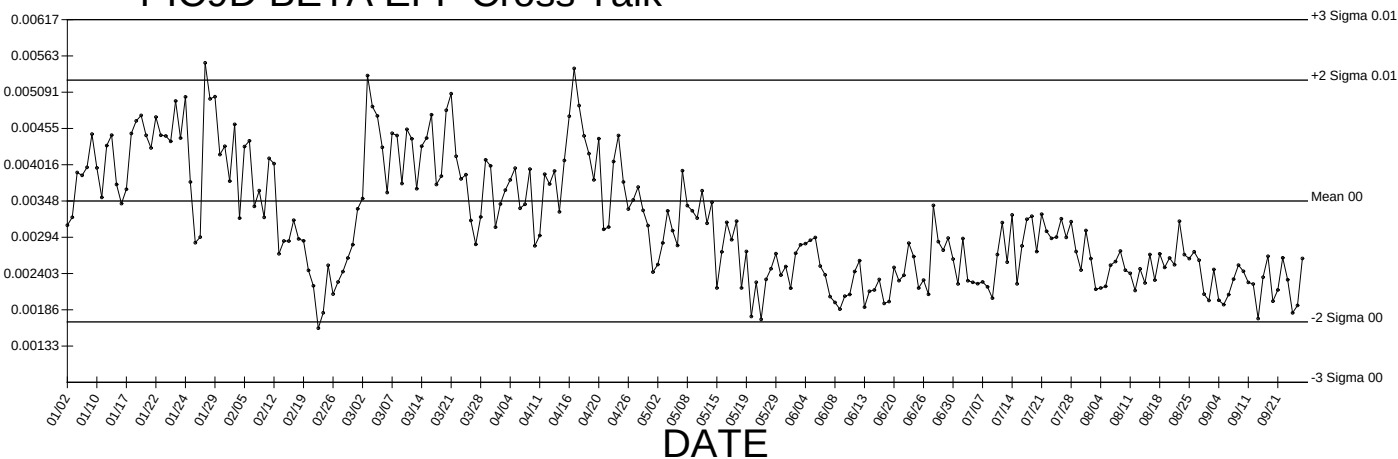


PIC9D BETA EFF

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 $4\pi(c+X)$ - 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				$\times 2$
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 [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
Source 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	5668.77	0.818570	6930.75	4490.11
2	3622.28	0.818570	4426.19	4628.58
3	3625.44	0.818570	4431.90	4431.90

Mean Value = 4460.14
 Stdev = 10293326
 Certificate Value* = 4467.7
 Two sigma = 347.65
 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 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 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-201

[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 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 ^{1a)}	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 % ^{1b)} . 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

^{1a)} Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^{1b)} 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 ($s^{-1} g^{-1}$) ⁽ⁱ⁾	S_m (%) ⁽ⁱⁱ⁾
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

(i) Grand mean for $n = 11$ determinations with three sources in three to five different detectors.

(ii) 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/grp04/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	
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)

pCi/L

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: 17353

Expiration Date: 12/16/18

Vol: 0.1

End Initial/Degas Date/Time: 9/24/18

133S Isotope: Radium-226 133S Code: 17353

Expiration Date: 12/16/18

Vol: 0.1

End 133S 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: 2-60-933

Balance ID: 1836255

Initials: PLW

Witness: H/O

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDI	Client	Position (Label)	Aspirated (mL or g)	End 133S 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	10
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	6	11
459197007-1	FILE 09092018	SAMPLE		GROUNDWATER	1.5	LANC006	18	500	0536	0920	1801	18	6	11
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(MIS)	MIS		GROUNDWATER	1.5	QC ACCOUNT	20	500	0620	1630	2002	20	8	6
1204113015-1	MW-6, 459187001(MIS)	MIS		GROUNDWATER	1.5	QC ACCOUNT	21	500	0620	1630	2103	21	8	19
1204113016-1	MW-8, 459187001(MIS)	MIS		GROUNDWATER	1.5	QC ACCOUNT	22	500	0620	1630	2201	22	8	699
1204113017-1	133S for batch 1802180	133S		GROUNDWATER	1.5	QC ACCOUNT	23	500	0620	1630	2301	23	8	673

Comments:

Data Reviewed By:

Page 1 of 1

RA1802180.xls

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
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	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

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	Net Count Rate Error	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

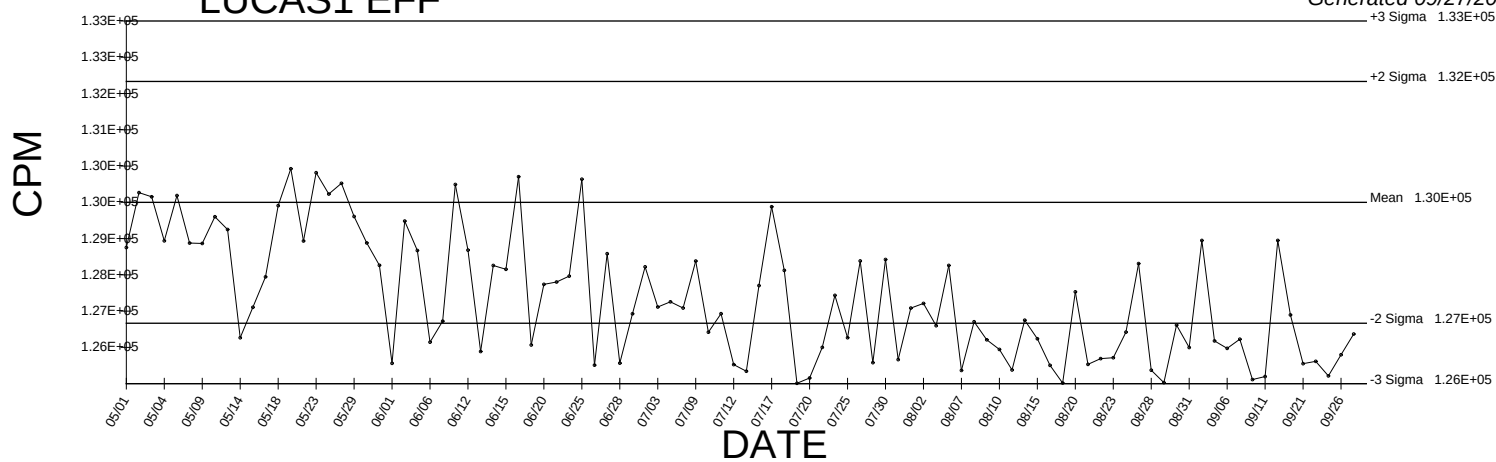
Date: 27-SEP-18

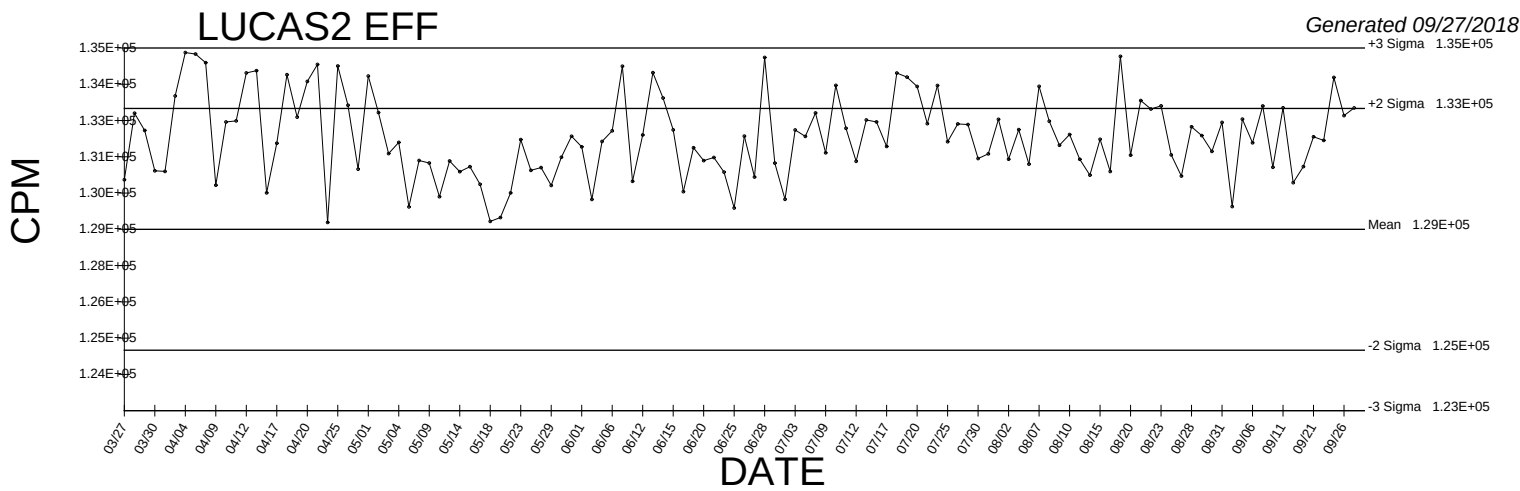
GEL Laboratories LLC

Efficiency Data

LUCAS1 EFF

Generated 09/27/2018

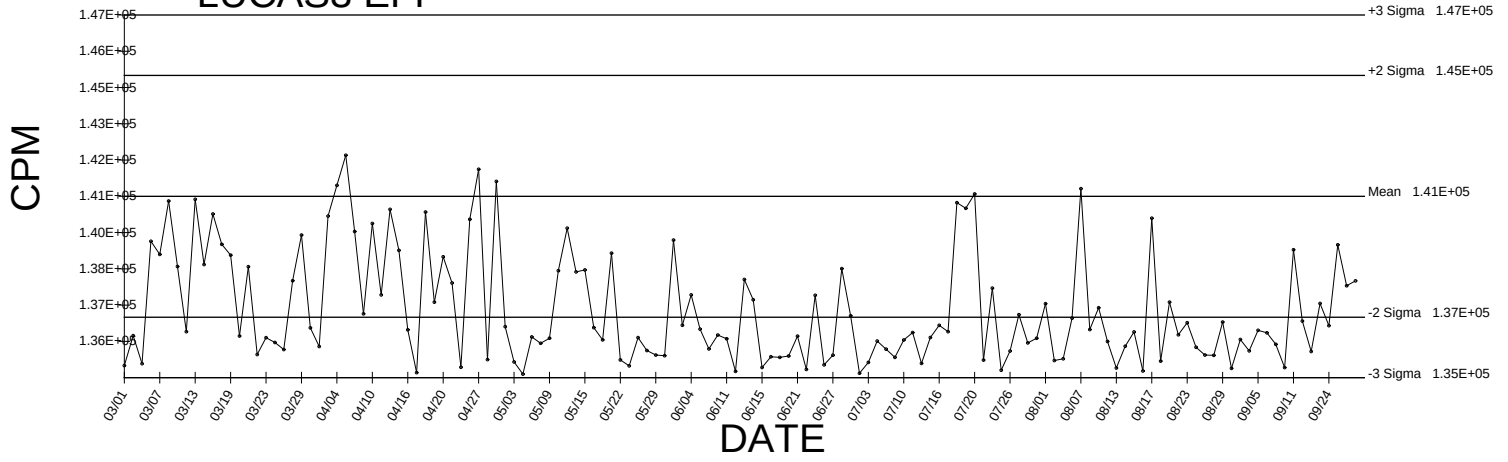




● Denotes Outlier

LUCAS3 EFF

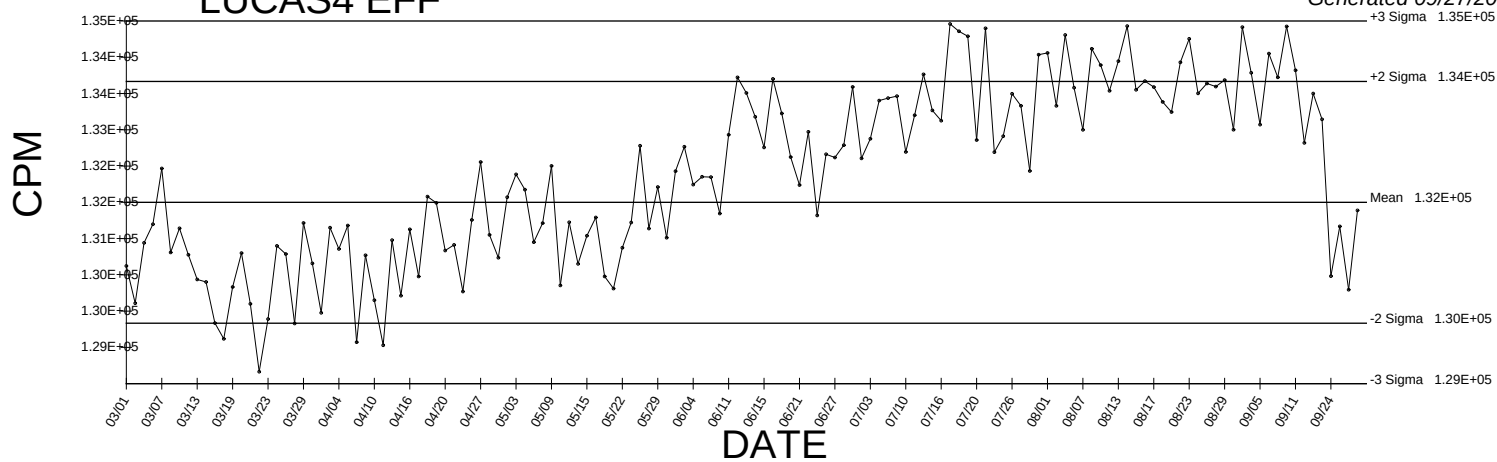
Generated 09/27/2018



● Denotes Outlier

LUCAS4 EFF

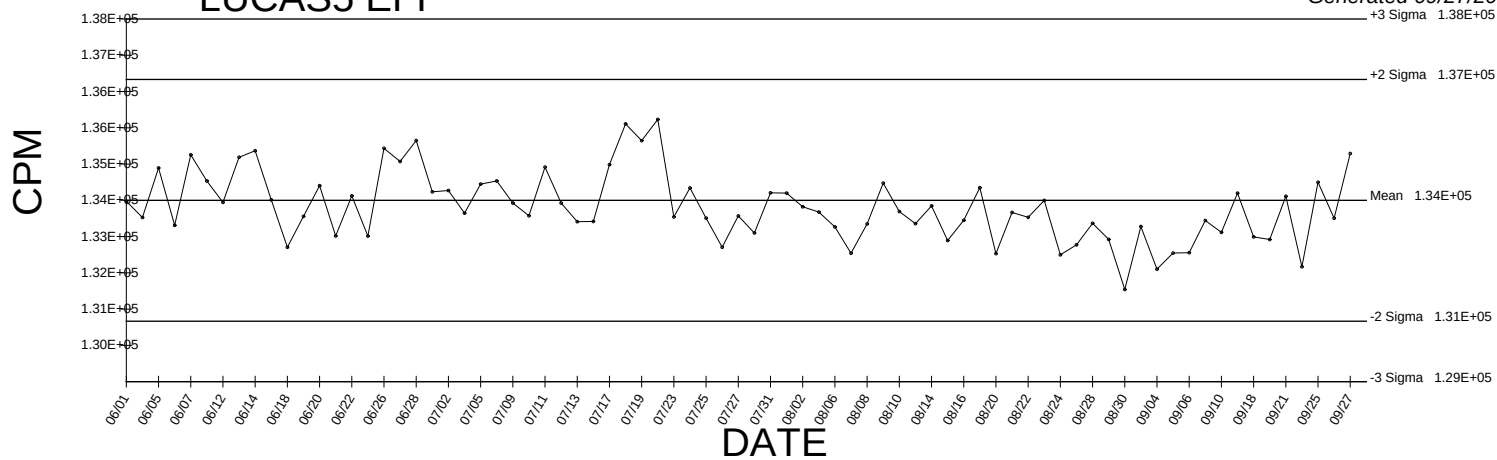
Generated 09/27/2018



● Denotes Outlier

LUCAS5 EFF

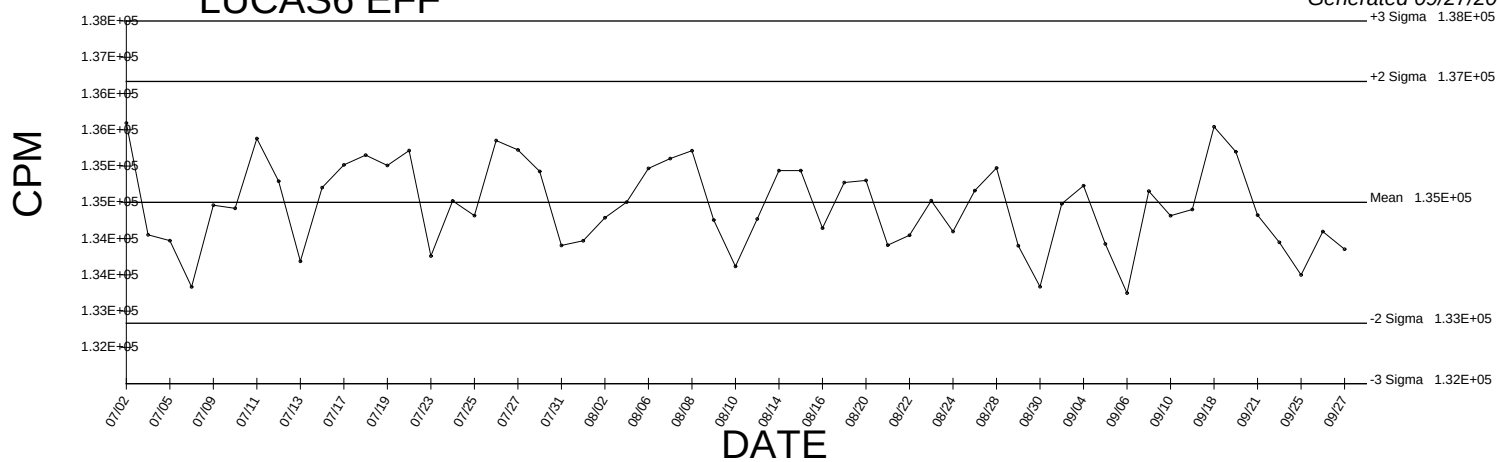
Generated 09/27/2018



● Denotes Outlier

LUCAS6 EFF

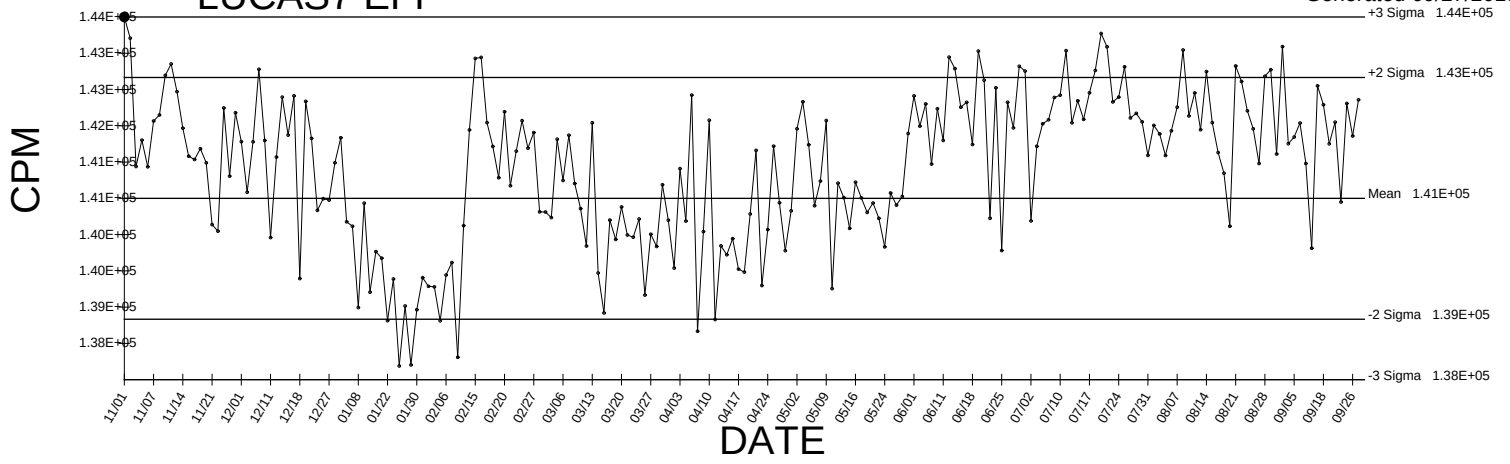
Generated 09/27/2018



● Denotes Outlier

LUCAS7 EFF

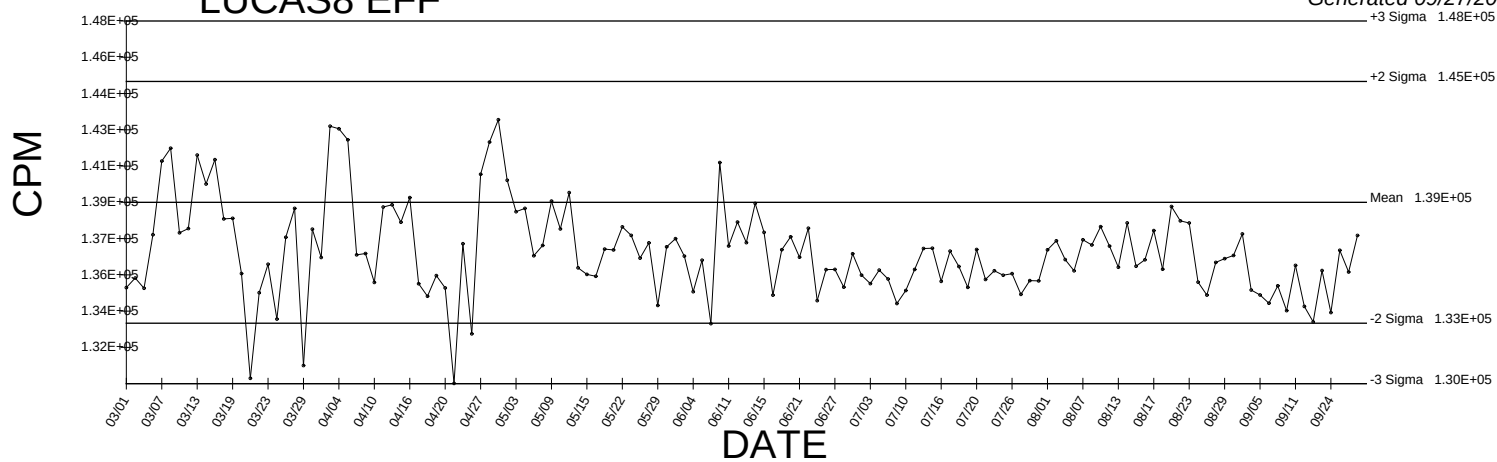
Generated 09/27/2018



● Denotes Outlier

LUCAS8 EFF

Generated 09/27/2018



● Denotes Outlier

RAD Standards Traceability



Eckert & Ziegler

Analytics

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Atlanta, Georgia 30318
Tel: 404-352-8677
Fax: 404-352-2817
www.analytics-ez.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	3.576E+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

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:	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	145.71
2	59.70	0.422157	286.47	141.42
3	62.30	0.422157	286.47	147.58

Mean Value = 286.47
 Stddev = 0.95402063
 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: 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 Hudson
Groundwater and Water Samples
Collected on 10/01/18-10/02/18

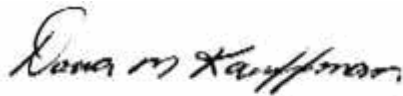
SDG# GEJ55

GROUP	SAMPLE NUMBERS
1994403	9834961-9834971

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: 10/26/2018

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 GEJ55
with a Data Package Type of III**

07701 - GEI Consultants, Inc.

Project: PSEG Hudson

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9834961	MW-6	10/01/2018 11:30	10/03/2018 18:10
9834962	MW-5	10/01/2018 11:10	10/03/2018 18:10
9834963	MW-9	10/01/2018 13:10	10/03/2018 18:10
9834964	MW-7	10/01/2018 14:40	10/03/2018 18:10
9834965	MW-8	10/01/2018 14:50	10/03/2018 18:10
9834966	FB-20181001	10/01/2018 12:00	10/03/2018 18:10
9834967	FB-20181002	10/02/2018 12:00	10/03/2018 18:10
9834968	MW-1	10/02/2018 10:05	10/03/2018 18:10
9834969	MW-2	10/02/2018 09:55	10/03/2018 18:10
9834970	MW-4	10/02/2018 11:40	10/03/2018 18:10
9834971	MW-3	10/02/2018 12:05	10/03/2018 18:10

Sample pH Log

SDG: GEJ55

<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>
9834961	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:57AM	1382
9834961	015A	7	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:01:54AM	12616
9834961	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:00:16AM	1382
9834961	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:02AM	1382
9834961	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:55:10AM	1382
9834961	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:14:17PM	12616
9834961	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:57AM	1382
9834961	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:57AM	1382
9834962	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:12AM	1382
9834962	015A	7	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:01:37AM	12616
9834962	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:53AM	1382
9834962	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:00:58AM	1382
9834962	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:56:02AM	1382
9834962	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:26:06PM	12616
9834962	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:12AM	1382
9834962	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:12AM	1382
9834963	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:54AM	1382
9834963	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:01:20AM	12616
9834963	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:57AM	1382
9834963	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:16AM	1382
9834963	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:53:54AM	1382
9834963	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 11:15:43AM	12616
9834963	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:54AM	1382
9834963	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:47:54AM	1382
9834964	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:08AM	1382
9834964	015A	7	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:02:10AM	12616
9834964	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:31AM	1382
9834964	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:33AM	1382
9834964	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:54:04AM	1382
9834964	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:21:28PM	12616
9834964	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:08AM	1382
9834964	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:51:08AM	1382
9834965	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:49:44AM	1382
9834965	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:01:01AM	12616
9834965	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:38AM	1382
9834965	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:11AM	1382
9834965	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:54:37AM	1382
9834965	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 11:11:53AM	12616

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
9834965	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:49:44AM	1382
9834965	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:49:44AM	1382
9834966	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:46:26AM	1382
9834966	015A	5	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:00:42AM	12616
9834966	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:41AM	1382
9834966	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:27AM	1382
9834966	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:54:13AM	1382
9834966	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:22:58PM	12616
9834966	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:46:26AM	1382
9834966	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:46:26AM	1382
9834967	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:50:24AM	1382
9834967	015A	5	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:00:27AM	12616
9834967	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:23AM	1382
9834967	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:25AM	1382
9834967	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:54:59AM	1382
9834967	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:19:39PM	12616
9834967	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:50:24AM	1382
9834967	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:50:24AM	1382
9834968	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:52:40AM	1382
9834968	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:00:09AM	12616
9834968	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:34AM	1382
9834968	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:20AM	1382
9834968	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:53:43AM	1382
9834968	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:27:48PM	12616
9834968	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:36:48PM	12616
9834968	148A	7	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 9:02:39AM	12616
9834968	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:52:40AM	1382
9834968	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:52:40AM	1382
9834969	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:45:44AM	1382
9834969	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 8:59:54AM	12616
9834969	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:59:27AM	1382
9834969	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:41AM	1382
9834969	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:54:47AM	1382
9834969	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 11:04:49AM	12616
9834969	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:45:44AM	1382
9834969	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:45:44AM	1382
9834970	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:01AM	1382
9834970	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 8:59:37AM	12616
9834970	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:00:01AM	1382
9834970	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:08AM	1382
9834970	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:53:31AM	1382
9834970	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 12:24:35PM	12616
9834970	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:01AM	1382
9834970	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:01AM	1382

<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>
9834971	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:53AM	1382
9834971	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:00:04AM	1382
9834971	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 11:01:36AM	1382
9834971	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:55:20AM	1382
9834971	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/8/2018 11:17:29AM	12616
9834971	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:53AM	1382
9834971	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	10/4/2018 10:44:53AM	1382

<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: October 15, 2018 13:24

Project: PSEG Hudson

Account #: 07701
Group Number: 1994403
SDG: GEJ55
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-6 Grab Groundwater	10/01/2018 11:30	9834961
MW-5 Grab Groundwater	10/01/2018 11:10	9834962
MW-9 Grab Groundwater	10/01/2018 13:10	9834963
MW-7 Grab Groundwater	10/01/2018 14:40	9834964
MW-8 Grab Groundwater	10/01/2018 14:50	9834965
FB-20181001 Grab Water	10/01/2018 12:00	9834966
FB-20181002 Grab Water	10/02/2018 12:00	9834967
MW-1 Grab Groundwater	10/02/2018 10:05	9834968
MW-2 Grab Groundwater	10/02/2018 09:55	9834969
MW-4 Grab Groundwater	10/02/2018 11:40	9834970
MW-3 Grab Groundwater	10/02/2018 12:05	9834971

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

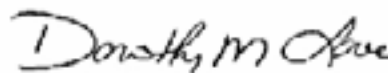
Sampling Date(s): 10/01/18 - 10/02/18

Laboratory Sample ID(s): 9834961-9834971

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

10/15/2018



Project Name: PSEG Hudson
ELLE Group #: 1994403

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: 9834961, 9834962, 9834963, 9834964, 9834965, 9834966, 9834967, 9834968, 9834969, 9834970, 9834971

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

Batch #: 182831404402 (Sample number(s): 9834961-9834971 UNSPK: 9834961 BKG: 9834961)

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

The relative percent difference(s) for the following analyte(s) in the MS/MSD were outside acceptance windows: Selenium

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

Sample #s: 9834961, 9834962, 9834963, 9834964, 9834965, 9834966, 9834967, 9834968, 9834969, 9834970, 9834971

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

SM 2540 C-2011, Wet Chemistry

Sample #s: 9834963

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,410 mg/L result. We are reporting the result obtained within the holding time.

Sample #s: 9834961

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18,

three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,510 mg/L result. We are reporting the result obtained within the holding time.

Sample #s: 9834962

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 2,900 mg/L result. We are reporting the result obtained within the holding time.

Batch #: 18278921201A (Sample number(s): 9834968-9834970 UNSPK: 9834970 BKG: 9834970)

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

Sample Description: MW-6 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834961
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 11:30
SDG#: GEJ55-01

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	0.0927	0.0010	0.0050	1
08014	Boron	7440-42-8	0.822	0.0120	0.0500	1
01750	Calcium	7440-70-2	110	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 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	0.00075 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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
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	692	100	200	500
01504	Fluoride	16984-48-8	0.42 J	0.25	0.50	5
00228	Sulfate	14808-79-8	9.1	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,500	20.0	60.0	1

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

Sample Description: MW-6 Grab Groundwater
PSEG Hudson**GEI Consultants, Inc.**
ELLE Sample #: GW 9834961
ELLE Group #: 1994403
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 10/03/2018 18:10**Collection Date/Time:** 10/01/2018 11:30**SDG#:** GEJ55-01

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry SM 2540 C-2011						
	This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,510 mg/L result. We are reporting the result obtained within the holding time.					
	Wet Chemistry SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.9	0.010	0.010	1
	SM 4500-H+ B-2011		Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.3	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 filtered in the lab 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	182831404402	10/11/2018 17:47	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 17:47	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:52	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:52	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:52	Patrick J Engle	1

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

Sample Description: MW-6 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834961
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 11:30
SDG#: GEJ55-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:52	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:52	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 11:52	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:33	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115A	10/11/2018 22:23	Samuel J Weaver	500
01504	Fluoride	EPA 300.0	1	18284837115A	10/11/2018 22:06	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	1	18284837115A	10/11/2018 22:06	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004208A	10/05/2018 10:41	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004208A	10/05/2018 10:41	Jeremy L Bolf	1

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

Sample Description: MW-5 Grab Groundwater
PSEG Hudson**GEI Consultants, Inc.**
ELLE Sample #: GW 9834962
ELLE Group #: 1994403
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 10/03/2018 18:10**Collection Date/Time:** 10/01/2018 11:10**SDG#:** GEJ55-02

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	0.116	0.0010	0.0050	1
08014	Boron	7440-42-8	0.679	0.0120	0.0500	1
01750	Calcium	7440-70-2	129	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	0.0190 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, 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	0.0011 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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.00037 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	1,100	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	4.0 J	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	2,940	20.0	60.0	1

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

Sample Description: MW-5 Grab Groundwater
PSEG Hudson**GEI Consultants, Inc.**
ELLE Sample #: GW 9834962
ELLE Group #: 1994403
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 10/03/2018 18:10
Collection Date/Time: 10/01/2018 11:10
SDG#: GEJ55-02

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry SM 2540 C-2011						
	This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 2,900 mg/L result. We are reporting the result obtained within the holding time.					
			mg/l	mg/l	mg/l	
Wet Chemistry SM 2550 B-2010						
12151	Temperature of pH	n.a.	23.0	0.010	0.010	1
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 filtered in the lab 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	182831404402	10/11/2018 18:02	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:02	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:59	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:59	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:59	Patrick J Engle	1

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

Sample Description: MW-5 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834962
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 11:10
SDG#: GEJ55-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:59	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 11:59	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 11:59	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:35	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115A	10/11/2018 22:56	Samuel J Weaver	500
01504	Fluoride	EPA 300.0	1	18284837115A	10/11/2018 22:40	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	1	18284837115A	10/11/2018 22:40	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004208A	10/05/2018 10:44	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004208A	10/05/2018 10:44	Jeremy L Bolf	1

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

Sample Description: MW-9 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834963
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 13:10
SDG#: GEJ55-03

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	0.0892	0.0010	0.0050	1
08014	Boron	7440-42-8	0.473	0.0120	0.0500	1
01750	Calcium	7440-70-2	101	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 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	0.00066 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0048	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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.0058	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	631	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	51.9	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,270	20.0	60.0	1

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

Sample Description: MW-9 Grab Groundwater
PSEG Hudson**GEI Consultants, Inc.**
ELLE Sample #: GW 9834963
ELLE Group #: 1994403
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 10/03/2018 18:10**Collection Date/Time:** 10/01/2018 13:10**SDG#:** GEJ55-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
	Wet Chemistry	SM 2540 C-2011	mg/l	mg/l	mg/l	
	This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,410 mg/L result. We are reporting the result obtained within the holding time.					
	Wet Chemistry	SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.8	0.010	0.010	1
		SM 4500-H+ B-2011	Std. Units	Std. Units	Std. Units	
12152	pH	n.a.	7.3	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 filtered in the lab 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	182831404402	10/11/2018 18:05	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:05	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:01	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:01	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:01	Patrick J Engle	1

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

Sample Description: MW-9 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834963
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 13:10
SDG#: GEJ55-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:01	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:01	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:01	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:37	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 00:53	Samuel J Weaver	500
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 00:36	Samuel J Weaver	5
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 00:36	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 10:14	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 10:14	Jeremy L Bolf	1

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

Sample Description: MW-7 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834964
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 14:40
SDG#: GEJ55-04

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	0.0318	0.0010	0.0050	1
08014	Boron	7440-42-8	0.197	0.0120	0.0500	1
01750	Calcium	7440-70-2	28.9	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 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	0.00084 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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.0061	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	29.2	1.0	2.0	5
01504	Fluoride	16984-48-8	0.48 J	0.25	0.50	5
00228	Sulfate	14808-79-8	9.9	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	223	20.0	60.0	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-7 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834964
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 14:40
SDG#: GEJ55-04

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.	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 filtered in the lab 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	182831404402	10/11/2018 18:13	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:13	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:03	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:03	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:03	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:03	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:03	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:03	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:39	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 01:10	Samuel J Weaver	5
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 01:10	Samuel J Weaver	5

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

Sample Description: MW-7 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834964
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/01/2018 14:40

SDG#: GEJ55-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 01:10	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 10:10	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 10:10	Jeremy L Bolf	1

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

Sample Description: MW-8 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834965
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 14:50
SDG#: GEJ55-05

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	0.0657	0.0010	0.0050	1
08014	Boron	7440-42-8	0.331	0.0120	0.0500	1
01750	Calcium	7440-70-2	24.9	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0090	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, 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	0.0016 J	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	0.00069 J	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.0031	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	409	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	23.3	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	899	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: MW-8 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834965
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 14:50
SDG#: GEJ55-05

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.	7.4	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 filtered in the lab 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	182831404402	10/11/2018 18:15	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:15	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:05	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:05	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:05	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:05	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:05	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:05	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:41	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 02:00	Samuel J Weaver	500
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 01:43	Samuel J Weaver	5

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

Sample Description: MW-8 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834965
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/01/2018 14:50

SDG#: GEJ55-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 01:43	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 09:39	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 09:39	Jeremy L Bolf	1

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

Sample Description: FB-20181001 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834966
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 12:00
SDG#: GEJ55-06FB

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	0.0735 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 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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
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.	22.8	0.010	0.010	1

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

Sample Description: FB-20181001 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834966
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/01/2018 12:00
SDG#: GEJ55-06FB

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 filtered in the lab 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	182831404402	10/11/2018 18:18	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:18	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:07	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:07	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:07	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:07	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:07	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:07	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:43	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 02:17	Samuel J Weaver	1
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 02:17	Samuel J Weaver	1

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

Sample Description: FB-20181001 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834966
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/01/2018 12:00

SDG#: GEJ55-06FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 02:17	Samuel J Weaver	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18277921203A	10/04/2018 23:15	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 10:03	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 10:03	Jeremy L Bolf	1

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

Sample Description: FB-20181002 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834967
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 12:00
SDG#: GEJ55-07FB

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	0.0902 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 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
	The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.					
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-20181002 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834967
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 12:00
SDG#: GEJ55-07FB

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 filtered in the lab 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	182831404402	10/11/2018 18:20	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:20	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:09	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:09	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:09	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:09	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:09	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:09	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:45	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 02:33	Samuel J Weaver	1
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 02:33	Samuel J Weaver	1

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

Analysis Report

Sample Description: FB-20181002 Grab Water
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834967
ELLE Group #: 1994403
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/02/2018 12:00

SDG#: GEJ55-07FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 02:33	Samuel J Weaver	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18278921204A	10/05/2018 23:55	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 09:43	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 09:43	Jeremy L Bolf	1

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

Sample Description: MW-1 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834968
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 10:05
SDG#: GEJ55-08

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	0.672	0.0010	0.0050	1
08014	Boron	7440-42-8	1.09	0.0120	0.0500	1
01750	Calcium	7440-70-2	393	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0044 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0372 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, 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	0.0013 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0017 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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
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	2,840	200	400	1000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	116	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	17,600	400	1,200	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-1 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834968
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 10:05
SDG#: GEJ55-08

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.	7.6	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 filtered in the lab 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	182831404402	10/11/2018 18:23	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:23	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:11	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:11	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:11	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:11	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:11	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:11	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:21	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	3	18284837115B	10/12/2018 14:09	Samuel J Weaver	1000
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 02:50	Samuel J Weaver	5

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

Analysis Report

Sample Description: MW-1 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834968
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/02/2018 10:05

SDG#: GEJ55-08

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 03:40	Samuel J Weaver	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18278921201A	10/05/2018 16:26	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 10:07	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 10:07	Jeremy L Bolf	1

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

Sample Description: MW-2 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834969
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 09:55
SDG#: GEJ55-09

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	2.15	0.0010	0.0050	1
08014	Boron	7440-42-8	0.912	0.0120	0.0500	1
01750	Calcium	7440-70-2	446	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0032 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0430 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.105	0.250	5
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	0.00053 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0030	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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
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	3,770	200	400	1000
01504	Fluoride	16984-48-8	0.40 J	0.25	0.50	5
00228	Sulfate	14808-79-8	14.2	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	15,100	400	1,200	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.9	0.010	0.010	1

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

Sample Description: MW-2 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834969
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 09:55
SDG#: GEJ55-09

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.	7.6	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 filtered in the lab 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	182831404402	10/11/2018 18:26	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/12/2018 15:05	Jonathan J Allen	5
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:26	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:14	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:14	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:14	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:14	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:14	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:14	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:47	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	3	18284837115B	10/12/2018 14:26	Samuel J Weaver	1000
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 04:14	Samuel J Weaver	5

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

Sample Description: MW-2 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834969
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/02/2018 09:55

SDG#: GEJ55-09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 04:14	Samuel J Weaver	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18278921201A	10/05/2018 16:26	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 09:47	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 09:47	Jeremy L Bolf	1

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

Sample Description: MW-4 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834970
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 11:40
SDG#: GEJ55-10

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	0.149	0.0010	0.0050	1
08014	Boron	7440-42-8	1.38	0.0120	0.0500	1
01750	Calcium	7440-70-2	123	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	0.0474 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, 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	0.00072 J	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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.0069	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	1,150	200	400	1000
01504	Fluoride	16984-48-8	0.34 J	0.25	0.50	5
00228	Sulfate	14808-79-8	493	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	6,800	400	1,200	1
	SM 2550 B-2010		Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.9	0.010	0.010	1

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

Sample Description: MW-4 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834970
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 11:40
SDG#: GEJ55-10

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 filtered in the lab 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	182831404402	10/11/2018 18:28	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:28	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:16	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:16	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:16	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:16	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:16	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:16	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:49	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	3	18284837115B	10/12/2018 14:43	Samuel J Weaver	1000
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 04:47	Samuel J Weaver	5

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

Sample Description: MW-4 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834970
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/02/2018 11:40

SDG#: GEJ55-10

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	2	18284837115B	10/12/2018 05:04	Samuel J Weaver	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18278921201A	10/05/2018 16:26	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 09:51	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 09:51	Jeremy L Bolf	1

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

Sample Description: MW-3 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834971
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 12:05
SDG#: GEJ55-11

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	0.0572	0.0010	0.0050	1
08014	Boron	7440-42-8	0.610	0.0120	0.0500	1
01750	Calcium	7440-70-2	53.4	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 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	0.0013 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0045	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
The NJ DKQP analyte list requirement was not met for Metals. The client specified list is reported.						
06038	Molybdenum	7439-98-7	0.0139	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	587	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	78.6	3.0	10.0	10
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,270	160	480	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
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834971
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10
Collection Date/Time: 10/02/2018 12:05
SDG#: GEJ55-11

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 filtered in the lab 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	182831404402	10/11/2018 18:31	Cindy M Gehman	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	182831404402	10/11/2018 18:31	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:22	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:22	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:22	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:22	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	182821404703A	10/11/2018 12:22	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	182821404703C	10/11/2018 12:22	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	182810571305	10/11/2018 08:51	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U5	SW-846 3005A	1	182831404402	10/11/2018 06:09	Annamaria Kuhns	1
14047	ICPMS - Water, 3020A - U5	SW-846 3020A	1	182821404703	10/10/2018 15:15	JoElla L Rice	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	182810571305	10/10/2018 16:20	JoElla L Rice	1
00224	Chloride	EPA 300.0	2	18284837115B	10/12/2018 05:54	Samuel J Weaver	500
01504	Fluoride	EPA 300.0	2	18284837115B	10/12/2018 05:37	Samuel J Weaver	5

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

Sample Description: MW-3 Grab Groundwater
PSEG Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9834971
ELLE Group #: 1994403
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 10/03/2018 18:10

Collection Date/Time: 10/02/2018 12:05

SDG#: GEJ55-11

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00228	Sulfate	EPA 300.0	3	18284837115B	10/12/2018 15:00	Samuel J Weaver	10
00212	Total Dissolved Solids	SM 2540 C-2011	1	18278921204A	10/05/2018 23:55	Hannah M Royer	1
12151	Temperature of pH	SM 2550 B-2010	1	18277004207A	10/05/2018 09:59	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18277004207A	10/05/2018 09:59	Jeremy L Bolf	1

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

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 10/15/2018 13:24

Group Number: 1994403

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: 182810571305	Sample number(s): 9834961-9834971		
Mercury	N.D.	0.000050	0.00020
Batch number: 182821404703A	Sample number(s): 9834961-9834971		
Antimony	N.D.	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: 182821404703C	Sample number(s): 9834961-9834971		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 182831404402	Sample number(s): 9834961-9834971		
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: 18284837115A	Sample number(s): 9834961-9834962		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18284837115B	Sample number(s): 9834963-9834971		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18277921203A	Sample number(s): 9834961-9834966		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18278921201A	Sample number(s): 9834968-9834970		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18278921204A	Sample number(s): 9834967,9834971		
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: 10/15/2018 13:24

Group Number: 1994403

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: 182810571305 Mercury	Sample number(s): 9834961-9834971 0.00100	0.000905			91		80-120		
Batch number: 182821404703A Antimony	Sample number(s): 9834961-9834971 0.00600	0.00596			99		80-120		
Arsenic	0.0100	0.00953			95		80-120		
Beryllium	0.00400	0.00382			96		80-120		
Cadmium	0.00500	0.00454			91		80-120		
Lead	0.0150	0.0146			97		80-120		
Batch number: 182821404703C Molybdenum	Sample number(s): 9834961-9834971 0.0500	0.0476			95		80-120		
Batch number: 182831404402 Barium	Sample number(s): 9834961-9834971 2.00	2.04			102		80-120		
Boron	2.00	1.96			98		80-120		
Calcium	4.00	3.98			100		80-120		
Chromium	0.200	0.197			99		80-120		
Cobalt	0.500	0.503			101		80-120		
Lithium	1.00	0.991			99		80-120		
Selenium	0.150	0.143			95		80-120		
Thallium	0.150	0.159			106		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18284837115A Chloride	Sample number(s): 9834961-9834962 3.00	2.84			95		90-110		
Fluoride	0.750	0.674			90		90-110		
Sulfate	7.50	6.80			91		90-110		
Batch number: 18284837115B Chloride	Sample number(s): 9834963-9834971 3.00	2.84			95		90-110		
Fluoride	0.750	0.674			90		90-110		
Sulfate	7.50	6.80			91		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18277921203A Total Dissolved Solids	Sample number(s): 9834961-9834966 200	196			98		62-127		
Batch number: 18278921201A Total Dissolved Solids	Sample number(s): 9834968-9834970 200	193			97		62-127		
Batch number: 18278921204A Total Dissolved Solids	Sample number(s): 9834967,9834971 200	203			102		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					

*- 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: 10/15/2018 13:24

Group Number: 1994403

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: 18277004207A pH	Sample number(s): 9834963-9834971 7.00	7.04			101		95-105		
Batch number: 18277004208A pH	Sample number(s): 9834961-9834962 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: 182810571305 Mercury	Sample number(s): 9834961-9834971 UNSPK: 9834968 N.D.	0.00100	0.000857	0.00100	0.000873	86	87	75-125	2	20
Batch number: 182831404402	Sample number(s): 9834961-9834971 UNSPK: 9834961									
Barium	0.0927	2.00	2.04	2.00	2.08	97	100	75-125	2	20
Boron	0.822	2.00	2.63	2.00	2.83	91	100	75-125	7	20
Calcium	110.26	4.00	107.68	4.00	112.59	-65 (2)	58 (2)	75-125	4	20
Chromium	N.D.	0.200	0.183	0.200	0.195	91	98	75-125	7	20
Cobalt	N.D.	0.500	0.501	0.500	0.500	100	100	75-125	0	20
Lithium	N.D.	1.00	1.03	1.00	1.02	103	102	75-125	1	20
Selenium	N.D.	0.150	0.0933	0.150	0.131	62*	87	75-125	33*	20
Thallium	N.D.	0.150	0.127	0.150	0.146	84	98	75-125	14	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18278921201A Total Dissolved Solids	Sample number(s): 9834968-9834970 UNSPK: 9834970 6800	4000	11810			125		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: 182810571305 Mercury	Sample number(s): 9834961-9834971 BKG: 9834968 N.D.	N.D.	0 (1)	20
Batch number: 182831404402	Sample number(s): 9834961-9834971 BKG: 9834961			

*- 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: 10/15/2018 13:24

Group Number: 1994403

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
Barium	0.0927	0.0910	2	20
Boron	0.822	0.821	0	20
Calcium	110.26	110.05	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
	mg/l	mg/l		
Batch number: 18278921201A	Sample number(s): 9834968-9834970 BKG: 9834970			
Total Dissolved Solids	6800	8350	20*	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.

✱ currins

For English Language Learners: Environmental use only

Aug 1 7701 Group # 994403 Sample # 9934961-71

COC # 56 / 0150

Evans Lancaster Laboratories Environmental, LLC - 2425 New Holland Pike - 1-800-451-1400 - <http://www.evansl.com> - FGS F.E. P. COMPLETING FGSN CHECK OUT <http://www.evansl.com>

eurofins

Acc# 7701

Cuzco # 196-442 Telephone # 953-6161 - 11

COC # 567051

"Page 54 of 154 CR HELP COMPLETING FORM CHECK OUT HERE" www.irs.gov/efile

Sample Administration
Receipt Documentation Log

Doc Log ID: 228977



Group Number(s): 1994403

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

Delivery Method: ELLE Courier Arrival Timestamp: 10/03/2018 18:10

Number of Packages: 3 Number of Projects: 1

State/Province of Origin: NJ

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 Wanita Curry (14057) at 01:32 on 10/04/2018***Samples Chilled Details***Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.*

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Corrected Temp</u>	<u>Therm. Type</u>	<u>Ice Type</u>	<u>Ice Present?</u>	<u>Ice Container</u>	<u>Elevated Temp?</u>	<u>Samples Collected Same Day as Receipt?</u>
1	DT42-01	2.5	DT	Wet	Y	Bagged	N	N
2	DT42-01	1.9	DT	Wet	Y	Bagged	N	N
3	DT42-01	9.8	DT	Wet	Y	Bagged	Y	N

Elevated Temperature Details*All Temperatures in °C*

<u>Cooler #</u>	<u>Thermometer ID</u>	<u>Top Left Temp</u>	<u>Top Right Temp</u>	<u>Bottom Left Temp</u>	<u>Bottom Right Temp</u>	<u>Center Temp</u>	<u>Factors Contributing to Elevated Temp</u>	<u>Comments</u>
3	32170023	3.1	5.3	5.8	3.0	5.0	Temp bottle not near ice	

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: GEJ55

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9834961	MW-6	X		
9834962	MW-5	X		
9834963	MW-9	X		
9834964	MW-7	X		
9834965	MW-8	X		
9834966	FB-20181001	X		Field Blank
9834967	FB-20181002	X		Field Blank
9834968	MW-1	X		
9834969	MW-2	X		
9834970	MW-4	X		
9834971	MW-3	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:

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

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ55

ICP Metals

Fraction: Metals in Liquid

Method defined actions are taken for any failed matrix QC.

Batch#: 182831404402 (Sample number(s): 9834961-9834971, UNSPK: 9834961, BKG: 9834961)
The relative percent difference(s) for the following analyte(s) in the MS/MSD is outside the acceptance window: Selenium
The recovery(ies) for the following analyte(s) in the MS were below the acceptance window: Selenium
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 instruments are used for an analysis. The method detection limits (MDLs) are used for determining all other U flags.

(Sample number(s): 9834961-9834971: 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): 9834961-9834971: Analysis: 06035)
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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834961, 9834961BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.75	B		MS
7440-39-3	Barium	92.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	822			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	110000			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834962
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.1	B		MS
7440-39-3	Barium	116			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	679			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	129000			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	19.0	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	0.37	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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834963
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.66	B		MS
7440-38-2	Arsenic	4.8			MS
7440-39-3	Barium	89.2			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	473			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	5.8			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834964
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.84	B		MS
7440-39-3	Barium	31.8			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	197			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	28900			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	6.1			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834965
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.6	B		MS
7440-39-3	Barium	65.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	331			P
7440-43-9	Cadmium	0.69	B		MS
7440-70-2	Calcium	24900			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	9.0			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	3.1			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834966
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

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	73.5	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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834967
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

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	90.2	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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 1

INORGANIC ANALYSIS DATA SHEET

SDG No.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834968, 9834968BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.3	B		MS
7440-38-2	Arsenic	1.7	B		MS
7440-39-3	Barium	672			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1090			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	393000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.4	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	37.2	B		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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834969
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.53	B		MS
7440-38-2	Arsenic	3.0			MS
7440-39-3	Barium	2150			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	912			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	446000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.2	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	43.0	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	2.7			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834970
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.72	B		MS
7440-38-2	Arsenic	0.68	U		MS
7440-39-3	Barium	149			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1380			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	123000			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	47.4	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	6.9			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.: GEJ55

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9834971
Concentration Units: UG/L

% Solids: 0.0
Date Received: 10/03/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.3	B		MS
7440-38-2	Arsenic	4.5			MS
7440-39-3	Barium	57.2			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	610			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	53400			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	13.9			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

Quality Control and Calibration Summary Forms

Metals in Liquid

QUALITY CONTROL REFERENCE LIST

SDG No.: GEJ55

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	182831404402	9834961BKG
Boron		9834961MS
Calcium		9834961MSD
Chromium		9834961DUP
Cobalt		9834962
Lithium		9834963
Selenium		9834964
Thallium		9834965
		9834966
		9834967
		9834968
		9834969
		9834970
		9834971
		P28304BB
		P28304BQ

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.: GEJ55

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	182821404703	9834961
Arsenic		9834962
Beryllium		9834963
Cadmium		9834964
Lead		9834965
Molybdenum		9834966
		9834967
		9834968
		9834969
		9834970
		9834971
		*39159BKG
		P28204CB
		P28204CQ

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.: GEJ55

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	182810571305	9834961
		9834962
		9834963
		9834964
		9834965
		9834966
		9834967
		9834968BKG
		9834968MS
		9834968MSD
		9834968DUP
		9834969
		9834970
		9834971
		P28171EB
		P28171EQ

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.: GEJ55

Method: P
Run Name: 1828407T73
Calibration Date(s): 10/11/2018
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	600.25	100.0	500.0	501.16	100.2	500.0	500.67	100.1
Boron		600.0	657.78	109.6	500.0	525.71	105.1	500.0	531.90	106.4
Calcium		30000.0	29150.67	97.2	25000.0	24480.91	97.9	25000.0	24657.11	98.6
Chromium		600.0	580.42	96.7	500.0	479.03	95.8	500.0	481.80	96.4
Cobalt		600.0	573.21	95.5	500.0	483.29	96.7	500.0	488.88	97.8
Lithium		600.0	593.33	98.9	500.0	490.33	98.1	500.0	501.97	100.4
Selenium		600.0	556.34	92.7	500.0	472.59	94.5	500.0	486.66	97.3
Thallium		600.0	586.23	97.7	500.0	488.57	97.7	500.0	497.66	99.5

(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.: GEJ55

Method: P
Run Name: 1828407T73
Calibration Date(s): 10/11/2018
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	499.06	99.8	500.0	494.98	99.0
Boron					500.0	529.90	106.0	500.0	522.29	104.5
Calcium					25000.0	24575.69	98.3	25000.0	24028.34	96.1
Chromium					500.0	481.77	96.4	500.0	473.90	94.8
Cobalt					500.0	480.09	96.0	500.0	482.82	96.6
Lithium					500.0	497.10	99.4	500.0	477.37	95.5
Selenium					500.0	481.27	96.3	500.0	476.17	95.2
Thallium					500.0	491.70	98.3	500.0	496.60	99.3

(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.: GEJ55

Method: P
Run Name: 1828407T73
Calibration Date(s): 10/11/2018
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	496.84	99.4			
Boron					500.0	525.52	105.1			
Calcium					25000.0	24258.97	97.0			
Chromium										
Cobalt					500.0	489.60	97.9			
Lithium					500.0	502.92	100.6			
Selenium					500.0	482.52	96.5			
Thallium					500.0	503.11	100.6			

(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.: GEJ55

Method: P
Run Name: 1828504T72
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)
Barium										
Boron										
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium		600.0	591.19	98.5	500.0	480.56	96.1	500.0	482.61	96.5
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.: GEJ55

Method: P
Run Name: 1828504T72
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)
Barium										
Boron										
Calcium										
Chromium										
Cobalt										
Lithium										
Selenium					500.0	487.70	97.5			
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.: GEJ55

Method: MS
Run Name: 1828404E07
Calibration Date(s): 10/11/2018
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	50.50	101.0	25.0	25.83	103.3	25.0	25.83	103.3
Arsenic	75	500.0	503.35	100.7	250.0	257.38	103.0	250.0	253.74	101.5
Beryllium	9	50.0	50.04	100.1	25.0	24.07	96.3	25.0	23.32	93.3
Cadmium	111	50.0	49.67	99.3	25.0	25.61	102.4	25.0	26.45	105.8
Lead	208	50.0	50.17	100.3	25.0	25.58	102.3	25.0	25.64	102.6
Molybdenum	98	50.0	50.36	100.7	25.0	25.37	101.5	25.0	25.93	103.7

(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.: GEJ55

Method: MS
Run Name: 1828404E07
Calibration Date(s): 10/11/2018
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	23.75	95.0	25.0	24.28	97.1
Arsenic	75				250.0	265.99	106.4	250.0	261.62	104.6
Beryllium	9				25.0	26.65	106.6	25.0	25.75	103.0
Cadmium	111				25.0	25.39	101.6	25.0	24.86	99.4
Lead	208				25.0	25.09	100.4	25.0	25.69	102.8
Molybdenum	98				25.0	24.99	100.0	25.0	24.66	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.: GEJ55

Method: CV
Run Name: 1828401M09
Calibration Date(s): 10/11/2018
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	1.01	101.0	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.: GEJ55

Method: CV
Run Name: 1828401M09
Calibration Date(s): 10/11/2018
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.: GEJ55

Method: CV

Run Name: 1828401M09

Calibration Date(s): 10/11/2018

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	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 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ55

Method: P
Run Name: 1828407T73
Calibration Date(s): 10/11/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	5.51	110.2		
Boron		50.0	51.12	102.2		
Calcium		500.0	538.89	107.8		
Chromium		15.0	14.64	97.6		
Cobalt		5.0	5.54	110.8		
Lithium		50.0	44.17	88.3		
Selenium		50.0	58.45	116.9		
Thallium		30.0	35.37	117.9		

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.: GEJ55

Method: P

Run Name: 1828504T72

Calibration Date(s): 10/12/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron						
Calcium						
Chromium						
Cobalt						
Lithium						
Selenium		50.0	53.88	107.8		
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

Method: MS
Run Name: 1828404E07
Calibration Date(s): 10/11/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	1.95	97.5		
Arsenic	75	2.0	2.21	110.5		
Beryllium	9	0.5	0.55	110.0		
Cadmium	111	1.0	1.03	103.0		
Lead	208	3.0	3.03	101.0		
Molybdenum	98	2.0	1.86	93.0		

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.: GEJ55

Method: CV

Run Name: 1828401M09

Calibration Date(s): 10/11/2018

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.: GEJ55

Method: P

Run Name: 1828407T73

Calibration Date(s): 10/11/2018

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	U182831404402
Boron		8.4	U	8.4	U	8.4	U	8.4	U		12.000	U182831404402
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		33.000	U182831404402
Chromium		-0.79	B	0.55	U	-0.60	B	0.55	U		5.300	U182831404402
Cobalt		0.40	U	0.40	U	0.40	U	0.40	U		1.500	U182831404402
Lithium		5.3	U	5.3	U	5.3	U	-5.8	B		11.000	U182831404402
Selenium		9.2	U	9.2	U	9.2	U	13.3	B		21.000	U182831404402
Thallium		8.4	B	6.5	B	8.6	B	3.1	U		14.000	U182831404402

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.: GEJ55

Method: P
Run Name: 1828407T73
Calibration Date(s): 10/11/2018

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						
Cobalt				0.40	U	0.40	U				
Lithium				5.3	U	5.3	U				
Selenium				9.2	U	9.2	U				
Thallium				3.1	U	10.4	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.: GEJ55

Method: P
Run Name: 1828504T72
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
Barium											
Boron											
Calcium											
Chromium											
Cobalt											
Lithium											
Selenium		9.2U	9.2U		9.2U		9.2U				
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.: GEJ55

Method: MS

Run Name: 1828404E07

Calibration Date(s): 10/11/2018

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	0.29	U	0.32	B	0.29	U	0.29	U	121	0.410	U182821404703A
Arsenic	75	0.50	U	0.50	U	0.50	U	0.50	U	75	0.680	U182821404703A
Beryllium	9	0.073	U	0.073	U	0.073	U	0.073	U	9	0.106	B182821404703A
Cadmium	111	0.18	U	0.18	U	0.18	U	0.18	U	111	0.150	U182821404703A
Lead	208	0.14	U	0.14	U	0.14	U	0.14	U	208	1.100	U182821404703A
Molybdenum	98	0.30	U	0.30	U	0.30	U	0.30	U	98	0.310	U182821404703A

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.: GEJ55

Method: MS
Run Name: 1828404E07
Calibration Date(s): 10/11/2018

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			0.29	U						
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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ55

Method: CV

Run Name: 1828401M09

Calibration Date(s): 10/11/2018

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	182810571305

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.: GEJ55

Method: CV
Run Name: 1828401M09
Calibration Date(s): 10/11/2018

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 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ55

Instrument ID: 18255
Run Name: 1828407T73
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		477165	95.4						
Barium	0		0							
Boron	0		-9							
Calcium	500000		483383	96.7						
Chromium	0		0							
Cobalt	0		0							
Iron	200000		193773	96.9						
Lithium	0		-6							
Magnesium	500000		503996	100.8						
Selenium	0		4							
Thallium	0		12							

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ55

Instrument ID: 16417
Run Name: 1828504T72
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		495136	99.0						
Barium										
Boron										
Calcium	500000		495981	99.2						
Chromium										
Cobalt										
Iron	200000		192074	96.0						
Lithium										
Magnesium	500000		477936	95.6						
Selenium	0		36							
Thallium										

Control Limits: All Metals 80%-120%

Instrument ID: 27813
 Run Name: 1828404E07
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		104232	104.2		
Antimony	121	0		1			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		291435	97.1		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		244707	97.9		
Lead	208	0		1			
Magnesium	24	100000		98559	98.6		
Molybdenum	98	2000		2146	107.3		
Phosphorus	31	10000		NA			
Potassium	39	100000		103406	103.4		
Sodium	23	250000		241595	96.6		
Sulfur	34	10000		NA			
Titanium	47	2000		2068	103.4		

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ55

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9834961BKG Matrix Spike Lab Sample ID: 9834961MS Matrix Spike Duplicate Lab Sample ID: 9834961MSD

Batch Number(s): 182831404402

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		92.6600		2040.8900		2083.9000		2000.0000	2000.0000	UG/L	97		100		2		75 - 125	20	P
Boron		822.2800		2634.4500		2831.5500		2000.0000	2000.0000	UG/L	91		100		7		75 - 125	20	P
Calcium		110257.4400		107675.1900		112585.0000		4000.0000	4000.0000	UG/L	-65		58		4				P
Chromium		5.3000	U	182.8600		195.2600		200.0000	200.0000	UG/L	91		98		7		75 - 125	20	P
Cobalt		1.5000	U	500.5300		499.8600		500.0000	500.0000	UG/L	100		100		0		75 - 125	20	P
Lithium		11.0000	U	1028.7700		1021.4400		1000.0000	1000.0000	UG/L	103		102		1		75 - 125	20	P
Selenium		21.0000	U	93.3400		130.7600		150.0000	150.0000	UG/L	62	N	87		33	*	75 - 125	20	P
Thallium		14.0000	U	126.7000		146.2700		150.0000	150.0000	UG/L	84		98		14		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 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ55

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9834968BKG Matrix Spike Lab Sample ID: 9834968MS Matrix Spike Duplicate Lab Sample ID: 9834968MSD

Batch Number(s): 182810571305

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	0.8574		0.8727		1.0000	1.0000	UG/L	86		87		2		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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Environmental

QUALITY ASSURANCE SUMMARY

FORM 5B

POST DIGEST SPIKE SAMPLE RECOVERY

SDG No.: GEJ55

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9834961BKG

Analyte	Mass	Sample Result (SR)	C	Spike Added (SA)	Spiked Sample Result (SSR)	C	SRR %R	Spiked Sample Duplicate (SSD)	C	SSD %R	M
Selenium		21.0000	U	800.0000	763.7600		95	NA	U	NA	P

Comments:

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ55

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9834961BKG

Duplicate Lab Sample ID: 9834961DUP

Batch Number(s): 182831404402

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Barium			92.6600		91.0400		2		P
Boron			822.2800		821.3400		0		P
Calcium			110257.4400		110048.5800		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			-28.3300	B	21.0000	U	-200		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.: GEJ55

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9834968BKG

Duplicate Lab Sample ID: 9834968DUP

Batch Number(s): 182810571305

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ55
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	182821404703	UG/L	6.000	5.962		80 - 120	99	MS	Yes
Arsenic	75	182821404703	UG/L	10.000	9.533		80 - 120	95	MS	Yes
Barium		182831404402	UG/L	2000.000	2036.820		80 - 120	102	P	Yes
Beryllium	9	182821404703	UG/L	4.000	3.822		80 - 120	96	MS	Yes
Boron		182831404402	UG/L	2000.000	1959.590		80 - 120	98	P	Yes
Cadmium	111	182821404703	UG/L	5.000	4.541		80 - 120	91	MS	Yes
Calcium		182831404402	UG/L	4000.000	3982.040		80 - 120	100	P	Yes
Chromium		182831404402	UG/L	200.000	197.290		80 - 120	99	P	Yes
Cobalt		182831404402	UG/L	500.000	503.130		80 - 120	101	P	Yes
Lead	208	182821404703	UG/L	15.000	14.555		80 - 120	97	MS	Yes
Lithium		182831404402	UG/L	1000.000	991.120		80 - 120	99	P	Yes
Mercury		182810571305	UG/L	1.000	0.905		80 - 120	91	CV	Yes
Molybdenum	98	182821404703	UG/L	50.000	47.637		80 - 120	95	MS	Yes
Selenium		182831404402	UG/L	150.000	142.700		80 - 120	95	P	Yes
Thallium		182831404402	UG/L	150.000	159.260		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 9

SERIAL DILUTIONS

SDG No.: GEJ55

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *39159BKG

Serial Dilution Lab Sample ID: *39159L

Batch Number(s): 182821404703

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	1.6349	B	3.4000	U	100		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	0.4753	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.: GEJ55

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9834961BKG

Serial Dilution Lab Sample ID: 9834961L

Batch Number(s): 182831404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		92.6600		90.6500		2		P
Boron		822.2800		820.8000		0		P
Calcium		110257.4400		104894.3500		5		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: 16417
Date: 07/2018

Analyte	Wavelength (nm)	Background	IDL (UG/L)
Barium			
Boron			
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: 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: 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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 10

INSTRUMENT DETECTION LIMITS (QUARTERLY)

SDG No.: GEJ55

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.: GEJ55
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.: GEJ55
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



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 10 MDL
METHOD DETECTION LIMITS (ANNUALLY)
SDG No.: GEJ55
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.: GEJ55
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_INS27814
 Acq/Data Batch D:\Agilent\ICPMH\1\DATA\EPA_Tune.b
 Acq. Date-Time 2018-10-11 09:04:35
 Report Comment ---
 Instrument Name G8403A SG18254097

[No Gas]

Sensitivity

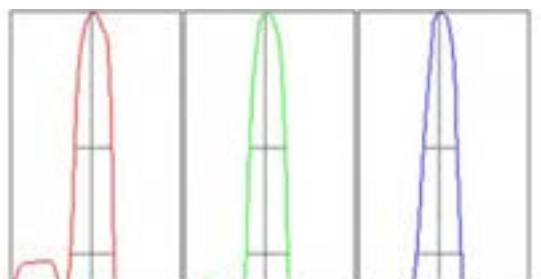
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	737	7367.31			0.501	5.000
89	10.00	4621	46211.75			0.434	5.000
205	10.00	2371	23710.24			0.506	5.000

Mass	RSD% (Flag)
7	
89	
205	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	735	742	740	734	733
89	4640	4622	4629	4587	4627
205	2373	2361	2359	2373	2389

Integration Time [sec] 0.1

Resolution/Axis



Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	1157.58	6.95	6.90 - 7.10	
89	7640.81	88.95	88.90 - 89.10	
205	4103.95	204.95	204.90 - 205.10	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.66	0.765	0.800	
89	0.64	0.731	0.800	
205	0.60	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	12.2 V	Deflect	15.8 V
Extract 2	-245.0 V	Cell Entrance	-38 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	0.04		

Hardware Settings

Torch

Torch H	0.2 mm	Torch V	-0.2 mm

EM

Discriminator	3.9 mV	Analog HV	2138 V	Pulse HV	1343 V

Instrument ID: 27813

Start Date: 10/11/2018

Run Name: 1828404E07

End Date: 10/11/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	GE-1-72	BE
IN-3-115	AS, CD, MO, SB		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element GE-1-72	Q	Element IN-3-115	Q	Element BI-3-209	Q	Element	Q	Element	Q	Element	Q
S0	11:09	100		100		100							
S	11:11	107		101		103							
ICV	11:14	109		104		105							
ICB	11:16	104		101		102							
LLC	11:18	100		99		100							
ICSA	11:20	107		88		87							
LRS2	11:22	107		99		99							
LRS3	11:24	101		102		103							
CCS	11:26	110		102		105							
CCS	11:29	111		101		102							
CCV	11:31	110		101		101							
CCB	11:33	105		99		102							
P28204CB	11:35	105		102		101							
P28204CQ	11:37	112		89		90							
*39159BKG	11:39	113		101		103							
ZZZZZZ	11:41												
ZZZZZZ	11:44												
ZZZZZZ	11:46												
ZZZZZZ	11:48												
*39159L	11:50	113		104		106							
9834961	11:52	108		101		99							
CCV	11:54	94		98		100							
CCB	11:56	103		97		98							
9834962	11:59	105		101		97							
9834963	12:01	110		102		100							
9834964	12:03	95		101		102							
9834965	12:05	111		110		108							
9834966	12:07	108		114		116							
9834967	12:09	122	R	107		106							
9834968	12:11	114		102		87							
9834969	12:14	96		96		79							
9834970	12:16	91		104		86							

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: 10/11/2018

Run Name: 1828404E07

End Date: 10/11/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	GE-1-72	BE
IN-3-115	AS, CD, MO, SB		

Lab Sample ID	Time	Internal Standards %RI For:											
		Element GE-1-72	Q	Element IN-3-115	Q	Element BI-3-209	Q	Element	Q	Element	Q	Element	Q
CCV	12:18	120		116		104							
CCB	12:20	115		115		103							
9834971	12:22	105		110		97							
ZZZZZZ	12:24												
ZZZZZZ	12:27												
ZZZZZZ	12:29												
ZZZZZZ	12:31												
ZZZZZZ	12:33												
ZZZZZZ	12:35												
ZZZZZZ	12:37												
ZZZZZZ	12:39												
CCV	12:42	106		101		92							
CCB	12:44	97		96		90							

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: 182831404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9834962	10/11/2018	50.00	50
9834963	10/11/2018	50.00	50
9834964	10/11/2018	50.00	50
9834965	10/11/2018	50.00	50
9834966	10/11/2018	50.00	50
9834967	10/11/2018	50.00	50
9834968	10/11/2018	50.00	50
9834969	10/11/2018	50.00	50
9834970	10/11/2018	50.00	50
9834971	10/11/2018	50.00	50
9834961BKG	10/11/2018	25.00	25
9834961DUP	10/11/2018	25.00	25
9834961MSD	10/11/2018	25.00	25
9834961MS	10/11/2018	25.00	25
P28304BB	10/11/2018	50.00	50
P28304BQ	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

Method: MS
Batch Number: 182821404703

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9834961	10/10/2018	50.00	50
9834962	10/10/2018	50.00	50
9834963	10/10/2018	50.00	50
9834964	10/10/2018	50.00	50
9834965	10/10/2018	50.00	50
9834966	10/10/2018	50.00	50
9834967	10/10/2018	50.00	50
9834968	10/10/2018	50.00	50
9834969	10/10/2018	50.00	50
9834970	10/10/2018	50.00	50
9834971	10/10/2018	50.00	50
*39159BKG	10/10/2018	50.00	50
P28204CB	10/10/2018	50.00	50
P28204CQ	10/10/2018	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

Method: CV
Batch Number: 182810571305

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9834961	10/10/2018	40.00	40
9834962	10/10/2018	40.00	40
9834963	10/10/2018	40.00	40
9834964	10/10/2018	40.00	40
9834965	10/10/2018	20.00	20
9834966	10/10/2018	40.00	40
9834967	10/10/2018	40.00	40
9834969	10/10/2018	40.00	40
9834970	10/10/2018	40.00	40
9834971	10/10/2018	40.00	40
9834968BKG	10/10/2018	40.00	40
9834968DUP	10/10/2018	40.00	40
9834968MSD	10/10/2018	40.00	40
9834968MS	10/10/2018	40.00	40
P28171EB	10/10/2018	40.00	40
P28171EQ	10/10/2018	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.: GEJ55

Method: P

Instrument ID: 18255

Run Name: 1828407T73

Run Start Date: 10/11/2018

Run End Date: 10/11/2018

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	17:00			X		X		X	X	X		X			X	X											
S	1.00	17:03							X																			
S	1.00	17:05			X		X				X	X				X	X											
S	1.00	17:08								X																		
ICV	1.00	17:11			X		X		X	X	X		X			X	X											
ICB	1.00	17:13			X		X		X	X	X		X			X	X											
LLC	1.00	17:16			X		X		X	X	X		X			X	X											
ICSA	1.00	17:18			X		X		X	X	X		X			X	X											
CCV	1.00	17:21			X		X		X	X	X		X			X	X											
CCB	1.00	17:23			X		X		X	X	X		X			X	X											
LRS2	1.00	17:26			X		X		X	X	X		X			X	X											
LRS4	1.00	17:29			X		X		X	X	X		X			X	X											
LRS3	1.00	17:32			X		X		X	X	X		X			X	X											
LRS5	1.00	17:35			X		X		X	X	X		X			X	X											
CCV	1.00	17:37			X		X		X	X	X		X			X	X											
CCB	1.00	17:39			X		X		X	X	X		X			X	X											
P28304BB	1.00	17:42			X		X		X	X	X		X			X	X											
P28304BQ	1.00	17:44			X		X		X	X	X		X			X	X											
9834961BKG	1.00	17:47			X		X		X	X	X		X			X	X											
9834961A	1.00	17:50																										
9834961DUP	1.00	17:52			X		X		X	X	X		X			X	X											
9834961MS	1.00	17:55			X		X		X	X	X		X			X	X											
9834961MSD	1.00	17:57			X		X		X	X	X		X			X	X											
9834961L	5.00	18:00			X		X		X	X	X		X			X	X											
9834962	1.00	18:02			X		X		X	X	X		X			X	X											
9834963	1.00	18:05			X		X		X	X	X		X			X	X											
CCV	1.00	18:08			X		X		X	X	X		X			X	X											
CCB	1.00	18:10			X		X		X	X	X		X			X	X											
9834964	1.00	18:13			X		X		X	X	X		X			X	X											
9834965	1.00	18:15			X		X		X	X	X		X			X	X											
9834966	1.00	18:18			X		X		X	X	X		X			X	X											
9834967	1.00	18:20			X		X		X	X	X		X			X	X											
9834968	1.00	18:23			X		X		X	X	X		X			X	X											
9834969	1.00	18:26			X		X		X	X	X		X				X											
9834970	1.00	18:28			X		X		X	X	X		X			X	X											
9834971	1.00	18:31			X		X		X	X	X		X			X	X											
ZZZZZZ	1.00	18:34																										
ZZZZZZ	1.00	18:36																										

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.: GEJ55

Method: P
Instrument ID: 18255
Run Name: 1828407T73

Run Start Date: 10/11/2018
Run End Date: 10/11/2018

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	18:39			X		X		X	X	X		X			X	X													
CCB	1.00	18:41			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	18:44																												
ZZZZZZ	1.00	18:46																												
ZZZZZZ	1.00	18:49																												
ZZZZZZ	1.00	18:52																												
ZZZZZZ	1.00	18:54																												
ZZZZZZ	1.00	18:57																												
ZZZZZZ	1.00	18:59																												
9834961DA	1.00	19:02														X														
CCV	1.00	19:04			X		X		X		X		X			X	X													
CCB	1.00	19:07			X		X		X		X		X			X	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
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Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ55

Method: P
Instrument ID: 16417
Run Name: 1828504T72

Run Start Date: 10/12/2018
Run End Date: 10/12/2018

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	14:07														X														
S	1.00	14:10																												
S	1.00	14:12														X														
S	1.00	14:15																												
ICV	1.00	14:18														X														
ICB	1.00	14:21														X														
LLC	1.00	14:24														X														
ICSA	1.00	14:27														X														
CCV	1.00	14:30														X														
CCB	1.00	14:33														X														
LRS2	1.00	14:35														X														
LRS4	1.00	14:39														X														
LRS3	1.00	14:42														X														
LRS5	1.00	14:45														X														
CCV	1.00	14:48														X														
CCB	1.00	14:51														X														
P28304BQ	1.00	14:53																												
ZZZZZZ	1.00	14:56																												
ZZZZZZ	1.00	14:59																												
ZZZZZZ	1.00	15:02																												
9834969	5.00	15:05														X														
ZZZZZZ	1.00	15:08																												
ZZZZZZ	5.00	15:11																												
CCV	1.00	15:14														X														
CCB	1.00	15:17														X														

METHODS:

P = ICP Atomic Emission Spectrometer
MS = ICP Mass Spectrometry
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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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 14

ANALYSIS RUN LOG

SDG No.: GEJ55

Method: MS

Instrument ID: 27813

Run Name: 1828404E07

Run Start Date: 10/11/2018

Run End Date: 10/11/2018

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	11:09	X	X		X		X				X			X															
S	1.00	11:11	X	X		X		X				X			X															
ICV	1.00	11:14	X	X		X		X				X			X															
ICB	1.00	11:16	X	X		X		X				X			X															
LLC	1.00	11:18	X	X		X		X				X			X															
ICSA	1.00	11:20	X	X		X		X				X			X															
LRS2	1.00	11:22	X	X		X		X				X			X															
LRS3	1.00	11:24	X	X		X		X				X			X															
CCS	1.00	11:26	X	X		X		X				X			X															
CCS	1.00	11:29	X	X		X		X				X			X															
CCV	1.00	11:31	X	X		X		X				X			X															
CCB	1.00	11:33	X	X		X		X				X			X															
P28204CB	1.00	11:35	X	X		X		X				X			X															
P28204CQ	1.00	11:37	X	X		X		X				X			X															
*39159BKG	1.00	11:39	X	X		X		X				X			X															
ZZZZZZ	1.00	11:41																												
ZZZZZZ	1.00	11:44																												
ZZZZZZ	1.00	11:46																												
ZZZZZZ	1.00	11:48																												
*39159L	5.00	11:50	X	X		X		X				X			X															
9834961	1.00	11:52	X	X		X		X				X			X															
CCV	1.00	11:54	X	X		X		X				X			X															
CCB	1.00	11:56	X	X		X		X				X			X															
9834962	1.00	11:59	X	X		X		X				X			X															
9834963	1.00	12:01	X	X		X		X				X			X															
9834964	1.00	12:03	X	X		X		X				X			X															
9834965	1.00	12:05	X	X		X		X				X			X															
9834966	1.00	12:07	X	X		X		X				X			X															
9834967	1.00	12:09	X	X		X		X				X			X															
9834968	1.00	12:11	X	X		X		X				X			X															
9834969	1.00	12:14	X	X		X		X				X			X															
9834970	1.00	12:16	X	X		X		X				X			X															
CCV	1.00	12:18	X	X		X		X				X			X															
CCB	1.00	12:20	X	X		X		X				X			X															
9834971	1.00	12:22	X	X		X		X				X			X															
ZZZZZZ	1.00	12:24																												
ZZZZZZ	1.00	12:27																												
ZZZZZZ	1.00	12:29																												

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.: GEJ55

Method: MS

Instrument ID: 27813

Run Name: 1828404E07

Run Start Date: 10/11/2018

Run End Date: 10/11/2018

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													
ZZZZZZ	1.00	12:31																												
ZZZZZZ	1.00	12:33																												
ZZZZZZ	1.00	12:35																												
ZZZZZZ	1.00	12:37																												
ZZZZZZ	1.00	12:39																												
CCV	1.00	12:42	X	X		X		X				X			X															
CCB	1.00	12:44	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.: GEJ55

Method: CV

Instrument ID: 23283

Run Name: 1828401M09

Run Start Date: 10/11/2018

Run End Date: 10/11/2018

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	06:18												X																
S0.2	1.00	06:20												X																
S0.5	1.00	06:22												X																
S1.0	1.00	06:24												X																
S2.5	1.00	06:26												X																
S5.0	1.00	06:28												X																
ICV	1.00	06:42												X																
ICB	1.00	06:44												X																
CRA	1.00	06:46												X																
CCV	1.00	06:48												X																
CCB	1.00	06:50												X																
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	07:03																												
ZZZZZZ	1.00	07:05																												
ZZZZZZ	1.00	07:08																												
ZZZZZZ	1.00	07:10																												
ZZZZZZ	1.00	07:12																												
CCV	1.00	07:15												X																
CCB	1.00	07:17												X																
ZZZZZZ	1.00	07:19																												
ZZZZZZ	1.00	07:22																												
ZZZZZZ	1.00	07:24																												
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																												
CCV	1.00	07:40												X																
CCB	1.00	07:42												X																
ZZZZZZ	1.00	07:44																												
ZZZZZZ	1.00	07:46																												
ZZZZZZ	1.00	07:48																												

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.: GEJ55

Method: CV

Instrument ID: 23283

Run Name: 1828401M09

Run Start Date: 10/11/2018

Run End Date: 10/11/2018

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	07:50																												
ZZZZZZ	1.00	07:52																												
ZZZZZZ	1.00	07:54																												
ZZZZZZ	1.00	07:56																												
ZZZZZZ	1.00	07:58																												
ZZZZZZ	1.00	08:00																												
ZZZZZZ	1.00	08:02																												
CCV	1.00	08:04												X																
CCB	1.00	08:06												X																
ZZZZZZ	1.00	08:08																												
ZZZZZZ	1.00	08:10																												
ZZZZZZ	1.00	08:12																												
ZZZZZZ	1.00	08:15																												
P28171EB	1.00	08:17												X																
P28171EQ	1.00	08:19												X																
9834968BKG	1.00	08:21												X																
9834968DUP	1.00	08:23												X																
9834968MS	1.00	08:25												X																
9834968MSD	1.00	08:27												X																
CCV	1.00	08:29												X																
CCB	1.00	08:31												X																
9834961	1.00	08:33												X																
9834962	1.00	08:35												X																
9834963	1.00	08:37												X																
9834964	1.00	08:39												X																
9834965	1.00	08:41												X																
9834966	1.00	08:43												X																
9834967	1.00	08:45												X																
9834969	1.00	08:47												X																
9834970	1.00	08:49												X																
9834971	1.00	08:51												X																
CCV	1.00	08:53												X																
CCB	1.00	08:55												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

Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ55

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9834961	MW-6	X		
9834962	MW-5	X		
9834963	MW-9	X		
9834964	MW-7	X		
9834965	MW-8	X		
9834966	FB-20181001	X		Field Blank
9834967	FB-20181002	X		Field Blank
9834968	MW-1	X		
9834969	MW-2	X		
9834970	MW-4	X		
9834971	MW-3	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.

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ55

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9834961	DF500	DF5	DF5
9834962	DF500	DF5	DF5
9834963	DF500	DF5	DF5
9834964	DF5	DF5	DF5
9834965	DF500	DF5	DF5
9834966	DF1	DF1	DF1
9834967	DF1	DF1	DF1
9834968	DF1000	DF5	DF50
9834969	DF1000	DF5	DF5
9834970	DF1000	DF5	DF50
9834971	DF500	DF5	DF10

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: GEJ55

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18284837115A	9834961	10/11/2018 22:06:00		X	X
	9834961	10/11/2018 22:23:00	X		
	9834962	10/11/2018 22:40:00		X	X
	9834962	10/11/2018 22:56:00	X		
	P284370B	10/11/2018 18:29:00	X	X	X
	P284370Q	10/11/2018 18:12:00	X	X	X
18284837115B	9834963	10/12/2018 00:36:00		X	X
	9834963	10/12/2018 00:53:00	X		
	9834964	10/12/2018 01:10:00	X	X	X
	9834965	10/12/2018 01:43:00		X	X
	9834965	10/12/2018 02:00:00	X		
	9834966	10/12/2018 02:17:00	X	X	X
	9834967	10/12/2018 02:33:00	X	X	X
	9834968	10/12/2018 02:50:00		X	
	9834968	10/12/2018 03:40:00			X
	9834968	10/12/2018 14:09:00	X		
	9834969	10/12/2018 04:14:00		X	X
	9834969	10/12/2018 14:26:00	X		
	9834970	10/12/2018 04:47:00		X	
	9834970	10/12/2018 05:04:00			X
	9834970	10/12/2018 14:43:00	X		
	9834971	10/12/2018 05:37:00		X	
	9834971	10/12/2018 05:54:00	X		
	9834971	10/12/2018 15:00:00			X

Fraction: Instrumental Wet Chemistry

18284837115A / P28437OB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	10/11/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	10/11/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	10/11/18	N.D.	mg/l	0.30	1.0

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P28437OQ	Batch: 18284837115A (Sample number(s): 9834961-9834962)								
	Batch: 18284837115B (Sample number(s): 9834963-9834971)								
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	2.84	NA	95	NA	90-110	NA	NA
Fluoride	IC	0.750	0.674	NA	90	NA	90-110	NA	NA
Sulfate	IC	7.50	6.80	NA	91	NA	90-110	NA	NA



Lancaster Laboratories
Environmental

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

SDG: GEJ55

Instrument ID: 12115
Calibration Date: 09/29/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	1.037403	2.041477	5.219284	10.851470	17.490093	0.9954	0.9977
Fluoride	0.236313	0.925457	2.418468	5.136735	8.442792	0.9965	0.9983
Sulfate	0.625176	1.274492	3.246368	6.855216	11.396219	0.9963	0.9981

Concentration units: mg/L

Batch Numbers: 18284837115A, 18284837115B
Run Start Dates: 10/11/2018
Run Names: 1828401D15

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9780	99	7.5	7.4559	99	0.75	0.7456	99
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9206	97	7.5	7.1218	95	0.75	0.7066	94
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9443	98	7.5	7.2257	96	0.75	0.7136	95
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9770	99	7.5	7.3930	99	0.75	0.7566	101
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0806	103	7.5	7.4216	99	0.75	0.7815	104
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0425	101	7.5	7.5011	100	0.75	0.7769	104
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9781	99	7.5	7.3087	97			
CCB	0	ND	NA	0	ND	NA			
CCV2	3	2.7871	93	7.5	7.1807	96			
CCB	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: GEJ55

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9834961	MW-6	X		1	
9834962	MW-5	X		1	
9834963	MW-9	X		1	
9834964	MW-7	X		1	
9834965	MW-8	X		1	
9834966	FB-20181001	X		1	Field Blank
9834967	FB-20181002	X		1	Field Blank
9834968	MW-1	X		1	
9834969	MW-2	X		1	
9834970	MW-4	X		1	
9834971	MW-3	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:

Sample Duplicate

Method defined actions are taken for any failed matrix QC.

Batch#: 18278921201A (Sample number(s): 9834968-9834970, UNSPK: 9834970, BKG: 9834970)
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: GEJ55

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

(Sample number(s): 9834962: Analysis: 00212)

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 2,900 mg/L result. We are reporting the result obtained within the holding time.

(Sample number(s): 9834961: Analysis: 00212)

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,510 mg/L result. We are reporting the result obtained within the holding time.

(Sample number(s): 9834963: Analysis: 00212)

This sample's TDS prescreen led to aliquot selection that yielded a weight of dried residue over the method's 200 mg limit. We reanalyzed on 10/11/18, three days past the holding time, using a smaller sample aliquot that yielded dried residue under 200 mg and a 1,410 mg/L result. We are reporting the result obtained within the holding time.

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: GEJ55

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18277921203A	B277873B	10/04/2018 23:15
		L277873Q	10/04/2018 23:15
		9834961	10/04/2018 23:15
		9834962	10/04/2018 23:15
		9834963	10/04/2018 23:15
		9834964	10/04/2018 23:15
		9834965	10/04/2018 23:15
		9834966	10/04/2018 23:15
Total Dissolved Solids	18278921201A	B278871B	10/05/2018 16:27
		L278871Q	10/05/2018 16:27
		9834968	10/05/2018 16:26
		9834969	10/05/2018 16:26
		9834970 UNSPK/BKG	10/05/2018 16:26
		9834970 MS,DUP	10/05/2018 16:27
Total Dissolved Solids	18278921204A	B278874B	10/05/2018 23:55
		L278874Q	10/05/2018 23:55
		9834967	10/05/2018 23:55
		9834971	10/05/2018 23:55

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ55

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18277004207A	9834963	10/05/2018 10:14:00	X	X
	9834964	10/05/2018 10:10:00	X	X
	9834965	10/05/2018 09:39:00	X	X
	9834966	10/05/2018 10:03:00	X	X
	9834967	10/05/2018 09:43:00	X	X
	9834968	10/05/2018 10:07:00	X	X
	9834969	10/05/2018 09:47:00	X	X
	9834970	10/05/2018 09:51:00	X	X
	9834971	10/05/2018 09:59:00	X	X
	P004207Q	10/05/2018 08:40:00	X	
18277004208A	9834961	10/05/2018 10:41:00	X	X
	9834962	10/05/2018 10:44:00	X	X
	P004208Q	10/05/2018 10:22:00	X	

Fraction: Wet Chemistry

18277921203A / B277873B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/04/18	N.D.	mg/l	20.0	60.0

18278921201A / B278871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/05/18	N.D.	mg/l	20.0	60.0

18278921204A / B278874B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	10/05/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9834970	Batch: 18278921201A (Sample number(s): 9834968-9834970)									
MS: 9834970		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	4000	6800.	11810.	NA	125	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: 9834970 DUP: 9834970	Batch: 18278921201A (Sample number(s): 9834968-9834970)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	6800.	8350.	20*	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: GEJ55
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: P004207Q	Batch: 18277004207A (Sample number(s): 9834963-9834971)								
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	7.04	NA	101	NA	95-105	NA	NA

LCS: P004208Q	Batch: 18277004208A (Sample number(s): 9834961-9834962)								
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: L277873Q	Batch: 18277921203A (Sample number(s): 9834961-9834966)								
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	196	NA	98	NA	62-127	NA	NA

LCS: L278871Q	Batch: 18278921201A (Sample number(s): 9834968-9834970)								
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

LCS: L278874Q	Batch: 18278921204A (Sample number(s): 9834967, 9834971)								
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	203	NA	102	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

October 31, 2018

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

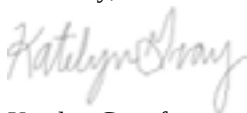
Re: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603
Work Order: 461032

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 05, 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,



Katelyn Gray for
Julie Robinson
Project Manager

Purchase Order: GELP15-0603
Chain of Custody: 1994404
Enclosures



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Case Narrative

Eurofins Lancaster Laboratories
Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603
SDG: 461032

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 461032**

October 31, 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 05, 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>
461032001	MW-6
461032002	MW-5
461032003	MW-9
461032004	MW-7
461032005	MW-8
461032006	FB-20181001
461032007	FB-20181002
461032008	MW-1
461032009	MW-2
461032010	MW-4
461032011	MW-3

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.

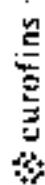
The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

A handwritten signature in cursive script, appearing to read "Katelyn Gray".

Katelyn Gray for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

461032 Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

Acct # 1994404 Invoice # 9834972-52

Subcontractor		GEL		Analyses Requested		For Lab Use Only	
Project Name#		Sub ID #		Preservation and Filtration Codes		SF #	
Requestor		PO #		None		SCR #	
Sampler		PWSID #		None		Preservation Codes	
Phone #		Order #		None		Remarks	
State where samples were collected		NYS For Compliance		Total # of Containers			
Sample Identification		Collection		Matrix			
		Date		Time			
MW-5		10/1/2018		1130		X	
MW-6		10/1/2018		1110		X	
MW-8		10/1/2018		1310		X	
MW-7		10/1/2018		1440		X	
MW-8		10/1/2018		1450		X	
FB-20181001		10/1/2018		1200		X	
FB-20181002		10/2/2018		1200		X	
MW-1		10/2/2018		1505		X	
MW-2		10/2/2018		0935		X	
MW-4		10/2/2018		1140		X	
MW-3		10/2/2018		1205		X	
Turnaround Time Requested (TAT) (please check)		Standard		Rush			
Date results are needed		Preservation Needed		Relinquished by		Relinquished by	
Rush results requested by (please check)		E-Mail		Date		Time	
E-Mail Address: ENVsubinfo@eurofins.com		Phone		Date		Time	
Phone: 717-656-2300 Ext 1896				Date		Time	
Data Package Options (please check if required)		Level IV DCC		Date		Time	
Type I (Validation) CLP		MA MCP		Date		Time	
Type II (Reduced non-CLP)		CT RCP		Date		Time	
Type VI (Raw Data Only)		1X THRP-13		Date		Time	
NYS DEC Category		A or B		Date		Time	
EDD Required?		Yes No		Signature upon receipt		C	

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

10/5/18

Year of birth	Number of children per woman
1950	3.5
1952	3.2
1955	3.8
1958	3.5
1960	3.2
1962	3.0
1965	2.8
1968	2.5
1970	2.2
1972	2.0
1975	1.8
1978	1.5
1980	1.2
1982	1.0
1985	0.8
1988	0.5

SAMPLE RECEIPT & REVIEW FORM

Client: LARC		SERIALS/STUDY Work Order: 461032	
Received By: LH		Date Received: 6/5/90	
Carrier and Tracking Number:		(Carrier Express) FedEx Ground 105 5035 4715 1487 AL 5035 4245 1498 AL	
Suspected Hazing Information:		If Not Listed as 1-800 phone number, we need information from the National Safety Council member investigation.	
Shipped as "OOB Hazardous":		Hazard Class Summary: UN	
COC Samples marked or classified as hazardous? :		Material in Not Listed as shipped if Required by Code. As well as listed Under OCT / mRTR Classified as: Rad 1 Rad 2 Rad 3	
Is package COC, and/or samples marked IIAZ?		If you select Hazards by law, contact the following State Group: PCHP Hazardous Transport Unit RT RA Addressed Attention Other	
Sample Receipt Criteria		Comments/Numbers (Required for Non-Conforming Items)	
1 Shipment container released intact and sealed?	☒	Single Applicable: No broken - Damage to contents - Leaking containers - Other numbers	
2 Chain of custody documents included w/shipment?	☒		
3 Samples requiring cold preservation without refrigeration?	☒	Refrigerated Storage: Yes No No Temp. device used to monitor chain TEMP. See 4	
4 Only checks performed and preserved at temperature per?	☒	Temperature Device Serial #: 123-18 Number Temp. or Pres. device ID App. Log	
5 Sample containers intact and sealed?	☒	Leakage Applicable: No Broken - Damaged - Leaking - Stains - Other comments	
6 Samples requiring chemical preservation at proper pH?	☒	Preservation method used: All methods good All chemicals used	
7 Do any samples require Volatile Analysis?	☒	If Yes, Are Fumes or Solvents present? Yes No off yes due to VOA presence Do VOA vials contain acid preservative? Yes No N/A (acid must be added) VOA vials free of headspace? Yes No N/A Sample IDs and containers collected	
8 Samples received within holding time?	☒	Expiry date noted?	
9 Sample IDs on COC match IDs on bottles?	☒	Sample IDs are consistently filled?	
10 Date & time on COC match Date & time on bottles?	☒	Sample IDs collected	
11 Number of primary containers match number indicated on COC?	☒	Sample IDs collected	
12 Are sample containers identifiable by label provided?	☒		
13 COC form is properly signed or being addressed/revised sections?	☒		
Comments describing deviation from standard:			

PM & PM_{2.5} (2004)

Date: 10/2/15 Page 1 of 1

GL-CH-5R-001 Rev 5

Laboratory Certifications

List of current GEL Certifications as of 31 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 (LEANC)
SDG #: 461032**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1810350

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
461032001	MW-6
461032002	MW-5
461032003	MW-9
461032004	MW-7
461032005	MW-8
461032006	FB-20181001
461032007	FB-20181002
461032008	MW-1
461032009	MW-2
461032010	MW-4
461032011	MW-3
1204131260	Method Blank (MB)
1204131261	461024001(NonSDG) Sample Duplicate (DUP)
1204131262	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. 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.

Product: Lucas Cell, Ra226, liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 1810045

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
461032001	MW-6
461032002	MW-5
461032003	MW-9
461032004	MW-7
461032005	MW-8

461032006	FB-20181001
461032007	FB-20181002
461032008	MW-1
461032009	MW-2
461032010	MW-4
461032011	MW-3
1204130612	Method Blank (MB)
1204130613	461032001(MW-6) Sample Duplicate (DUP)
1204130614	461032001(MW-6) Matrix Spike (MS)
1204130615	461032001(MW-6) Matrix Spike Duplicate (MSD)
1204130616	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, 1204130614 (MW-6MS) and 1204130615 (MW-6MSD), 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

LANC001 Eurofins Lancaster Laboratories

Client SDG: 461032 GEL Work Order: 461032

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: 31 OCT 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
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994
Contact: Ms. Hannah Cottman
Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Report Date: October 31, 2018

Client Sample ID: MW-6
Sample ID: 461032001
Matrix: Water
Collect Date: 01-OCT-18
Receive Date: 05-OCT-18
Collector: Client
Project: LANC00216
Client ID: LANC001

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	-0.339	+/-0.900	1.75	+/-0.900	3.00	pCi/L			JXC9	10/17/18	0937	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		7.72	+/-1.10	0.381	+/-1.86	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	93.6	(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

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
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P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-5
Sample ID: 461032002
Matrix: Water
Collect Date: 01-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	-0.0263	+/-0.841	1.59	+/-0.841	3.00	pCi/L			JXC9	10/17/18	0937	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		5.02	+/-0.955	0.617	+/-1.30	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	91.3	(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
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P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-9
Sample ID: 461032003
Matrix: Water
Collect Date: 01-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	0.239	+/-0.788	1.44	+/-0.791	3.00	pCi/L			JXC9	10/17/18	0937	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.87	+/-0.600	0.366	+/-0.747	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	88.8	(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

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Eurofins Lancaster Laboratories
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Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-7
Sample ID: 461032004
Matrix: Water
Collect Date: 01-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	0.455	+/-0.594	1.02	+/-0.607	3.00	pCi/L			JXC9	10/17/18	0937	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		9.21	+/-1.24	0.406	+/-1.82	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	99.8	(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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Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-8
Sample ID: 461032005
Matrix: Water
Collect Date: 01-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	0.355	+/-0.591	1.04	+/-0.599	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		72.8	+/-3.52	0.591	+/-17.7	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	98.6	(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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Company : Eurofins Lancaster Laboratories
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Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: FB-20181001

Project: LANC00216

Sample ID: 461032006

Client ID: LANC001

Matrix: Water

Collect Date: 01-OCT-18

Receive Date: 05-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	0.217	+/-0.658	1.21	+/-0.660	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.169	+/-0.234	0.405	+/-0.237	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	98.3	(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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Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: FB-20181002

Project: LANC00216

Sample ID: 461032007

Client ID: LANC001

Matrix: Water

Collect Date: 02-OCT-18

Receive Date: 05-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	1.30	+/-0.869	1.31	+/-0.939	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.00	+/-0.246	0.531	+/-0.246	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	85.1	(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
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-1
Sample ID: 461032008
Matrix: Water
Collect Date: 02-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	0.928	+/-0.659	0.977	+/-0.706	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		9.90	+/-1.47	0.673	+/-2.10	1.00	pCi/L			PCW	10/11/18	0635	1810045	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"	1810350	91.1	(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
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman
Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-2
Sample ID: 461032009
Matrix: Water
Collect Date: 02-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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		3.81	+/-1.15	1.34	+/-1.55	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		4.70	+/-0.884	0.618	+/-1.20	1.00	pCi/L			PCW	10/11/18	0725	1810045	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"	1810350	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	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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Address : 2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-4
Sample ID: 461032010
Matrix: Water
Collect Date: 02-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	+/-1.17	1.95	+/-1.21	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.92	+/-0.614	0.587	+/-0.678	1.00	pCi/L			PCW	10/11/18	0725	1810045	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"	1810350	70.1	(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
P.O. Box 12425
Lancaster, Pennsylvania 17601-5994

Report Date: October 31, 2018

Contact: Ms. Hannah Cottman

Project: Radiochemistry Analyses Level V/4-file Equis EDD - GELP15-0603

Client Sample ID: MW-3
Sample ID: 461032011
Matrix: Water
Collect Date: 02-OCT-18
Receive Date: 05-OCT-18
Collector: Client

Project: LANC00216
Client ID: LANC001

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	-0.28	+/-0.662	1.36	+/-0.662	3.00	pCi/L			JXC9	10/17/18	0938	1810350	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		2.68	+/-0.753	0.684	+/-0.909	1.00	pCi/L			PCW	10/11/18	0725	1810045	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"	1810350	95.2	(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	

Quality Control Summary

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QC Summary

Report Date: October 31, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 461032

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1810350										
QC1204131261	461024001	DUP									
Radium-228		U	0.266	U	-0.795	pCi/L	0		N/A	JXC9	10/17/1809:40
		Uncert:	+/-0.804		+/-0.780						
		TPU:	+/-0.807		+/-0.780						
QC1204131262	LCS										
Radium-228		17.2			15.4	pCi/L	89.8	(75%-125%)	JXC9	10/17/1809:40	
		Uncert:			+/-1.98						
		TPU:			+/-4.64						
QC1204131260	MB										
Radium-228				U	0.716	pCi/L			JXC9	10/17/1809:40	
		Uncert:			+/-0.831						
		TPU:			+/-0.854						
Rad Ra-226											
Batch	1810045										
QC1204130613	461032001	DUP									
Radium-226			7.72		8.13	pCi/L	5.25	(0%-20%)	PCW	10/11/1808:05	
		Uncert:	+/-1.10		+/-1.14						
		TPU:	+/-1.86		+/-1.84						
QC1204130616	LCS										
Radium-226		26.0			25.7	pCi/L	98.9	(75%-125%)	PCW	10/11/1808:05	
		Uncert:			+/-2.00						
		TPU:			+/-4.49						
QC1204130612	MB										
Radium-226				U	0.208	pCi/L			PCW	10/11/1808:05	
		Uncert:			+/-0.250						
		TPU:			+/-0.252						
QC1204130614	461032001	MS									
Radium-226		130	7.72		120	pCi/L	86.1	(75%-125%)	PCW	10/11/1808:05	
		Uncert:	+/-1.10		+/-9.47						
		TPU:	+/-1.86		+/-20.3						
QC1204130615	461032001	MSD									
Radium-226		130	7.72		116	pCi/L	3.2	83.2	(0%-20%)	PCW	10/11/1808:05
		Uncert:	+/-1.10		+/-9.39						
		TPU:	+/-1.86		+/-19.8						

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

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QC Summary

Workorder: 461032

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.

** 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 1810350 Check-list

This check-list was completed on 17-OCT-18 by Kenshalla Oston

This batch was reviewed by Kenshalla Oston on 17-OCT-18 and Nat Long on 17-OCT-18.

Batch ID:
1810350

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 relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
11	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
12	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID: 1810350
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: 29-OCT-2018 **Package:** 31-OCT-2018 **SDG:** 02-NOV-2018

Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units
LCS	1204131262	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	461024001	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
2	461032001	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
3	461032002	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
4	461032003	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
5	461032004	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
6	461032005	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
7	461032006	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
8	461032007	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
9	461032008	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
10	461032009	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
11	461032010	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
12	461032011	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
13	461045001	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
14	1204131260 MB	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
15	1204131261 DUP (461024001)	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20
16	1204131262 LCS	11-OCT-2018	3	300	10/12/18 13:16	10/17/18 07:20

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 11-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	

RA1810350.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 : 1810350
Analyst : JAS02031
Prep Date : 10/11/2018
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					
		Sample Aliquot	Sample Aliquot StDev.	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)
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot L	Sample Date/Time						
1	461024001.1	0.3000	1.8459E-05	10/4/2018 9:27	176.1	7.54%	160.5	7.89%	0.1	0.000200
2	461032001.1	0.3000	1.8459E-05	10/1/2018 11:30	176.1	7.54%	164.8	7.79%	0.1	0.000200
3	461032002.1	0.3000	1.8459E-05	10/1/2018 11:10	176.1	7.54%	160.7	7.89%	0.1	0.000200
4	461032003.1	0.3000	1.8459E-05	10/1/2018 13:10	176.1	7.54%	156.4	8.00%	0.1	0.000200
5	461032004.1	0.3000	1.8459E-05	10/1/2018 14:40	176.1	7.54%	175.8	7.54%	0.1	0.000200
6	461032005.1	0.3000	1.8459E-05	10/1/2018 14:50	176.1	7.54%	173.7	7.59%	0.1	0.000200
7	461032006.1	0.3000	1.8459E-05	10/1/2018 12:00	176.1	7.54%	173.0	7.60%	0.1	0.000200
8	461032007.1	0.3000	1.8459E-05	10/2/2018 12:00	176.1	7.54%	149.8	8.17%	0.1	0.000200
9	461032008.1	0.3000	1.8459E-05	10/2/2018 10:05	176.1	7.54%	160.5	7.89%	0.1	0.000200
10	461032009.1	0.3000	1.8459E-05	10/2/2018 9:55	176.1	7.54%	157.6	7.97%	0.1	0.000200
11	461032010.1	0.3000	1.8459E-05	10/2/2018 11:40	176.1	7.54%	123.5	9.00%	0.1	0.000200
12	461032011.1	0.3000	1.8459E-05	10/2/2018 12:05	176.1	7.54%	167.7	7.72%	0.1	0.000200
13	461045001.1	0.3000	1.8459E-05	10/4/2018 9:00	176.1	7.54%	79.6	11.21%	0.1	0.000200
14	1204131260.1	0.3000	1.8459E-05	10/11/2018 0:00	176.1	7.54%	153.4	8.07%	0.1	0.000200
15	1204131261.1	0.3000	1.8459E-05	10/4/2018 9:27	176.1	7.54%	159.6	7.92%	0.1	0.000200
16	1204131262.1	0.3000	1.8459E-05	10/11/2018 0:00	176.1	7.54%	154.2	8.05%	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	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 %
		Time (min.)	Alpha	Beta										
1	6A	60	17	48	0.800	10/17/2018 9:37	10/12/2018 13:16	10/17/2018 7:20	0.996	0.772	1.000	1.057	91.2%	5.46%
2	6B	60	5	61	1.017	10/17/2018 9:37	10/12/2018 13:16	10/17/2018 7:20	0.995	0.772	1.000	1.057	93.6%	5.43%
3	6C	60	8	53	0.883	10/17/2018 9:37	10/12/2018 13:16	10/17/2018 7:20	0.995	0.772	1.000	1.057	91.3%	5.46%
4	7A	60	7	44	0.733	10/17/2018 9:37	10/12/2018 13:16	10/17/2018 7:20	0.995	0.772	1.000	1.057	88.8%	5.50%
5	7B	60	9	33	0.550	10/17/2018 9:37	10/12/2018 13:16	10/17/2018 7:20	0.995	0.772	1.000	1.057	99.8%	5.34%
6	7C	60	5	31	0.517	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.772	1.000	1.057	98.6%	5.36%
7	7D	60	12	35	0.583	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	98.3%	5.36%
8	8B	60	7	53	0.883	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	85.1%	5.57%
9	8C	60	9	33	0.550	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	91.1%	5.46%
10	9A	60	3	102	1.700	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	89.5%	5.49%
11	9B	60	3	64	1.067	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	70.1%	5.88%
12	9C	60	13	33	0.550	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.995	0.771	1.000	1.057	95.2%	5.40%
13	9D	60	14	39	0.650	10/17/2018 9:38	10/12/2018 13:16	10/17/2018 7:20	0.996	0.771	1.000	1.057	45.2%	6.76%
14	10A	60	5	47	0.783	10/17/2018 9:40	10/12/2018 13:16	10/17/2018 7:20	0.998	0.768	1.000	1.057	87.1%	5.53%
15	10B	60	4	42	0.700	10/17/2018 9:40	10/12/2018 13:16	10/17/2018 7:20	0.996	0.768	1.000	1.057	90.6%	5.47%
16	10C	60	3	283	4.717	10/17/2018 9:40	10/12/2018 13:16	10/17/2018 7:20	0.998	0.767	1.000	1.057	87.6%	5.52%

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	0.6547	0.02228	0.723	10/12/2018 15:04	1000
2	PIC	6/1/2017	5/31/2019	0.6465	0.00851	1.116	10/12/2018 15:04	1000
3	PIC	6/1/2017	5/31/2019	0.6594	0.01970	0.891	10/12/2018 15:04	1000
4	PIC	6/1/2017	5/31/2019	0.6570	0.00594	0.666	10/12/2018 15:05	1000
5	PIC	6/1/2017	5/31/2019	0.6688	0.00627	0.403	10/12/2018 15:05	1000
6	PIC	6/1/2017	5/31/2019	0.6600	0.00790	0.405	10/12/2018 15:05	1000
7	PIC	6/1/2017	5/31/2019	0.6352	0.01113	0.518	10/12/2018 15:05	1000
8	PIC	6/1/2017	5/31/2019	0.6773	0.02148	0.522	10/12/2018 15:05	1000
9	PIC	6/1/2017	5/31/2019	0.6559	0.01955	0.282	10/12/2018 15:05	1000
10	PIC	6/1/2017	5/31/2019	0.6688	0.00758	0.599	10/12/2018 15:05	1000
11	PIC	6/1/2017	5/31/2019	0.6716	0.00754	0.815	10/12/2018 15:06	1000
12	PIC	6/1/2017	5/31/2019	0.6373	0.00584	0.632	10/12/2018 15:06	1000
13	PIC	6/1/2017	5/31/2019	0.6494	0.02610	0.507	10/12/2018 15:06	1000
14	PIC	6/1/2017	5/31/2019	0.6554	0.00651	0.586	10/12/2018 15:06	1000
15	PIC	6/1/2017	5/31/2019	0.6461	0.00652	0.924	10/12/2018 15:06	1000
16	PIC	6/1/2017	5/31/2019	0.6584	0.00638	0.419	10/12/2018 15:06	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 : N/A
 Spike Exp Date : N/A
 Spike Activity (dpm/ml): N/A
 Spike Volume Added: N/A

* - 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): 114.58
 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	0.9110	0.6432	3	1.4594	0.2664	154.09%	0.0770	0.1186	0.8039	0.8073		SAMPLE			
2	1.1178	0.7892	3	1.7492	-0.3394	135.40%	-0.0993	0.1344	0.8999	0.9001		SAMPLE			
3	1.0041	0.7089	3	1.5895	-0.0263	1629.83%	-0.0077	0.1250	0.8412	0.8414		SAMPLE			
4	0.8956	0.6323	3	1.4417	0.2386	168.69%	0.0673	0.1135	0.7884	0.7911		SAMPLE			
5	0.6091	0.4301	3	1.0150	0.4555	66.76%	0.1470	0.0978	0.5941	0.6067		SAMPLE			
6	0.6262	0.4421	3	1.0431	0.3548	85.20%	0.1117	0.0950	0.5913	0.5990		SAMPLE			
7	0.7390	0.5217	3	1.2092	0.2166	154.99%	0.0653	0.1012	0.6576	0.6602		SAMPLE			
8	0.8035	0.5673	3	1.3141	1.2976	34.69%	0.3613	0.1235	0.8690	0.9393		SAMPLE			
9	0.5692	0.4019	3	0.9768	0.9276	36.73%	0.2680	0.0972	0.6594	0.7064		SAMPLE			
10	0.8286	0.5850	3	1.3428	3.8061	16.41%	1.1010	0.1701	1.1525	1.5473		SAMPLE			
11	1.2286	0.8674	3	1.9546	1.1060	54.50%	0.2517	0.1364	1.1745	1.2130		SAMPLE			
12	0.8399	0.5930	3	1.3565	-0.2797	120.84%	-0.0820	0.0990	0.6619	0.6620		SAMPLE			
13	1.5553	1.0980	3	2.5487	1.0086	74.82%	0.1430	0.1065	1.4721	1.5001		SAMPLE			
14	0.8607	0.6077	3	1.3969	0.7165	59.45%	0.1973	0.1168	0.8311	0.8536		MB			
15	1.0560	0.7456	3	1.6685	-0.7946	50.40%	-0.2240	0.1122	0.7802	0.7803	461024001.1	DUP	* 0.0%		
16	0.7206	0.5088	3	1.1973	15.4494	8.58%	4.2977	0.2811	1.9808	4.6367		LCS			17.2046 89.8%

ASSAY 12-Oct-18 16:05:37

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 10/12/2018
Run id. 1896

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	97	1	180.03	613.6	176.08	7.54		04:05:37
2	97	2	180.04	566.9	160.5	7.89	91.15	04:08:51
3	97	3	180.06	579.77	164.77	7.79	93.58	04:12:05
4	97	4	180.06	567.6	160.71	7.89	91.27	04:15:19
5	97	5	180.04	554.65	156.41	8	88.83	04:19:01
1	87	1	180.03	612.6	175.75	7.54	99.81	04:22:45
2	87	2	180.03	606.39	173.68	7.59	98.64	04:25:59
3	87	3	180.06	604.48	173	7.6	98.25	04:29:12
4	87	4	180.04	534.68	149.76	8.17	85.05	04:32:26
5	87	5	180.04	566.88	160.49	7.89	91.15	04:35:41
1	92	1	180.03	558.19	157.61	7.97	89.51	04:39:25
2	92	2	180.06	455.9	123.49	9	70.13	04:42:38
3	92	3	180.06	588.48	167.67	7.72	95.22	04:45:52
4	92	4	180.04	324.05	79.56	11.21	45.18	04:49:06
5	92	5	180.06	545.53	153.36	8.07	87.10	04:52:21
1	70	1	180.06	564.22	159.59	7.92	90.63	04:56:04
2	70	2	180.04	548.14	154.24	8.05	87.60	04:59:18

END OF ASSAY

1810350.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
461024001	6A	60	17	48	10/17/2018 9:37	10/17/2018 10:37	PIC	1810350
461032001	6B	60	5	61	10/17/2018 9:37	10/17/2018 10:37	PIC	1810350
461032002	6C	60	8	53	10/17/2018 9:37	10/17/2018 10:37	PIC	1810350
461032003	7A	60	7	44	10/17/2018 9:37	10/17/2018 10:37	PIC	1810350
461032004	7B	60	9	33	10/17/2018 9:37	10/17/2018 10:37	PIC	1810350
461032005	7C	60	5	31	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032006	7D	60	12	35	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032007	8B	60	7	53	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032008	8C	60	9	33	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032009	9A	60	3	102	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032010	9B	60	3	64	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461032011	9C	60	13	33	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
461045001	9D	60	14	39	10/17/2018 9:38	10/17/2018 10:38	PIC	1810350
1204131260	10A	60	5	47	10/17/2018 9:40	10/17/2018 10:40	PIC	1810350
1204131261	10B	60	4	42	10/17/2018 9:40	10/17/2018 10:40	PIC	1810350
1204131262	10C	60	3	283	10/17/2018 9:40	10/17/2018 10:40	PIC	1810350

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 17-Oct-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
LB4100C1	need 2nd	Beta bkg	17-Oct 06:18	60	1.783	1.035	1.925	+2.04
LB4100C4	Above	Beta bkg	17-Oct 06:18	60	6.800	0.686	2.113	+22.70
LB4100E2	Above	Beta bkg	17-Oct 06:01	60	2.567	0.261	3.241	+1.64
LB4100E3	Above	Beta bkg	17-Oct 06:01	60	2.780	0.473	2.078	+5.33
LB4100G2	Above	Alpha XTalk	17-Oct 05:42	5	0.800	0.256	0.419	+17.79
LB4100G2	Above	Beta bkg	17-Oct 06:01	60	2940	0.414	2.180	+9,984.83
LB4100G2	Above	Beta eff	17-Oct 05:52	5	21800	15140	19980	+5.25
LB4100H2	Above	Beta bkg	17-Oct 07:16	60	3.000	-1.72E+0	4.379	+1.64
LB4100J2	Above	Beta bkg	17-Oct 05:43	60	3.250	-1.65E+1	28.950	-0.39
LB4100I3	Above	Beta bkg	17-Oct 05:43	60	2.617	-5.60E+1	3.474	+1.72
LB4100J3	Below	Alpha eff	17-Oct 07:03	5	19850	20390	22810	-4.26
PIC1A	Above	Alpha bkg	17-Oct 05:35	60	0.317	-4.72E-2	0.389	+1.90
PIC4D	Below	Alpha XTalk	17-Oct 05:44	5	0.249	0.256	0.273	-5.28
PIC5D	Above	Beta bkg	17-Oct 07:03	60	2.233	0.019	2.073	+3.47
PIC8A	Above	Beta XTalk	17-Oct 07:10	5	3.03E-4	5.74E-5	2.92E-4	+3.29
PIC12D	need 2nd	Beta bkg	17-Oct 05:17	60	1.483	0.504	1.615	+2.29

INSTRUMENTS NOT LISTED HAVE PASSED ALL QUALITY ASSURANCE PARAMETERS

The following detectors may not have properly transferred to the LIMS system

LB4100B1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100B2	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
LB4100B4	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100C1	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100C2	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100C3	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk
LB4100C4	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
PIC5D	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

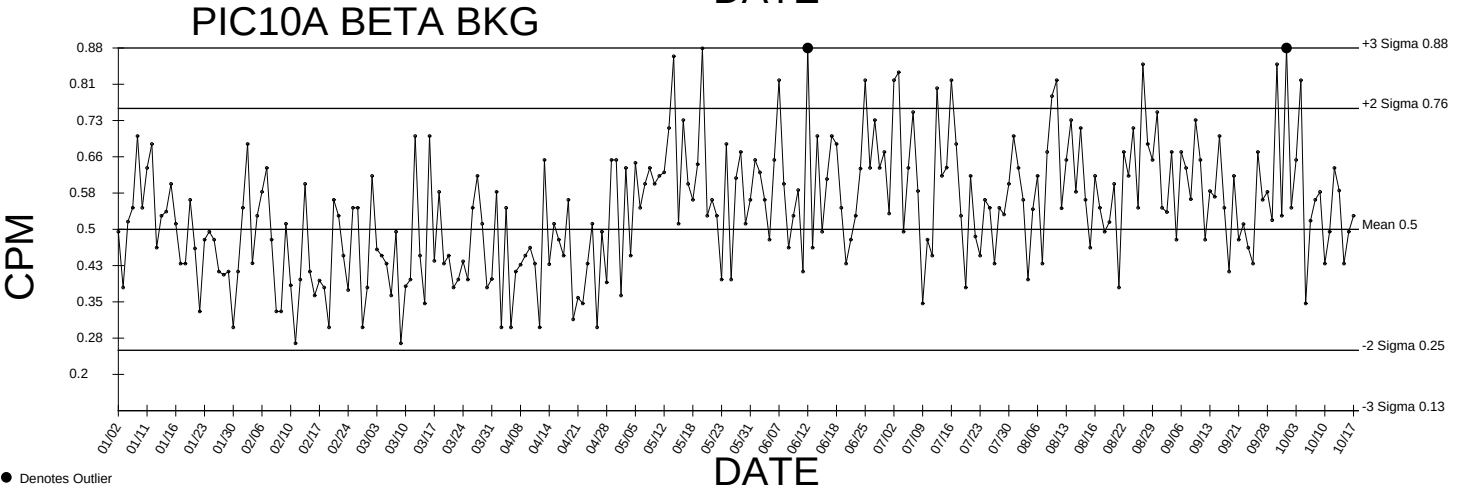
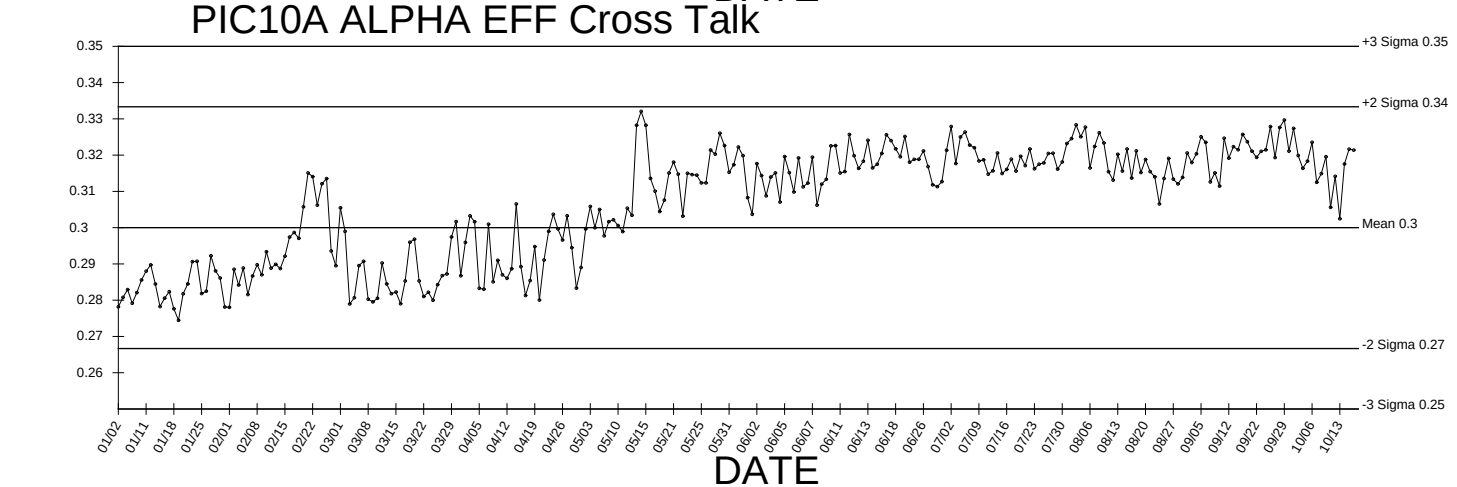
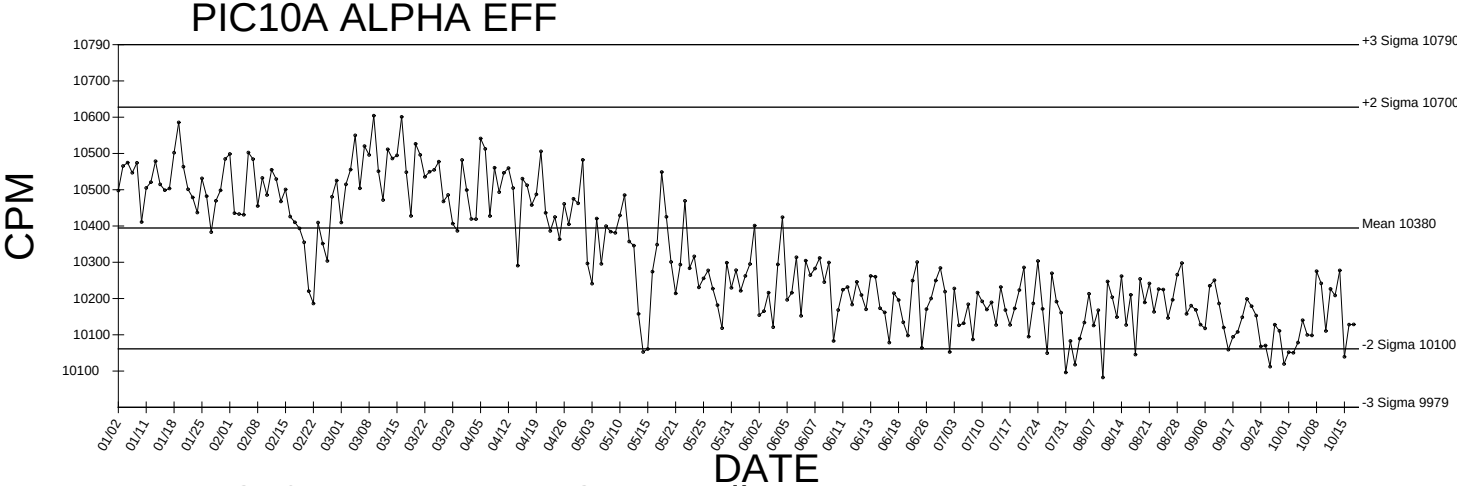
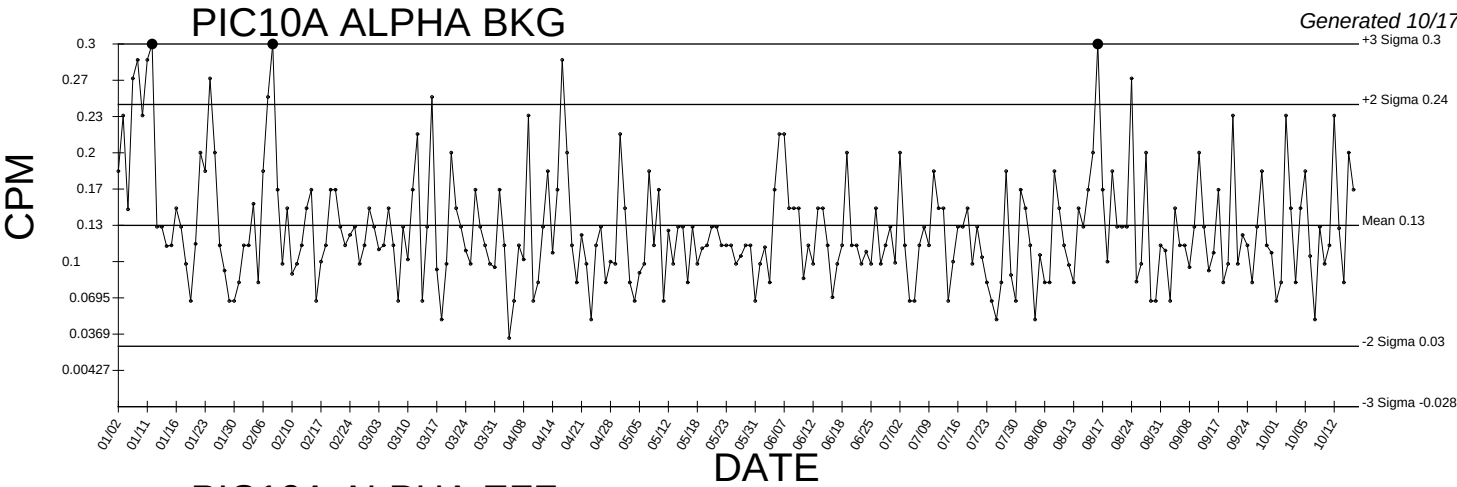
Alpha pkg, Alpha ell, Alpha XTalk, Beta pkg, Beta off, Beta XTalk

Reviewed by A. B. C. D. E. F. G. H. I. J. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z.

Date 8/1/19

GE Laboratories LLC

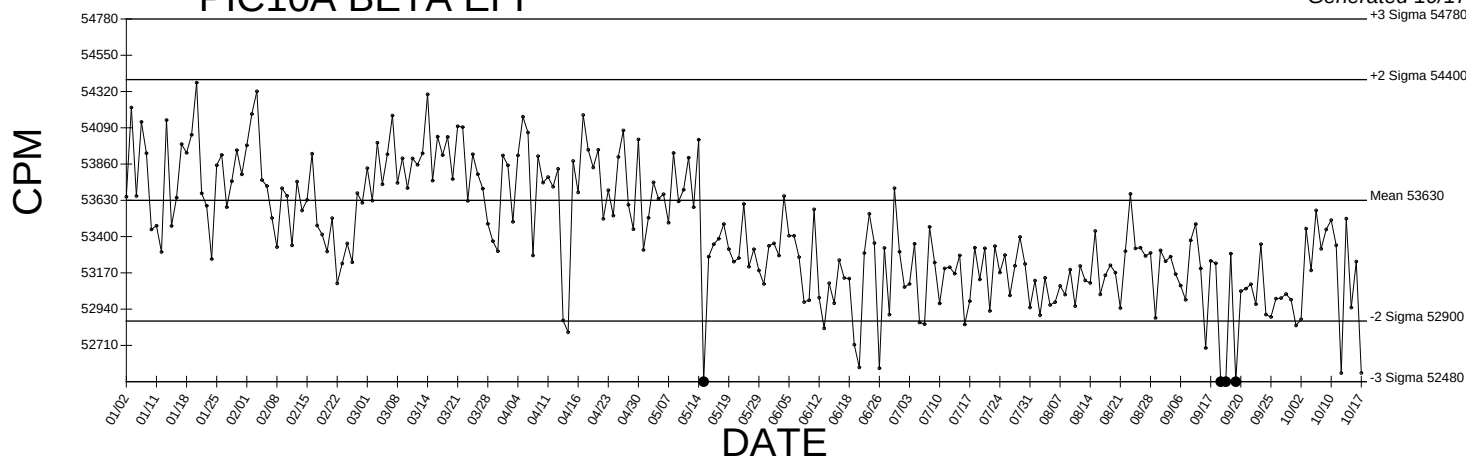
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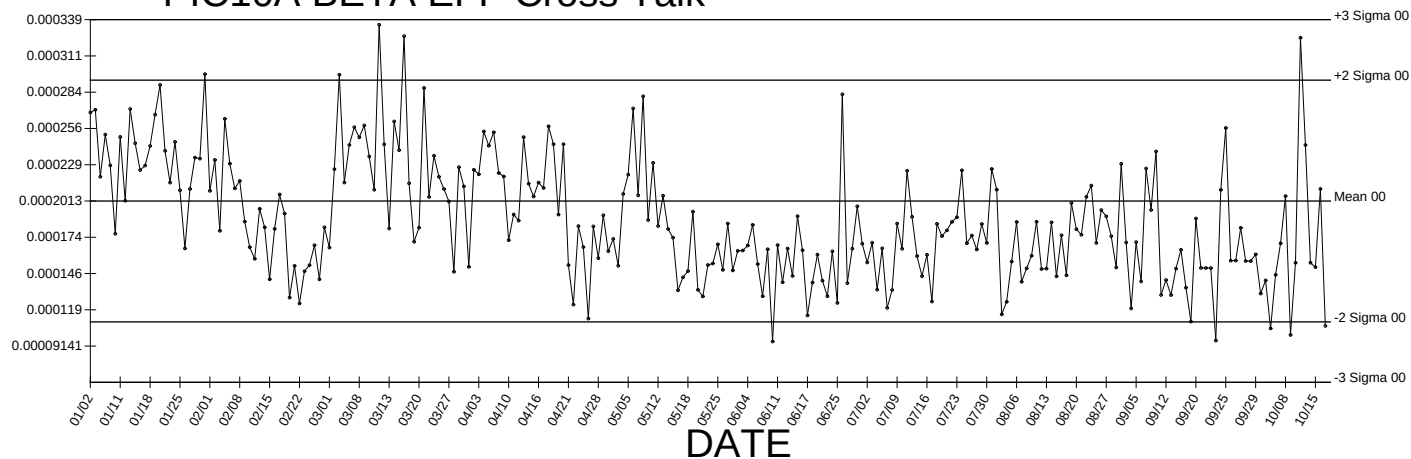
● Denotes Outlier

PIC10A BETA EFF

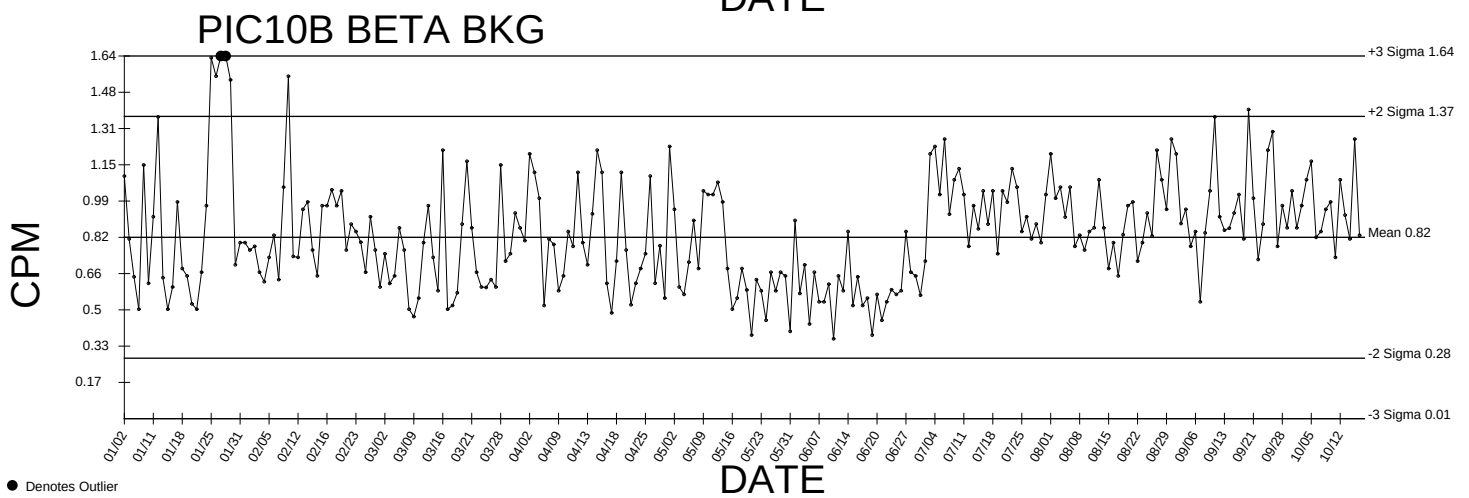
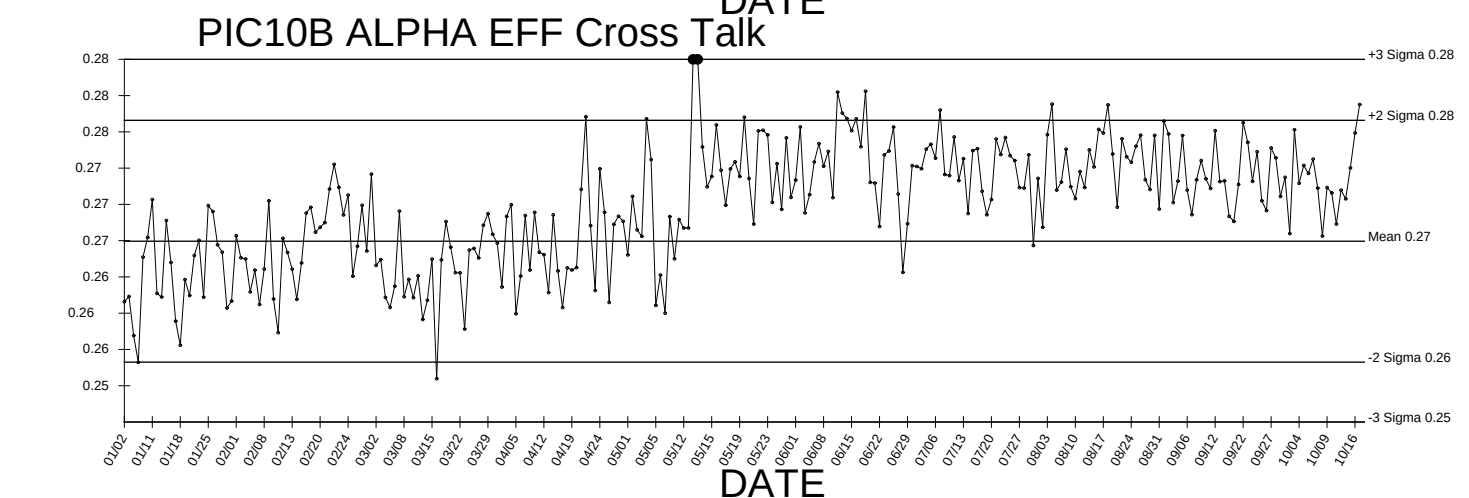
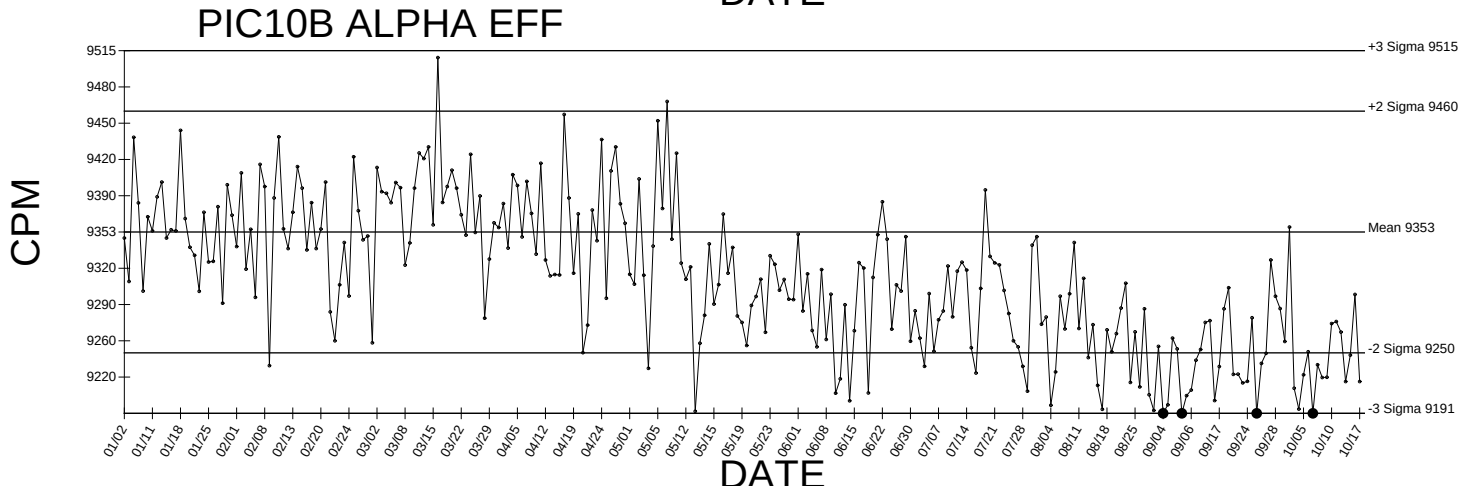
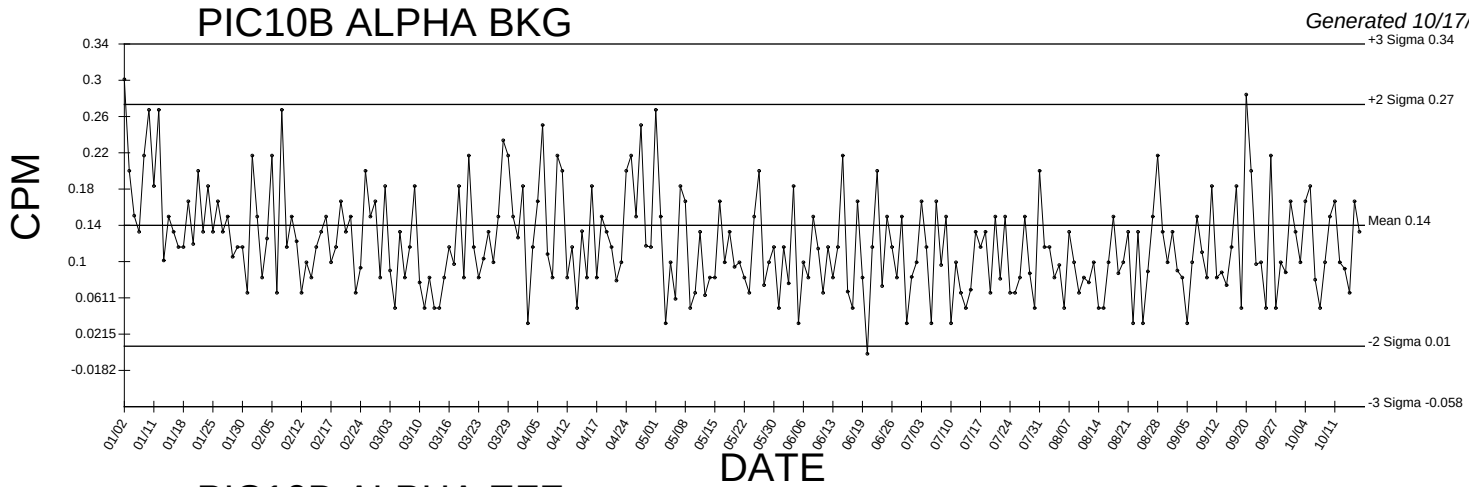
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+3 Sigma 54780



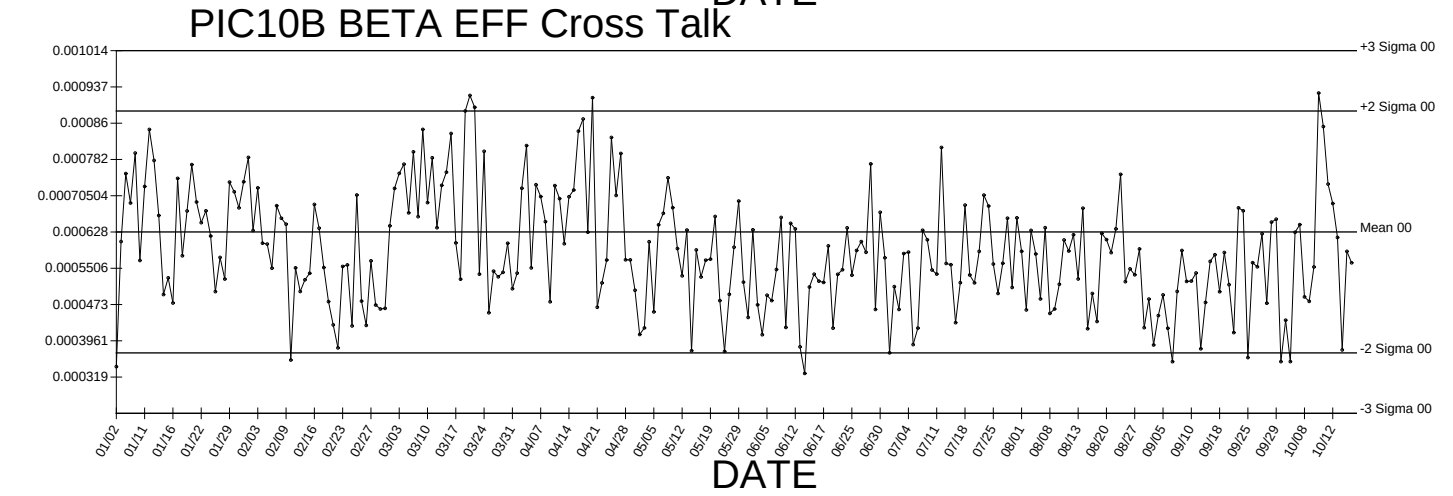
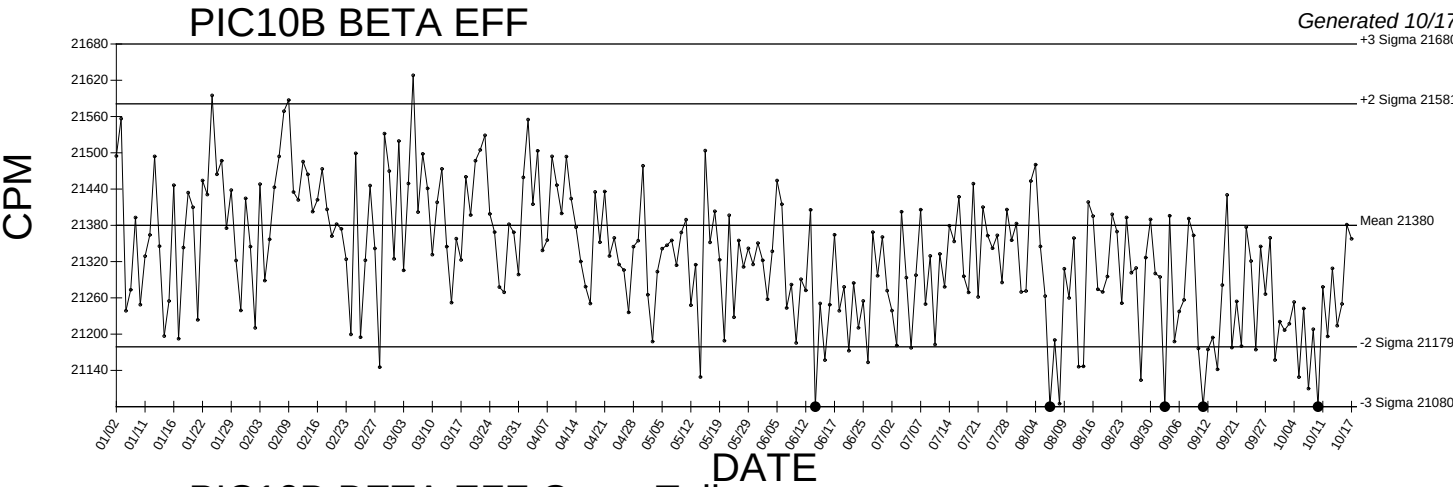
PIC10A BETA EFF Cross Talk



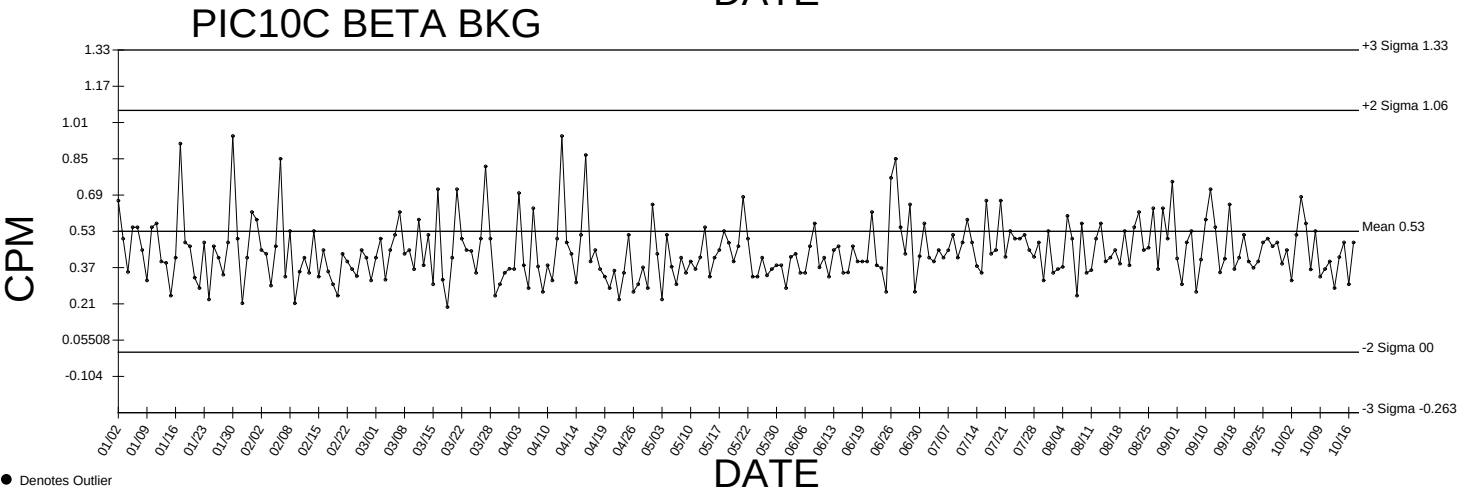
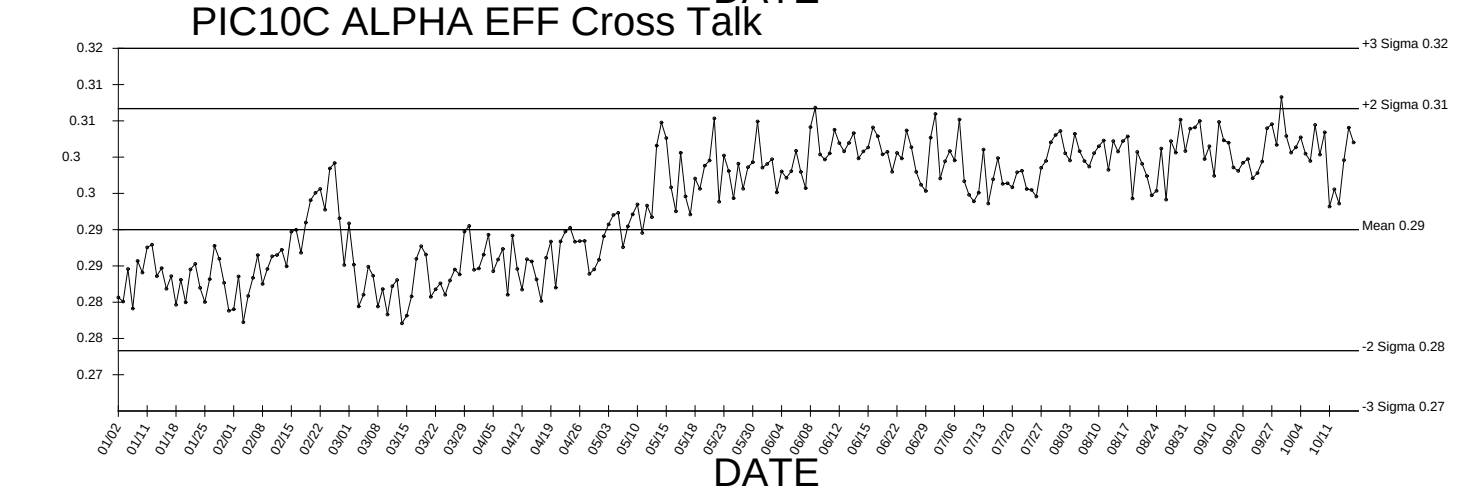
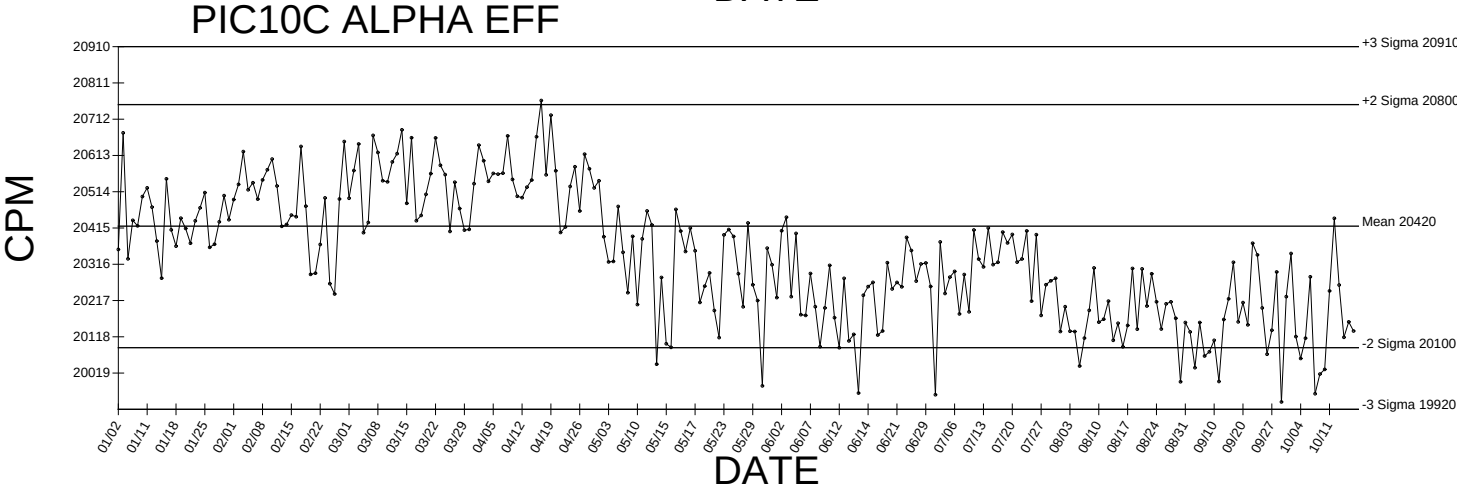
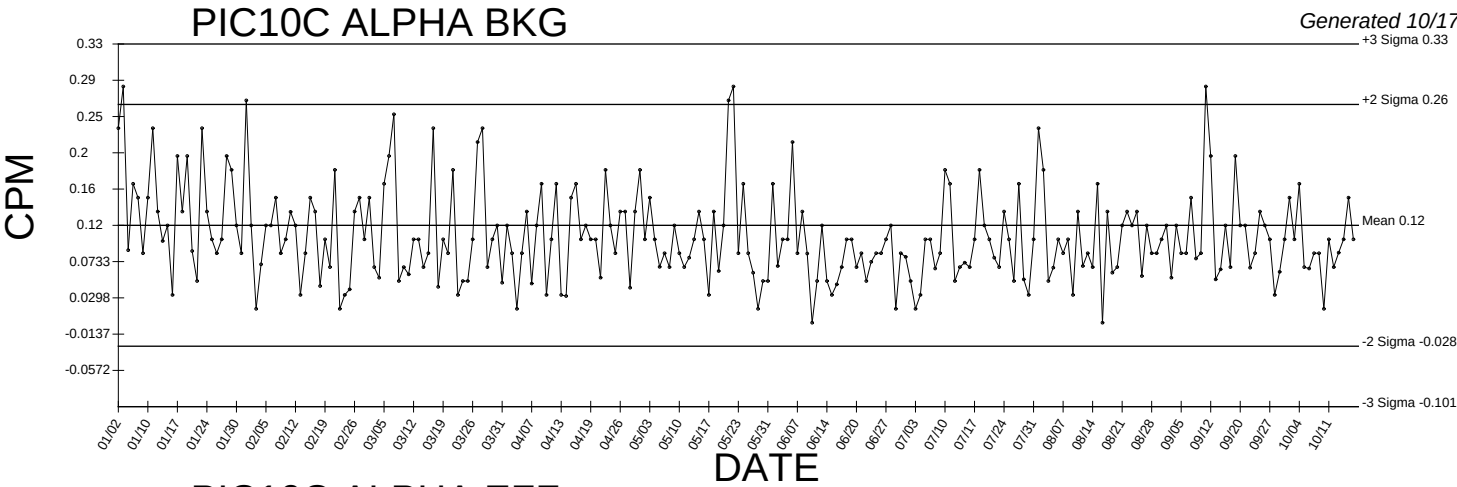
● Denotes Outlier



● Denotes Outlier



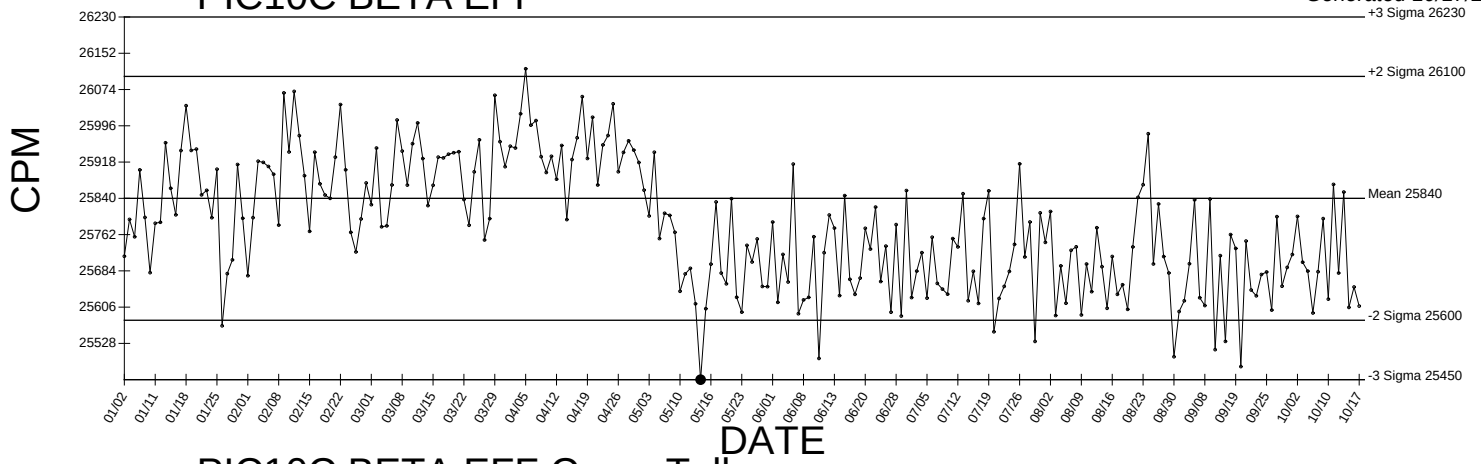
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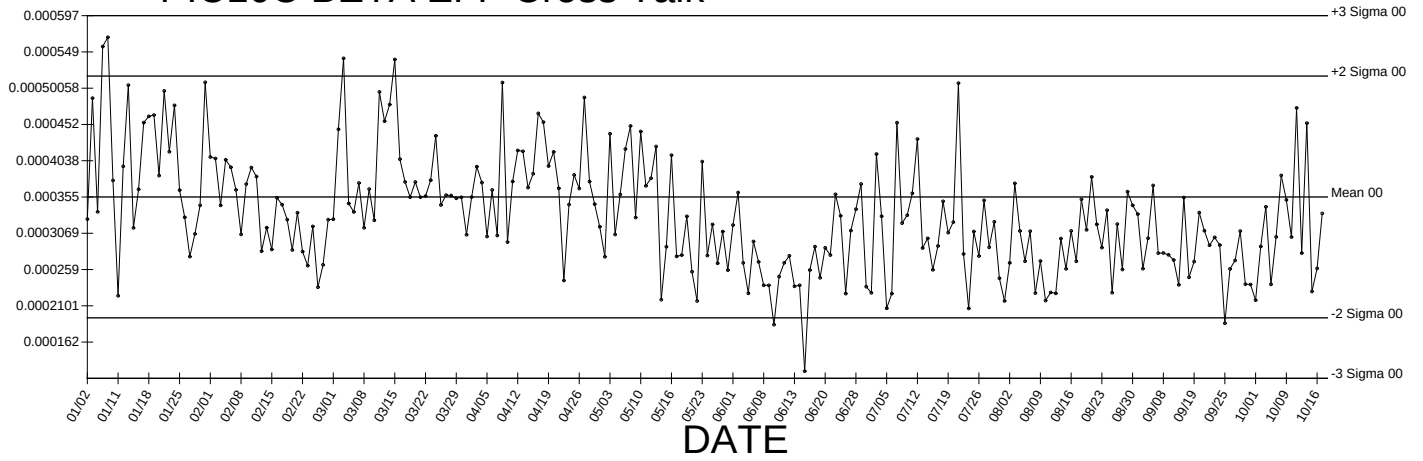
● Denotes Outlier

PIC10C BETA EFF

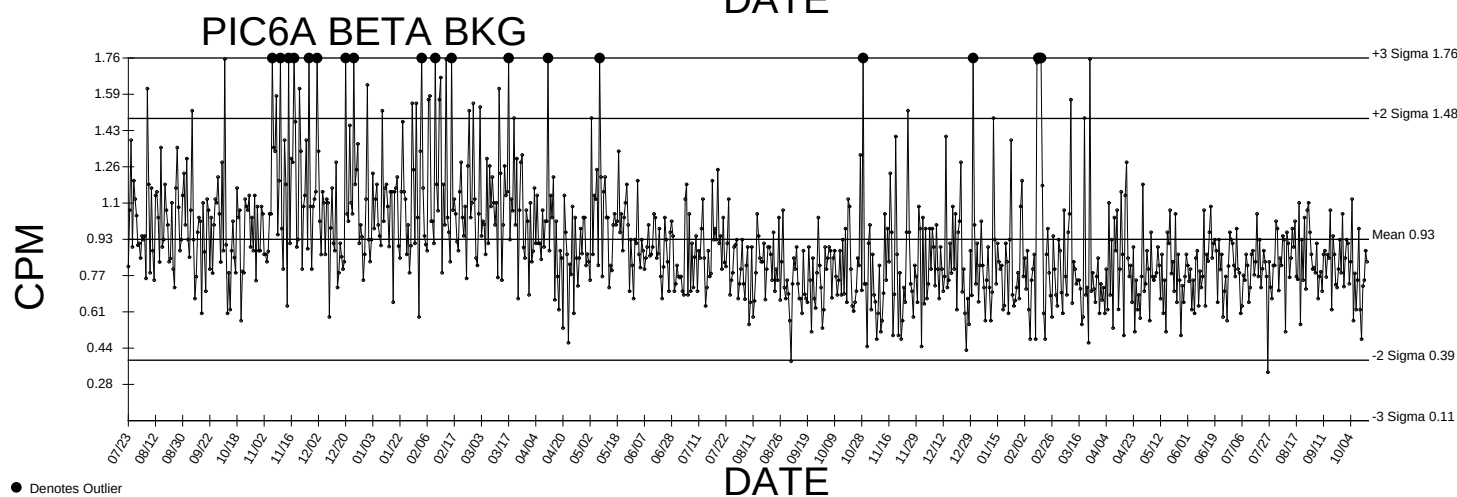
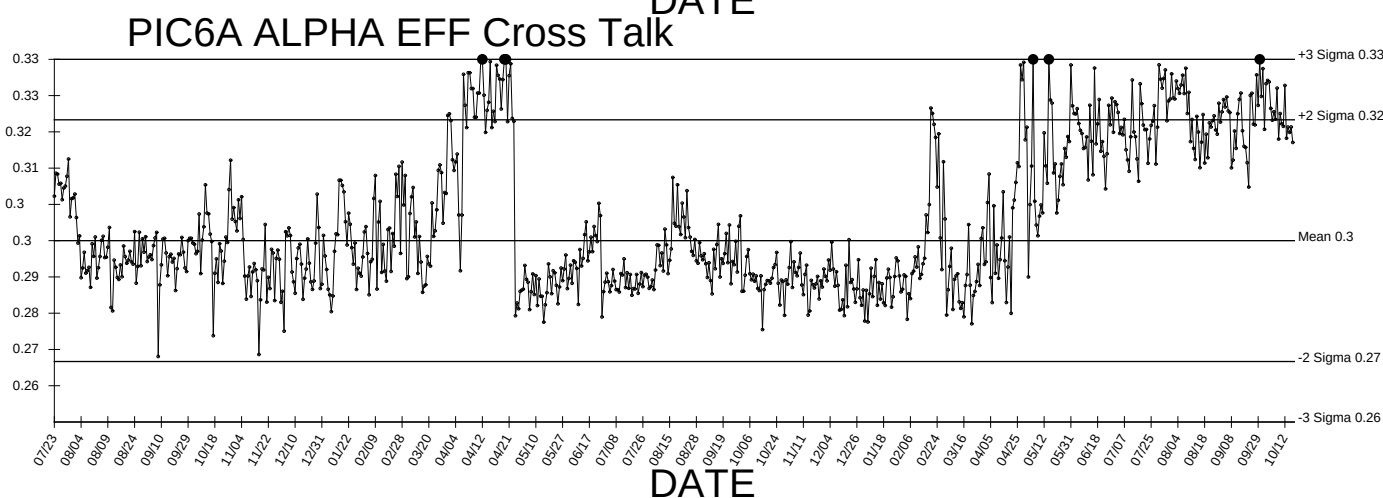
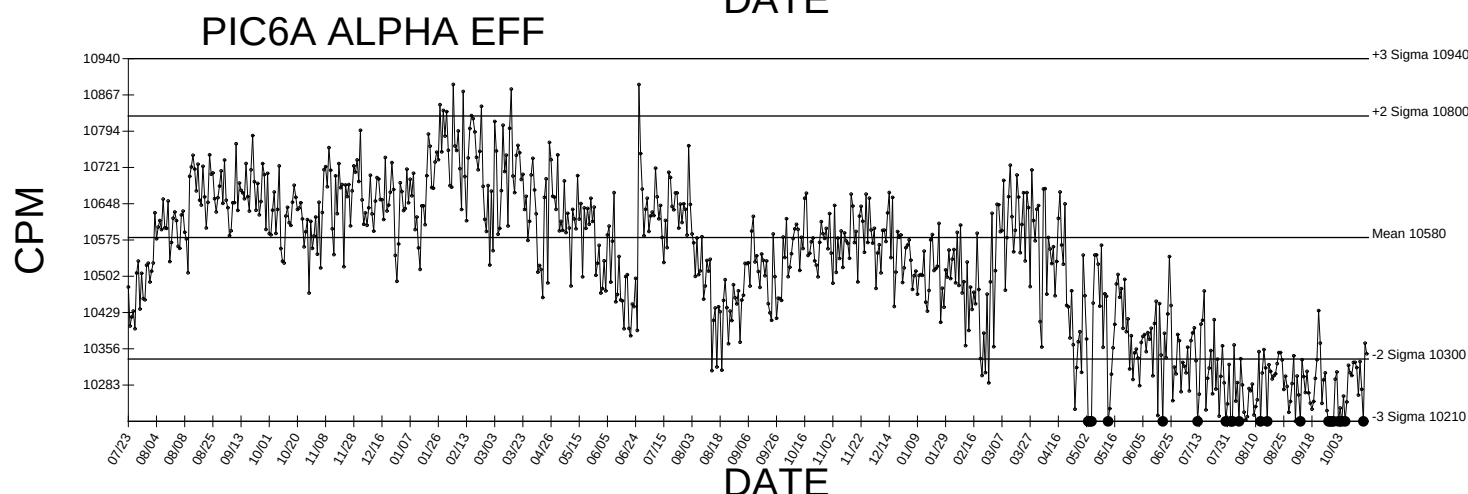
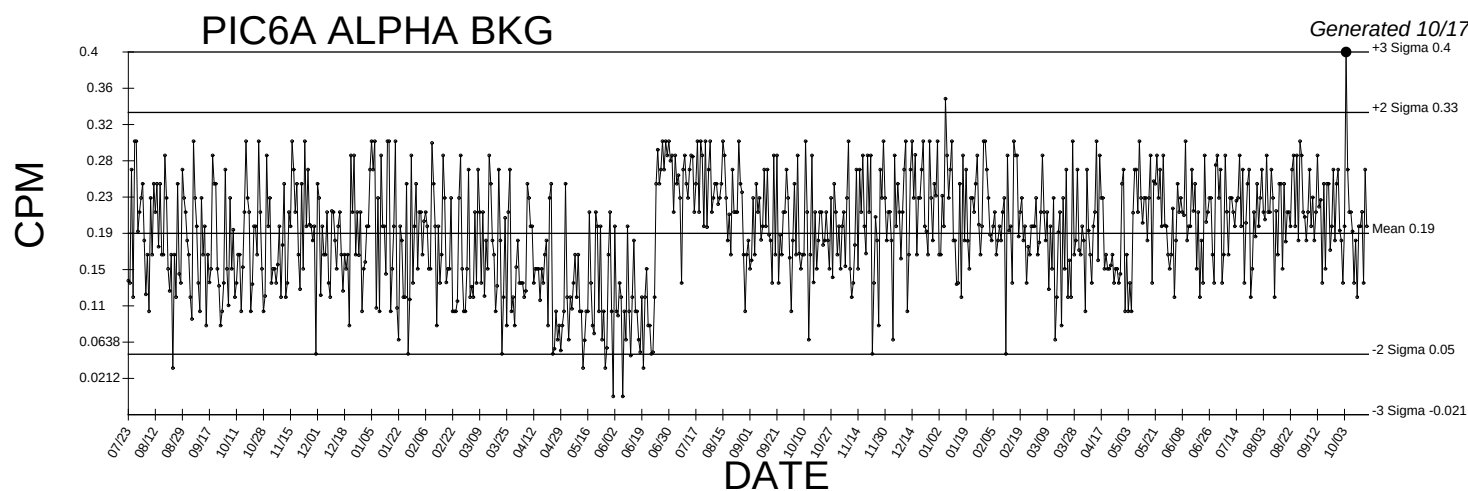
Generated 10/17/2018



PIC10C BETA EFF Cross Talk



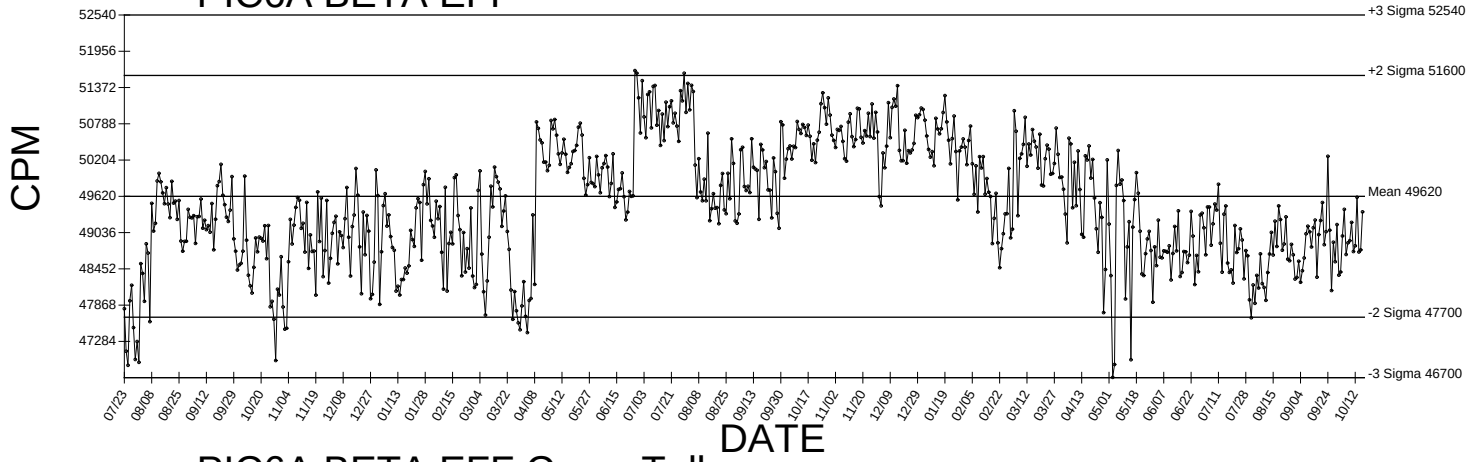
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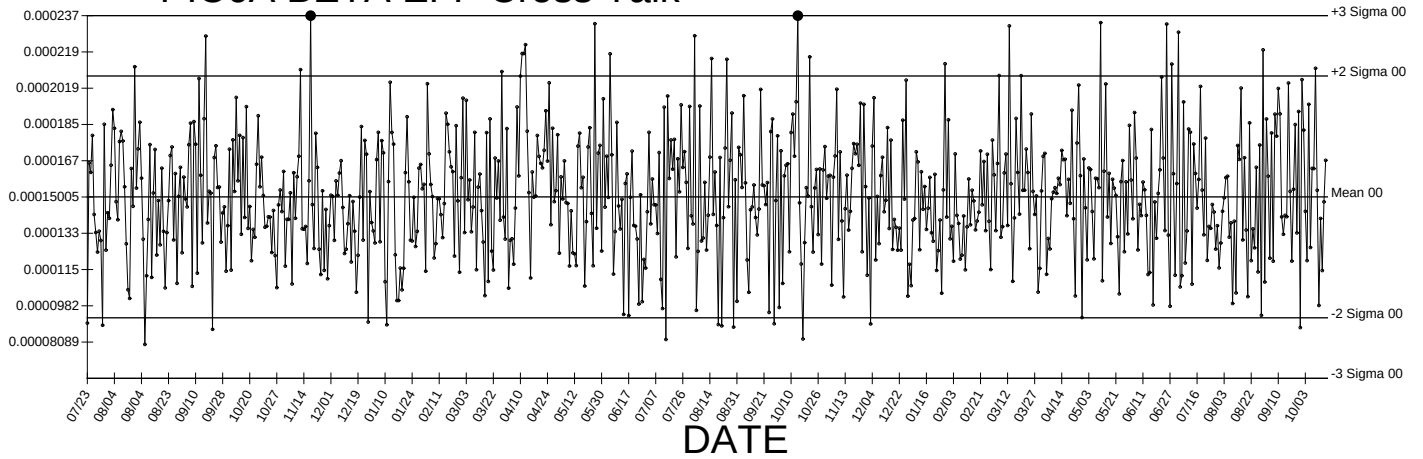
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PIC6A BETA EFF

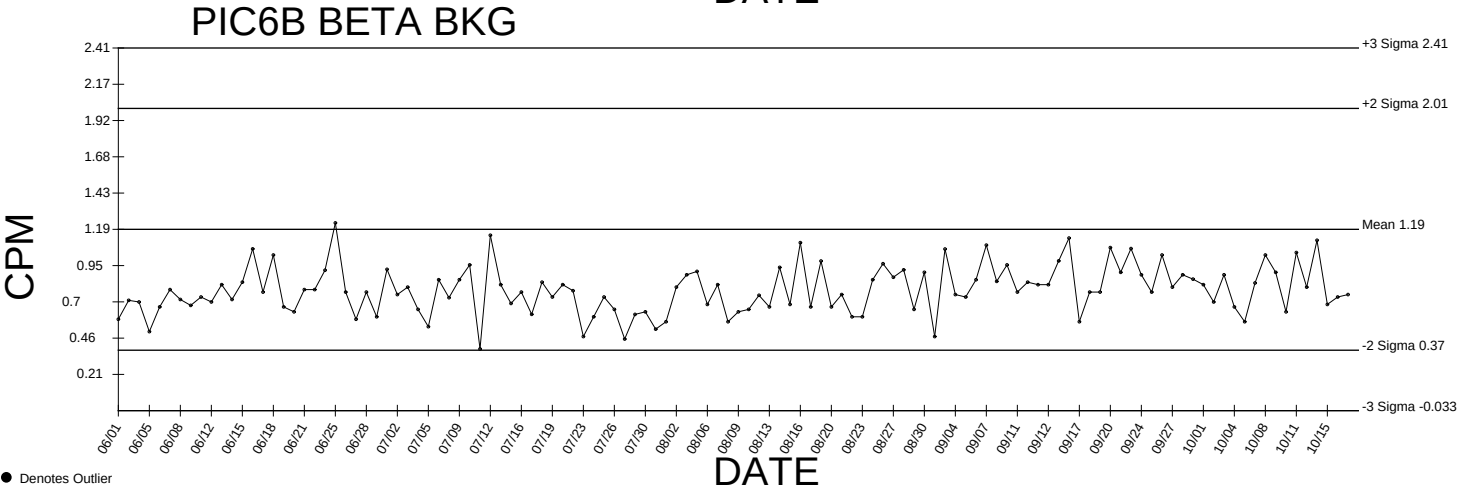
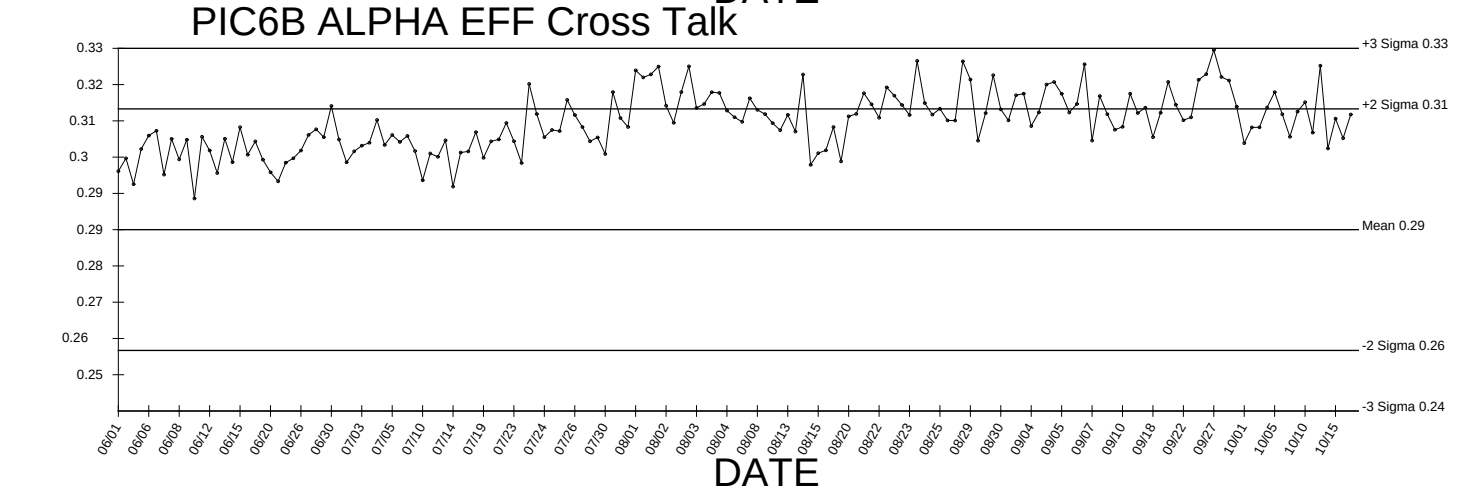
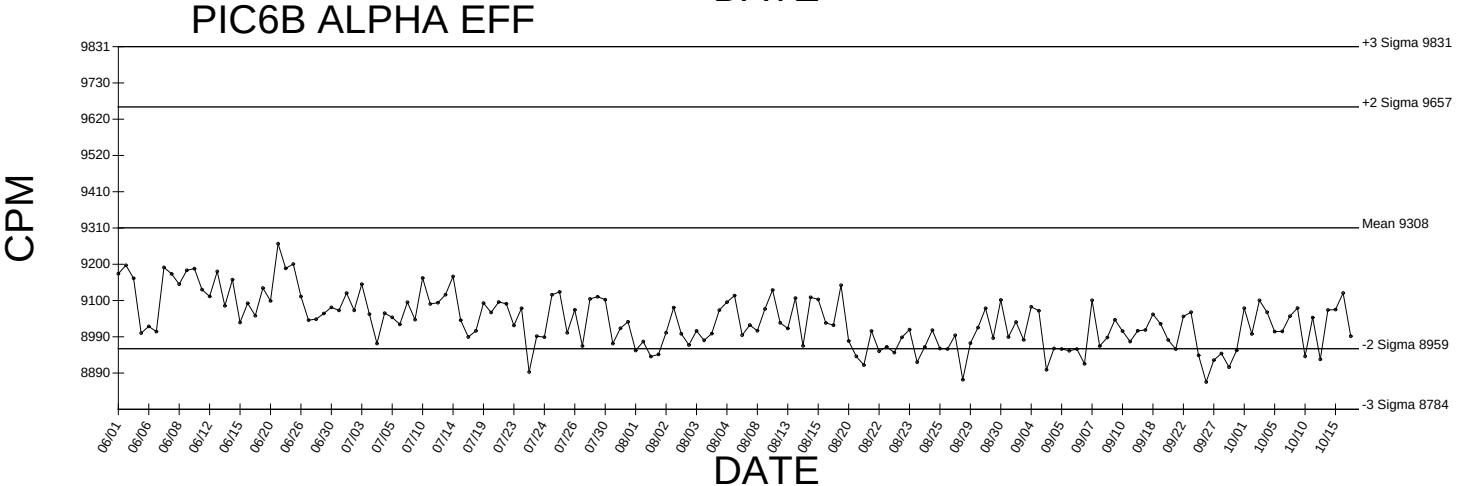
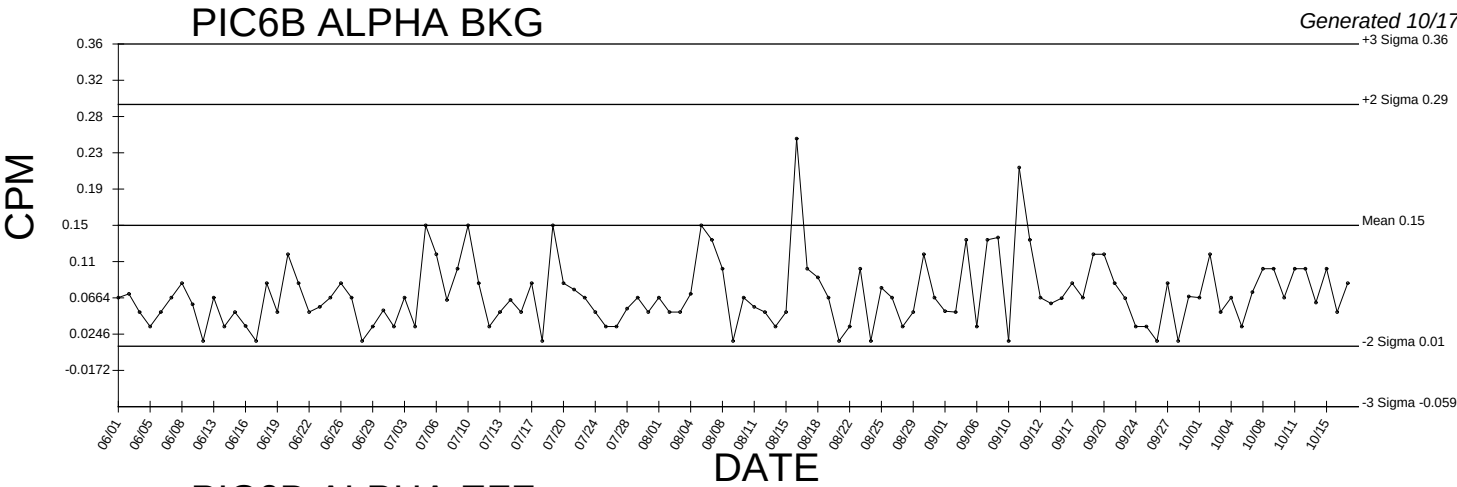
Generated 10/17/2018
+3 Sigma 52540



PIC6A BETA EFF Cross Talk



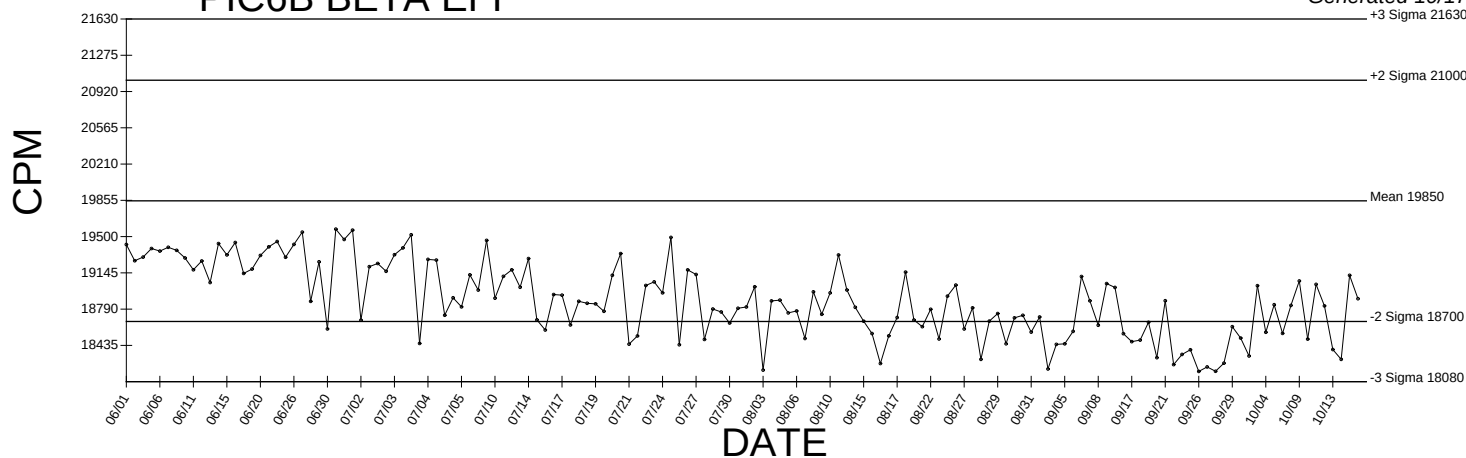
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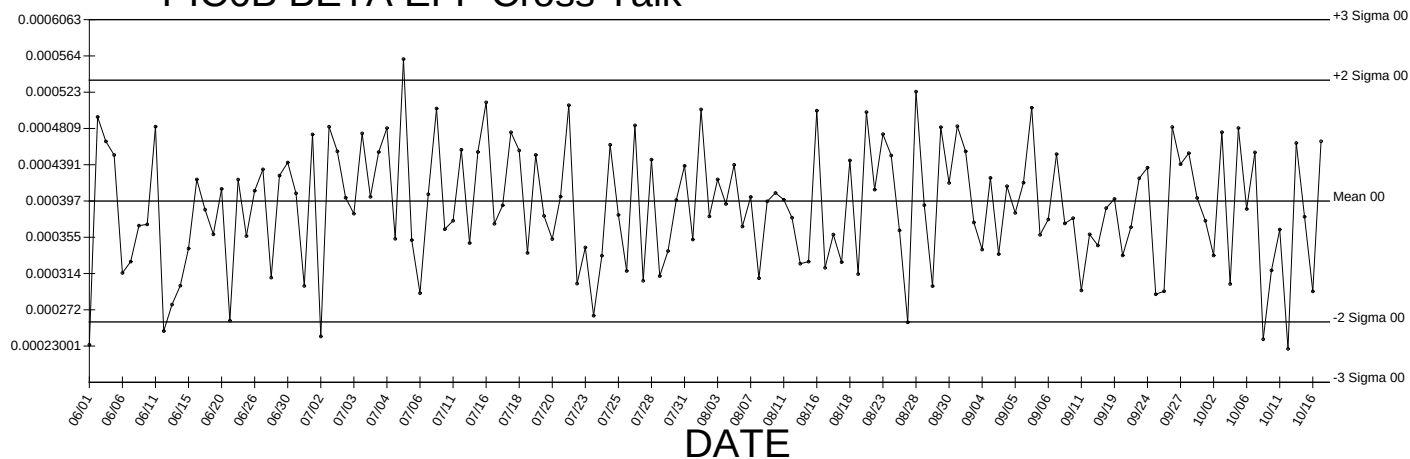
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PIC6B BETA EFF

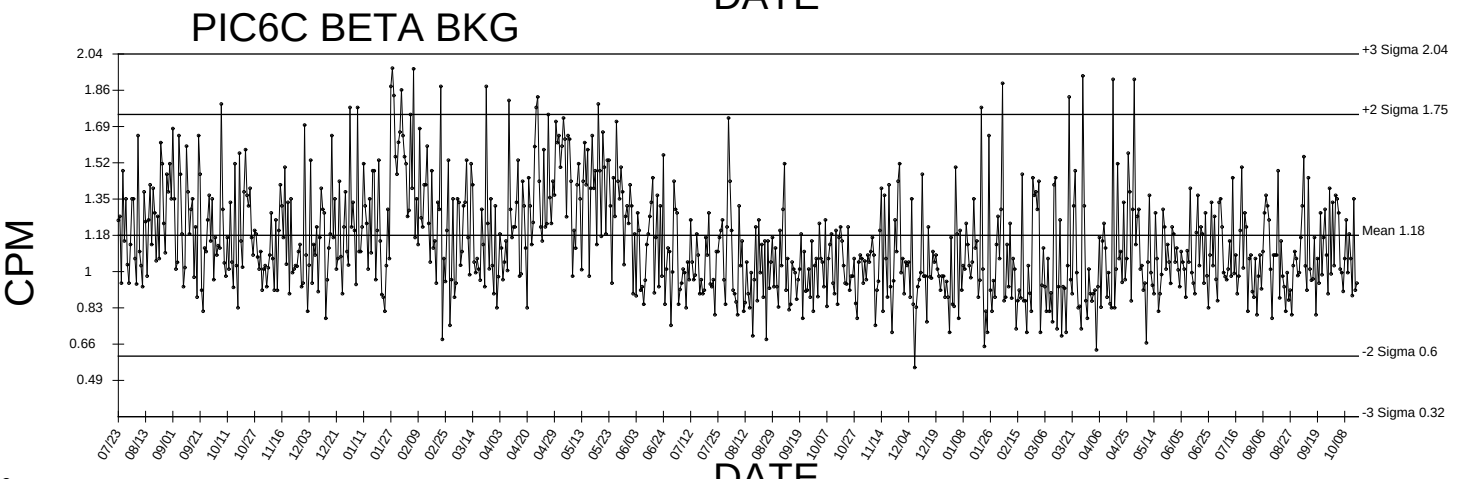
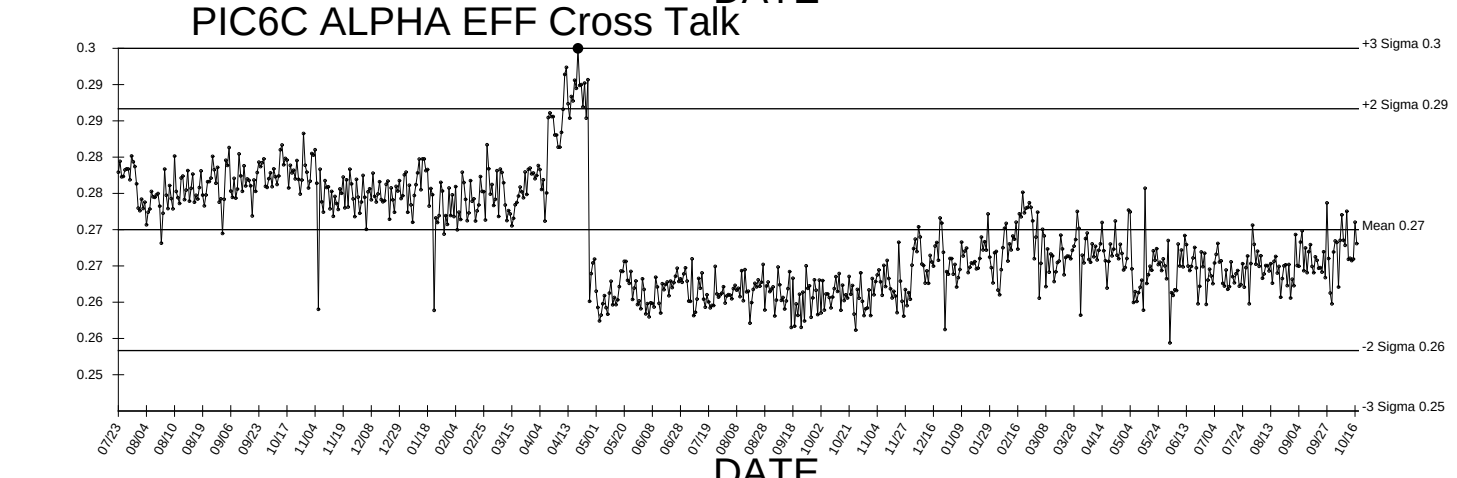
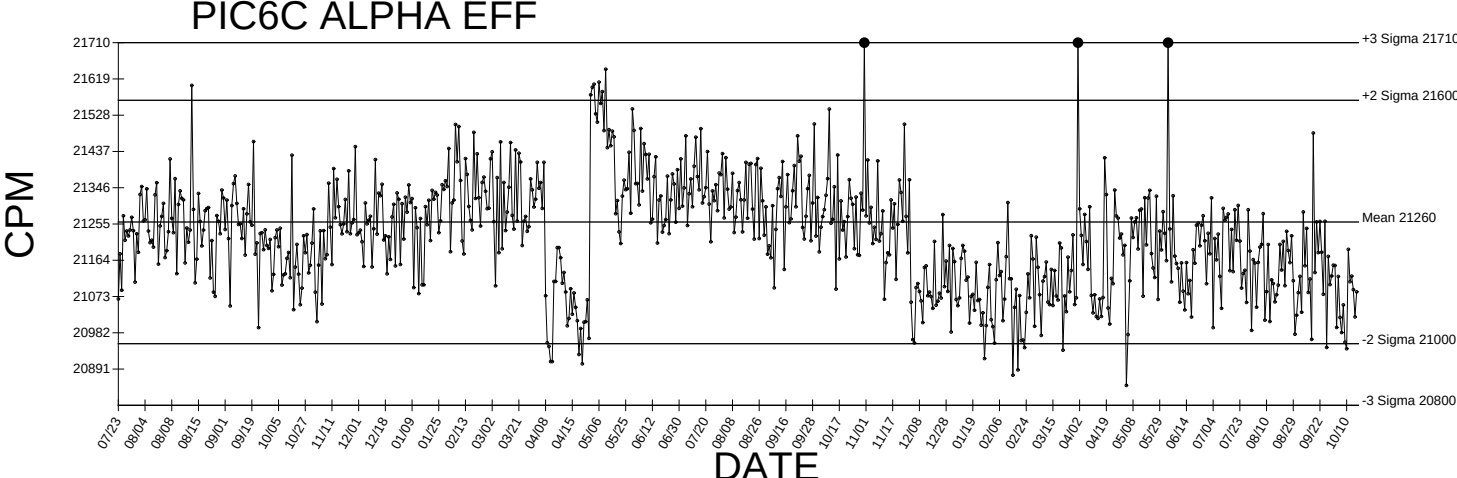
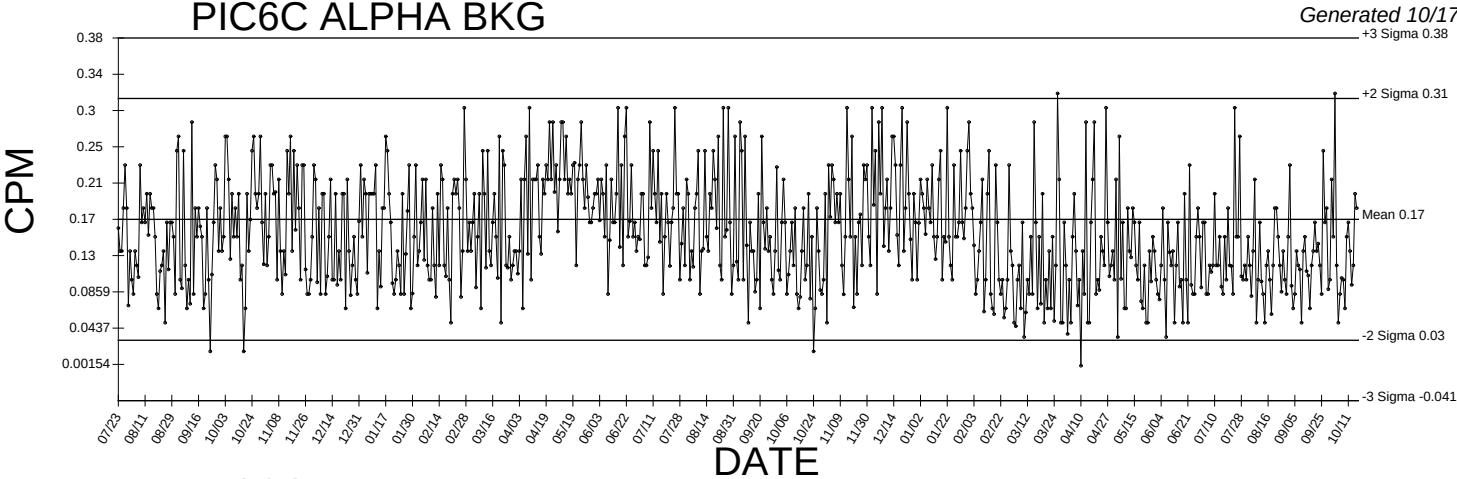
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PIC6B BETA EFF Cross Talk



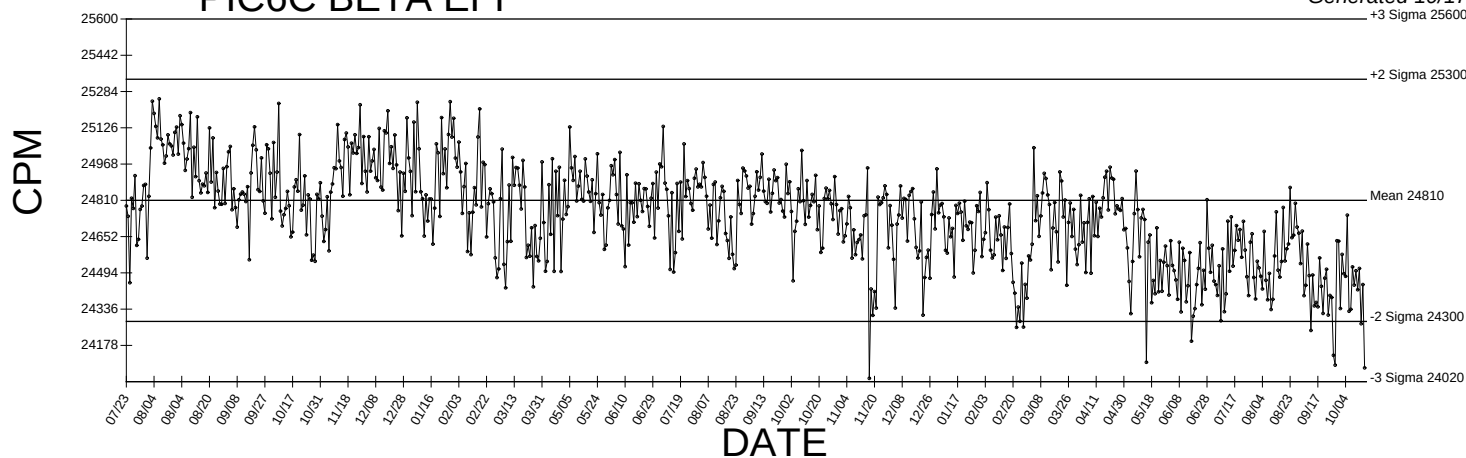
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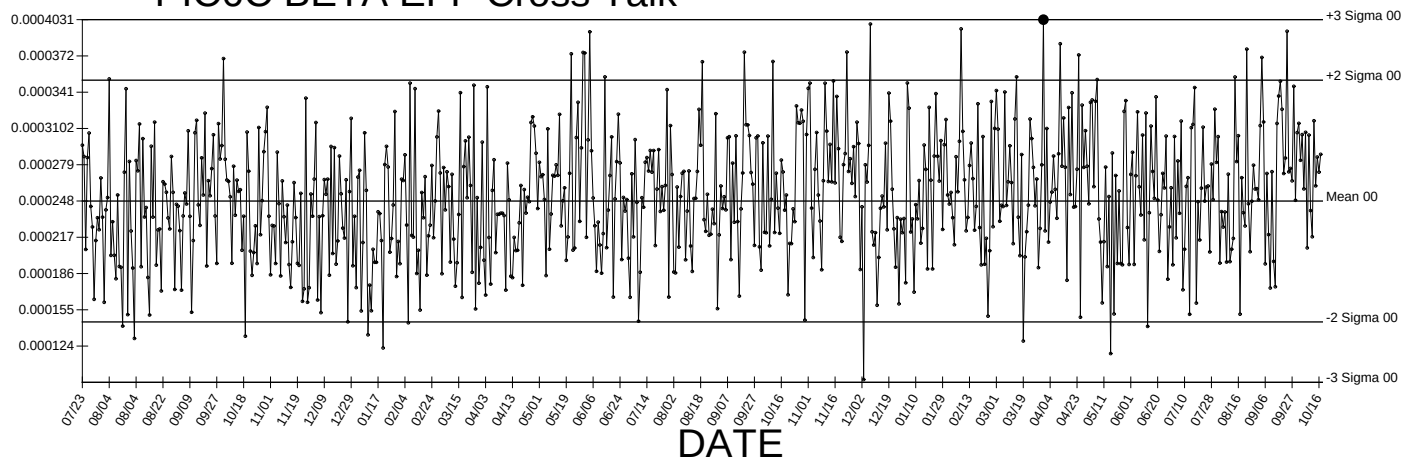
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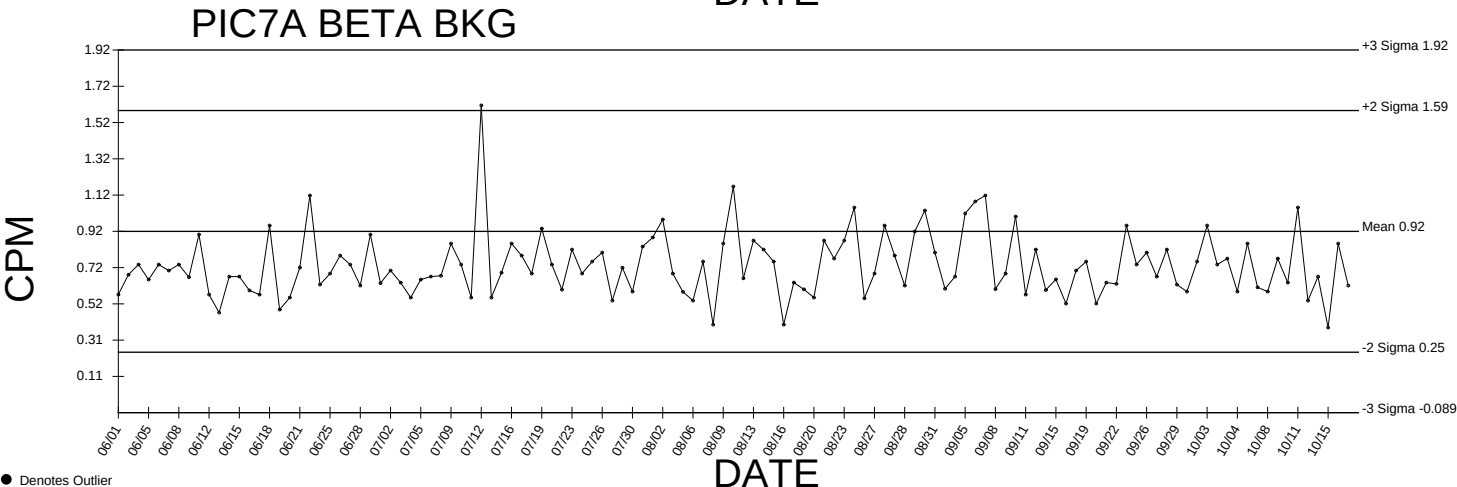
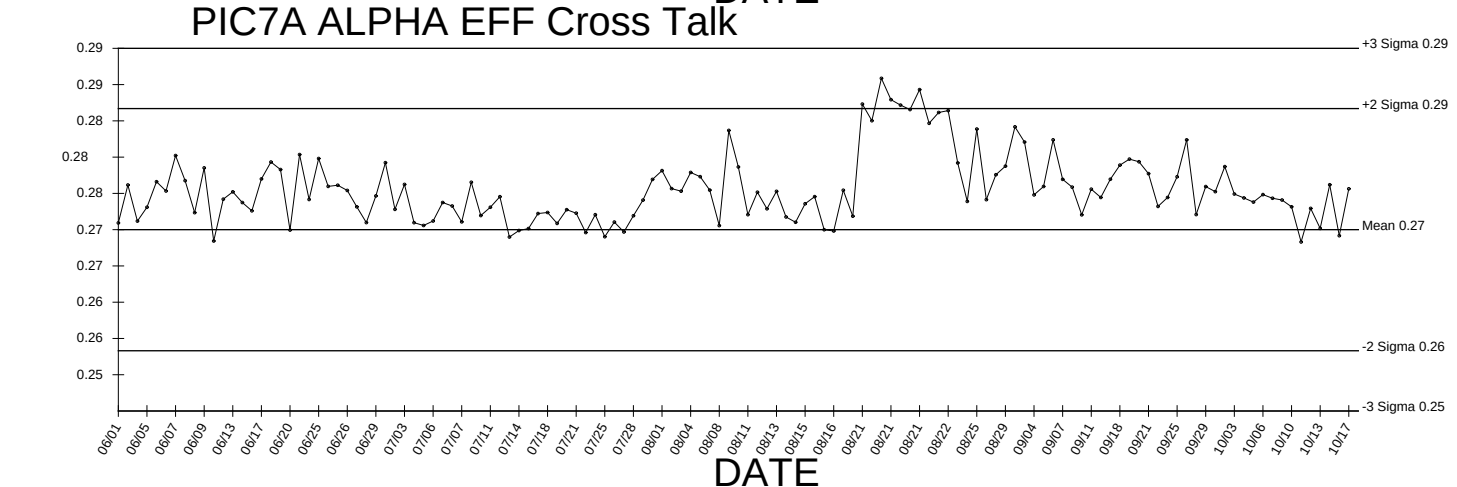
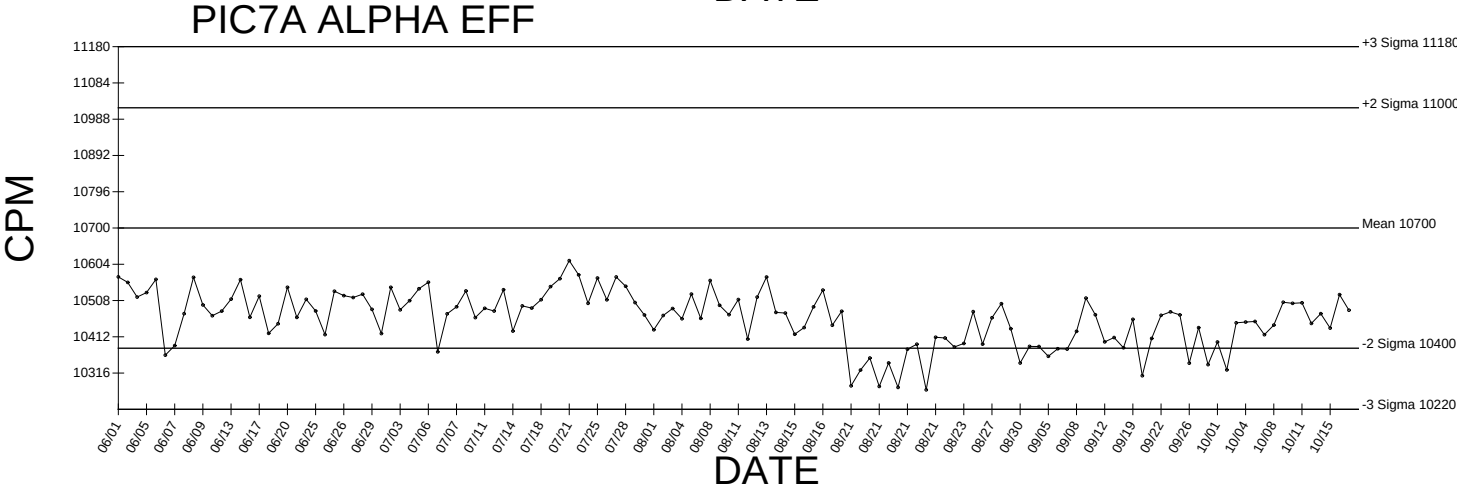
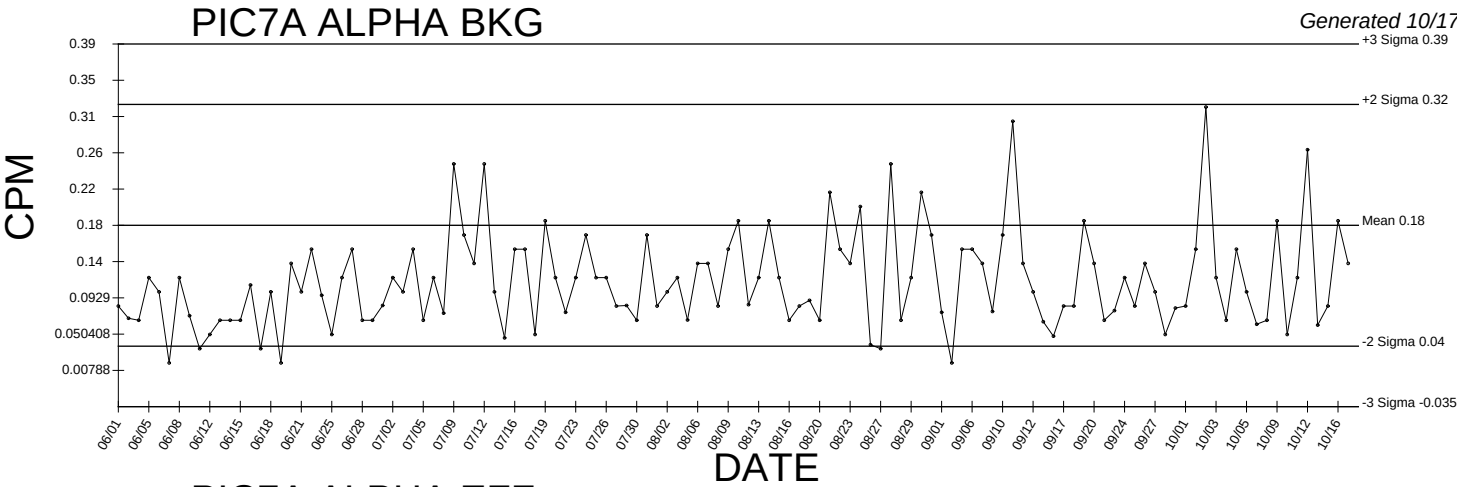
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+3 Sigma 25600



PIC6C BETA EFF Cross Talk



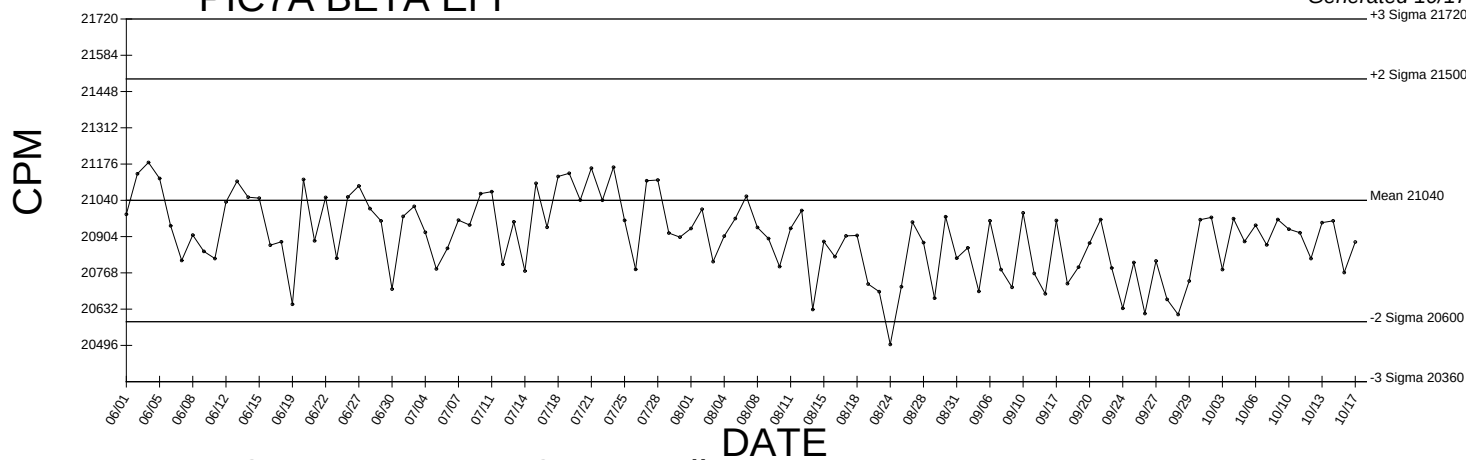
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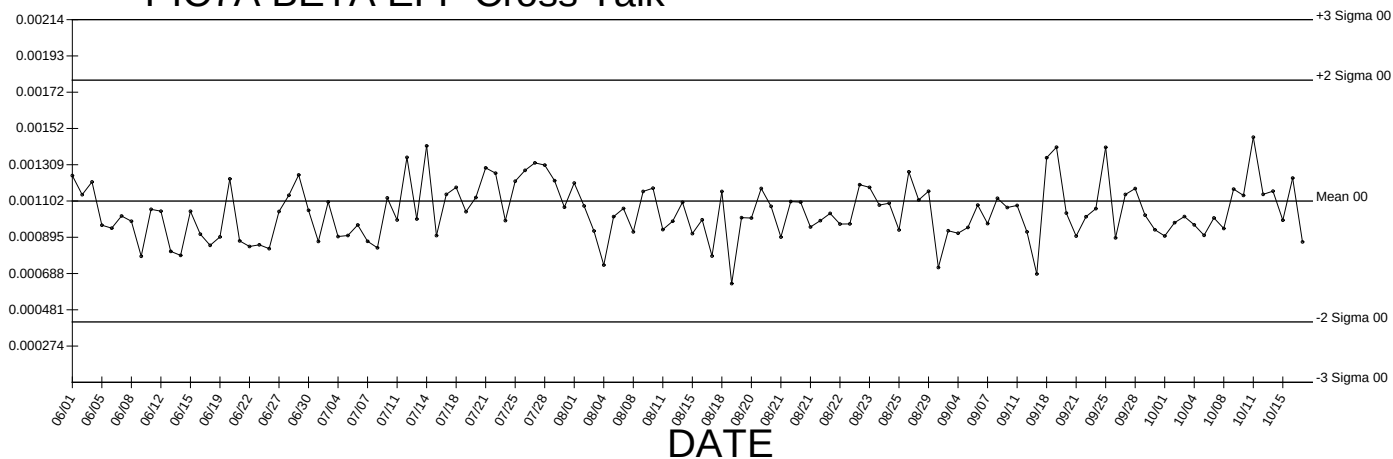
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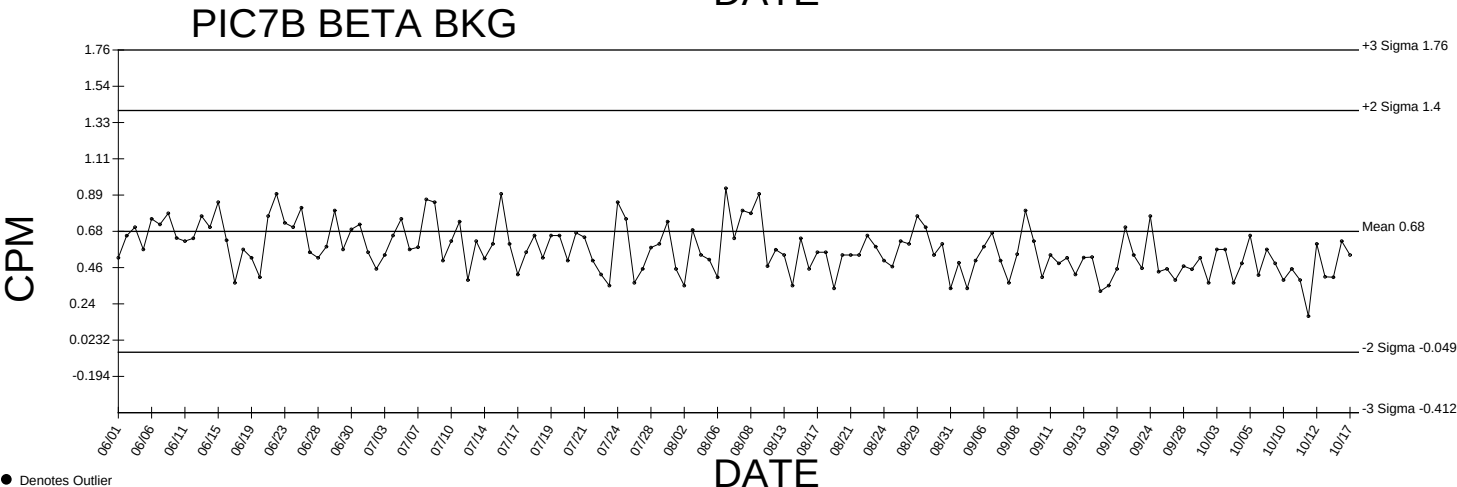
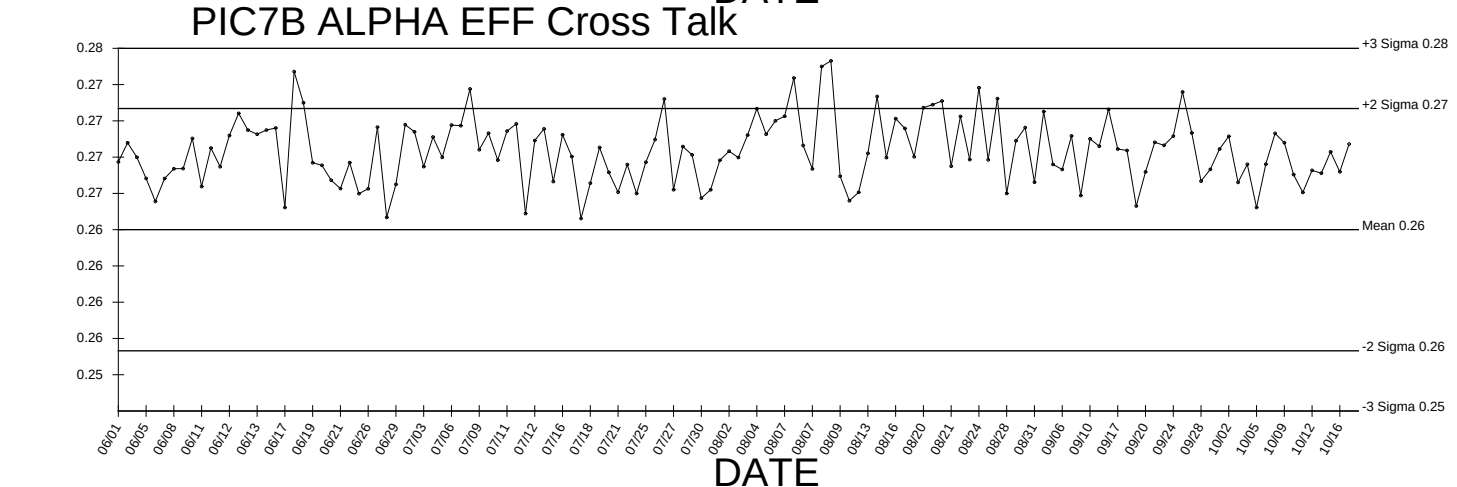
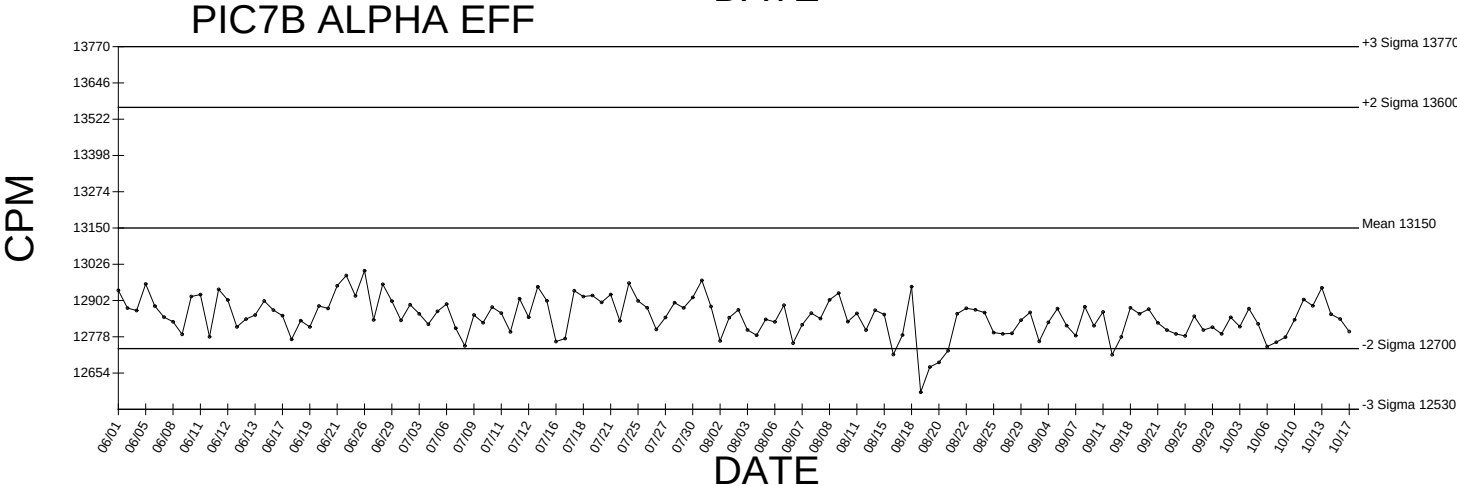
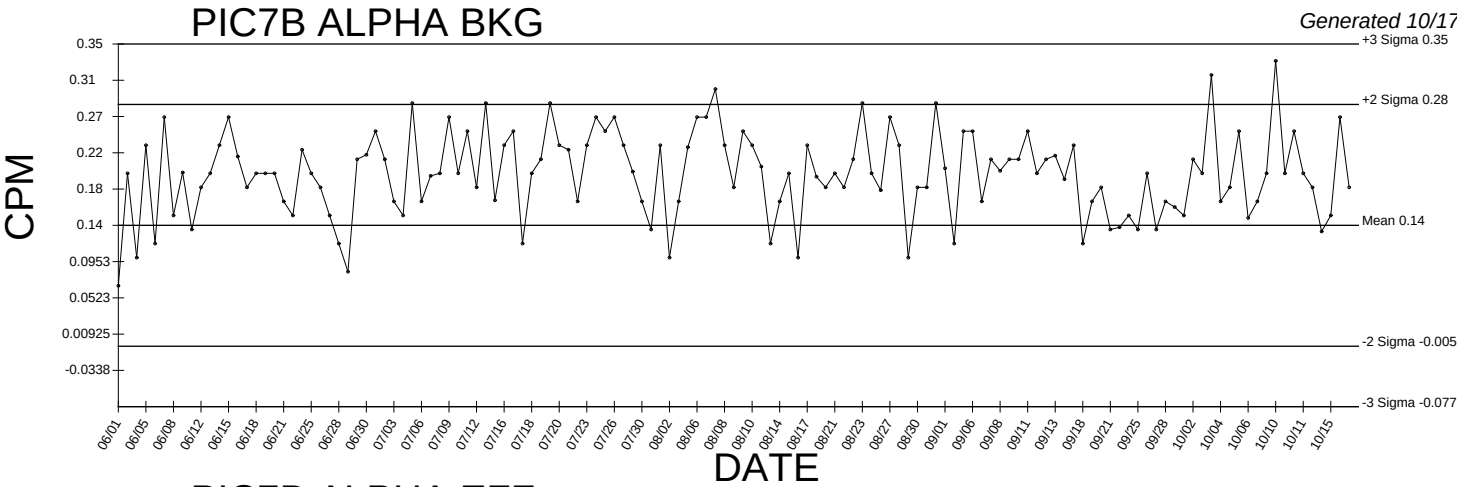
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PIC7A BETA EFF Cross Talk



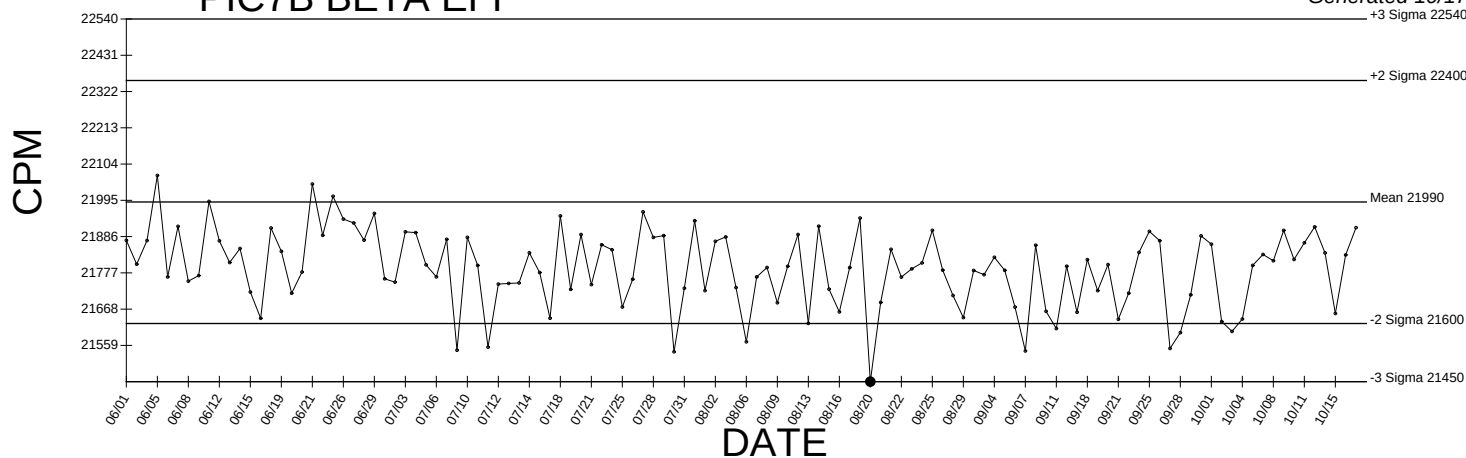
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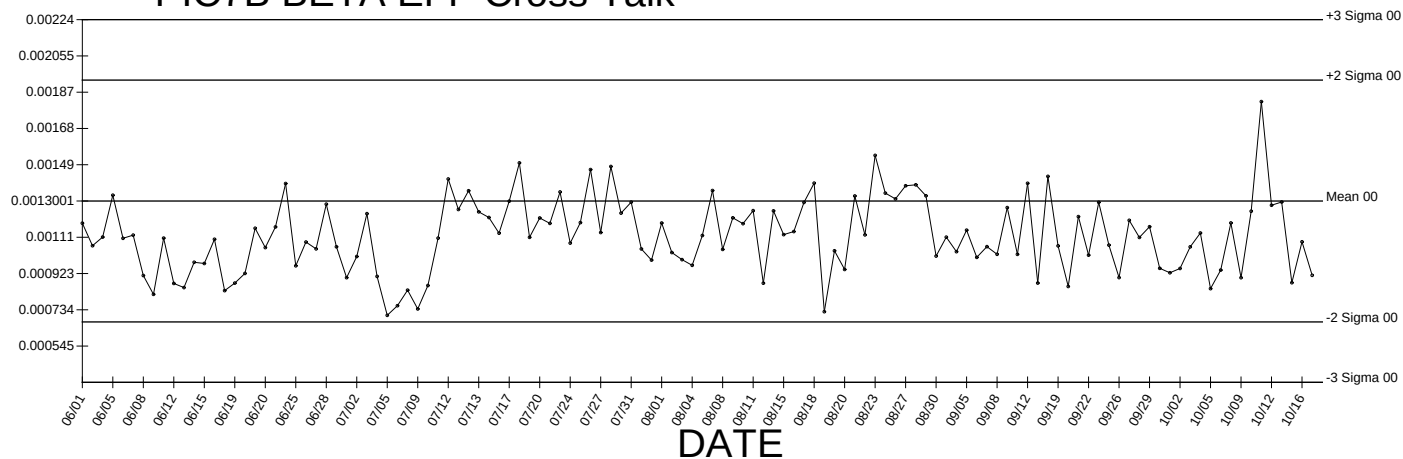
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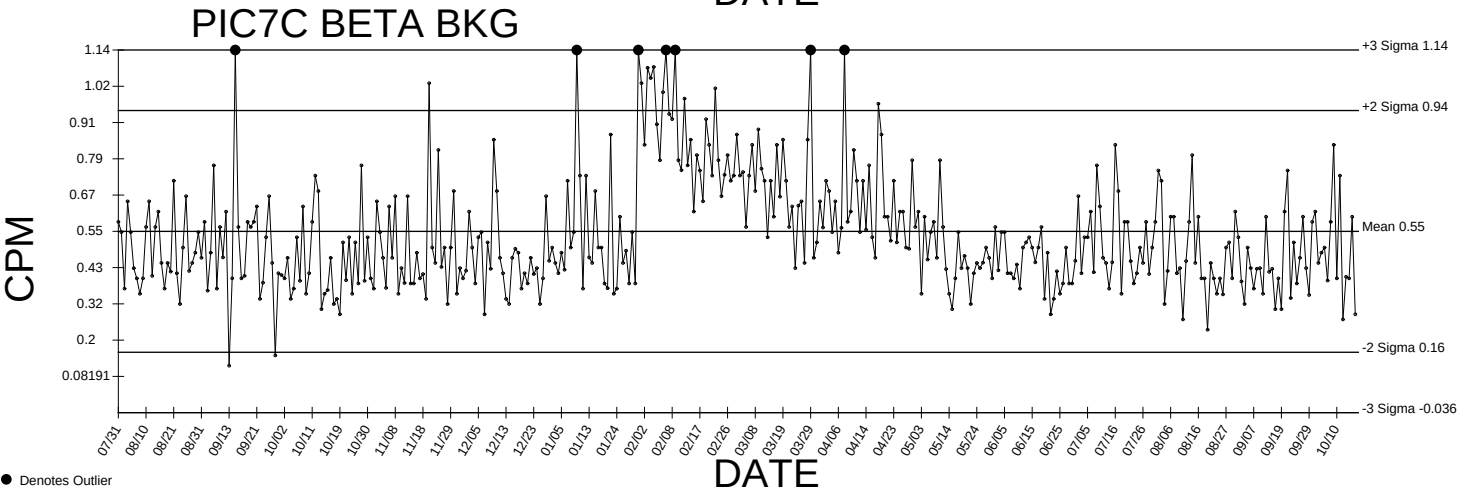
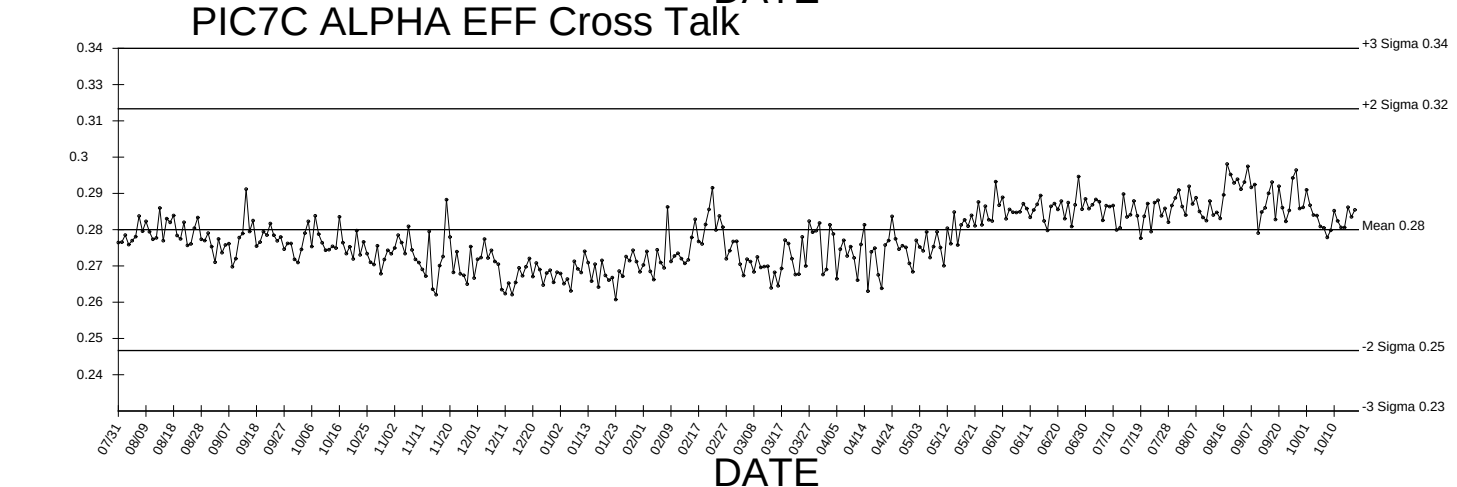
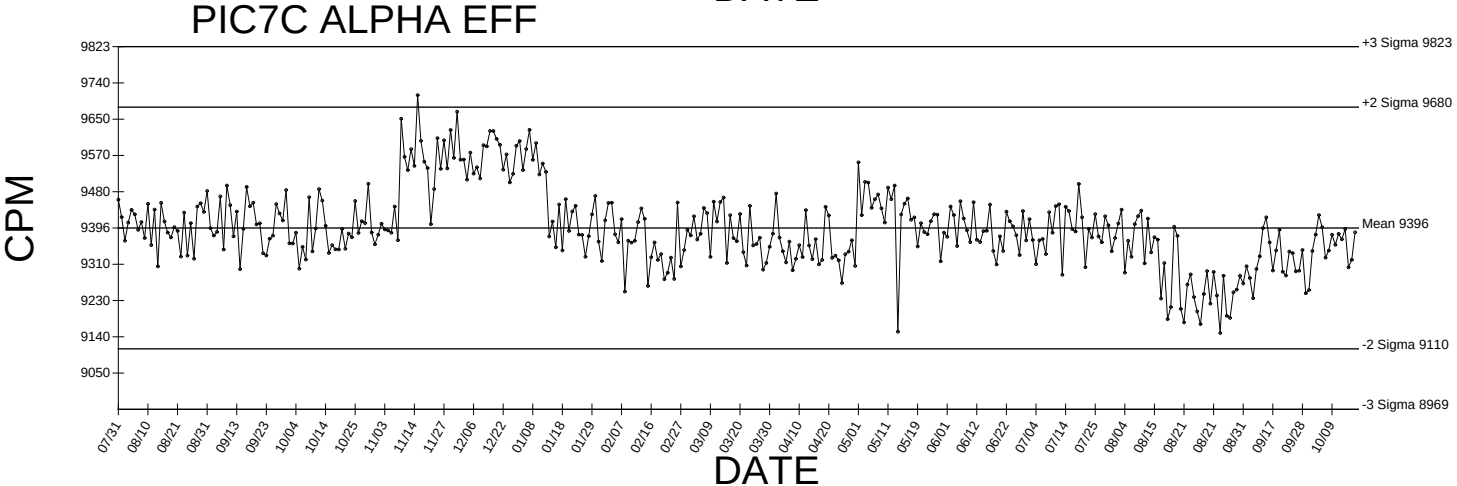
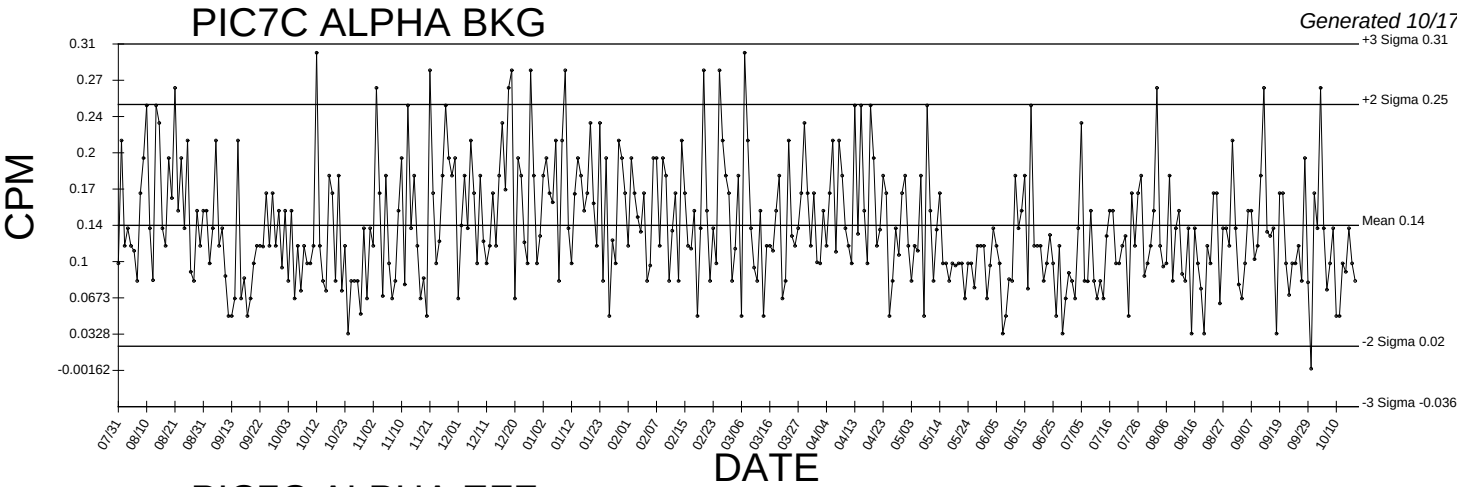
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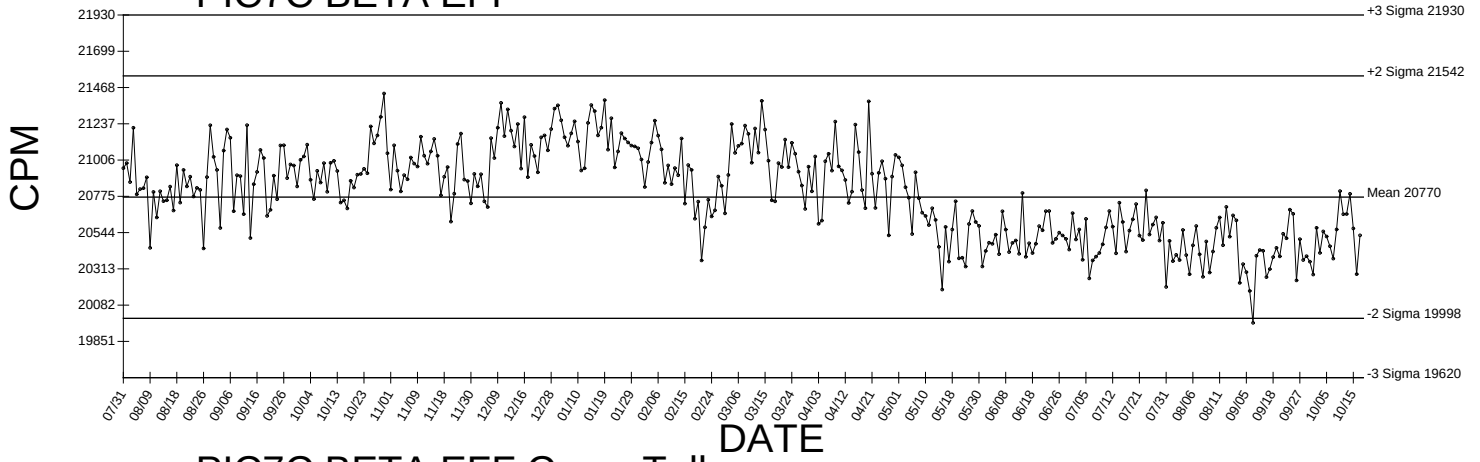


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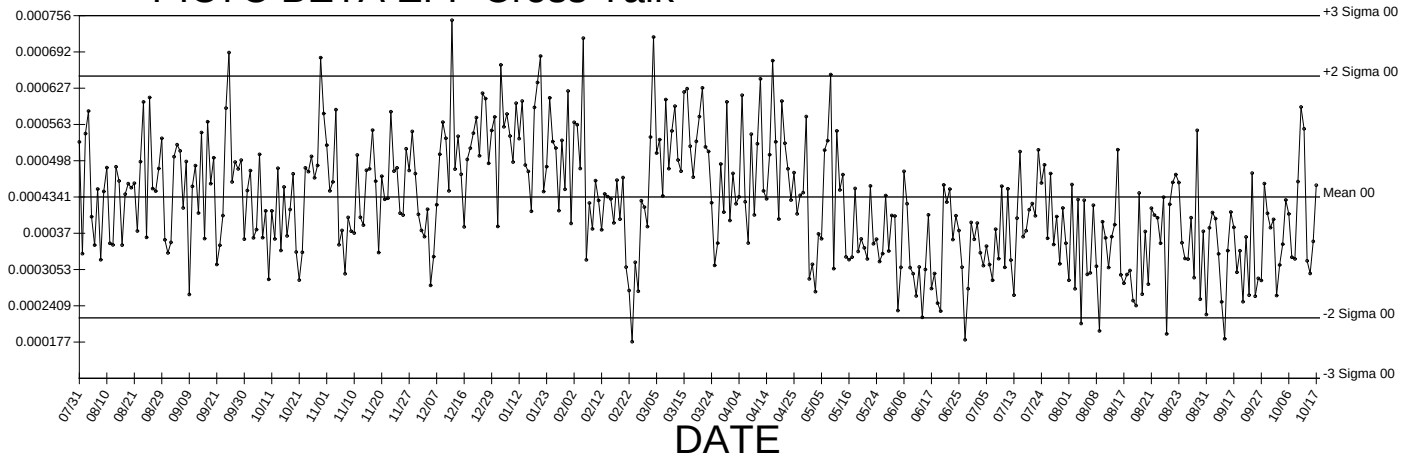


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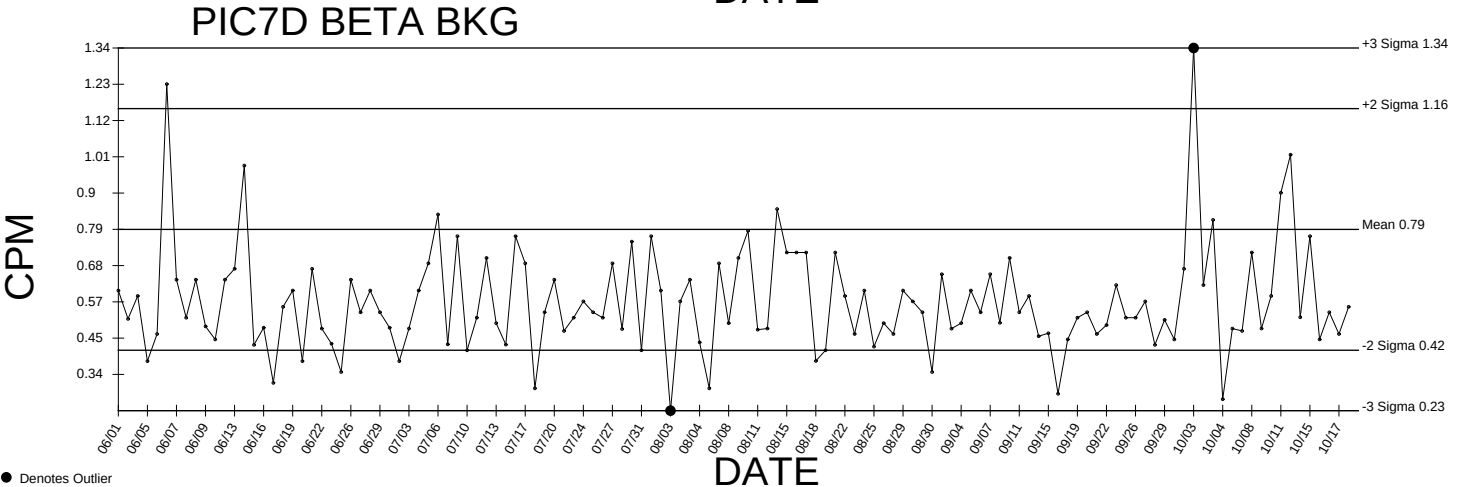
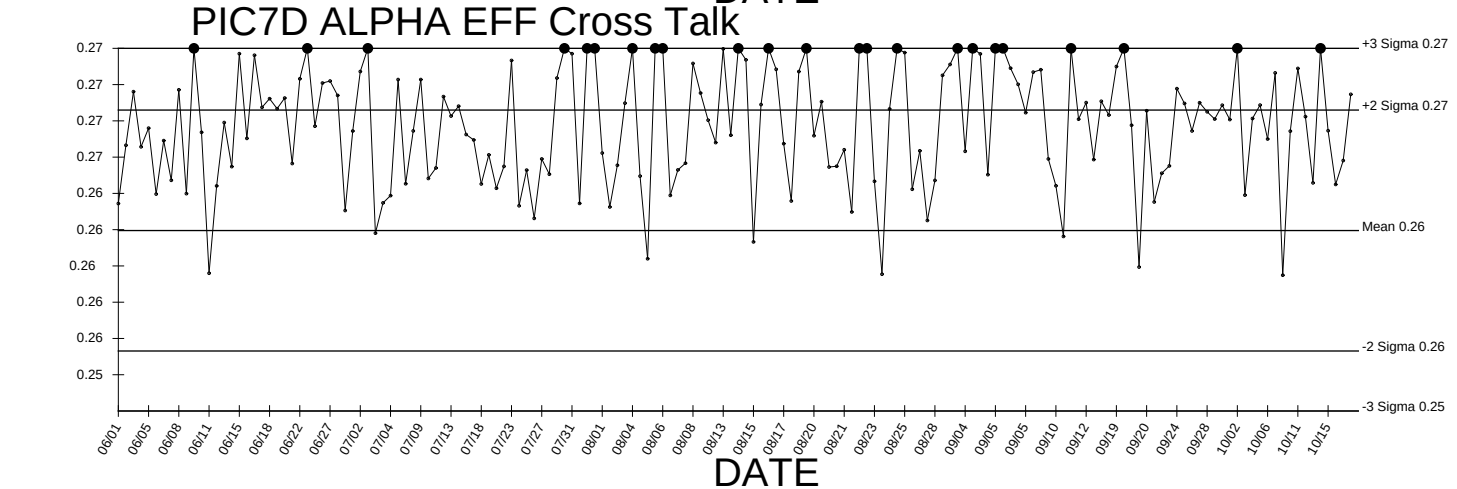
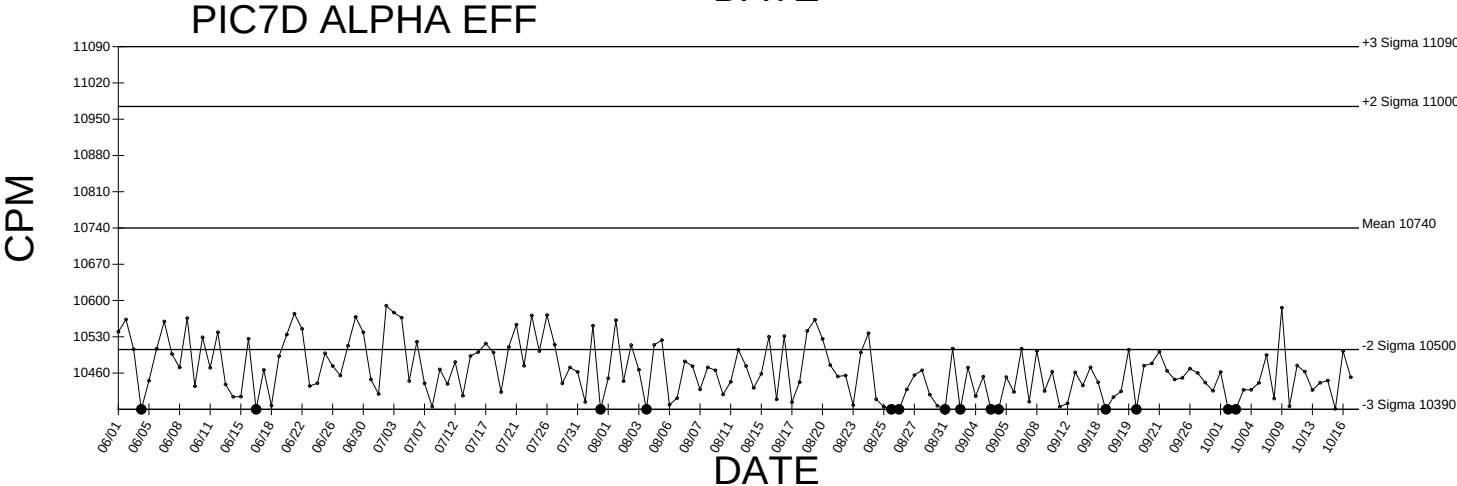
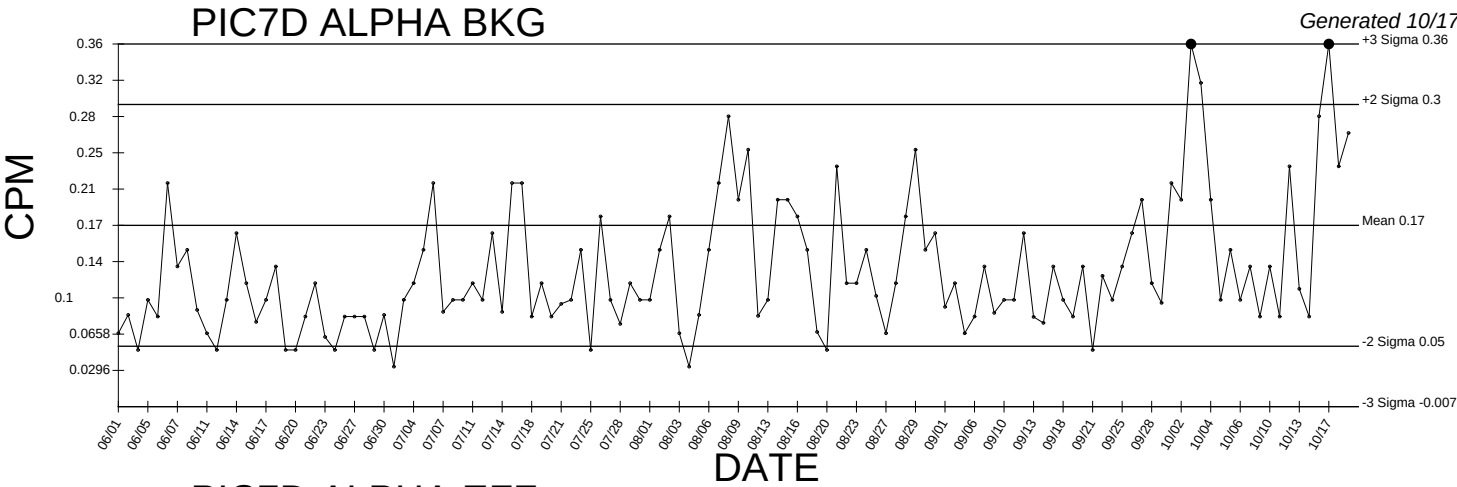
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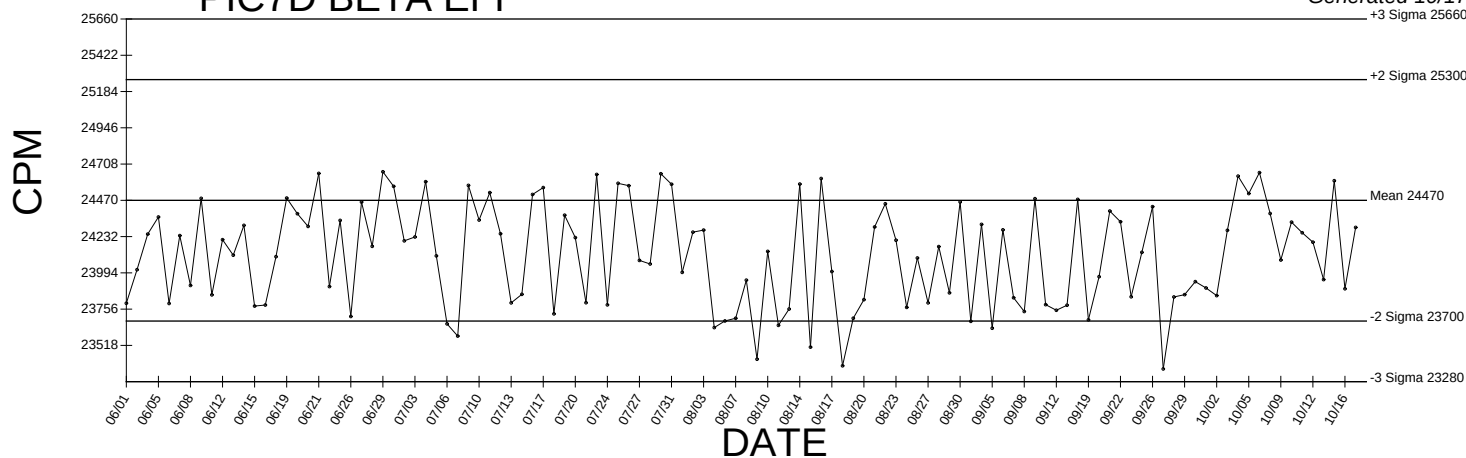
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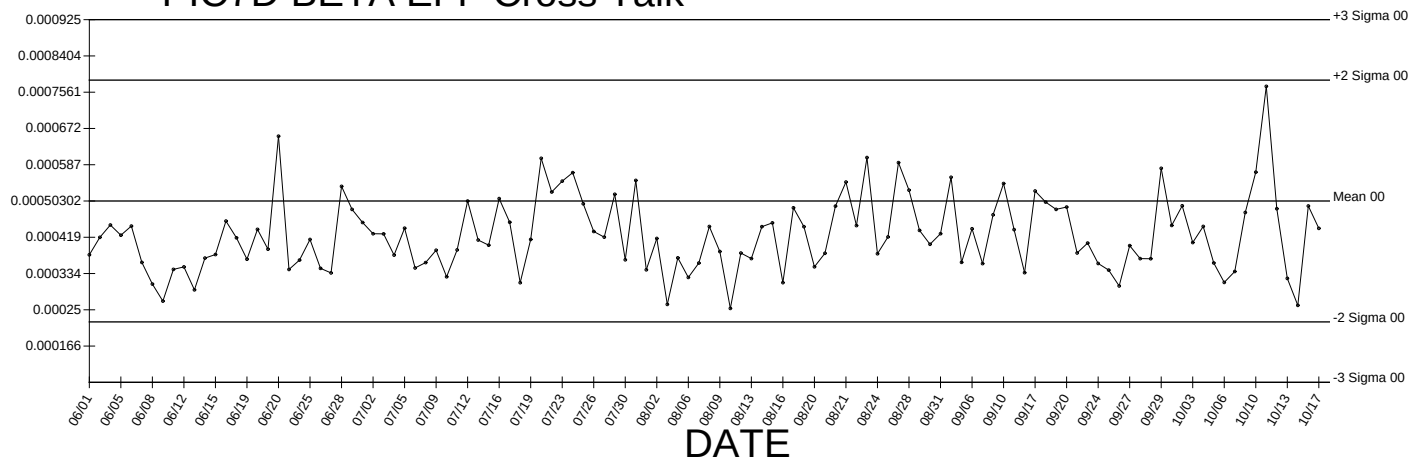
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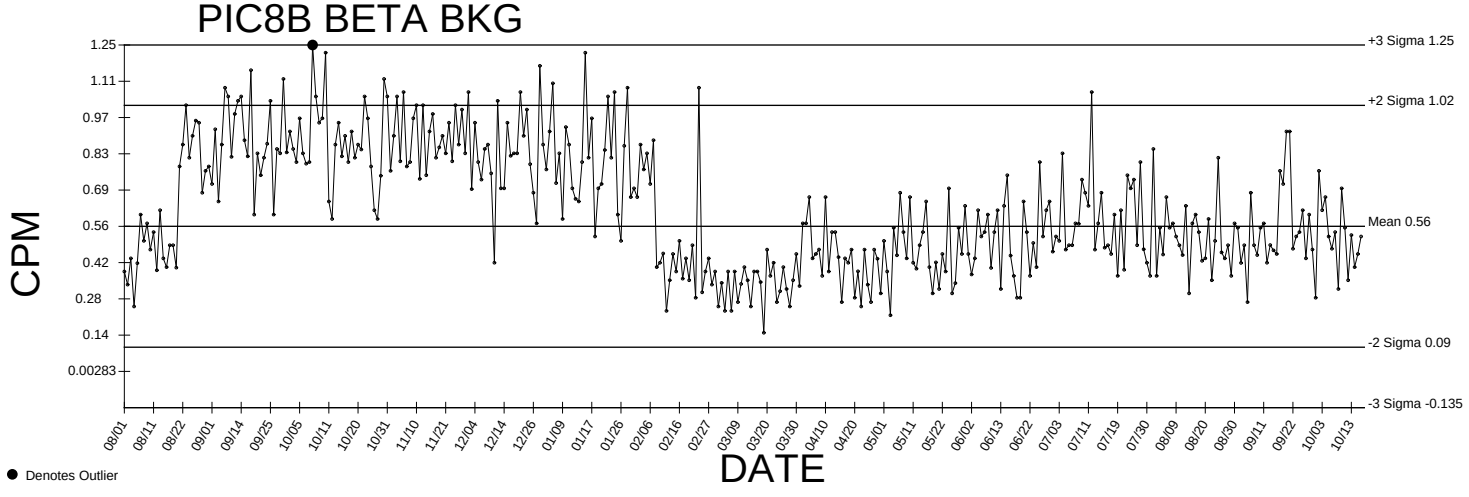
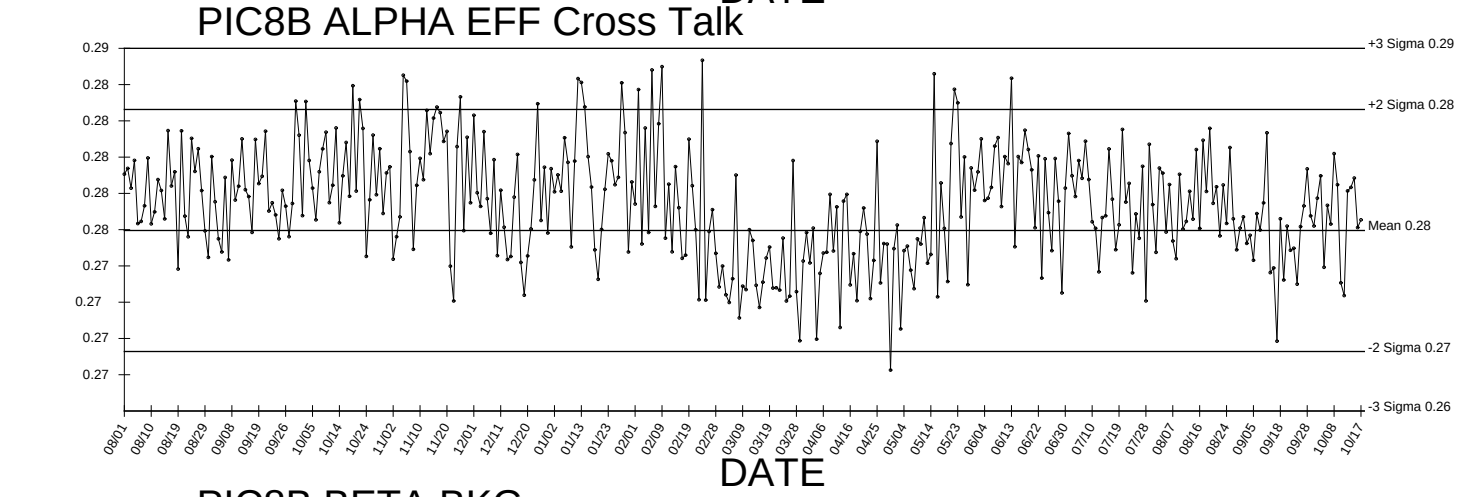
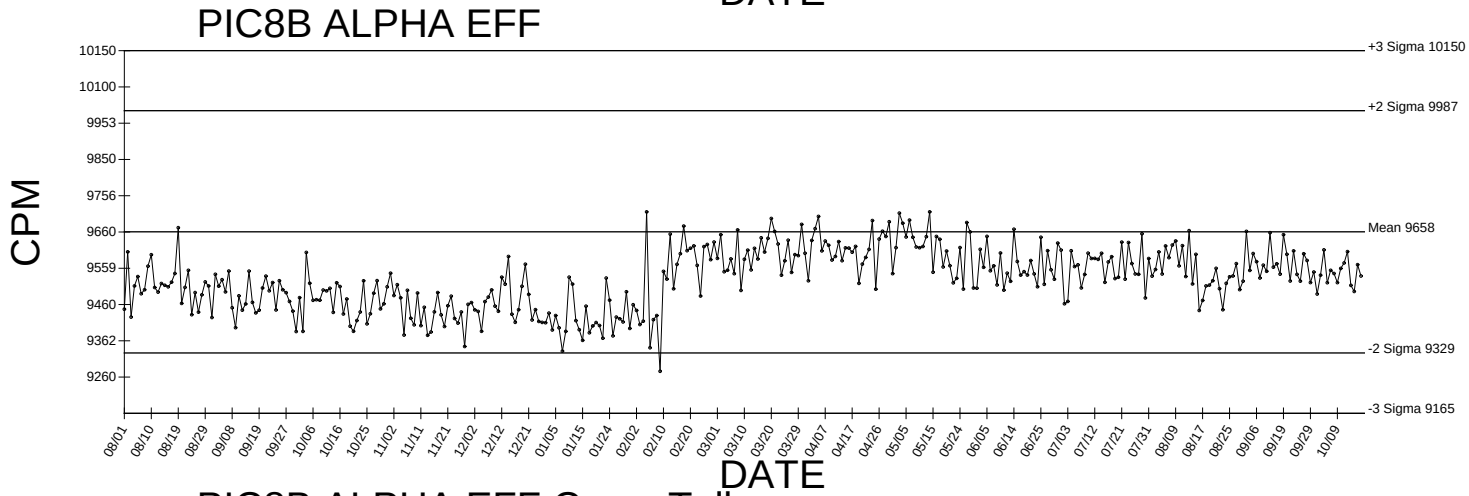
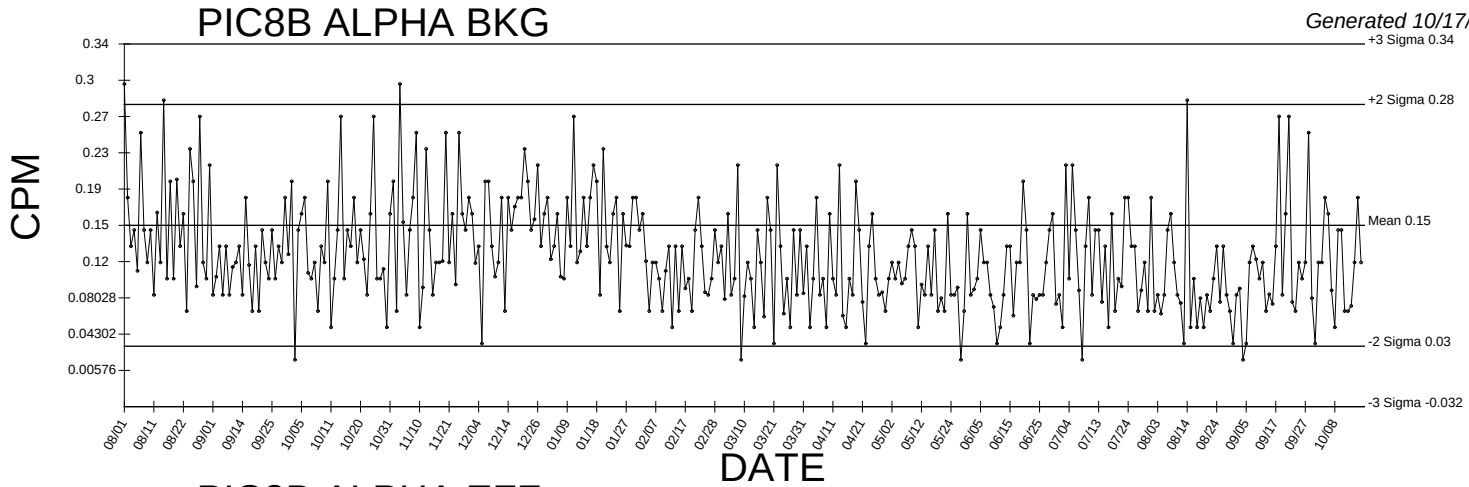
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PIC7D BETA EFF Cross Talk

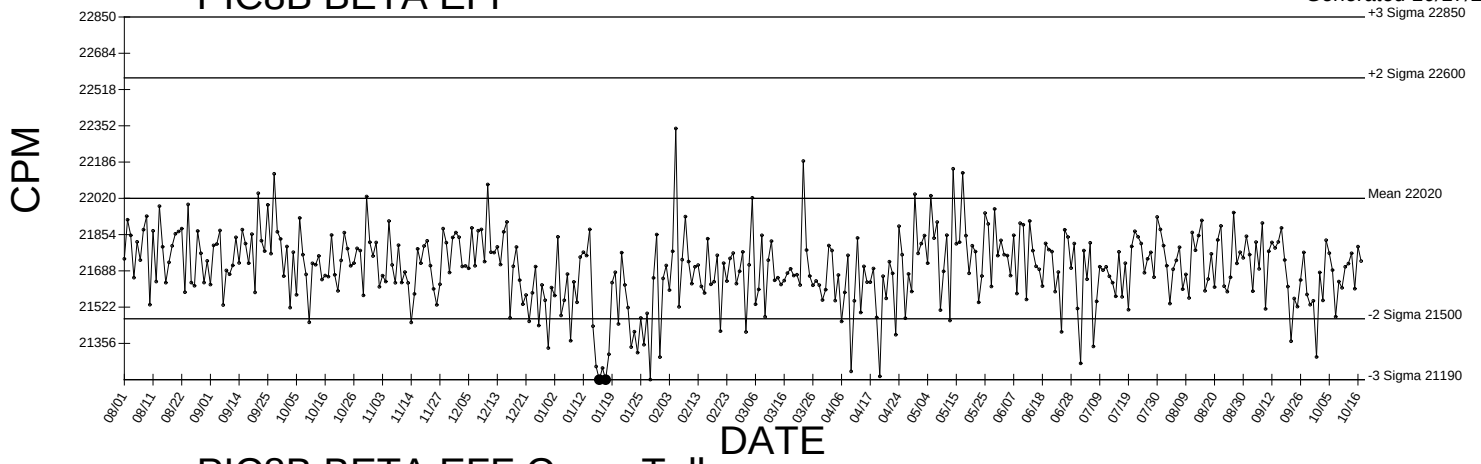


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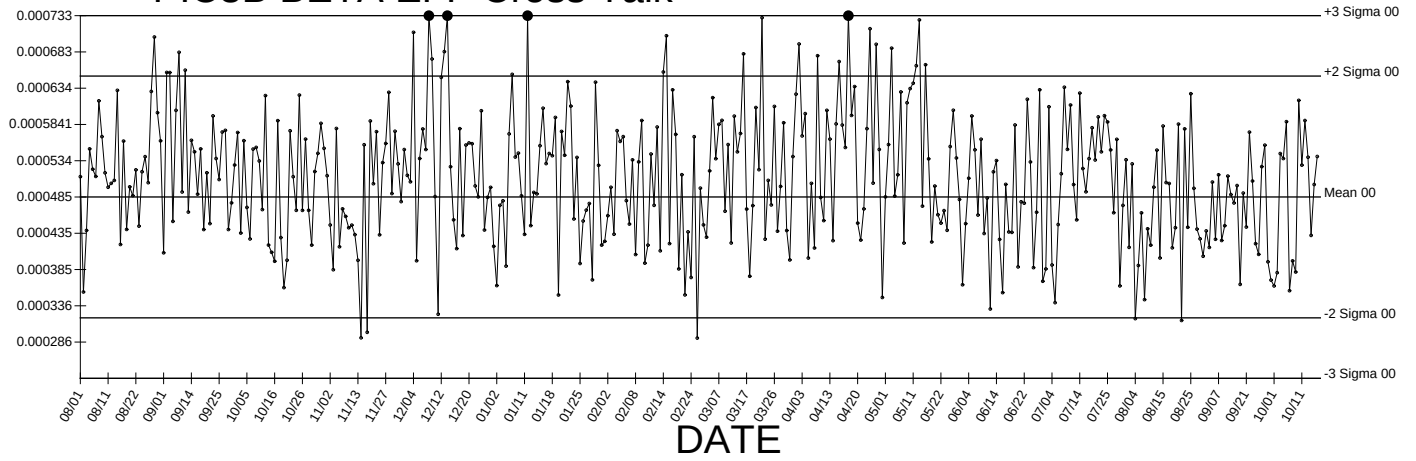


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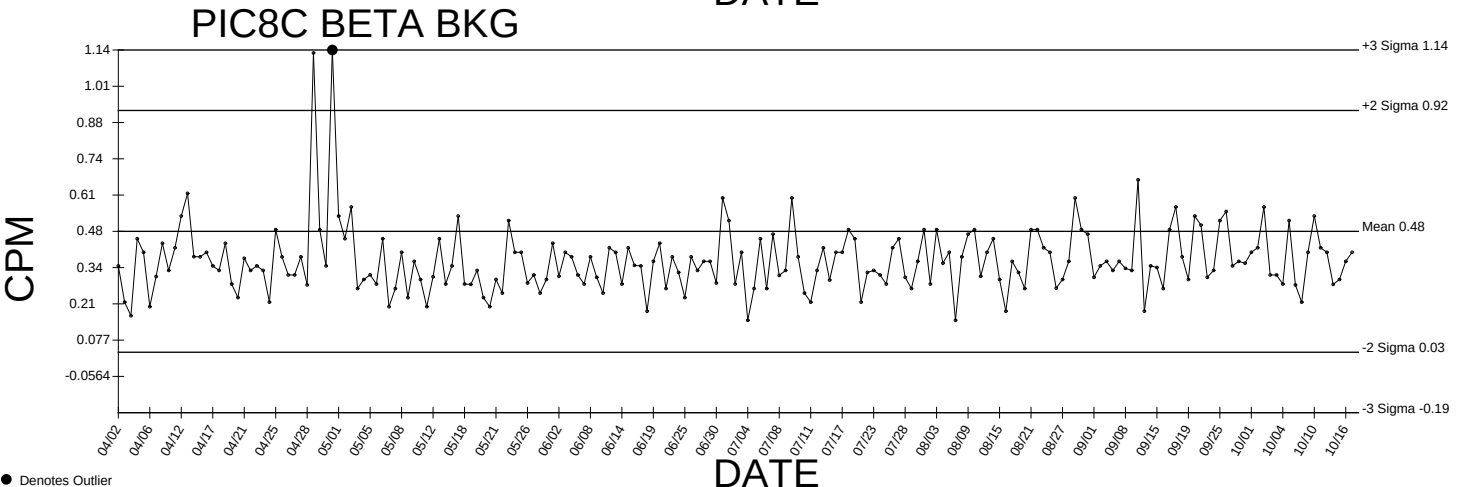
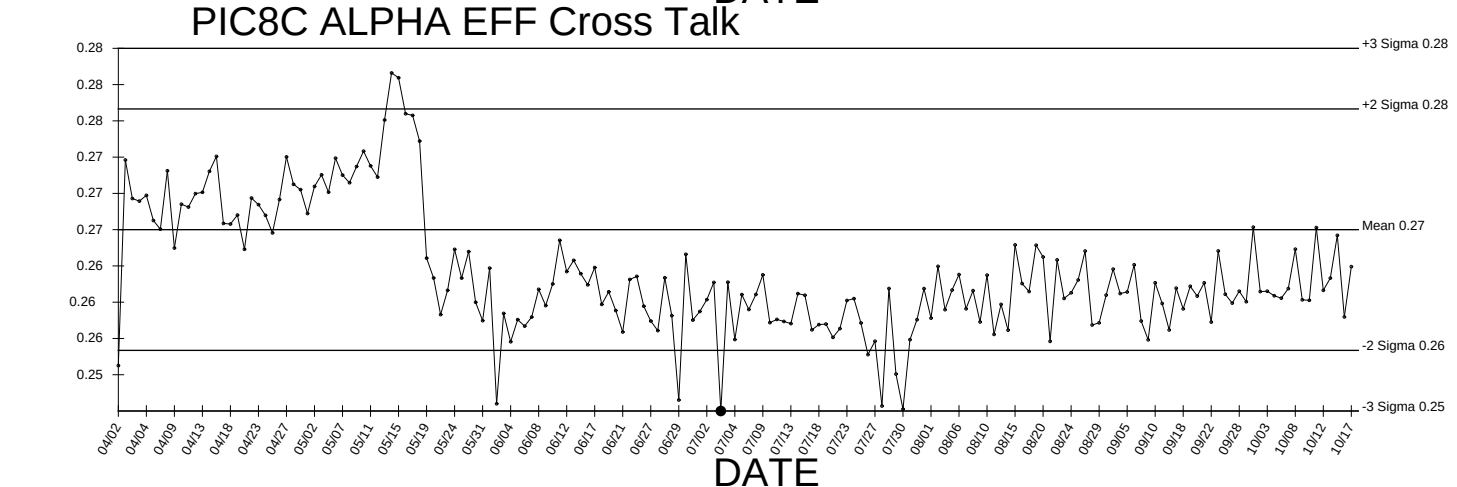
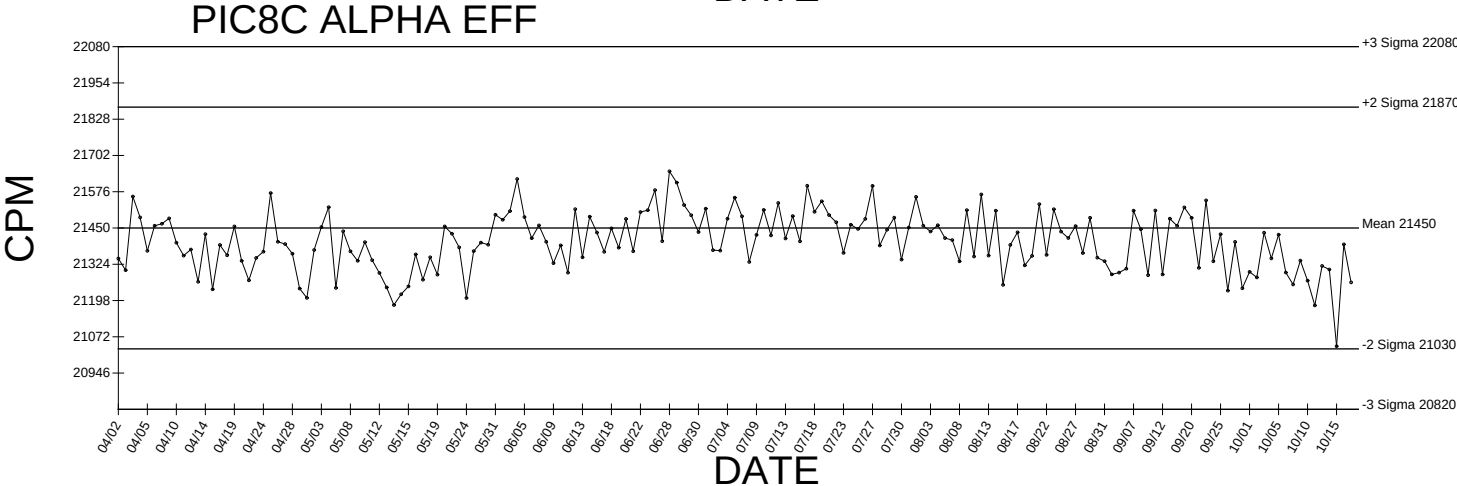
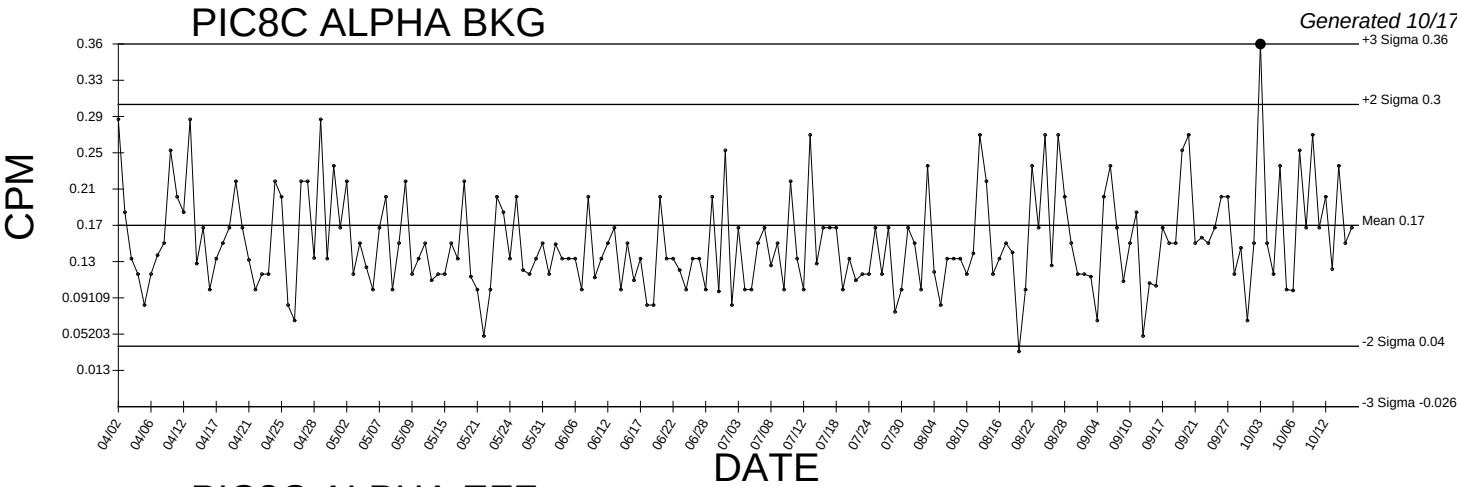
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PIC8B BETA EFF Cross Talk



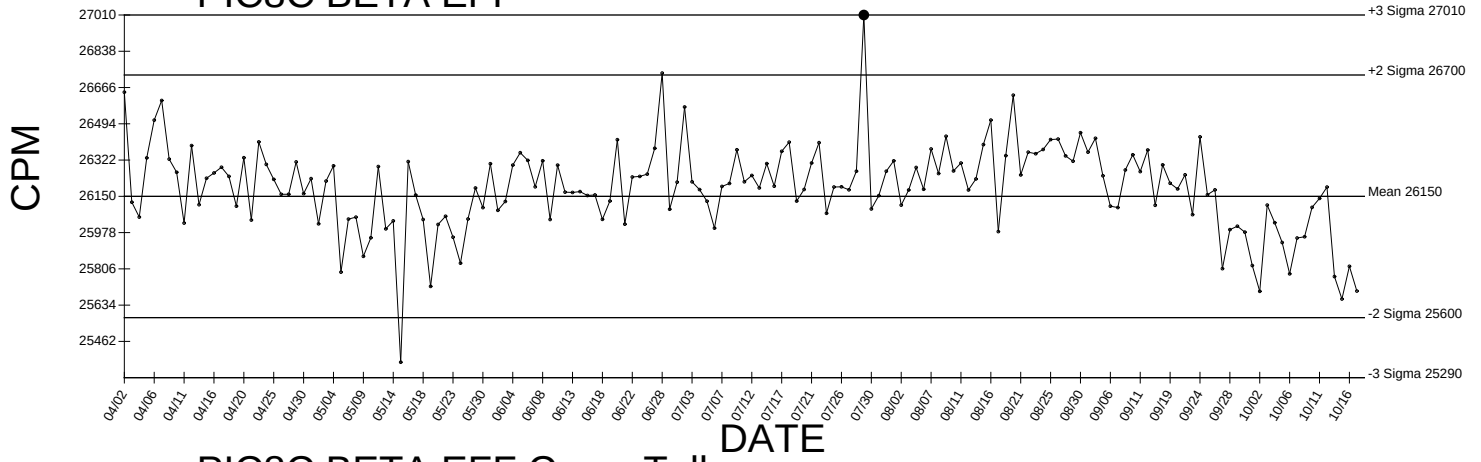
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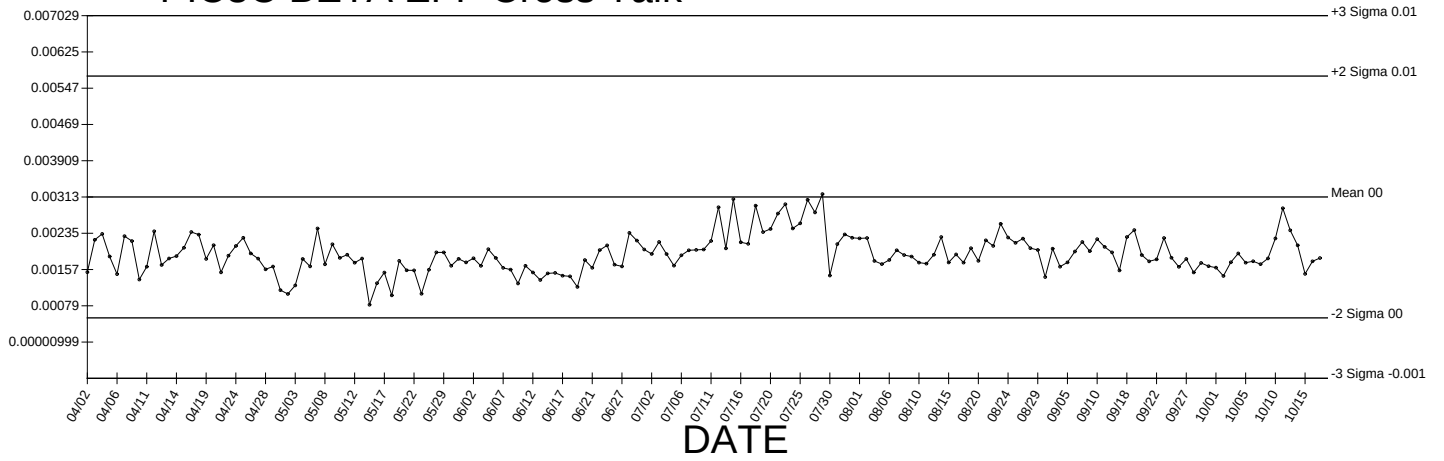
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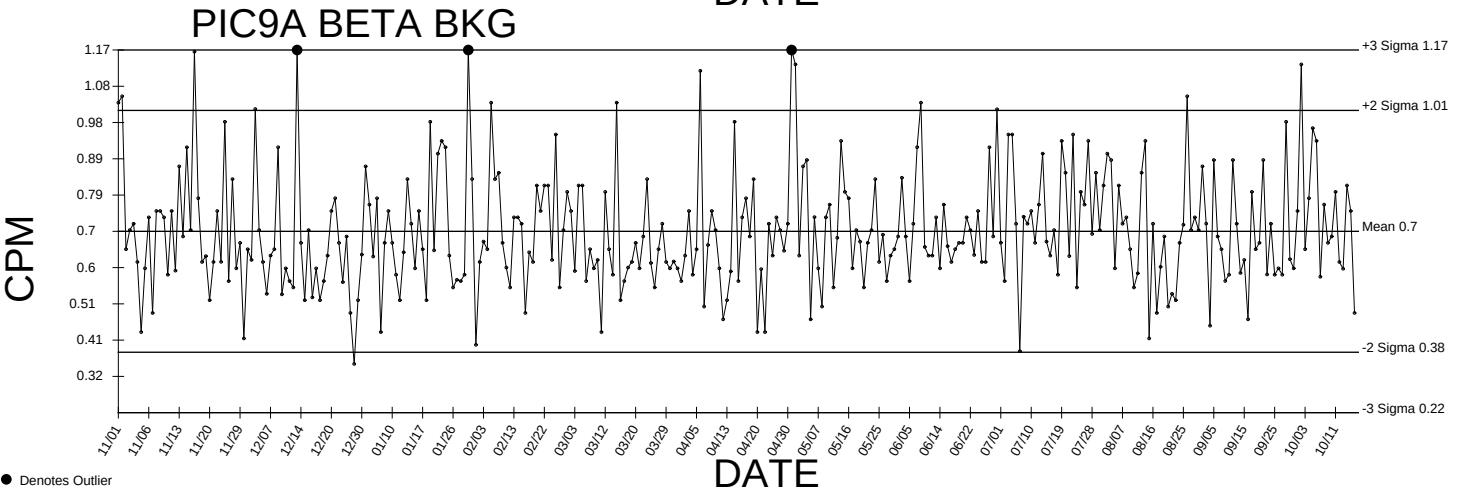
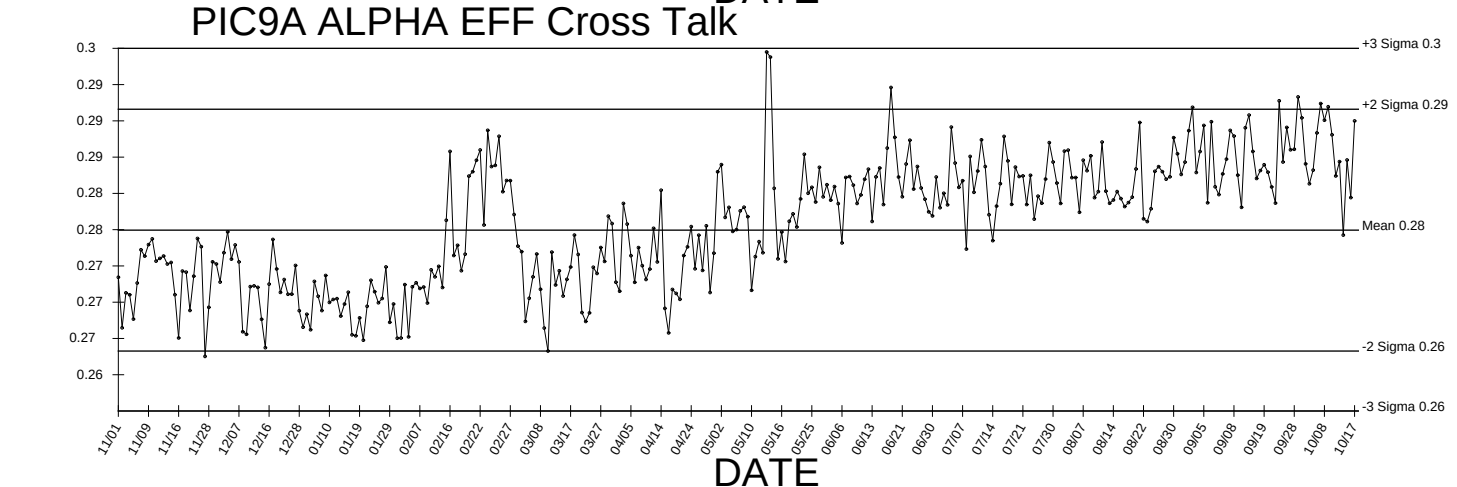
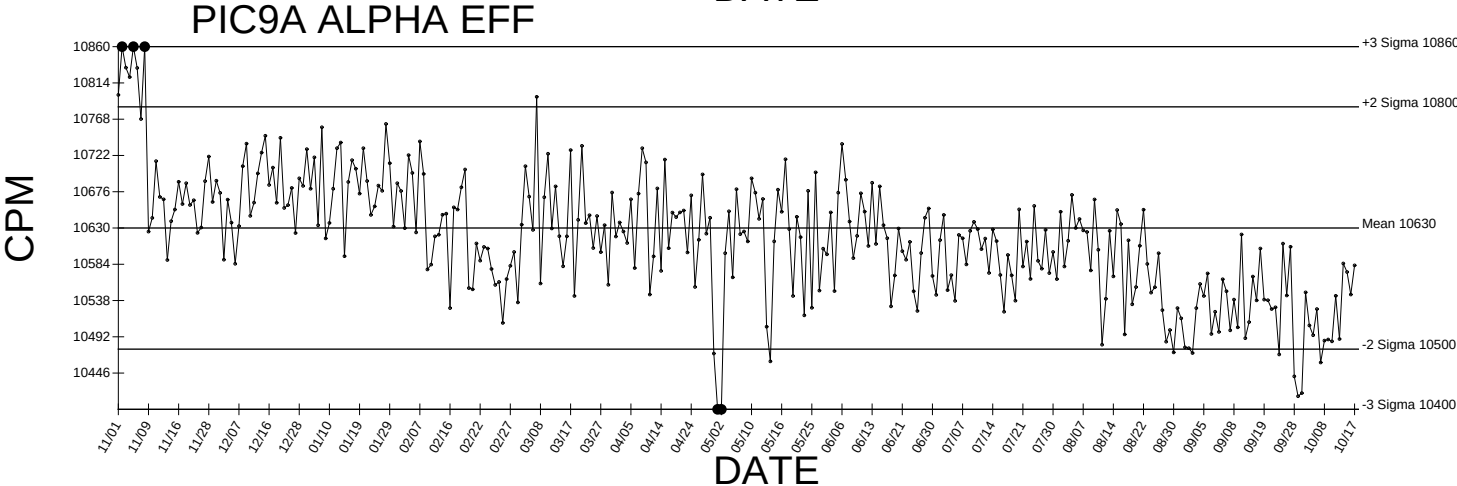
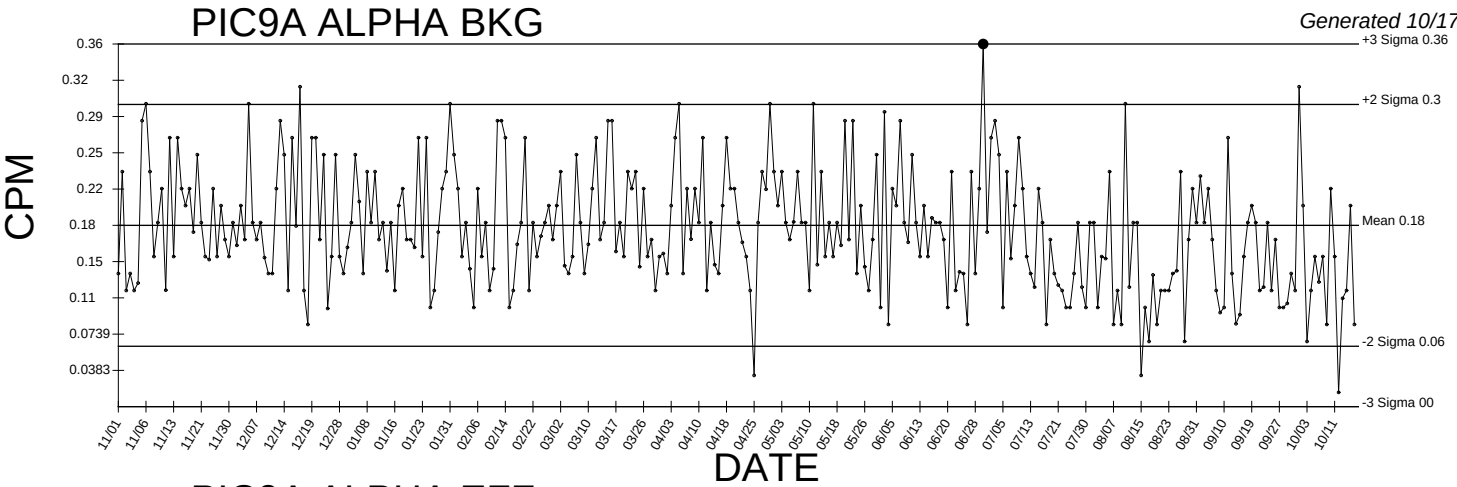
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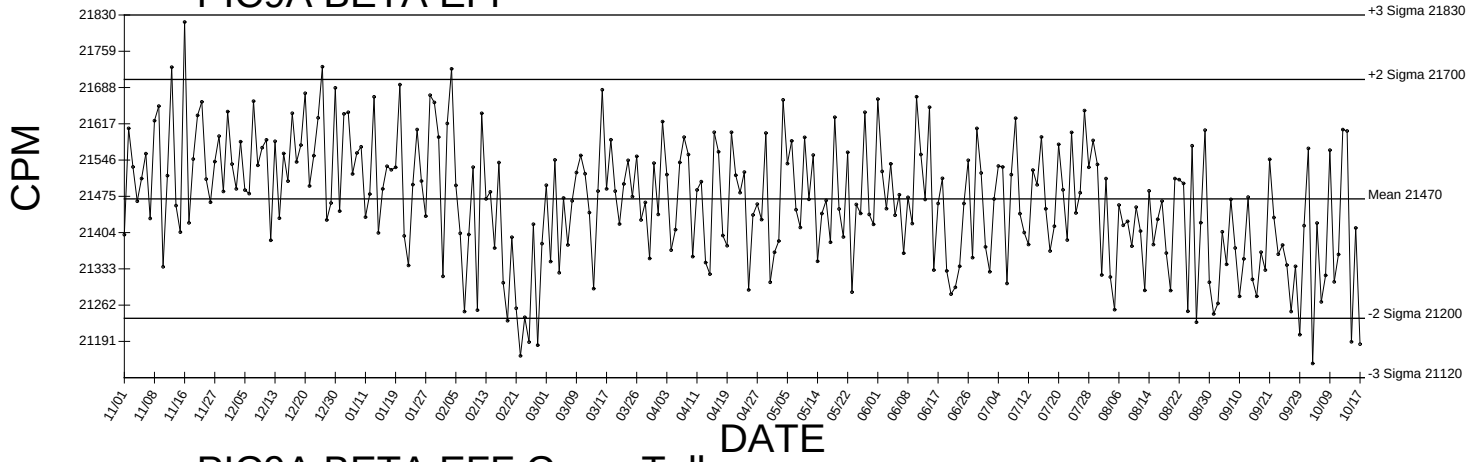
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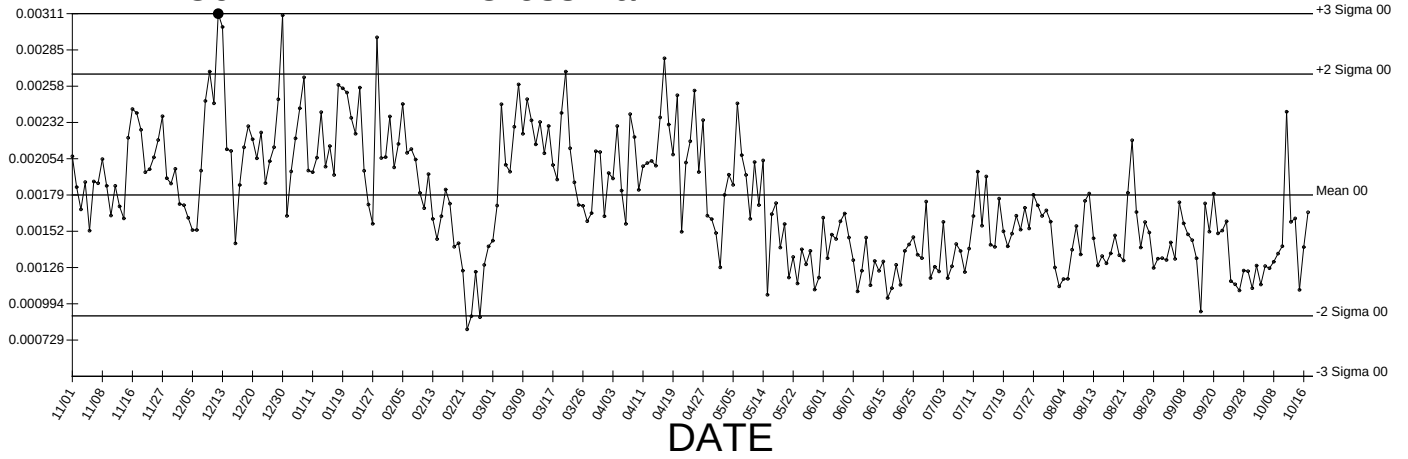
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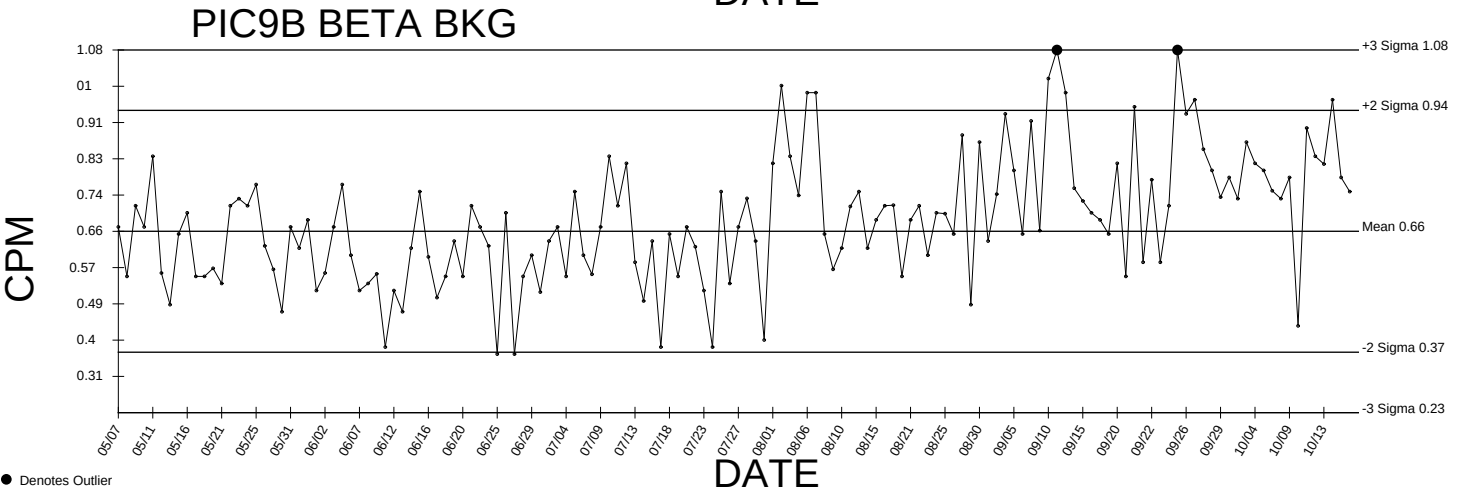
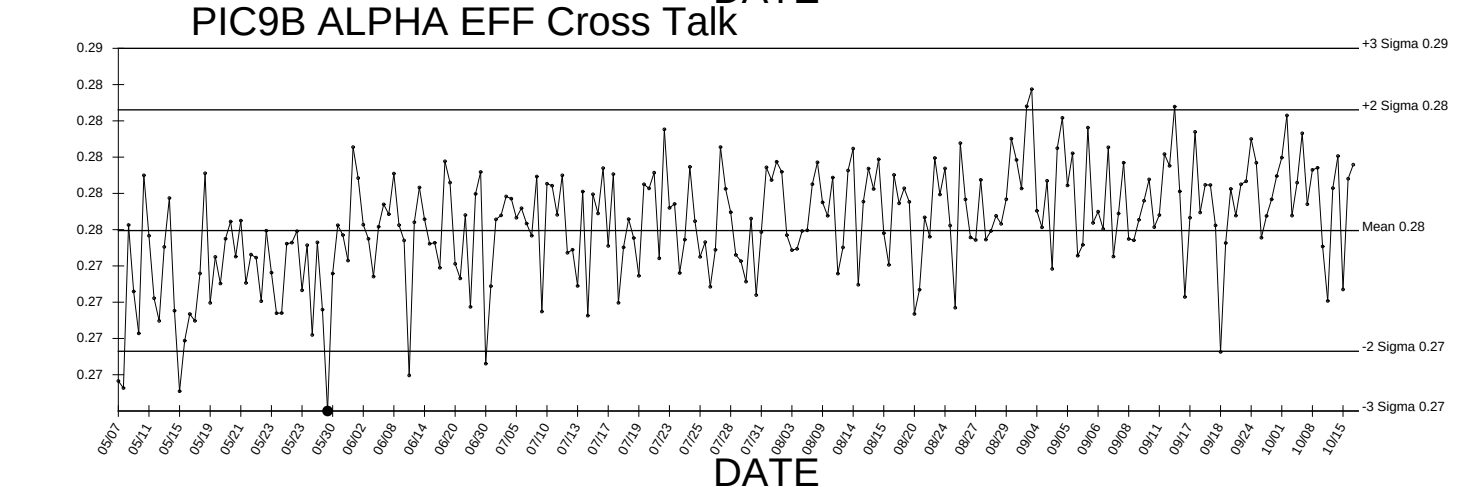
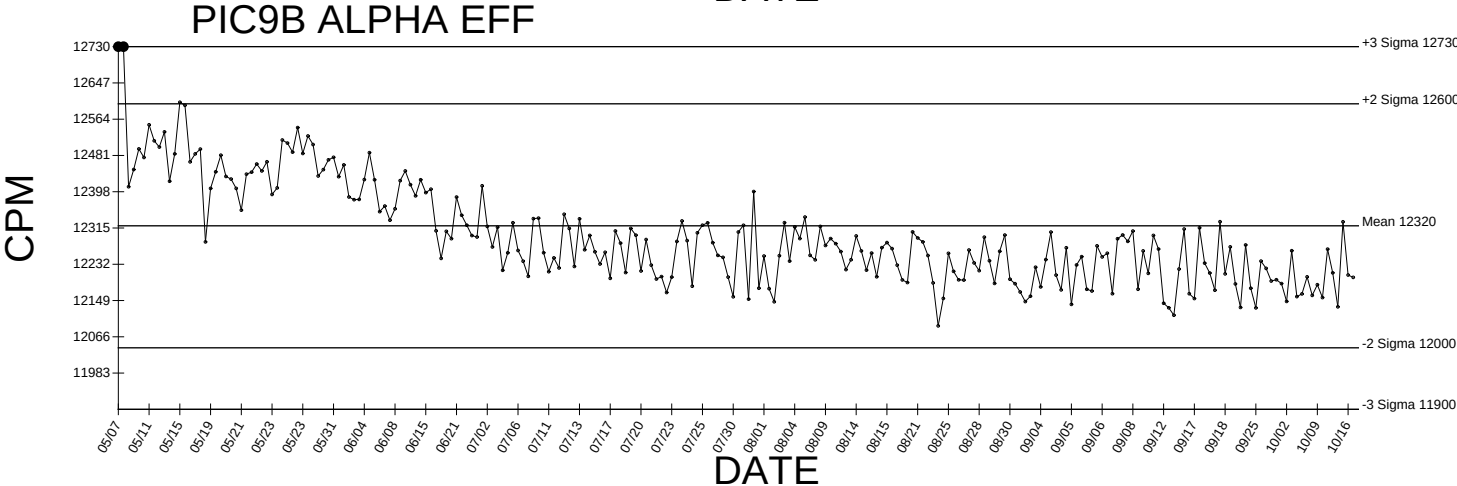
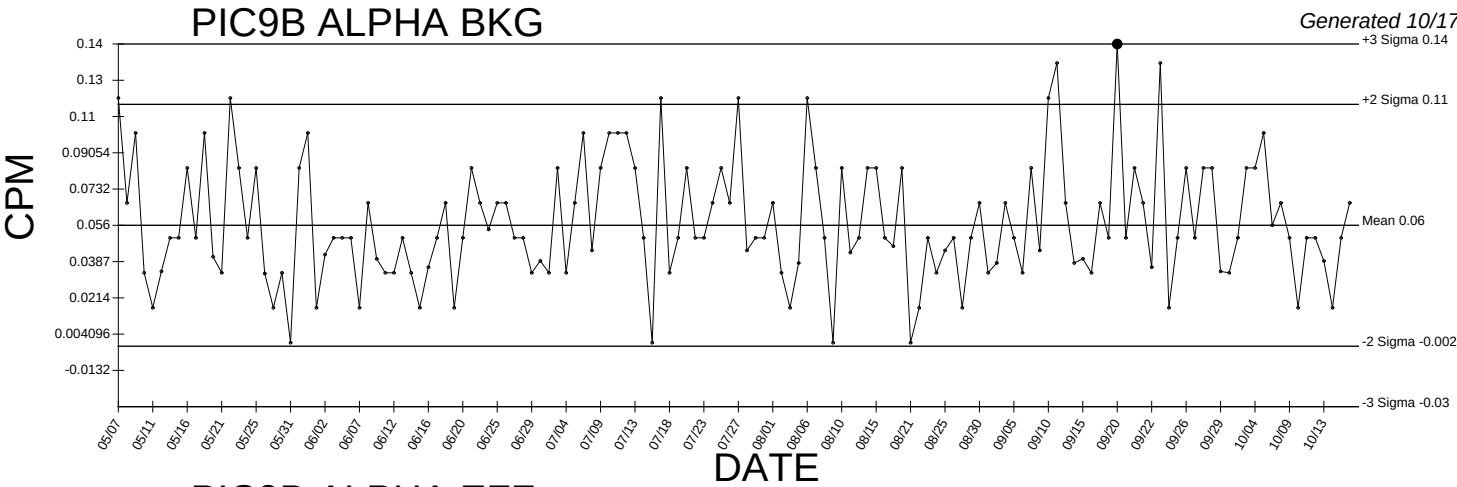
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PIC9A BETA EFF Cross Talk



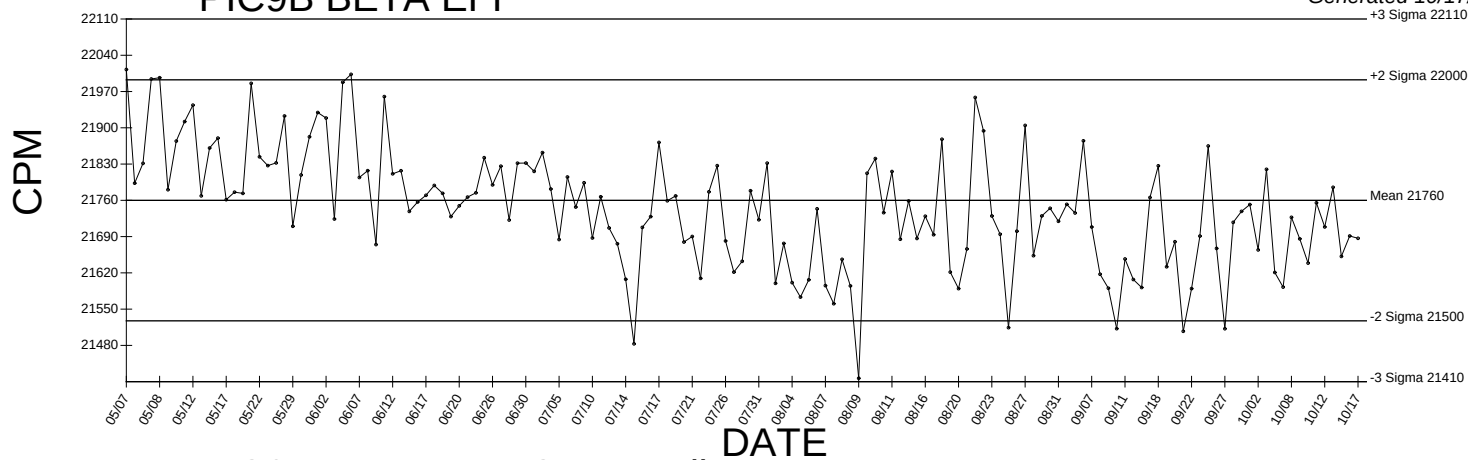
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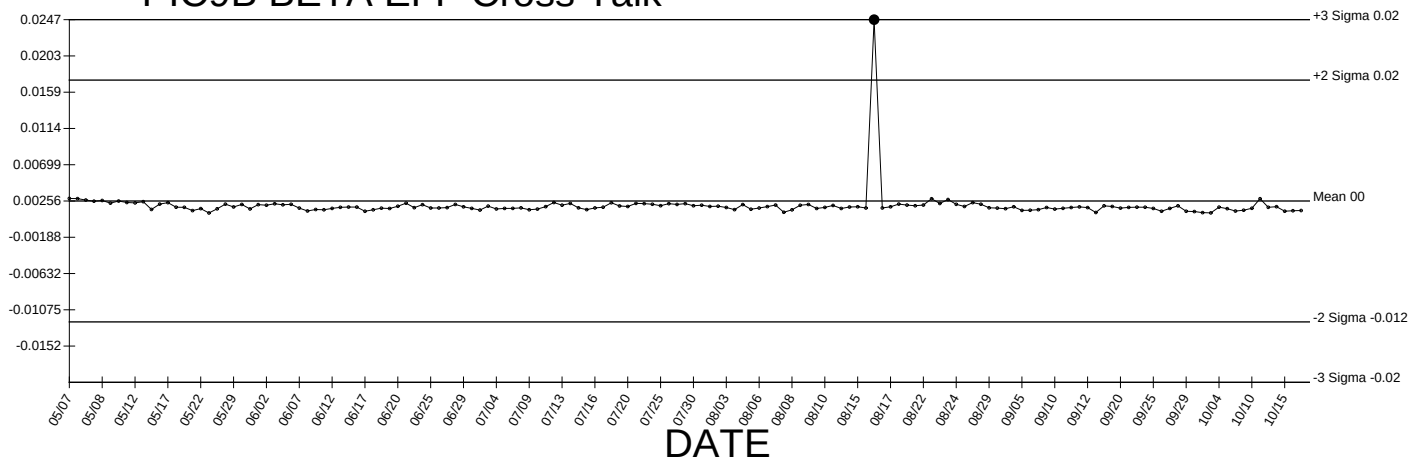
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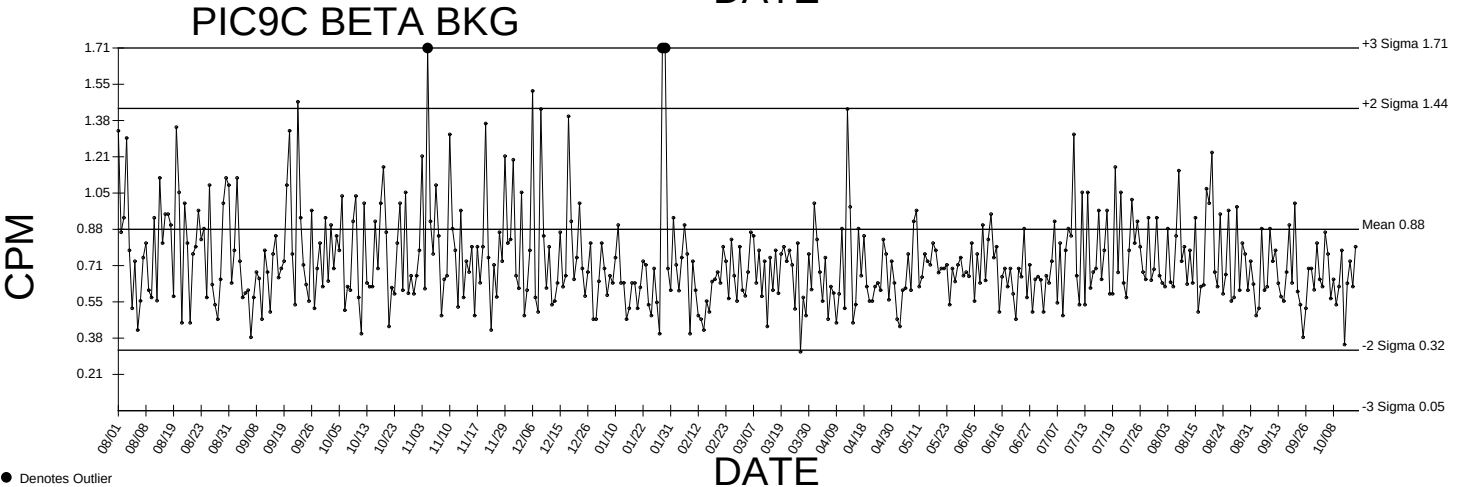
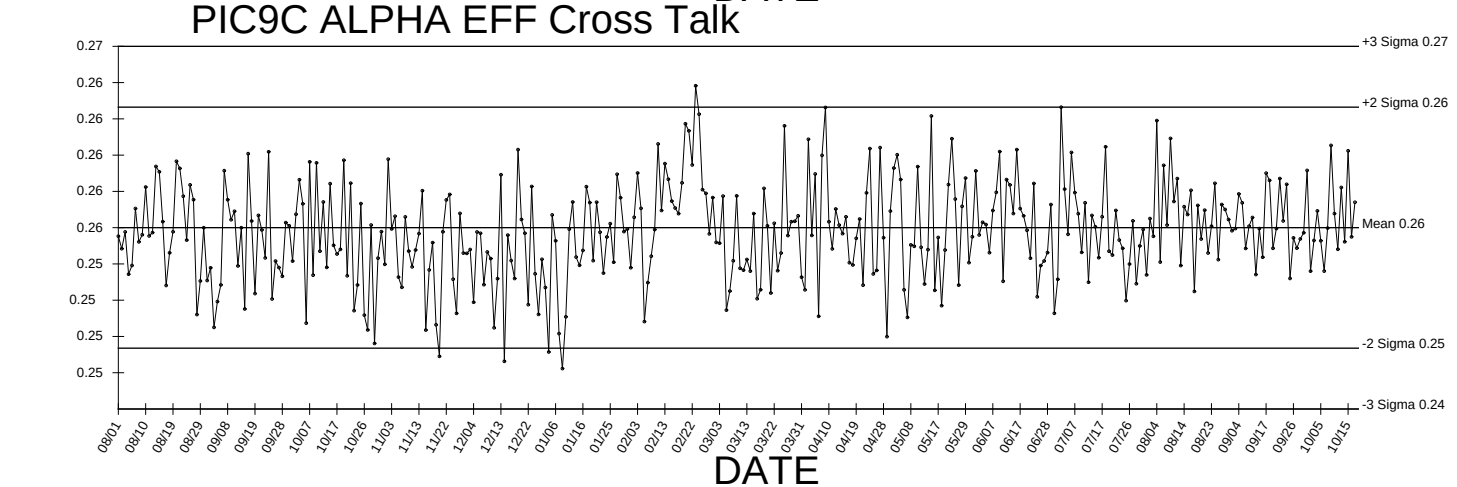
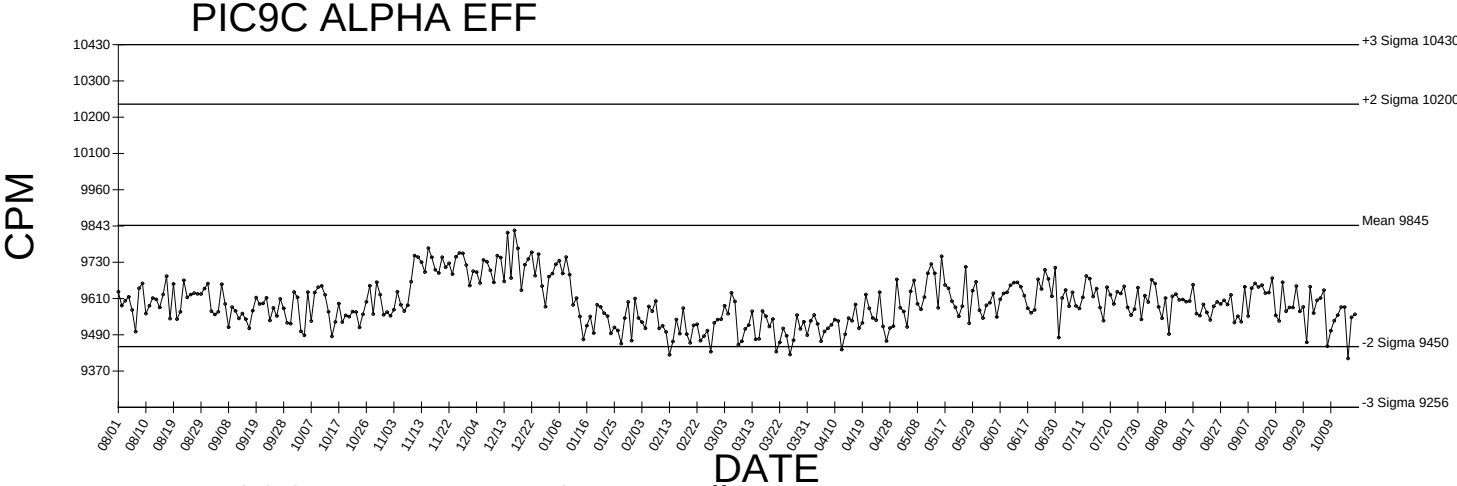
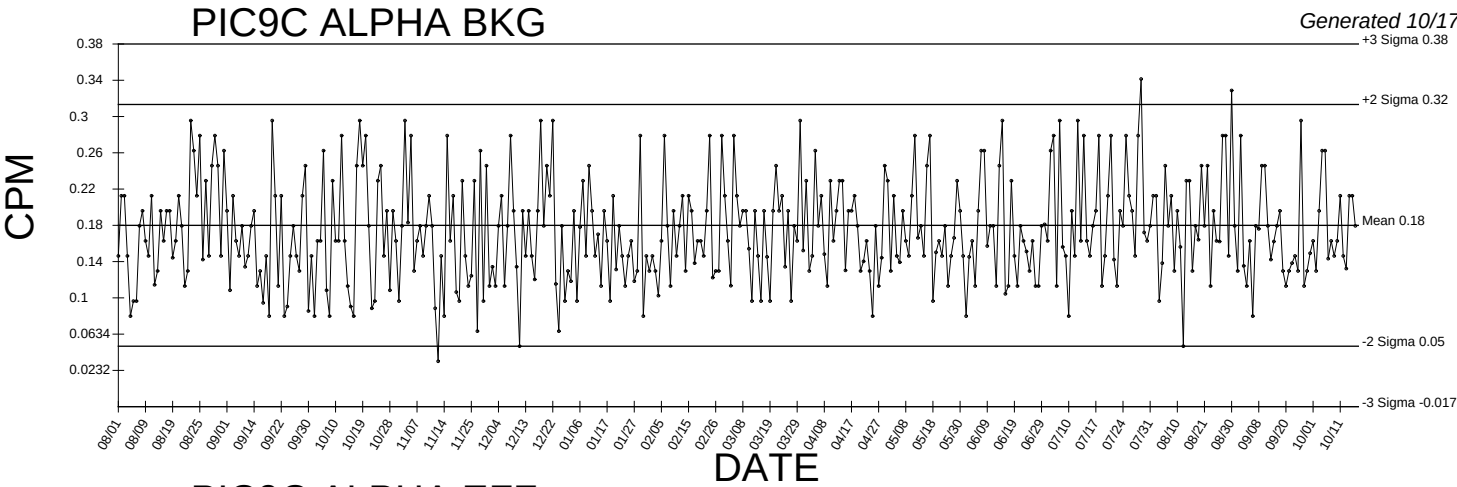
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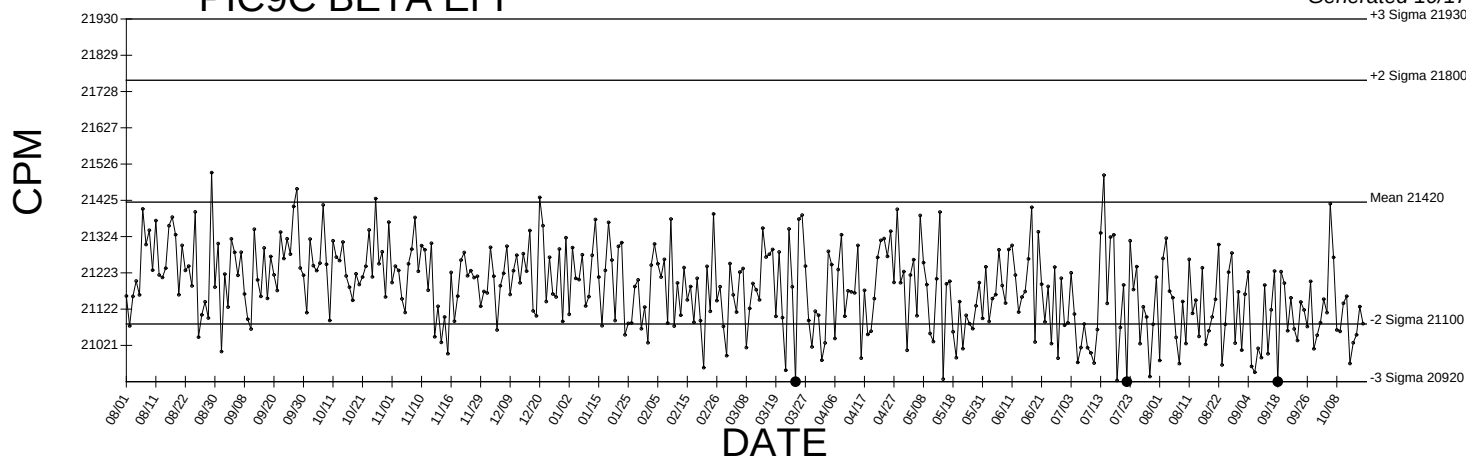
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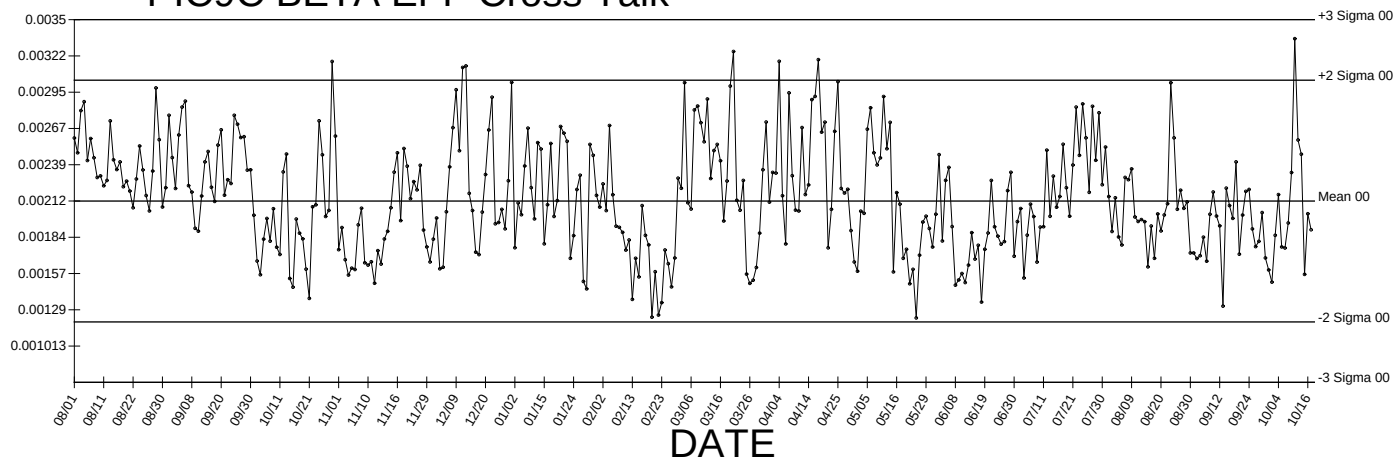
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PIC9C BETA EFF

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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 ± 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 4πγ ionization chamber. A calibrated using a barium-133 solution whose activity was determined by 4π(ε+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, $u_c(y)/y$, (%)				0.26
Coverage Factor, k				$\times 2$
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 [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 (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	6930.75	4490.11
2	3622.28	0.818570	4426.63	4628.58
3	3625.44	0.818570	4431.90	4431.90

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 15 mL scintillation 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 LSCELEUE 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



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 ⁻¹ ^{1b)}
Alpha-emitting impurities	²³² Th: < 0.08 Bq g ⁻¹ ^{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 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 (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
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	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/grp04/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	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 is stable

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1810350

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
461024001	SAMPLE	JXC9	PIC6A	OCT-17-18 09:37:31	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032001	SAMPLE	JXC9	PIC6B	OCT-17-18 09:37:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032002	SAMPLE	JXC9	PIC6C	OCT-17-18 09:37:42	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032003	SAMPLE	JXC9	PIC7A	OCT-17-18 09:37:52	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032004	SAMPLE	JXC9	PIC7B	OCT-17-18 09:37:58	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032005	SAMPLE	JXC9	PIC7C	OCT-17-18 09:38:03	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032006	SAMPLE	JXC9	PIC7D	OCT-17-18 09:38:09	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032007	SAMPLE	JXC9	PIC8B	OCT-17-18 09:38:14	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032008	SAMPLE	JXC9	PIC8C	OCT-17-18 09:38:19	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032009	SAMPLE	JXC9	PIC9A	OCT-17-18 09:38:26	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032010	SAMPLE	JXC9	PIC9B	OCT-17-18 09:38:33	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461032011	SAMPLE	JXC9	PIC9C	OCT-17-18 09:38:39	DONE	CeF on 25mm Filter	01-JUN-17 00:00
461045001	SAMPLE	JXC9	PIC9D	OCT-17-18 09:38:47	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204131260	MB	JXC9	PIC10A	OCT-17-18 09:40:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204131261	DUP	JXC9	PIC10B	OCT-17-18 09:40:49	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204131262	LCS	JXC9	PIC10C	OCT-17-18 09:40:54	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1810045 Check-list

This check-list was completed on 11-OCT-18 by Elizabeth Krouse

This batch was reviewed by Elizabeth Krouse on 11-OCT-18 and Lyndsey Pace on 11-OCT-18.

Batch ID:
1810045

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

08-OCT-18

GEL Laboratory, Radiochemistry Division

Batch #: 1810045 Analyst: PCW First Client Due Date: 11/02/2018 Internal Due Date: 10/29/2018
 Spike Isotope: Radium-226 Spike Code: 17 S 2 Expiration Date: 12/31/18 Vol: 2 End Initial/Degas Date/Time: 10/18/18 12:00
 LCS Isotope: Radium-226 LCS Code: 17 C 2 Expiration Date: 12/31/18 Vol: 1 End LN De-em Date: 10/18/18
 Bkg Count Time: 30 (Min) Sample Count Time: 30 (Min) Start Count Date: 10/10/18
 Prep Date: 10/18/18 Pipet ID: 226 (55) Balance ID: 1253-253 Initials: PCW Witness: J/P

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
461032001-1	MSW-6	SAMPLE		WATER	1 pCi/L	LANC001	1	5.00	0335	0635	108	1	2	196
461032002-1	MSW-6	SAMPLE		WATER	1 pCi/L	LANC001	2	5.00	0335	0635	208	2	2	123
461032003-1	MSW-9	SAMPLE		WATER	1 pCi/L	LANC001	3	5.00	0335	0635	302	3	1	46
461032004-1	MSW-7	SAMPLE		WATER	1 pCi/L	LANC001	4	5.00	0335	0635	401	4	2	319
461032005-1	MSW-8	SAMPLE		WATER	1 pCi/L	LANC001	5	5.00	0335	0635	504	5	5	1650
461032006-1	FE-20181001	SAMPLE		WATER	1 pCi/L	LANC001	6	5.00	0335	0635	601	6	2	6
461032007-1	FE-20181002	SAMPLE		WATER	1 pCi/L	LANC001	7	5.00	0335	0635	707	7	3	5
461032008-1	SW-1	SAMPLE		WATER	1 pCi/L	LANC001	8	5.00	0335	0635	803	8	4	153
461032009-1	SW-2	SAMPLE		WATER	1 pCi/L	LANC001	9	5.00	0335	0725	907	9	5	133
461032010-1	SW-4	SAMPLE		WATER	1 pCi/L	LANC001	10	5.00	0335	0725	1007	10	6	53
461032011-1	SW-5	SAMPLE		WATER	1 pCi/L	LANC001	11	5.00	0335	0725	1107	11	7	67
46125001-1	AE21673	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	12	5.00	0335	0725	1207	12	3	234
46125002-1	AE21674	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	13	5.00	0335	0725	1307	13	3	58
46125003-1	AE21677	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	14	5.00	0335	0725	1407	14	4	25
46125004-1	AE21678	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	15	5.00	0335	0725	1507	15	7	210
46125005-1	AE21679	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	16	5.00	0335	0725	1607	16	8	77
46125006-1	AE21680	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	17	5.00	0421	0805	1707	17	3	84
46125007-1	AE21675	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	18	5.00	0421	0805	1807	18	7	58
46125008-1	AE21676	SAMPLE		GROUNDED WATER	1 pCi/L	SOOP001	19	5.00	0421	0805	1907	19	8	50
1204130612-1	MSW for batch 1810045	MSW		WATER	1 pCi/L	QC ACCOUNT	20	5.00	0421	0805	2007	20	1	5
1204130613-1	MSW-6461032001101 P1	MSW		WATER	1 pCi/L	QC ACCOUNT	21	5.00	0421	0805	2107	21	3	305
1204130614-1	MSW-6461032001101 P2	MSW		WATER	1 pCi/L	QC ACCOUNT	22	5.00	0421	0805	2207	22	6	431
1204130615-1	MSW-6461032001101 P3	MSW		WATER	1 pCi/L	QC ACCOUNT	23	5.00	0421	0805	2307	23	5	609
1204130616-1	LCS for batch 1810045	LCS		WATER	1 pCi/L	QC ACCOUNT	24	5.00	0421	0805	2407	24	1	431

Comments:

Data Reviewed By:

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1810045
Analyst : PCW
Prep Date : 10/8/2018
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	461032001.1	0.5000	2.0256E-05	10/1/2018 11:30	108	30	196	6.533	2	0.067	30	2.0290
2	461032002.1	0.5000	2.0256E-05	10/1/2018 11:10	208	30	123	4.100	6	0.200	30	1.8820
3	461032003.1	0.5000	2.0256E-05	10/1/2018 13:10	302	30	40	1.333	1	0.033	30	1.6870
4	461032004.1	0.5000	2.0256E-05	10/1/2018 14:40	401	30	219	7.300	2	0.067	30	1.9020
5	461032005.1	0.5000	2.0256E-05	10/1/2018 14:50	504	30	1656	55.200	5	0.167	30	1.8310
6	461032006.1	0.5000	2.0256E-05	10/1/2018 12:00	601	30	6	0.200	2	0.067	30	1.9080
7	461032007.1	0.5000	2.0256E-05	10/2/2018 12:00	707	30	5	0.167	5	0.167	30	2.0370
8	461032008.1	0.5000	2.0256E-05	10/2/2018 10:05	803	30	185	6.167	4	0.133	30	1.4750
9	461032009.1	0.5000	2.0256E-05	10/2/2018 9:55	106	30	131	4.367	8	0.267	30	2.1070
10	461032010.1	0.5000	2.0256E-05	10/2/2018 11:40	207	30	53	1.767	6	0.200	30	1.9750
11	461032011.1	0.5000	2.0256E-05	10/2/2018 12:05	307	30	67	2.233	7	0.233	30	1.8050
12	461125001.1	0.5000	2.0256E-05	10/1/2018 10:43	403	30	239	7.967	3	0.100	30	1.4320
13	461125002.1	0.5000	2.0256E-05	10/1/2018 11:25	506	30	58	1.933	3	0.100	30	2.0990
14	461125003.1	0.5000	2.0256E-05	10/1/2018 12:46	607	30	25	0.833	4	0.133	30	2.1300
15	461125004.1	0.5000	2.0256E-05	10/1/2018 13:43	701	30	212	7.067	7	0.233	30	1.9520
16	461125005.1	0.5000	2.0256E-05	10/1/2018 14:43	804	30	77	2.567	8	0.267	30	1.8590
17	461125006.1	0.5000	2.0256E-05	10/1/2018 15:43	101	30	84	2.800	3	0.100	30	1.5100
18	461125007.1	0.5000	2.0256E-05	10/2/2018 10:23	203	30	58	1.933	7	0.233	30	1.8290
19	461125008.1	0.5000	2.0256E-05	10/2/2018 10:28	308	30	80	2.667	8	0.267	30	1.4570
20	1204130612.1	0.5000	2.0256E-05	10/8/2018 0:00	405	30	5	0.167	1	0.033	30	1.5460
21	1204130613.1	0.5000	2.0256E-05	10/1/2018 11:30	507	30	205	6.833	3	0.100	30	1.9970
22	1204130614.1	0.1000	1.1370E-05	10/1/2018 11:30	602	30	631	21.033	6	0.200	30	2.1000
23	1204130615.1	0.1000	1.1370E-05	10/1/2018 11:30	704	30	609	20.300	8	0.267	30	2.0850
24	1204130616.1	0.5000	2.0256E-05	10/8/2018 0:00	805	30	634	21.133	1	0.033	30	1.9810

RA1810045.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	
6.700%	5/1/2018	4/30/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
5.200%	8/1/2018	7/31/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
9.700%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
0.500%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
9.700%	6/1/2018	5/31/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
8.500%	7/1/2018	6/30/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
4.300%	11/1/2017	10/31/2018	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
2.200%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:35	10/11/2018 6:35	0.381	0.978	1.002	1.000
4.700%	5/1/2018	4/30/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
2.100%	8/1/2018	7/31/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
6.300%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
4.500%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
2.500%	6/1/2018	5/31/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
2.900%	7/1/2018	6/30/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
1.900%	11/1/2017	10/31/2018	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
4.200%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 3:58	10/11/2018 7:25	0.383	0.974	1.002	1.000
5.300%	5/1/2018	4/30/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
9.900%	8/1/2018	7/31/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
9.500%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
2.500%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
5.300%	6/1/2018	5/31/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
2.100%	7/1/2018	6/30/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
2.200%	11/1/2017	10/31/2018	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	1.002	1.000
3.100%	3/1/2018	2/28/2019	10/8/2018 12:00	10/11/2018 4:21	10/11/2018 8:05	0.385	0.972	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	0.1853	0.1308	1	0.3810	7.7156	9.87%	6.4667	0.4690	1.0969	1.8628		SAMPLE				
2	0.3461	0.2443	1	0.6173	5.0167	11.01%	3.9000	0.3786	0.9545	1.3027		SAMPLE				
3	0.1576	0.1113	1	0.3661	1.8655	19.07%	1.3000	0.2134	0.6003	0.7475		SAMPLE				
4	0.1977	0.1396	1	0.4064	9.2066	6.87%	7.2333	0.4955	1.2362	1.8173		SAMPLE				
5	0.3247	0.2293	1	0.5907	72.7627	10.01%	55.0333	1.3585	3.5205	17.7224		SAMPLE				
6	0.1971	0.1391	1	0.4052	0.1692	71.22%	0.1333	0.0943	0.2345	0.2374		SAMPLE				
7	0.2919	0.2061	1	0.5310	0.000E+00	0.00%	0.0000	0.1054	0.2455	0.2456		SAMPLE				
8	0.3605	0.2545	1	0.6732	9.9023	7.91%	6.0333	0.4583	1.4742	2.0973		SAMPLE				
9	0.3565	0.2517	1	0.6181	4.7047	10.68%	4.1000	0.3930	0.8839	1.1959		SAMPLE				
10	0.3294	0.2325	1	0.5875	1.9179	16.48%	1.5667	0.2560	0.6143	0.6784		SAMPLE				
11	0.3893	0.2748	1	0.6836	2.6790	15.66%	2.0000	0.2867	0.7528	0.9087		SAMPLE				
12	0.3212	0.2268	1	0.6224	13.2820	7.98%	7.8667	0.5185	1.7160	2.8272		SAMPLE				
13	0.2191	0.1547	1	0.4246	2.1118	14.42%	1.8333	0.2603	0.5878	0.6701		SAMPLE				
14	0.2494	0.1760	1	0.4656	0.7946	25.81%	0.7000	0.1795	0.3994	0.4180		SAMPLE				
15	0.3599	0.2541	1	0.6321	8.4639	7.46%	6.8333	0.4933	1.1975	1.7396		SAMPLE				
16	0.4040	0.2853	1	0.7006	2.9913	14.01%	2.3000	0.3073	0.7834	0.9278		SAMPLE				
17	0.3039	0.2145	1	0.5888	4.3124	12.68%	2.7000	0.3109	0.9733	1.2391		SAMPLE				
18	0.3832	0.2705	1	0.6729	2.2416	18.65%	1.7000	0.2687	0.6946	0.8811		SAMPLE				
19	0.5142	0.3631	1	0.8916	3.9726	16.12%	2.4000	0.3127	1.0145	1.3803		SAMPLE				
20	0.1713	0.1210	1	0.3979	0.2080	61.29%	0.1333	0.0816	0.2496	0.2517		MB				
21	0.2298	0.1622	1	0.4452	8.1317	8.89%	6.7333	0.4807	1.1379	1.8402	461032001.1	DUP	5.3%			
22	1.5449	1.0907	1	2.7557	119.6294	4.55%	20.8333	0.8413	9.4686	20.3003	461032001.1	MS			129.9234	86.1%
23	1.7967	1.2685	1	3.1154	115.8632	4.68%	20.0333	0.8280	9.3858	19.8185	461032001.1	MSD	3.2%		129.9234	83.2%
24	0.1337	0.0944	1	0.3106	25.6876	5.05%	21.1000	0.8400	2.0043	4.4947		LCS			25.9845	98.9%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 11-OCT-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	07:15	1	1.26E+05	125839	-2.89		
LUCAS2	EFF	07:15	1	1.34E+05	134200	2.52		
LUCAS3	EFF	07:15	1	1.37E+05	137221	-1.8		
LUCAS4	EFF	07:15	1	1.31E+05	130618	-1.01		
LUCAS5	EFF	07:15	1	1.34E+05	133991	0.2		
LUCAS6	EFF	07:15	1	1.33E+05	133120	-1.63		
LUCAS7	EFF	07:15	1	1.43E+05	142589	1.78		
LUCAS8	EFF	07:15	1	1.38E+05	137710	-0.47		

Reviewed by:

Lyndsey Pace

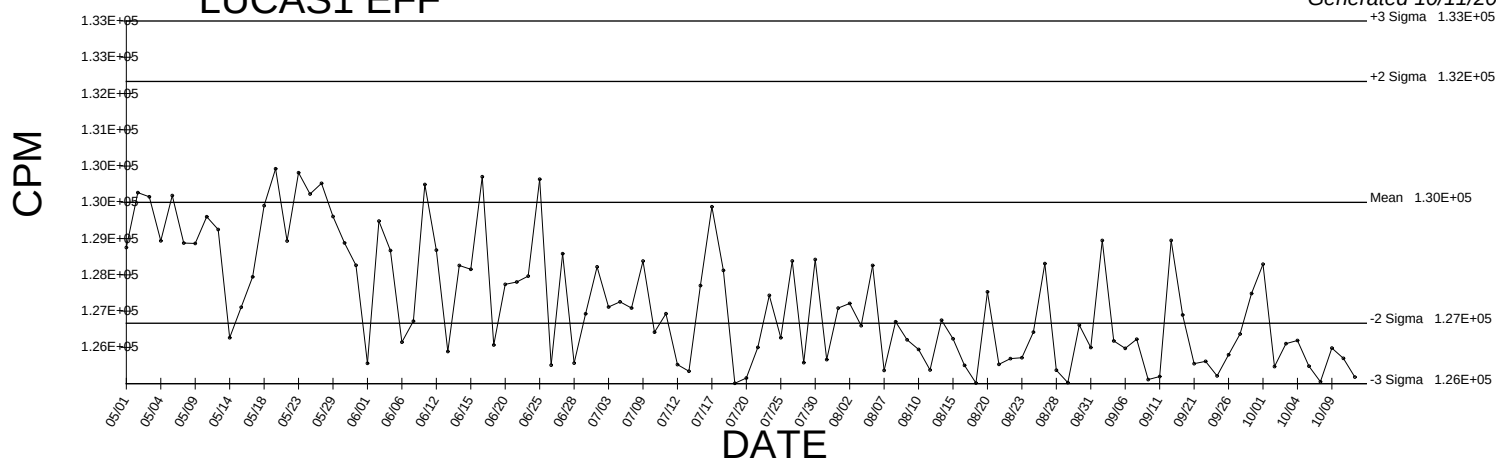
Date: 11-OCT-18

GEL Laboratories LLC

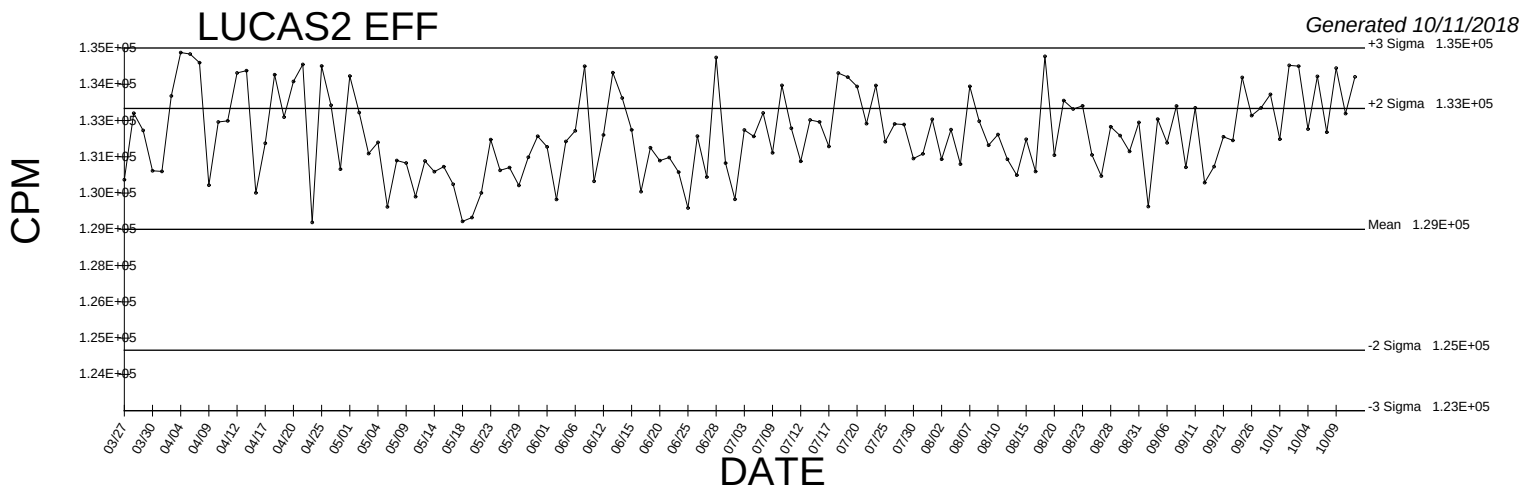
Efficiency Data

LUCAS1 EFF

Generated 10/11/2018



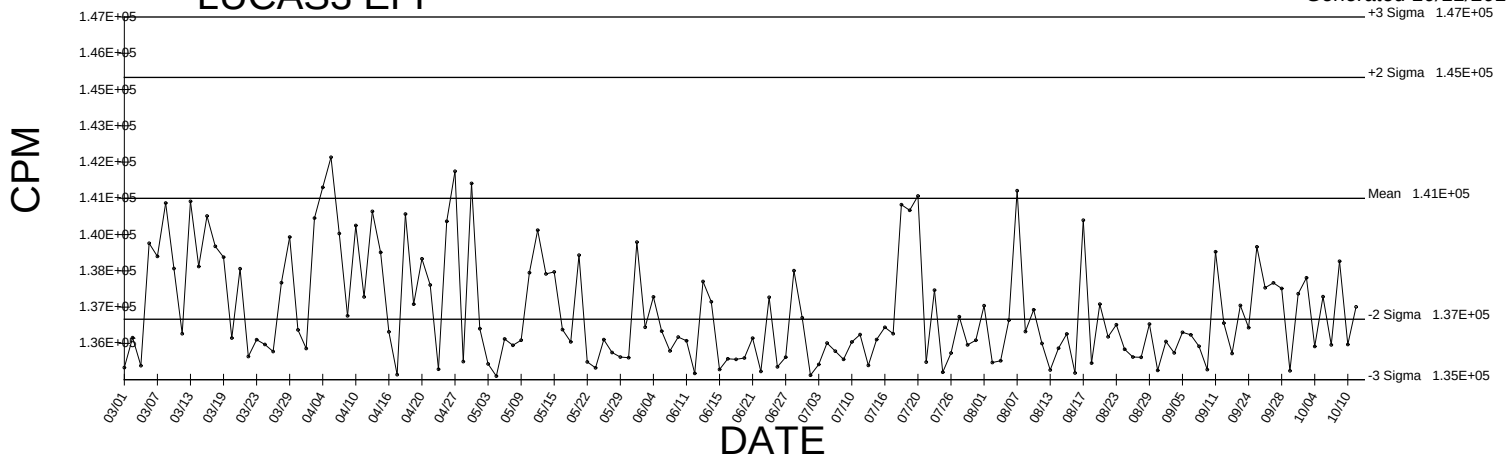
● Denotes Outlier



● Denotes Outlier

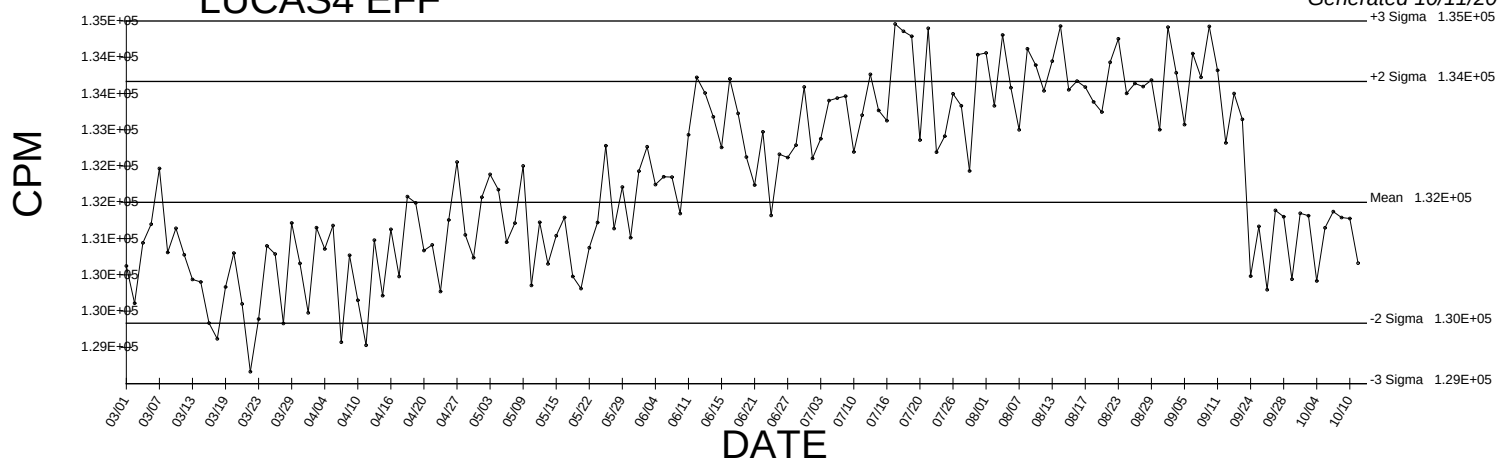
LUCAS3 EFF

Generated 10/11/2018



LUCAS4 EFF

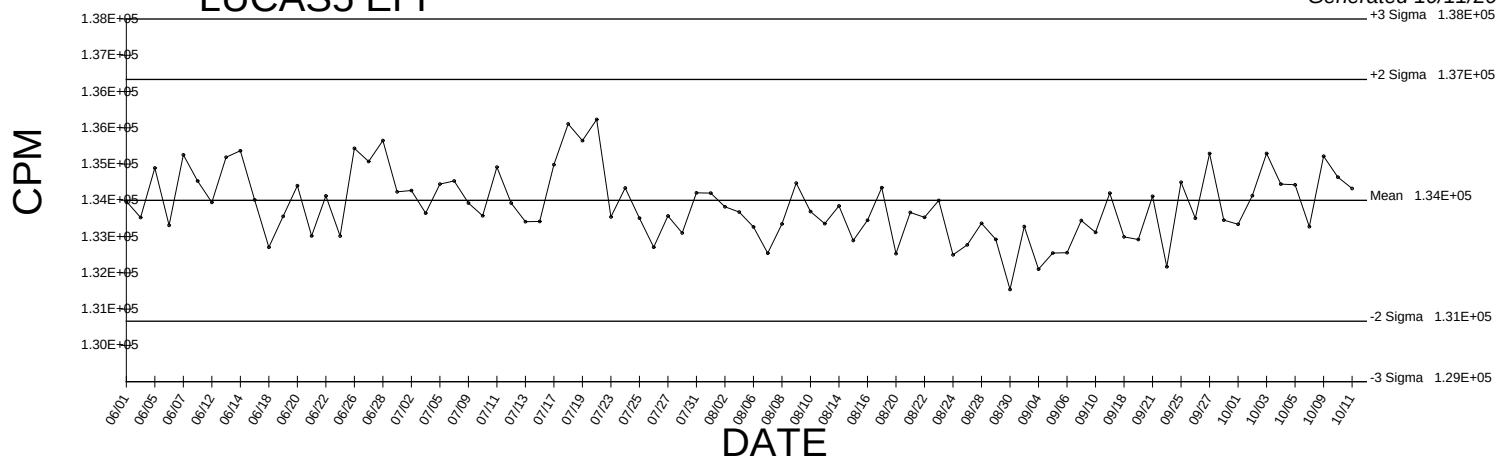
Generated 10/11/2018



● Denotes Outlier

LUCAS5 EFF

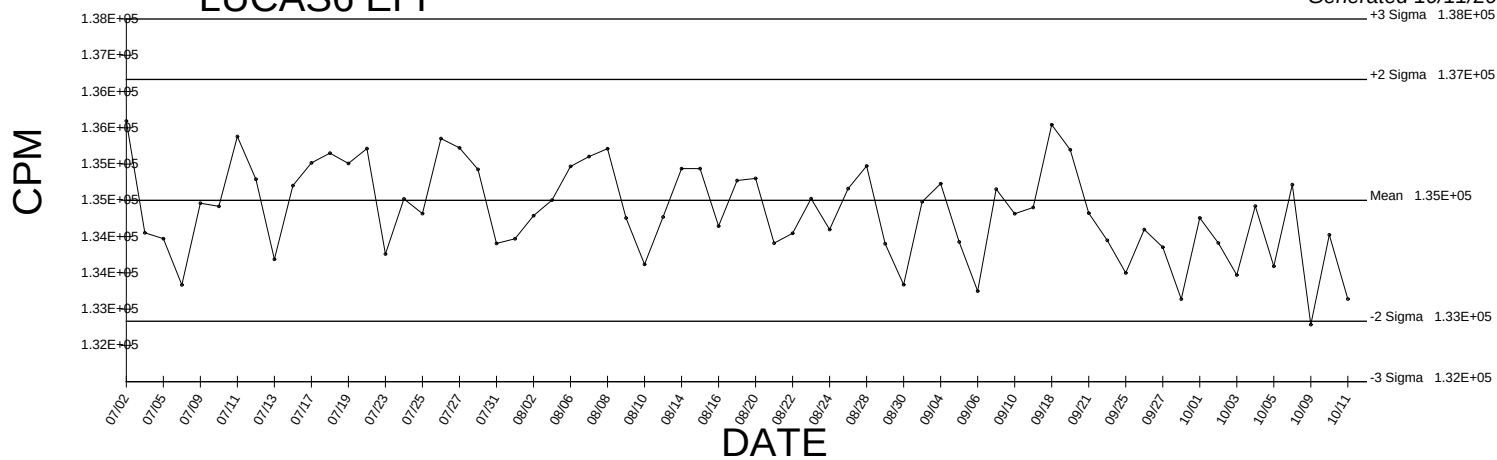
Generated 10/11/2018



● Denotes Outlier

LUCAS6 EFF

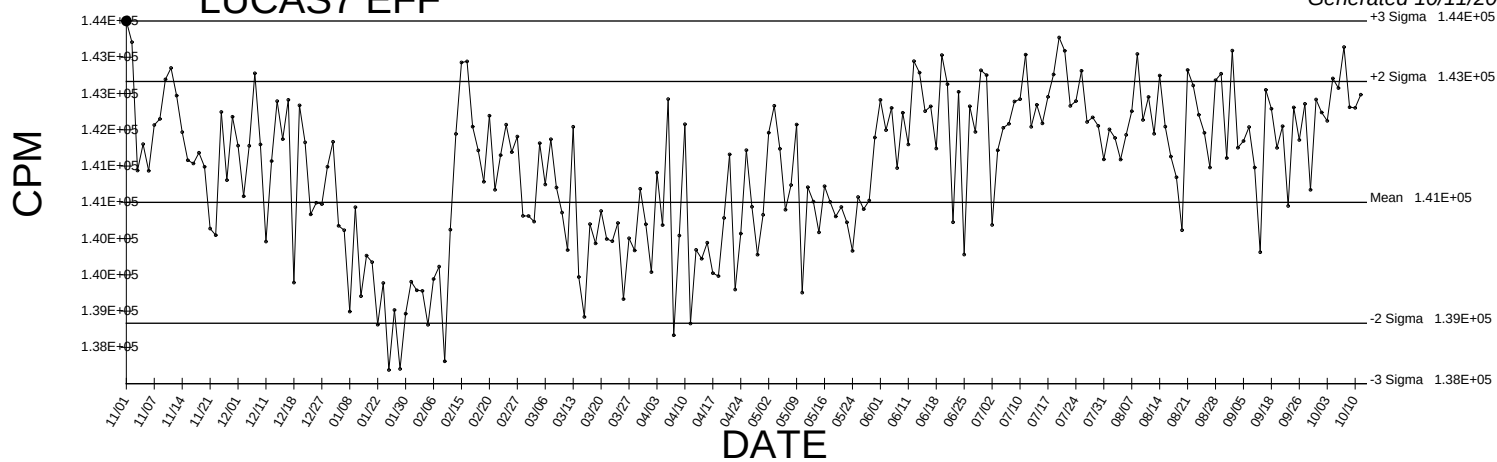
Generated 10/11/2018



● Denotes Outlier

LUCAS7 EFF

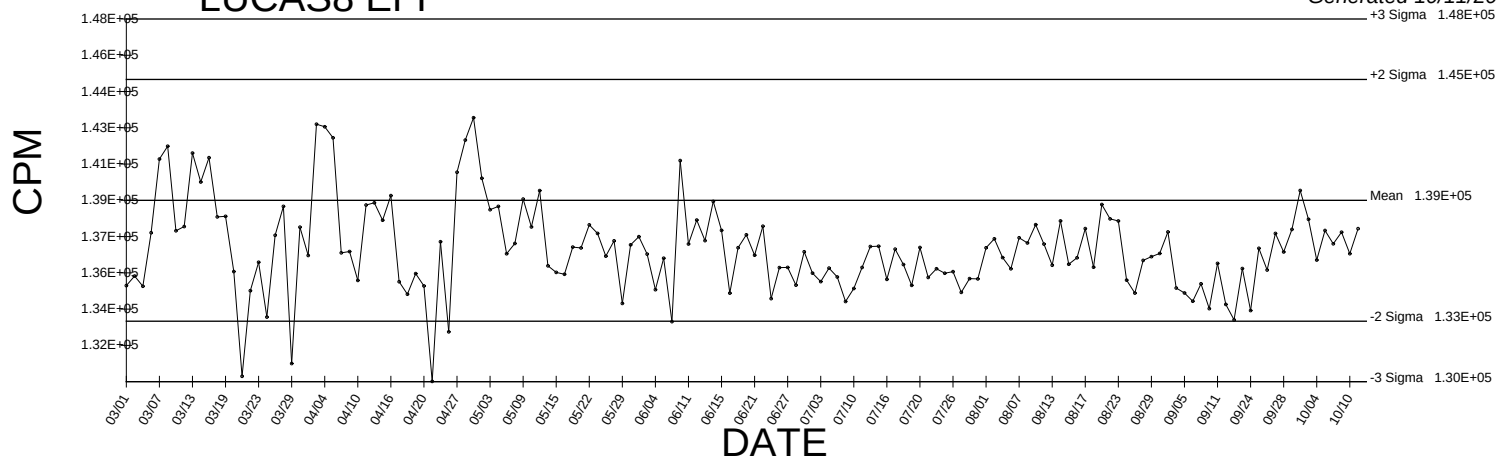
Generated 10/11/2018



● Denotes Outlier

LUCAS8 EFF

Generated 10/11/2018



● 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_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 $\mu\text{g/g}$ Ba carrier.

Source Prepared by:

R. Ormsby
R. Ormsby, Radiochemist

QC Approved:

L. Trivelpiece
L. Trivelpiece, Nuclear Metrologist

Date: 9 Sep 14

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:	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	05/04/2006

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	145.71
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 59.73%
 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 = 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: 1810045

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
461032001	SAMPLE	PCW	LUCAS1	OCT-11-18 06:35:00	DONE	Lucas Cell	01-MAY-18 00:00
461032002	SAMPLE	PCW	LUCAS2	OCT-11-18 06:35:00	DONE	Lucas Cell	01-AUG-18 00:00
461032003	SAMPLE	PCW	LUCAS3	OCT-11-18 06:35:00	DONE	Lucas Cell	01-MAR-18 00:00
461032004	SAMPLE	PCW	LUCAS4	OCT-11-18 06:35:00	DONE	Lucas Cell	01-MAR-18 00:00
461032005	SAMPLE	PCW	LUCAS5	OCT-11-18 06:35:00	DONE	Lucas Cell	01-JUN-18 00:00
461032006	SAMPLE	PCW	LUCAS6	OCT-11-18 06:35:00	DONE	Lucas Cell	01-JUL-18 00:00
461032007	SAMPLE	PCW	LUCAS7	OCT-11-18 06:35:00	DONE	Lucas Cell	01-NOV-17 00:00
461032008	SAMPLE	PCW	LUCAS8	OCT-11-18 06:35:00	DONE	Lucas Cell	01-MAR-18 00:00
461032009	SAMPLE	PCW	LUCAS1	OCT-11-18 07:25:00	DONE	Lucas Cell	01-MAY-18 00:00
461032010	SAMPLE	PCW	LUCAS2	OCT-11-18 07:25:00	DONE	Lucas Cell	01-AUG-18 00:00
461032011	SAMPLE	PCW	LUCAS3	OCT-11-18 07:25:00	DONE	Lucas Cell	01-MAR-18 00:00
461125001	SAMPLE	PCW	LUCAS4	OCT-11-18 07:25:00	DONE	Lucas Cell	01-MAR-18 00:00
461125002	SAMPLE	PCW	LUCAS5	OCT-11-18 07:25:00	DONE	Lucas Cell	01-JUN-18 00:00
461125003	SAMPLE	PCW	LUCAS6	OCT-11-18 07:25:00	DONE	Lucas Cell	01-JUL-18 00:00
461125004	SAMPLE	PCW	LUCAS7	OCT-11-18 07:25:00	DONE	Lucas Cell	01-NOV-17 00:00
461125005	SAMPLE	PCW	LUCAS8	OCT-11-18 07:25:00	DONE	Lucas Cell	01-MAR-18 00:00
461125006	SAMPLE	PCW	LUCAS1	OCT-11-18 08:05:00	DONE	Lucas Cell	01-MAY-18 00:00
461125007	SAMPLE	PCW	LUCAS2	OCT-11-18 08:05:00	DONE	Lucas Cell	01-AUG-18 00:00
461125008	SAMPLE	PCW	LUCAS3	OCT-11-18 08:05:00	DONE	Lucas Cell	01-MAR-18 00:00
1204130612	MB	PCW	LUCAS4	OCT-11-18 08:05:00	DONE	Lucas Cell	01-MAR-18 00:00
1204130613	DUP	PCW	LUCAS5	OCT-11-18 08:05:00	DONE	Lucas Cell	01-JUN-18 00:00
1204130614	MS	PCW	LUCAS6	OCT-11-18 08:05:00	DONE	Lucas Cell	01-JUL-18 00:00
1204130615	MSD	PCW	LUCAS7	OCT-11-18 08:05:00	DONE	Lucas Cell	01-NOV-17 00:00
1204130616	LCS	PCW	LUCAS8	OCT-11-18 08:05:00	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 Hudson
Groundwater and Water Samples
Collected on 10/31/18-11/01/18

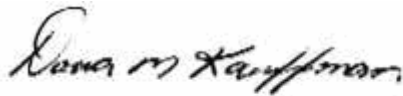
SDG# GEJ60

GROUP	SAMPLE NUMBERS
2005364	9881981-9881991

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: 11/28/2018

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 GEJ60
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Hudson

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9881981	MW-9	10/31/2018 11:05	11/02/2018 17:20
9881982	MW-7	10/31/2018 12:55	11/02/2018 17:20
9881983	MW-8	10/31/2018 12:35	11/02/2018 17:20
9881984	MW-5	10/31/2018 10:50	11/02/2018 17:20
9881985	MW-6	10/31/2018 14:20	11/02/2018 17:20
9881986	FB-20181031	10/31/2018 11:00	11/02/2018 17:20
9881987	MW-1	11/01/2018 09:45	11/02/2018 17:20
9881988	MW-4	11/01/2018 11:40	11/02/2018 17:20
9881989	MW-2	11/01/2018 10:35	11/02/2018 17:20
9881990	MW-3	11/01/2018 12:00	11/02/2018 17:20
9881991	FB-20181101	11/01/2018 11:00	11/02/2018 17:20

Sample pH Log

SDG: GEJ60

<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>
9881981	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:55:34PM	25804
9881981	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 6:55:22PM	12665
9881981	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:06:49AM	25684
9881981	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:49:52PM	25804
9881981	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:20:56AM	25684
9881981	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:55:24AM	12616
9881981	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:55:34PM	25804
9881981	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:20:56AM	25684
9881982	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:17:06AM	25684
9881982	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:01:23PM	12665
9881982	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:07:48AM	25684
9881982	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:50:18PM	25804
9881982	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:10:43AM	25684
9881982	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:47:03AM	12616
9881982	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:17:06AM	25684
9881982	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:10:43AM	25684
9881983	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:12:57AM	25684
9881983	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:01:47PM	12665
9881983	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:48:57PM	25804
9881983	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:47:00PM	25804
9881983	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:16:06AM	25684
9881983	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:44:58AM	12616
9881983	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:12:57AM	25684
9881983	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:12:57AM	25684
9881984	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:14:00AM	25684
9881984	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:02:46PM	12665
9881984	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:45:07PM	25804
9881984	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:51:53PM	25804
9881984	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:19:31AM	25684
9881984	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:42:45AM	12616
9881984	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:14:00AM	25684
9881984	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:14:00AM	25684
9881985	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:06:39PM	25804
9881985	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:03:20PM	12665
9881985	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:51:29PM	25804
9881985	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:45:26PM	25804
9881985	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:19:55AM	25684
9881985	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:41:06AM	12616

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
9881985	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:06:39PM	25804
9881985	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:19:55AM	25684
9881986	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:15:02AM	25684
9881986	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:02:28PM	12665
9881986	055A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:46:28PM	25804
9881986	055B	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:49:27PM	25804
9881986	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:23:42AM	25684
9881986	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:49:21AM	12616
9881986	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:15:02AM	25684
9881986	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:15:02AM	25684
9881987	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:17:52AM	25684
9881987	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:02:07PM	12665
9881987	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:47:49PM	25804
9881987	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:48:35PM	25804
9881987	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:24:00AM	25684
9881987	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:39:11AM	12616
9881987	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:17:52AM	25684
9881987	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:17:52AM	25684
9881988	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:04:51PM	25804
9881988	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:03:03PM	12665
9881988	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:51:02PM	25804
9881988	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:50:40PM	25804
9881988	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:21:59AM	25684
9881988	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 11:00:43AM	12616
9881988	148A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:04:46PM	12665
9881988	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:04:51PM	25804
9881988	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:21:59AM	25684
9881989	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:09:45PM	25804
9881989	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:03:43PM	12665
9881989	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:47:19PM	25804
9881989	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:48:09PM	25804
9881989	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:23:00AM	25684
9881989	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:57:05AM	12616
9881989	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:09:45PM	25804
9881989	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:23:00AM	25684
9881990	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:05:52PM	25804
9881990	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:04:19PM	12665
9881990	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:06:26AM	25684
9881990	055B	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:07:22AM	25684
9881990	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:05:40AM	25684
9881990	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:51:07AM	12616
9881990	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 1:05:52PM	25804
9881990	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:05:40AM	25684
9881991	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:11:39AM	25684

<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>
9881991	015A	6	5-7	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 7:04:01PM	12665
9881991	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:45:55PM	25804
9881991	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 12:44:42PM	25804
9881991	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:09:15AM	25684
9881991	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/6/2018 10:52:51AM	12616
9881991	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:11:39AM	25684
9881991	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	11/3/2018 9:09:15AM	25684

<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) - 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: November 16, 2018 12:45

Project: PSEG Hudson

Account #: 07701
Group Number: 2005364
SDG: GEJ60
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 Date/Time</u>	<u>ELLE#</u>
MW-9 Grab Groundwater	10/31/2018 11:05	9881981
MW-7 Grab Groundwater	10/31/2018 12:55	9881982
MW-8 Grab Groundwater	10/31/2018 12:35	9881983
MW-5 Grab Groundwater	10/31/2018 10:50	9881984
MW-6 Grab Groundwater	10/31/2018 14:20	9881985
FB-20181031 Grab Water	10/31/2018 11:00	9881986
MW-1 Grab Groundwater	11/01/2018 09:45	9881987
MW-4 Grab Groundwater	11/01/2018 11:40	9881988
MW-2 Grab Groundwater	11/01/2018 10:35	9881989
MW-3 Grab Groundwater	11/01/2018 12:00	9881990
FB-20181101 Grab Water	11/01/2018 11:00	9881991

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

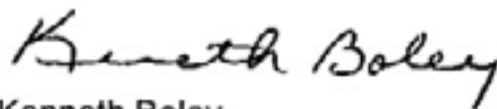
Sampling Date(s): 10/31/18 - 11/01/18

Laboratory Sample ID(s): 9881981-9881991

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.		



Kenneth Boley
Senior Specialist, Quality Assurance

11/16/2018



Project Name: PSEG Hudson
ELLE Group #: 2005364

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: 9881981, 9881982, 9881983, 9881984, 9881985, 9881986, 9881987, 9881988, 9881989, 9881990, 9881991

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 #: 183111404401 (Sample number(s): 9881981-9881991 UNSPK: 9881989 BKG: 9881989)

The recovery(ies) for the following analyte(s) in the MS and/or MSD exceeded the acceptance window indicating a positive bias: Calcium

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

Batch #: 183121404701A (Sample number(s): 9881981-9881991 UNSPK: 9881987 BKG: 9881987)

The duplicate RPD for the following analyte(s) exceeded the acceptance window: Antimony, Cadmium

SM 2540 C-2011, Wet Chemistry

Sample #s: 9881988

The sample was originally ran within holding time for Total Dissolved Solids at a reduced volume with a result that was less than the Limit of Quantitation, the sample was reanalyzed for Total Dissolved Solids outside of the 7 day holding time on 11/12/2018.

The sample is being reported per client request.

Batch #: 18309921202B (Sample number(s): 9881981 UNSPK: 9881984 BKG: 9881981, 9881984)

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

Batch #: 18316921201B (Sample number(s): 9881988 BKG: 9881988)

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

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881981
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:05
SDG#: GEJ60-01

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	0.0549	0.0010	0.0050	1
08014	Boron	7440-42-8	0.274	0.0120	0.0500	1
01750	Calcium	7440-70-2	76.2	0.0330	0.500	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.						
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
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	0.0017 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0058	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	0.0120	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	291	20.0	40.0	100
01504	Fluoride	16984-48-8	0.37 J	0.25	0.50	5
00228	Sulfate	14808-79-8	67.1	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	860	80.0	240	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-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881981
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:05
SDG#: GEJ60-01

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.	7.2	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 filtered in the lab 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	183111404401	11/08/2018 07:58	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:58	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:46	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:46	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:46	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:46	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:46	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:46	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:35	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18308520117B	11/05/2018 20:08	Ashlynn M Cornelius	100

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

Analysis Report

Sample Description: MW-9 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881981
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:05
SDG#: GEJ60-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18308520117B	11/06/2018 15:47	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18308520117B	11/05/2018 19:51	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202B	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005104A	11/06/2018 02:54	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005104A	11/06/2018 02:54	Jeremy L Bolf	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881982
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:55
SDG#: GEJ60-02

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	0.0381	0.0010	0.0050	1
08014	Boron	7440-42-8	0.151	0.0120	0.0500	1
01750	Calcium	7440-70-2	32.7	0.0330	0.500	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.						
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
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	0.00075 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	0.0056	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	44.4	4.0	8.0	20
01504	Fluoride	16984-48-8	0.39 J	0.25	0.50	5
00228	Sulfate	14808-79-8	11.8	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	253	40.0	120	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.9	0.010	0.010	1

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881982
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:55
SDG#: GEJ60-02

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.	7.5	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 Comments

State of New Jersey Lab Certification No. PA011
This sample was filtered in the lab 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	183111404401	11/08/2018 08:01	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:01	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:53	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:53	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:53	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:53	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:53	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:53	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:47	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18308520117B	11/05/2018 20:42	Ashlynn M Cornelius	20

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

Sample Description: MW-7 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881982
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:55
SDG#: GEJ60-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18308520117B	11/06/2018 16:04	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18308520117B	11/05/2018 20:25	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:45	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:45	Jeremy L Bolf	1

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881983
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:35
SDG#: GEJ60-03

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	0.0618	0.0010	0.0050	1
08014	Boron	7440-42-8	0.191	0.0120	0.0500	1
01750	Calcium	7440-70-2	28.5	0.0330	0.500	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.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0037 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
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	0.00070 J	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	0.00069 J	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0039	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	mg/l	
00224	Chloride	16887-00-6	349	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	17.5	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	828	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-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881983
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:35
SDG#: GEJ60-03

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.	7.3	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 filtered in the lab 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	183111404401	11/08/2018 08:09	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:09	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:55	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:55	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:55	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:55	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:55	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:55	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:49	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117A	11/06/2018 02:04	Ashlynn M Cornelius	500

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

Sample Description: MW-8 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881983
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 12:35
SDG#: GEJ60-03

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117A	11/06/2018 01:46	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18309520117A	11/06/2018 01:46	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:50	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:50	Jeremy L Bolf	1

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

Sample Description: MW-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881984
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 10:50
SDG#: GEJ60-04

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	0.0844	0.0010	0.0050	1
08014	Boron	7440-42-8	0.444	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. The NJ DKQP required reporting limit could not be attained using the laboratory LOQ. The following were evaluated using the MDL: selenium, thallium.						
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	0.0150 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
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	0.00087 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	N.D.	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	mg/l	
00224	Chloride	16887-00-6	849	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	8.0	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,760	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-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881984
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 10:50
SDG#: GEJ60-04

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.	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 filtered in the lab 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	183111404401	11/08/2018 08:12	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:12	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:57	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:57	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:57	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:57	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:57	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:57	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:51	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117A	11/06/2018 02:41	Ashlynn M Cornelius	500

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

Analysis Report

Sample Description: MW-5 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881984
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 10:50
SDG#: GEJ60-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117A	11/06/2018 02:22	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18309520117A	11/06/2018 02:22	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005104A	11/06/2018 02:49	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005104A	11/06/2018 02:49	Jeremy L Bolf	1

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

Sample Description: MW-6 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881985
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 14:20
SDG#: GEJ60-05

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	
07046	Barium	7440-39-3	0.0707	0.0010	0.0050	1
08014	Boron	7440-42-8	0.595	0.0120	0.0500	1
01750	Calcium	7440-70-2	99.9	0.0330	0.500	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.						
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
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	0.0015 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	0.00032 J	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	mg/l	
00224	Chloride	16887-00-6	434	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	32.2	1.5	5.0	5
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,130	160	480	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
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881985
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 14:20
SDG#: GEJ60-05

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.	7.5	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 Comments

State of New Jersey Lab Certification No. PA011
This sample was filtered in the lab 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	183111404401	11/08/2018 08:15	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:15	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:59	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:59	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:59	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:59	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:59	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:59	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:53	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117A	11/06/2018 03:54	Ashlynn M Cornelius	500

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

Sample Description: MW-6 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881985
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 14:20
SDG#: GEJ60-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117A	11/06/2018 02:59	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18309520117A	11/06/2018 02:59	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921201A	11/05/2018 13:05	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005104A	11/06/2018 02:44	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005104A	11/06/2018 02:44	Jeremy L Bolf	1

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

Sample Description: FB-20181031 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881986
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:00
SDG#: GEJ60-06FB

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	0.114 J	0.0330	0.500	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.						
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
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.	22.5	0.010	0.010	1

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

Sample Description: FB-20181031 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881986
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:00
SDG#: GEJ60-06FB

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.	6.4	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 filtered in the lab 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	183111404401	11/08/2018 08:18	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:18	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:01	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:01	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:01	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:01	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:01	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 12:01	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:55	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117A	11/06/2018 04:12	Ashlynn M Cornelius	1

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

Sample Description: FB-20181031 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881986
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 10/31/2018 11:00
SDG#: GEJ60-06FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117A	11/06/2018 04:12	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18309520117A	11/06/2018 04:12	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:36	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:36	Jeremy L Bolf	1

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

Sample Description: MW-1 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881987
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 09:45
SDG#: GEJ60-07

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	0.715	0.0010	0.0050	1
08014	Boron	7440-42-8	1.06	0.0120	0.0500	1
01750	Calcium	7440-70-2	382	0.0330	0.500	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.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0069	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0478 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
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	0.0016 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0020 J	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	0.00016 J	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	7,540	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	122	6.0	20.0	20
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	7,140	400	1,200	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.0	0.010	0.010	1

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

Sample Description: MW-1 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881987
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 09:45
SDG#: GEJ60-07

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.	7.4	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 filtered in the lab 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	183111404401	11/08/2018 08:20	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:20	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:33	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:33	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:33	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:33	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 11:33	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 11:33	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:57	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117A	11/08/2018 23:30	Ashlynn M Cornelius	2000

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

Sample Description: MW-1 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881987
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 09:45
SDG#: GEJ60-07

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117A	11/06/2018 04:30	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18309520117A	11/08/2018 22:35	Ashlynn M Cornelius	20
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:41	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:41	Jeremy L Bolf	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881988
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20

Collection Date/Time: 11/01/2018 11:40

SDG#: GEJ60-08

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	0.0997	0.0010	0.0050	1
08014	Boron	7440-42-8	1.19	0.0120	0.0500	1
01750	Calcium	7440-70-2	128	0.0330	0.500	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.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0030 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0497 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
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	0.00082 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.00069 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	0.0065	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	5,370	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	551	30.0	100	100
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	9,560	80.0	240	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881988
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 11:40
SDG#: GEJ60-08

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit*	As Received Limit of Quantitation	Dilution Factor
Wet Chemistry		SM 2540 C-2011	mg/l	mg/l	mg/l	
	The sample was originally ran within holding time for Total Dissolved Solids at a reduced volume with a result that was less than the Limit of Quantitation, the sample was reanalyzed for Total Dissolved Solids outside of the 7 day holding time on 11/12/2018. The sample is being reported per client request.					
Wet Chemistry		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	22.6	0.010	0.010	1
		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 Comments

State of New Jersey Lab Certification No. PA011
This sample was filtered in the lab 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	183111404401	11/08/2018 08:24	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:24	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:04	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:04	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:04	Patrick J Engle	1

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

Sample Description: MW-4 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881988
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 11:40
SDG#: GEJ60-08

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:04	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:04	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 12:04	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 06:59	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18308520117B	11/08/2018 14:04	Ashlynn M Cornelius	2000
01504	Fluoride	EPA 300.0	1	18308520117B	11/06/2018 16:21	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18308520117B	11/08/2018 13:46	Ashlynn M Cornelius	100
00212	Total Dissolved Solids	SM 2540 C-2011	2	18316921201B	11/12/2018 12:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:31	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:31	Jeremy L Bolf	1

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

Sample Description: MW-2 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881989
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 10:35
SDG#: GEJ60-09

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	1.98	0.0010	0.0050	1
08014	Boron	7440-42-8	0.814	0.0120	0.0500	1
01750	Calcium	7440-70-2	419	0.0330	0.500	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.						
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0047 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0505	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
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	0.00066 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0033	0.00068	0.0020	1
06027	Beryllium	7440-41-7	N.D.	0.000091	0.00050	1
06028	Cadmium	7440-43-9	0.00024 J	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	
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	7,650	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	15.1	1.5	5.0	5
			SM 2540 C-2011	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	17,300	400	1,200	1
			SM 2550 B-2010	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-2 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881989
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 10:35
SDG#: GEJ60-09

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 filtered in the lab 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	183111404401	11/08/2018 07:39	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 07:39	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:06	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:06	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:06	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:06	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:06	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 12:06	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 07:05	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117B	11/09/2018 00:06	Ashlynn M Cornelius	2000

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

Sample Description: MW-2 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881989
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 10:35
SDG#: GEJ60-09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117B	11/06/2018 09:41	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18309520117B	11/06/2018 09:41	Ashlynn M Cornelius	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005104A	11/06/2018 02:35	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005104A	11/06/2018 02:35	Jeremy L Bolf	1

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

Sample Description: MW-3 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881990
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 12:00
SDG#: GEJ60-10

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	0.0749	0.0010	0.0050	1
08014	Boron	7440-42-8	0.507	0.0120	0.0500	1
01750	Calcium	7440-70-2	78.6	0.0330	0.500	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.						
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	0.0138 J	0.0110	0.0500	1
07036	Selenium	7782-49-2	N.D.	0.0210	0.0500	1
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	0.00096 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0026	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	0.0115	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	mg/l	
00224	Chloride	16887-00-6	703	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	129	6.0	20.0	20
		SM 2540 C-2011	mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	2,720	160	480	1
		SM 2550 B-2010	Degrees C	Degrees C	Degrees C	
12151	Temperature of pH	n.a.	23.0	0.010	0.010	1

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

Sample Description: MW-3 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881990
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 12:00
SDG#: GEJ60-10

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 filtered in the lab 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	183111404401	11/08/2018 08:27	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:27	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:08	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:08	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:08	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:08	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:08	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 12:08	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 07:07	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18308520117B	11/05/2018 23:16	Ashlynn M Cornelius	500

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

Sample Description: MW-3 Grab Groundwater
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881990
ELLE Group #: 2005364
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 12:00
SDG#: GEJ60-10

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18308520117B	11/06/2018 16:38	Clinton M Wilson	5
00228	Sulfate	EPA 300.0	1	18308520117B	11/08/2018 14:22	Ashlynn M Cornelius	20
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:59	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:59	Jeremy L Bolf	1

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

Sample Description: FB-20181101 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881991
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 11:00
SDG#: GEJ60-11FB

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	0.0953 J	0.0330	0.500	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.						
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
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.	26.0 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: FB-20181101 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881991
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 11:00
SDG#: GEJ60-11FB

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 filtered in the lab 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	183111404401	11/08/2018 08:30	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183111404401	11/08/2018 08:30	Lisa J Cooke	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:10	Patrick J Engle	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:10	Patrick J Engle	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:10	Patrick J Engle	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:10	Patrick J Engle	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183121404701A	11/12/2018 12:10	Patrick J Engle	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183121404701C	11/12/2018 12:10	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	183110571301	11/08/2018 07:09	Damary Valentin	1
14044	ICP-WW, 3005A (tot rec) - U345	SW-846 3005A	1	183111404401	11/07/2018 15:50	JoElla L Rice	1
14047	ICPMS - Water, 3020A - U345	SW-846 3020A	1	183121404701	11/09/2018 04:10	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	183110571301	11/07/2018 16:15	JoElla L Rice	1
00224	Chloride	EPA 300.0	1	18309520117B	11/06/2018 10:17	Ashlynn M Cornelius	1

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

Analysis Report

Sample Description: FB-20181101 Grab Water
PSEG - Hudson

GEI Consultants, Inc.
ELLE Sample #: GW 9881991
ELLE Group #: 2005364
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 11/02/2018 17:20
Collection Date/Time: 11/01/2018 11:00
SDG#: GEJ60-11FB

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	18309520117B	11/06/2018 10:17	Ashlynn M Cornelius	1
00228	Sulfate	EPA 300.0	1	18309520117B	11/06/2018 10:17	Ashlynn M Cornelius	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18309921202A	11/05/2018 14:41	Alexa Sanchez	1
12151	Temperature of pH	SM 2550 B-2010	1	18309005103A	11/06/2018 01:55	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18309005103A	11/06/2018 01:55	Jeremy L Bolf	1

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

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 11/16/2018 12:45

Group Number: 2005364

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: 183110571301	Sample number(s): 9881981-9881991		
Mercury	N.D.	0.000050	0.00020
Batch number: 183111404401	Sample number(s): 9881981-9881991		
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: 183121404701A	Sample number(s): 9881981-9881991		
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: 183121404701C	Sample number(s): 9881981-9881991		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 18308520117B	Sample number(s): 9881981-9881982,9881988,9881990		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18309520117A	Sample number(s): 9881983-9881987		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18309520117B	Sample number(s): 9881989,9881991		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18309921201A	Sample number(s): 9881985		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18309921202A	Sample number(s): 9881982-9881984,9881986-9881987,9881989-9881991		
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: 11/16/2018 12:45

Group Number: 2005364

Method Blank (continued)

Analysis Name	Result mg/l	MDL** mg/l	LOQ mg/l
Batch number: 18309921202B Total Dissolved Solids	Sample number(s): 9881981 N.D.	20.0	60.0
Batch number: 18316921201B Total Dissolved Solids	Sample number(s): 9881988 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: 183110571301 Mercury	Sample number(s): 9881981-9881991 0.00100	0.000862			86		80-120		
Batch number: 183111404401	Sample number(s): 9881981-9881991								
Barium	2.00	2.04			102		80-120		
Boron	2.00	1.84			92		80-120		
Calcium	4.00	4.07			102		80-120		
Chromium	0.200	0.202			101		80-120		
Cobalt	0.500	0.515			103		80-120		
Lithium	1.00	1.02			102		80-120		
Selenium	0.150	0.145			97		80-120		
Thallium	0.150	0.159			106		80-120		
Batch number: 183121404701A	Sample number(s): 9881981-9881991								
Antimony	0.00600	0.00606			101		80-120		
Arsenic	0.0100	0.0101			101		80-120		
Beryllium	0.00400	0.00409			102		80-120		
Cadmium	0.00500	0.00521			104		80-120		
Lead	0.0150	0.0153			102		80-120		
Batch number: 183121404701C	Sample number(s): 9881981-9881991								
Molybdenum	0.0500	0.0526			105		80-120		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18308520117B	Sample number(s): 9881981-9881982,9881988,9881990								
Chloride	3.00	2.98			99		90-110		
Fluoride	0.750	0.784			105		90-110		
Sulfate	7.50	7.59			101		90-110		
Batch number: 18309520117A	Sample number(s): 9881983-9881987								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.750			100		90-110		
Sulfate	7.50	7.74			103		90-110		

*- 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: 11/16/2018 12:45

Group Number: 2005364

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: 18309520117B	Sample number(s): 9881989,9881991								
Chloride	3.00	2.99			100		90-110		
Fluoride	0.750	0.750			100		90-110		
Sulfate	7.50	7.74			103		90-110		
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18309921201A	Sample number(s): 9881985								
Total Dissolved Solids	200	195	200	200	98	100	62-127	3	14
Batch number: 18309921202A	Sample number(s): 9881982-9881984,9881986-9881987,9881989-9881991								
Total Dissolved Solids	200	203			102		62-127		
Batch number: 18309921202B	Sample number(s): 9881981								
Total Dissolved Solids	200	203			102		62-127		
Batch number: 18316921201B	Sample number(s): 9881988								
Total Dissolved Solids	200	196			98		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18309005103A	Sample number(s): 9881982-9881983,9881986-9881988,9881990-9881991								
pH	7.00	7.00			100		95-105		
Batch number: 18309005104A	Sample number(s): 9881981,9881984-9881985,9881989								
pH	7.00	7.00			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: 183110571301	Sample number(s): 9881981-9881991 UNSPK: 9881981									
Mercury	N.D.	0.00100	0.000815	0.00100	0.000807	82	81	75-125	1	20
Batch number: 183111404401	Sample number(s): 9881981-9881991 UNSPK: 9881989									
Barium	1.98	2.00	3.81	2.00	3.72	92	87	75-125	3	20
Boron	0.814	2.00	3.10	2.00	3.08	115	113	75-125	1	20
Calcium	419.46	4.00	426.06	4.00	419.26	165 (2)	-5 (2)	75-125	2	20
Chromium	N.D.	0.200	0.221	0.200	0.200	111	100	75-125	10	20
Cobalt	0.00467	0.500	0.478	0.500	0.477	95	95	75-125	0	20
Lithium	0.0505	1.00	1.08	1.00	1.10	103	105	75-125	2	20
Selenium	N.D.	0.150	0.154	0.150	0.156	103	104	75-125	2	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: 11/16/2018 12:45

Group Number: 2005364

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
Thallium	N.D.	0.150	0.131	0.150	0.131	87	87	75-125	0	20
Batch number: 183121404701A	Sample number(s): 9881981-9881991 UNSPK: 9881987									
Antimony	0.00164	0.00600	0.00689	0.00600	0.00730	88	94	75-125	6	20
Arsenic	0.00200	0.0100	0.0138	0.0100	0.0130	118	110	75-125	6	20
Beryllium	N.D.	0.00400	0.00389	0.00400	0.00412	97	103	75-125	6	20
Cadmium	0.000160	0.00500	0.00521	0.00500	0.00505	101	98	75-125	3	20
Lead	N.D.	0.0150	0.0162	0.0150	0.0164	108	109	75-125	1	20
Batch number: 183121404701C	Sample number(s): 9881981-9881991 UNSPK: 9881987									
Molybdenum	0.00329	0.0500	0.0556	0.0500	0.0567	105	107	75-125	2	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18309921201A	Sample number(s): 9881985 UNSPK: 9881985									
Total Dissolved Solids	1132	1600	2708			99		62-127		
Batch number: 18309921202A	Sample number(s): 9881982-9881984,9881986-9881987,9881989-9881991 UNSPK: 9881984									
Total Dissolved Solids	1756	1600	3176			89		62-127		
Batch number: 18309921202B	Sample number(s): 9881981 UNSPK: 9881984									
Total Dissolved Solids	1756	1600	3176			89		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: 183110571301	Sample number(s): 9881981-9881991 BKG: 9881981			
Mercury	N.D.	N.D.	0 (1)	20
Batch number: 183111404401	Sample number(s): 9881981-9881991 BKG: 9881989			
Barium	1.98	1.95	2	20
Boron	0.814	0.802	1	20
Calcium	419.46	408.84	3	20
Chromium	N.D.	N.D.	0 (1)	20
Cobalt	0.00467	0.00422	10 (1)	20
Lithium	0.0505	0.0513	2 (1)	20
Selenium	N.D.	N.D.	0 (1)	20
Thallium	N.D.	N.D.	0 (1)	20
Batch number: 183121404701A	Sample number(s): 9881981-9881991 BKG: 9881987			

*- 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: 11/16/2018 12:45

Group Number: 2005364

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
Antimony	0.00164	0.000708	79* (1)	20
Arsenic	0.00200	0.00164	20 (1)	20
Beryllium	N.D.	N.D.	0 (1)	20
Cadmium	0.000160	N.D.	200* (1)	20
Lead	N.D.	N.D.	0 (1)	20
Batch number: 183121404701C	Sample number(s): 9881981-9881991 BKG: 9881987			
Molybdenum	0.00329	0.00300	9 (1)	20
	Degrees C	Degrees C		
Batch number: 18309005104A	Sample number(s): 9881981,9881984-9881985,9881989 BKG: 9881989			
Temperature of pH	22.72	22.99	1	5
	mg/l	mg/l		
Batch number: 18309921201A	Sample number(s): 9881985 BKG: 9881985			
Total Dissolved Solids	1132	1100	3 (1)	5
Batch number: 18309921202A	Sample number(s): 9881982-9881984,9881986-9881987,9881989-9881991 BKG: 9881984			
Total Dissolved Solids	1756	1700	3 (1)	5
Batch number: 18309921202B	Sample number(s): 9881981 BKG: 9881981			
Total Dissolved Solids	860	926	7* (1)	5
Batch number: 18316921201B	Sample number(s): 9881988 BKG: 9881988			
Total Dissolved Solids	9556	9002	6*	5
	Std. Units	Std. Units		
Batch number: 18309005104A	Sample number(s): 9881981,9881984-9881985,9881989 BKG: 9881989			
pH	7.68	7.71	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.

Acc: 7761

Group: 2005341 Sample: 9581951-9

COC # 5159380

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

2061 07-8

Sample Administration
Receipt Documentation Log

Doc Log ID: 231997



Group Number(s): 2005364

Client: GEI

Delivery and Receipt Information

Delivery Method:	<u>ELLE Courier</u>	Arrival Timestamp:	<u>11/02/2018 17:20</u>
Number of Packages:	<u>3</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:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	VOA Vial Headspace $\geq$ 6mm:	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 Wanita Curry (14057) at 22:13 on 11/02/2018

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	8013596-IR	2.7	IR	Wet	Y	Bagged	N
2	8013596-IR	1.6	IR	Wet	Y	Bagged	N
3	8013596-IR	2.2	IR	Wet	Y	Bagged	N

General Comments: QC Metals Batch for : MW-4 (1 Container)

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.

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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: GEJ60

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9881981	MW-9	X		
9881982	MW-7	X		
9881983	MW-8	X		
9881984	MW-5	X		
9881985	MW-6	X		
9881986	FB-20181031	X		Field Blank
9881987	MW-1	X		
9881988	MW-4	X		
9881989	MW-2	X		
9881990	MW-3	X		
9881991	FB-20181101	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

Method defined actions are taken for any failed matrix QC.

Batch#: 183111404401 (Sample number(s): 9881981-9881991, UNSPK: 9881989, BKG: 9881989)
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: GEJ60

ICP Metals

Fraction: Metals in Liquid

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

Sample Duplicate

Batch#: 183121404701A (Sample number(s): 9881981-9881991, UNSPK: 9881987, BKG: 9881987)
The duplicate RPD for the following analyte(s) is outside the acceptance window:
Antimony, Cadmium

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

(Sample number(s): 9881981-9881991: Analysis: 01750)

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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881981, 9881981BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.7	B		MS
7440-38-2	Arsenic	5.8			MS
7440-39-3	Barium	54.9			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	274			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	76200			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	12.0			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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881982
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.75	B		MS
7440-39-3	Barium	38.1			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	151			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	32700			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	5.6			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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881983
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

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	61.8			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	191			P
7440-43-9	Cadmium	0.69	B		MS
7440-70-2	Calcium	28500			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.7	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	3.9			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
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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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881984
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	0.87	B		MS
7440-39-3	Barium	84.4			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	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	15.0	B		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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881985
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.41	U		MS
7440-38-2	Arsenic	1.5	B		MS
7440-39-3	Barium	70.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	595			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	99900			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	0.32	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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881986
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

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	114	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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881987, 9881987BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.6	B		MS
7440-38-2	Arsenic	2.0	B		MS
7440-39-3	Barium	715			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1060			P
7440-43-9	Cadmium	0.16	B		MS
7440-70-2	Calcium	382000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	6.9			P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	47.8	B		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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881988
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.82	B		MS
7440-38-2	Arsenic	0.69	B		MS
7440-39-3	Barium	99.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1190			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	128000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	3.0	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	49.7	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	6.5			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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881989, 9881989BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.66	B		MS
7440-38-2	Arsenic	3.3			MS
7440-39-3	Barium	1980			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	814			P
7440-43-9	Cadmium	0.24	B		MS
7440-70-2	Calcium	419000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.7	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	50.5			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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881990
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.96	B		MS
7440-38-2	Arsenic	2.6			MS
7440-39-3	Barium	74.9			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	507			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	78600			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	13.8	B		P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	11.5			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.: GEJ60

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9881991
Concentration Units: UG/L

% Solids: 0.0
Date Received: 11/02/2018

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	95.3	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.: GEJ60

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	183111404401	9881981
Boron		9881982
Calcium		9881983
Chromium		9881984
Cobalt		9881985
Lithium		9881986
Selenium		9881987
Thallium		9881988
		9881989BKG
		9881989MS
		9881989MSD
		9881989DUP
		9881990
		9881991
		P31104AB
		P31104AQ

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.: GEJ60

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	183121404701	9881981
Arsenic		9881982
Beryllium		9881983
Cadmium		9881984
Lead		9881985
Molybdenum		9881986
		9881987BKG
		9881987MS
		9881987MSD
		9881987DUP
		9881988
		9881989
		9881990
		9881991
		P31204AB
		P31204AQ

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.: GEJ60

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	183110571301	9881981BKG
		9881981MS
		9881981MSD
		9881981DUP
		9881982
		9881983
		9881984
		9881985
		9881986
		9881987
		9881988
		9881989
		9881990
		9881991
		P31171AB
		P31171AQ

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.: GEJ60

Method: P
Run Name: 1831201T74
Calibration Date(s): 11/08/2018
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	608.55	101.4	500.0	496.58	99.3	500.0	500.18	100.0
Boron		600.0	582.20	97.0	500.0	467.07	93.4	500.0	484.05	96.8
Calcium		30000.0	29931.86	99.8	25000.0	25075.02	100.3	25000.0	24798.40	99.2
Chromium		600.0	608.83	101.5	500.0	493.78	98.8	500.0	507.47	101.5
Cobalt		600.0	599.13	99.9	500.0	482.67	96.5	500.0	495.09	99.0
Lithium		600.0	603.31	100.6	500.0	510.87	102.2	500.0	506.76	101.4
Selenium		600.0	591.68	98.6	500.0	477.46	95.5	500.0	494.82	99.0
Thallium		600.0	603.99	100.7	500.0	482.86	96.6	500.0	497.29	99.5

(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.: GEJ60

Method: P
Run Name: 1831201T74
Calibration Date(s): 11/08/2018
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	495.66	99.1	500.0	495.51	99.1
Boron					500.0	469.29	93.9	500.0	472.34	94.5
Calcium					25000.0	23986.70	95.9	25000.0	24018.88	96.1
Chromium					500.0	493.66	98.7	500.0	497.28	99.5
Cobalt					500.0	493.73	98.7	500.0	496.10	99.2
Lithium					500.0	497.26	99.5	500.0	505.58	101.1
Selenium					500.0	491.42	98.3	500.0	497.73	99.5
Thallium					500.0	496.79	99.4	500.0	497.19	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.: GEJ60

Method: P
Run Name: 1831402T75
Calibration Date(s): 11/10/2018
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	594.75	99.1	500.0	488.77	97.8	500.0	492.52	98.5
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.: GEJ60

Method: P
Run Name: 1831402T75
Calibration Date(s): 11/10/2018
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	501.40	100.3			
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

Method: MS

Run Name: 1831606E07

Calibration Date(s): 11/12/2018

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	54.34	108.7	25.0	26.95	107.8	25.0	25.51	102.0
Arsenic	75	500.0	512.16	102.4	250.0	261.40	104.6	250.0	263.41	105.4
Beryllium	9	50.0	51.18	102.4	25.0	24.33	97.3	25.0	27.22	108.9
Cadmium	111	50.0	52.51	105.0	25.0	27.02	108.1	25.0	25.67	102.7
Lead	208	50.0	51.76	103.5	25.0	26.30	105.2	25.0	26.64	106.6
Molybdenum	98	50.0	52.43	104.9	25.0	26.72	106.9	25.0	26.72	106.9

(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.: GEJ60

Method: MS
Run Name: 1831606E07
Calibration Date(s): 11/12/2018
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	25.00	100.0			
Arsenic	75				250.0	258.73	103.5			
Beryllium	9				25.0	26.52	106.1			
Cadmium	111				25.0	25.16	100.6			
Lead	208				25.0	26.93	107.7			
Molybdenum	98				25.0	26.03	104.1			

(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.: GEJ60

Method: CV
Run Name: 1831201M07
Calibration Date(s): 11/08/2018
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	2.33	93.2	1.0	0.97	97.0	1.0	0.94	94.0

(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.: GEJ60

Method: CV
Run Name: 1831201M07
Calibration Date(s): 11/08/2018
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	0.94	94.0	1.0	0.94	94.0

(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.: GEJ60

Method: CV
Run Name: 1831201M07
Calibration Date(s): 11/08/2018
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	0.93	93.0	1.0	0.91	91.0

(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.: GEJ60

Method: CV

Run Name: 1831201M07

Calibration Date(s): 11/08/2018

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	0.91	91.0			

(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.: GEJ60

Method: P
Run Name: 1831201T74
Calibration Date(s): 11/08/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium		5.0	5.13	102.6		
Boron		50.0	45.64	91.3		
Calcium		500.0	523.94	104.8		
Chromium		15.0	14.00	93.3		
Cobalt		5.0	5.68	113.6		
Lithium		50.0	54.93	109.9		
Selenium		50.0	51.00	102.0		
Thallium		30.0	32.37	107.9		

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.: GEJ60

Method: P

Run Name: 1831402T75

Calibration Date(s): 11/10/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Barium						
Boron		50.0	51.59	103.2		
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

Method: MS
Run Name: 1831606E07
Calibration Date(s): 11/12/2018
Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Antimony	121	2.0	2.14	107.0		
Arsenic	75	2.0	2.04	102.0		
Beryllium	9	0.5	0.50	100.0		
Cadmium	111	1.0	1.11	111.0		
Lead	208	3.0	3.14	104.7		
Molybdenum	98	2.0	2.11	105.5		

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.: GEJ60

Method: CV

Run Name: 1831201M07

Calibration Date(s): 11/08/2018

Concentration Units: UG/L

Analyte	Mass	Initial			Final	
		True	Found	%R	Found	%R
Mercury		0.2	0.17	85.0	0.16	80.0

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.: GEJ60

Method: P

Run Name: 1831201T74

Calibration Date(s): 11/08/2018

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	U183111404401
Boron		8.4	U	8.4	U	8.4	U	8.4	U		12.000	U183111404401
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		33.000	U183111404401
Chromium		0.85	U	0.85	U	0.85	U	-1.1	B		5.300	U183111404401
Cobalt		0.56	U	0.78	B	0.80	B	0.56	U		1.500	U183111404401
Lithium		7.5	U	7.5	U	7.5	U	7.5	U		11.000	U183111404401
Selenium		6.0	U	6.0	U	6.0	U	6.0	U		21.000	U183111404401
Thallium		4.9	U	4.9	U	4.9	U	4.9	U		14.000	U183111404401

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.: GEJ60

Method: P
Run Name: 1831201T74
Calibration Date(s): 11/08/2018

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				0.85	U								
Cobalt				0.56	U								
Lithium				7.5	U								
Selenium				6.0	U								
Thallium				4.9	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.: GEJ60

Method: P
Run Name: 1831402T75
Calibration Date(s): 11/10/2018

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



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QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ60

Method: MS

Run Name: 1831606E07

Calibration Date(s): 11/12/2018

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
Antimony	121	0.75	B	0.82	B	0.38	B	0.40	B	121	0.410	U183121404701A
Arsenic	75	0.50	U	0.50	U	0.50	U	0.50	U	75	0.680	U183121404701A
Beryllium	9	0.073	U	0.073	U	0.073	U	0.073	U	9	0.091	U183121404701A
Cadmium	111	0.18	U	0.18	U	0.18	U	0.18	U	111	0.150	U183121404701A
Lead	208	0.14	U	0.14	U	0.14	U	0.14	U	208	1.100	U183121404701A
Molybdenum	98	0.30	U	0.30	U	0.30	U	0.30	U	98	0.310	U183121404701A

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.: GEJ60

Method: CV

Run Name: 1831201M07

Calibration Date(s): 11/08/2018

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	183110571301

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.: GEJ60

Method: CV
Run Name: 1831201M07
Calibration Date(s): 11/08/2018

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.: GEJ60

Method: CV

Run Name: 1831201M07

Calibration Date(s): 11/08/2018

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						

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.: GEJ60

Instrument ID: 23745
Run Name: 1831201T74
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		486120	97.2						
Barium	0		1							
Boron	0		5							
Calcium	500000		489147	97.8						
Chromium	0		-8							
Cobalt	0		2							
Iron	200000		196140	98.1						
Lithium	0		1							
Magnesium	500000		453594	90.7						
Selenium	0		2							
Thallium	0		3							

Control Limits: All Metals 80%-120%



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 4A
ICP-AES INTERFERENCE CHECK SAMPLE
SDG No.: GEJ60

Instrument ID: 23290
Run Name: 1831402T75
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		489241	97.8						
Barium										
Boron	0		-52							
Calcium	500000		495455	99.1						
Chromium										
Cobalt										
Iron	200000		195510	97.8						
Lithium										
Magnesium	500000		488461	97.7						
Selenium										
Thallium										

Control Limits: All Metals 80%-120%

Instrument ID: 27813
 Run Name: 1831606E07
 Concentration Units: ug/L

Analyte	Mass	True		Found			
		Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R
Aluminum	27	100000		103716	103.7		
Antimony	121	0		2			
Arsenic	75	0		1			
Beryllium	9	0		0			
Cadmium	111	0		0			
Calcium	44	300000		295516	98.5		
Carbon	13	20000		NA			
Chloride	37	100000		NA			
Iron	57	250000		245617	98.2		
Lead	208	0		1			
Magnesium	24	100000		99808	99.8		
Molybdenum	98	2000		2128	106.4		
Phosphorus	31	10000		NA			
Potassium	39	100000		103067	103.1		
Sodium	23	250000		241597	96.6		
Sulfur	34	10000		NA			
Titanium	47	2000		2057	102.9		

Control Limits: All Metals 80%-120%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881981BKG Matrix Spike Lab Sample ID: 9881981MS Matrix Spike Duplicate Lab Sample ID: 9881981MSD

Batch Number(s): 183110571301

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	0.8151		0.8069		1.0000	1.0000	UG/L	82		81		1		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 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881987BKG Matrix Spike Lab Sample ID: 9881987MS Matrix Spike Duplicate Lab Sample ID: 9881987MSD

Batch Number(s): 183121404701

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	1.6358	B	6.8896		7.2995		6.0000	6.0000	UG/L	88		94		6		75 - 125	20	MS
Arsenic	75	1.9954	B	13.7849		12.9925		10.0000	10.0000	UG/L	118		110		6		75 - 125	20	MS
Beryllium	9	0.0910	U	3.8875		4.1192		4.0000	4.0000	UG/L	97		103		6		75 - 125	20	MS
Cadmium	111	0.1603	B	5.2103		5.0455		5.0000	5.0000	UG/L	101		98		3		75 - 125	20	MS
Lead	208	1.0700	U	16.2283		16.3524		15.0000	15.0000	UG/L	108		109		1		75 - 125	20	MS
Molybdenum	98	3.2928		55.6349		56.6726		50.0000	50.0000	UG/L	105		107		2		75 - 125	20	MS

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 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881989BKG Matrix Spike Lab Sample ID: 9881989MS Matrix Spike Duplicate Lab Sample ID: 9881989MSD
Batch Number(s): 183111404401

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		1982.6600		3813.6100		3715.3400		2000.0000	2000.0000	UG/L	92		87		3		75 - 125	20	P
Boron		813.5100		3103.7500		3078.3000		2000.0000	2000.0000	UG/L	115		113		1		75 - 125	20	P
Calcium		419461.5700		426059.9800		419260.9100		4000.0000	4000.0000	UG/L	165		-5		2				P
Chromium		5.3000	U	221.4300		199.9100		200.0000	200.0000	UG/L	111		100		10		75 - 125	20	P
Cobalt		4.6700	B	478.0200		477.4600		500.0000	500.0000	UG/L	95		95		0		75 - 125	20	P
Lithium		50.5300		1078.5700		1098.1100		1000.0000	1000.0000	UG/L	103		105		2		75 - 125	20	P
Selenium		21.0000	U	153.7900		156.4200		150.0000	150.0000	UG/L	103		104		2		75 - 125	20	P
Thallium		14.0000	U	131.0500		130.8500		150.0000	150.0000	UG/L	87		87		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
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881981BKG

Duplicate Lab Sample ID: 9881981DUP

Batch Number(s): 183110571301

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 6

DUPLICATES

SDG No.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881987BKG

Duplicate Lab Sample ID: 9881987DUP

Batch Number(s): 183121404701

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Antimony	121		1.6358	B	0.7080	B	79		MS
Arsenic	75		1.9954	B	1.6389	B	20		MS
Beryllium	9		0.0910	U	0.0910	U			MS
Cadmium	111		0.1603	B	0.1510	U	200		MS
Lead	208		1.0700	U	1.0700	U			MS
Molybdenum	98	2.0	3.2928		2.9966		9		MS

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.: GEJ60

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9881989BKG

Duplicate Lab Sample ID: 9881989DUP

Batch Number(s): 183111404401

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Q	M
Barium			1982.6600		1951.2000		2		P
Boron			813.5100		801.7100		1		P
Calcium			419461.5700		408836.9600		3		P
Chromium			5.3000	U	5.3000	U			P
Cobalt			4.6700	B	4.2200	B	10		P
Lithium		50.0	50.5300		51.3300		2		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



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QUALITY ASSURANCE SUMMARY
FORM 7
LABORATORY CONTROL SAMPLE
SDG No.: GEJ60
Matrix: WATER

Analyte	Mass	Batch Number	Units	True	Found	C	Control Limits (%)	%R	M	In Spec
Antimony	121	183121404701	UG/L	6.000	6.056		80 - 120	101	MS	Yes
Arsenic	75	183121404701	UG/L	10.000	10.139		80 - 120	101	MS	Yes
Barium		183111404401	UG/L	2000.000	2039.220		80 - 120	102	P	Yes
Beryllium	9	183121404701	UG/L	4.000	4.087		80 - 120	102	MS	Yes
Boron		183111404401	UG/L	2000.000	1835.700		80 - 120	92	P	Yes
Cadmium	111	183121404701	UG/L	5.000	5.210		80 - 120	104	MS	Yes
Calcium		183111404401	UG/L	4000.000	4074.890		80 - 120	102	P	Yes
Chromium		183111404401	UG/L	200.000	201.580		80 - 120	101	P	Yes
Cobalt		183111404401	UG/L	500.000	514.650		80 - 120	103	P	Yes
Lead	208	183121404701	UG/L	15.000	15.307		80 - 120	102	MS	Yes
Lithium		183111404401	UG/L	1000.000	1023.710		80 - 120	102	P	Yes
Mercury		183110571301	UG/L	1.000	0.862		80 - 120	86	CV	Yes
Molybdenum	98	183121404701	UG/L	50.000	52.569		80 - 120	105	MS	Yes
Selenium		183111404401	UG/L	150.000	145.300		80 - 120	97	P	Yes
Thallium		183111404401	UG/L	150.000	158.510		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.: GEJ60

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9881987BKG

Serial Dilution Lab Sample ID: 9881987L

Batch Number(s): 183121404701

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Antimony	121	1.6358	B	2.0300	U	100		MS
Arsenic	75	1.9954	B	3.4000	U	100		MS
Beryllium	9	0.0910	U	1.3501	B	100		MS
Cadmium	111	0.1603	B	0.7550	U	100		MS
Lead	208	1.0700	U	5.3500	U			MS
Molybdenum	98	3.2928		3.0932	B	6		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



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Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ60

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9881989BKG

Serial Dilution Lab Sample ID: 9881989L

Batch Number(s): 183111404401

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		1982.6600		2030.6000		2		P
Boron		813.5100		836.4000		3		P
Calcium		419461.5700		422550.9000		1		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		4.6700	B	7.8500	B	68		P
Lithium		50.5300		74.9000	B	48		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: 23290
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: P
Instrument ID: 23745
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		0.85
Cobalt	228.62		0.56
Lithium	670.78		7.5
Selenium	196.09		6.0
Thallium	190.86		4.9

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.: GEJ60
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.: GEJ60
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.: GEJ60
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.: GEJ60
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 2018-11-12 01:43:31
 Report Comment ---
 Instrument Name G8403A SG18254097

[No Gas]

Sensitivity

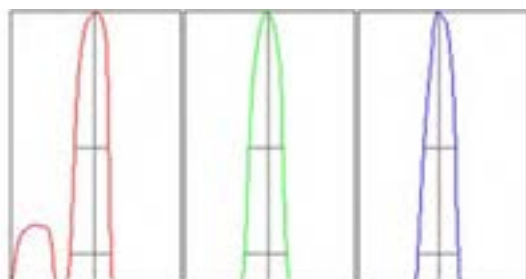
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	679	6792.65			2.195	5.000
89	10.00	2982	29818.34			1.937	5.000
205	10.00	1494	14935.78			2.609	5.000

Mass	RSD% (Flag)
7	
89	
205	

Mass	Rep#1 Count	Rep#2 Count	Rep#3 Count	Rep#4 Count	Rep#5 Count
7	686	690	691	655	674
89	2970	3029	3054	2928	2928
205	1498	1493	1519	1429	1529

Integration Time [sec] 0.1

Resolution/Axis



Mass	Peak Height	Axis	Axis (Required)	Axis (Flag)
7	1143.07	7.00	6.90 - 7.10	
89	5268.02	89.00	88.90 - 89.10	
205	2833.62	204.95	204.90 - 205.10	

Mass	W-50%	W-10%	W-10% (Required)	W-10% (Flag)
7	0.61	0.722	0.800	
89	0.60	0.744	0.800	
205	0.55	0.715	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	12.3 V	Deflect	17.0 V
Extract 2	-250.0 V	Cell Entrance	-40 V	Plate Bias	-50 V
Omega Bias	-95 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	125	Axis Gain	0.9994	QP Bias	-3.0 V
Mass Offset	125	Axis Offset	0.00		

Hardware Settings

Torch

Torch H	0.2 mm	Torch V	-0.1 mm

EM

Discriminator	4.1 mV	Analog HV	2147 V	Pulse HV	1671 V

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ60

Instrument ID: 27813

Start Date: 11/12/2018

Run Name: 1831606E07

End Date: 11/12/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	GE-3-72	AS
IN-3-115	CD, MO, SB	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 BI-3-209	Q	Element	Q	Element	Q
S0	11:03	100		100		100		100					
S	11:05	100		103		103		105					
ICV	11:08	99		102		99		101					
ICB	11:10	100		99		98		98					
LLC	11:12	100		98		96		98					
ICSA	11:14	94		95		93		94					
LRS2	11:16	99		99		94		96					
LRS3	11:18	102		101		100		99					
CCS	11:20	95		100		99		98					
CCS	11:23	98		98		99		97					
CCV	11:25	101		102		100		101					
CCB	11:27	97		101		101		99					
P31204AB	11:29	92		100		99		100					
P31204AQ	11:31	101		102		100		101					
9881987BKG	11:33	97		99		95		86					
9881987A	11:36	98		97		92		84					
9881987DUP	11:38	101		106		100		88					
9881987MS	11:40	100		100		95		83					
9881987MSD	11:42	100		99		95		83					
9881987L	11:44	84		119		113		99					
9881981	11:46	104		111		101		95					
CCV	11:49	100		108		102		96					
CCB	11:51	102		106		102		96					
9881982	11:53	103		107		99		94					
9881983	11:55	103		111		107		98					
9881984	11:57	106		107		103		94					
9881985	11:59	103		109		104		97					
9881986	12:01	95		102		100		95					
9881988	12:04	98		99		92		83					
9881989	12:06	91		100		93		81					
9881990	12:08	106		115		106		99					
9881991	12:10	104		108		104		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: 11/12/2018

Run Name: 1831606E07

End Date: 11/12/2018

Standard	Elements Applies to	Standard	Elements Applies to
BI-3-209	PB	GE-3-72	AS
IN-3-115	CD, MO, SB	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 BI-3-209	Q	Element	Q	Element	Q
CCV	12:12	105		107		102		96					
CCB	12:14	98		104		99		94					

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: 183111404401

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9881981	11/07/2018	50.00	50
9881982	11/07/2018	50.00	50
9881983	11/07/2018	50.00	50
9881984	11/07/2018	50.00	50
9881985	11/07/2018	50.00	50
9881986	11/07/2018	50.00	50
9881987	11/07/2018	50.00	50
9881988	11/07/2018	50.00	50
9881990	11/07/2018	50.00	50
9881991	11/07/2018	50.00	50
9881989BKG	11/07/2018	50.00	50
9881989DUP	11/07/2018	50.00	50
9881989MSD	11/07/2018	50.00	50
9881989MS	11/07/2018	50.00	50
P31104AB	11/07/2018	50.00	50
P31104AQ	11/07/2018	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: 183121404701

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9881981	11/09/2018	50.00	50
9881982	11/09/2018	50.00	50
9881983	11/09/2018	50.00	50
9881984	11/09/2018	50.00	50
9881985	11/09/2018	50.00	50
9881986	11/09/2018	50.00	50
9881988	11/09/2018	50.00	50
9881989	11/09/2018	50.00	50
9881990	11/09/2018	50.00	50
9881991	11/09/2018	50.00	50
9881987BKG	11/09/2018	50.00	50
9881987DUP	11/09/2018	50.00	50
9881987MSD	11/09/2018	50.00	50
9881987MS	11/09/2018	50.00	50
P31204AB	11/09/2018	50.00	50
P31204AQ	11/09/2018	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: 183110571301

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9881982	11/07/2018	40.00	40
9881983	11/07/2018	40.00	40
9881984	11/07/2018	40.00	40
9881985	11/07/2018	40.00	40
9881986	11/07/2018	40.00	40
9881987	11/07/2018	40.00	40
9881988	11/07/2018	40.00	40
9881989	11/07/2018	40.00	40
9881990	11/07/2018	40.00	40
9881991	11/07/2018	40.00	40
9881981BKG	11/07/2018	40.00	40
9881981DUP	11/07/2018	40.00	40
9881981MSD	11/07/2018	40.00	40
9881981MS	11/07/2018	40.00	40
P31171AB	11/07/2018	40.00	40
P31171AQ	11/07/2018	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.: GEJ60

Method: P

Instrument ID: 23745

Run Name: 1831201T74

Run Start Date: 11/08/2018

Run End Date: 11/08/2018

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	06:48			X		X		X	X	X		X			X	X													
S	1.00	06:51							X																					
S	1.00	06:53			X		X				X	X				X	X													
S	1.00	06:56								X																				
ICV	1.00	06:59			X		X		X	X	X		X			X	X													
ICB	1.00	07:02			X		X		X	X	X		X			X	X													
LLC	1.00	07:04			X		X		X	X	X		X			X	X													
ICSA	1.00	07:07			X		X		X	X	X		X			X	X													
CCV	1.00	07:10			X		X		X	X	X		X			X	X													
CCB	1.00	07:13			X		X		X	X	X		X			X	X													
LRS2	1.00	07:16			X		X		X	X	X		X			X	X													
LRS4	1.00	07:19			X		X		X	X	X		X			X	X													
LRS3	1.00	07:22			X		X		X	X	X		X			X	X													
LRS5	1.00	07:25			X		X		X	X	X		X			X	X													
CCV	1.00	07:27			X		X		X	X	X		X			X	X													
CCB	1.00	07:30			X		X		X	X	X		X			X	X													
P31104AB	1.00	07:33			X		X		X	X	X		X			X	X													
P31104AQ	1.00	07:36			X		X		X	X	X		X			X	X													
9881989BKG	1.00	07:39			X		X		X	X	X		X			X	X													
9881989A	1.00	07:42																												
9881989DUP	1.00	07:45			X		X		X	X	X		X			X	X													
9881989MS	1.00	07:48			X				X	X	X		X			X	X													
9881989MSD	1.00	07:52			X				X	X	X		X			X	X													
9881989L	5.00	07:55			X		X		X	X	X		X			X	X													
9881981	1.00	07:58			X		X		X	X	X		X			X	X													
9881982	1.00	08:01			X		X		X	X	X		X			X	X													
CCV	1.00	08:03			X		X		X	X	X		X			X	X													
CCB	1.00	08:06			X		X		X	X	X		X			X	X													
9881983	1.00	08:09			X		X		X	X	X		X			X	X													
9881984	1.00	08:12			X		X		X	X	X		X			X	X													
9881985	1.00	08:15			X		X		X	X	X		X			X	X													
9881986	1.00	08:18			X		X		X	X	X		X			X	X													
9881987	1.00	08:20			X		X		X	X	X		X			X	X													
9881988	1.00	08:24			X		X		X	X	X		X			X	X													
9881990	1.00	08:27			X		X		X	X	X		X			X	X													
9881991	1.00	08:30			X		X		X	X	X		X			X	X													
ZZZZZZ	1.00	08:33																												
ZZZZZZ	1.00	08:36																												

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.: GEJ60

Method: P
Instrument ID: 23745
Run Name: 1831201T74

Run Start Date: 11/08/2018
Run End Date: 11/08/2018

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	08:38			X		X		X	X	X		X			X	X													
CCB	1.00	08:41			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.: GEJ60

Method: P
Instrument ID: 23290
Run Name: 1831402T75

Run Start Date: 11/10/2018
Run End Date: 11/10/2018

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	09:15					X																							
S	1.00	09:17																												
S	1.00	09:20					X																							
S	1.00	09:23																												
ICV	1.00	09:26					X																							
ICB	1.00	09:28					X																							
LLC	1.00	09:31					X																							
ICSA	1.00	09:34					X																							
CCV	1.00	09:37					X																							
CCB	1.00	09:39					X																							
LRS2	1.00	09:42					X																							
LRS4	1.00	09:45					X																							
LRS3	1.00	09:48					X																							
LRS5	1.00	09:51					X																							
CCV	1.00	09:54					X																							
CCB	1.00	09:56					X																							
P31104AB	1.00	09:59																												
P31104AB	1.00	10:02																												
P31104AQ	1.00	10:05																												
9881989MS	5.00	10:08					X																							
9881989MSD	5.00	10:11					X																							
ZZZZZZ	1.00	10:14																												
ZZZZZZ	1.00	10:17																												
ZZZZZZ	5.00	10:19																												
CCV	1.00	10:22					X																							
CCB	1.00	10:25					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.: GEJ60

Method: MS

Instrument ID: 27813

Run Name: 1831606E07

Run Start Date: 11/12/2018

Run End Date: 11/12/2018

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	11:03	X	X		X		X				X			X															
S	1.00	11:05	X	X		X		X				X			X															
ICV	1.00	11:08	X	X		X		X				X			X															
ICB	1.00	11:10	X	X		X		X				X			X															
LLC	1.00	11:12	X	X		X		X				X			X															
ICSA	1.00	11:14	X	X		X		X				X			X															
LRS2	1.00	11:16	X	X		X		X				X			X															
LRS3	1.00	11:18	X	X		X		X				X			X															
CCS	1.00	11:20	X	X		X		X				X			X															
CCS	1.00	11:23	X	X		X		X				X			X															
CCV	1.00	11:25	X	X		X		X				X			X															
CCB	1.00	11:27	X	X		X		X				X			X															
P31204AB	1.00	11:29	X	X		X		X				X			X															
P31204AQ	1.00	11:31	X	X		X		X				X			X															
9881987BKG	1.00	11:33	X	X		X		X				X			X															
9881987A	1.00	11:36																												
9881987DUP	1.00	11:38	X	X		X		X				X			X															
9881987MS	1.00	11:40	X	X		X		X				X			X															
9881987MSD	1.00	11:42	X	X		X		X				X			X															
9881987L	5.00	11:44	X	X		X		X				X			X															
9881981	1.00	11:46	X	X		X		X				X			X															
CCV	1.00	11:49	X	X		X		X				X			X															
CCB	1.00	11:51	X	X		X		X				X			X															
9881982	1.00	11:53	X	X		X		X				X			X															
9881983	1.00	11:55	X	X		X		X				X			X															
9881984	1.00	11:57	X	X		X		X				X			X															
9881985	1.00	11:59	X	X		X		X				X			X															
9881986	1.00	12:01	X	X		X		X				X			X															
9881988	1.00	12:04	X	X		X		X				X			X															
9881989	1.00	12:06	X	X		X		X				X			X															
9881990	1.00	12:08	X	X		X		X				X			X															
9881991	1.00	12:10	X	X		X		X				X			X															
CCV	1.00	12:12	X	X		X		X				X			X															
CCB	1.00	12:14	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.: GEJ60

Method: CV

Instrument ID: 17384

Run Name: 1831201M07

Run Start Date: 11/08/2018

Run End Date: 11/08/2018

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	05:50												X																
S0.2	1.00	05:52												X																
S0.5	1.00	05:54												X																
S1.0	1.00	05:56												X																
S2.5	1.00	05:58												X																
S5.0	1.00	06:00												X																
ICV	1.00	06:06												X																
ICB	1.00	06:08												X																
CRA	1.00	06:10												X																
CCV	1.00	06:12												X																
CCB	1.00	06:14												X																
ZZZZZZ	1.00	06:16																												
ZZZZZZ	1.00	06:18																												
ZZZZZZ	1.00	06:20																												
ZZZZZZ	1.00	06:22																												
ZZZZZZ	1.00	06:24																												
ZZZZZZ	1.00	06:26																												
ZZZZZZ	1.00	06:28																												
P31171AB	1.00	06:31												X																
P31171AQ	1.00	06:33												X																
9881981BKG	1.00	06:35												X																
CCV	1.00	06:37												X																
CCB	1.00	06:39												X																
9881981DUP	1.00	06:41												X																
9881981MS	1.00	06:43												X																
9881981MSD	1.00	06:45												X																
9881982	1.00	06:47												X																
9881983	1.00	06:49												X																
9881984	1.00	06:51												X																
9881985	1.00	06:53												X																
9881986	1.00	06:55												X																
9881987	1.00	06:57												X																
9881988	1.00	06:59												X																
CCV	1.00	07:01												X																
CCB	1.00	07:03												X																
9881989	1.00	07:05												X																
9881990	1.00	07:07												X																
9881991	1.00	07:09												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.: GEJ60

Method: CV
Instrument ID: 17384
Run Name: 1831201M07

Run Start Date: 11/08/2018
Run End Date: 11/08/2018

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	07:11																										
ZZZZZZ	1.00	07:13																										
ZZZZZZ	1.00	07:15																										
ZZZZZZ	1.00	07:17																										
ZZZZZZ	1.00	07:19																										
ZZZZZZ	1.00	07:21																										
ZZZZZZ	1.00	07:23																										
CCV	1.00	07:25													X													
CCB	1.00	07:27													X													
ZZZZZZ	1.00	07:29																										
ZZZZZZ	1.00	07:31																										
ZZZZZZ	1.00	07:33																										
ZZZZZZ	1.00	07:35																										
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																										
CCV	1.00	07:50													X													
CCB	1.00	07:52													X													
ZZZZZZ	1.00	07:54																										
ZZZZZZ	1.00	07:56																										
ZZZZZZ	1.00	07:58																										
ZZZZZZ	1.00	08:00																										
ZZZZZZ	1.00	08:02																										
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																										
CCV	1.00	08:14													X													
CCB	1.00	08:16													X													
ZZZZZZ	1.00	08:18																										
ZZZZZZ	1.00	08:20																										
CRA	1.00	08:22													X													
CCV	1.00	08:24													X													
CCB	1.00	08:26													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.: GEJ60

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: GEJ60

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9881981	MW-9	X		
9881982	MW-7	X		
9881983	MW-8	X		
9881984	MW-5	X		
9881985	MW-6	X		
9881986	FB-20181031	X		Field Blank
9881987	MW-1	X		
9881988	MW-4	X		
9881989	MW-2	X		
9881990	MW-3	X		
9881991	FB-20181101	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: GEJ60

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

SAMPLE ANALYSIS:

Samples	Chloride	Fluoride	Sulfate
9881981	DF100	DF5	DF5
9881982	DF20	DF5	DF5
9881983	DF500	DF5	DF5
9881984	DF500	DF5	DF5
9881985	DF500	DF5	DF5
9881986	DF1	DF1	DF1
9881987	DF2000	DF5	DF20
9881988	DF2000	DF5	DF100
9881989	DF2000	DF5	DF5
9881990	DF500	DF5	DF20
9881991	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: GEJ60

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18308520117A	P30820QB	11/05/2018 11:35:00	X	X	X
	P30820QQ	11/05/2018 11:18:00	X		X
	P30820QQ	11/06/2018 15:12:00		X	
18308520117B	9881981	11/05/2018 19:51:00			X
	9881981	11/05/2018 20:08:00	X		
	9881981	11/06/2018 15:47:00		X	
	9881982	11/05/2018 20:25:00			X
	9881982	11/05/2018 20:42:00	X		
	9881982	11/06/2018 16:04:00		X	
	9881988	11/06/2018 16:21:00		X	
	9881988	11/08/2018 13:46:00			X
	9881988	11/08/2018 14:04:00	X		
	9881990	11/05/2018 23:16:00	X		
	9881990	11/06/2018 16:38:00		X	
	9881990	11/08/2018 14:22:00			X
18309520117A	9881983	11/06/2018 01:46:00		X	X
	9881983	11/06/2018 02:04:00	X		
	9881984	11/06/2018 02:22:00		X	X
	9881984	11/06/2018 02:41:00	X		
	9881985	11/06/2018 02:59:00		X	X
	9881985	11/06/2018 03:54:00	X		
	9881986	11/06/2018 04:12:00	X	X	X
	9881987	11/06/2018 04:30:00		X	
	9881987	11/08/2018 22:35:00			X
	9881987	11/08/2018 23:30:00	X		
	P30920QB	11/05/2018 12:23:00	X	X	X
	P30920QQ	11/05/2018 12:04:00	X	X	X
18309520117B	9881989	11/06/2018 09:41:00		X	X
	9881989	11/09/2018 00:06:00	X		
	9881991	11/06/2018 10:17:00	X	X	X

Fraction: Instrumental Wet Chemistry

18308520117A / P30820QB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	11/05/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	11/05/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	11/05/18	N.D.	mg/l	0.30	1.0

18309520117A / P30920QB Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Chloride	IC	11/05/18	N.D.	mg/l	0.20	0.40
Fluoride	IC	11/05/18	N.D.	mg/l	0.050	0.10
Sulfate	IC	11/05/18	N.D.	mg/l	0.30	1.0

SDG: GEJ60
Matrix: LIQUID

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P30820QQ	Batch: 18308520117B (Sample number(s): 9881981-9881982, 9881988, 9881990)								
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	0.784	NA	105	NA	90-110	NA	NA
Sulfate	IC	7.50	7.59	NA	101	NA	90-110	NA	NA

LCS: P30920QQ	Batch: 18309520117A (Sample number(s): 9881983-9881987)								
	Batch: 18309520117B (Sample number(s): 9881989, 9881991)								
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	0.750	NA	100	NA	90-110	NA	NA
Sulfate	IC	7.50	7.74	NA	103	NA	90-110	NA	NA

Instrument ID: 10913
Calibration Date: 10/19/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.497489	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

Concentration units: mg/L

Batch Numbers: 18308520117B, 18309520117A, 18309520117B
Run Start Dates: 11/08/2018, 11/05/2018
Run Names: 1831201D06, 1830901D06

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
Low Chk	1.5	1.4653	98	3.75	3.9262	105	0.75	0.7558	101
High Chk	4.5	4.6036	102	11.25	11.8342	105	2.25	2.4841	110
CCV2	3	2.9990	100	7.5	7.7885	104	0.75	0.7580	101
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0023	100	7.5	7.7403	103	0.75	0.7563	101
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9777	99	7.5	7.7744	104	0.75	0.7547	101
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9798	99	7.5	7.7383	103	0.75	0.7631	102
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0053	100	7.5	7.9190	106	0.75	0.7833	104
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9973	100	7.5	7.7602	103	0.75	0.7662	102
CCB	0	ND	NA	0	ND	NA	0	ND	NA
Low Chk	1.5	1.4775	99	3.75	3.6969	99			
High Chk	4.5	4.5741	102	11.25	12.1558	108			
CCV2	3	2.9558	99	7.5	7.5607	101			
CCB	0	ND	NA	0	ND	NA			
CCV2	3	2.9533	98	7.5	7.5811	101			
CCB	0	ND	NA	0	ND	NA			
CCV2				7.5	7.2438	97			
CCB				0	ND	NA			
CCV2	3	2.9484	98	7.5	7.5369	100			

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
CCB	0	ND	NA	0	ND	NA			
CCV2	3	2.9609	99						
CCB	0	ND	NA						

SDG: GEJ60

Instrument ID: 24811
Calibration Date: 11/02/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.677137	1.372108	3.447310	7.094930	11.237807	0.9981	0.9990
Fluoride	0.189605	0.722716	1.892251	4.164881	6.641591	0.9984	0.9992
Sulfate	0.405978	0.865700	2.165607	4.516121	6.997385	0.9997	0.9999

Concentration units: mg/L

Batch Numbers: 18308520117B
Run Start Dates: 11/05/2018, 11/06/2018
Run Names: 1830901D17, 1831001D17

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.9428	98	7.5	7.5797	101	0.75	0.7691	103
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9841	99	7.5	7.5599	101	0.75	0.7875	105
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.0080	100	7.5	7.7488	103	0.75	0.8540	114
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.9755	99	7.5	7.6480	102			
CCB	0	ND	NA	0	ND	NA			
CCV2	3	2.9827	99	7.5	7.7079	103			
CCB	0	ND	NA	0	ND	NA			
CCV2	3	3.0445	101						
CCB	0	ND	NA						
CCV2							0.75	0.7927	106
CCB							0	ND	NA
CCV2							0.75	0.7696	103
CCB							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: GEJ60

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9881981	MW-9	X		1	
9881982	MW-7	X		1	
9881983	MW-8	X		1	
9881984	MW-5	X		1	
9881985	MW-6	X		1	
9881986	FB-20181031	X		1	Field Blank
9881987	MW-1	X		1	
9881988	MW-4	X		1	
9881989	MW-2	X		1	
9881990	MW-3	X		1	
9881991	FB-20181101	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#: 18316921201B (Sample number(s): 9881988, BKG: 9881988)

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: GEJ60

Water Quality

Fraction: Wet Chemistry

Batch#: 18309921202B (Sample number(s): 9881981, UNSPK: 9881984, BKG: 9881981-9881984)
The duplicate RPD for the following analyte(s) is outside the acceptance window: Total Dissolved Solids

SAMPLE ANALYSIS:

(Sample number(s): 9881988: Analysis: 00212)
The sample was originally ran within holding time for Total Dissolved Solids at a reduced volume with a result that was less than the Limit of Quantitation, the sample was reanalyzed for Total Dissolved Solids outside of the 7 day holding time on 11/12/2018.
The sample is being reported per client request.

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: GEJ60

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18309921201A	B309871B	11/05/2018 13:07
		L309871Q	11/05/2018 13:07
		L309871Y	11/05/2018 13:07
		9881985 UNSPK/BKG	11/05/2018 13:05
		9881985 MS,DUP	11/05/2018 13:07
Total Dissolved Solids	18309921202A	B309872B	11/05/2018 14:42
		L309872Q	11/05/2018 14:42
		9881982	11/05/2018 14:41
		9881983	11/05/2018 14:41
		9881984 UNSPK/BKG	11/05/2018 14:41
		9881984 MS,DUP	11/05/2018 14:42
		9881986	11/05/2018 14:41
		9881987	11/05/2018 14:41
		9881989	11/05/2018 14:41
		9881990	11/05/2018 14:41
Total Dissolved Solids	18309921202B	9881981 BKG	11/05/2018 14:41
		9881981 DUP	11/05/2018 14:42
Total Dissolved Solids	18316921201A	B316871B	11/12/2018 12:59
		L316871Q	11/12/2018 12:59
Total Dissolved Solids	18316921201B	9881988 BKG	11/12/2018 12:57
		9881988 DUP	11/12/2018 12:59

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ60

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18309005103A	9881982	11/06/2018 01:45:00	X	X
	9881983	11/06/2018 01:50:00	X	X
	9881986	11/06/2018 01:36:00	X	X
	9881987	11/06/2018 01:41:00	X	X
	9881988	11/06/2018 01:31:00	X	X
	9881990	11/06/2018 01:59:00	X	X
	9881991	11/06/2018 01:55:00	X	X
	P005103Q	11/06/2018 00:37:00	X	
18309005104A	9881981	11/06/2018 02:54:00	X	X
	9881984	11/06/2018 02:49:00	X	X
	9881985	11/06/2018 02:44:00	X	X
	9881989 BKG	11/06/2018 02:35:00	X	X
	9881989 DUP	11/06/2018 02:40:00	X	X
	P005104Q	11/06/2018 02:30:00	X	

Fraction: Wet Chemistry

18309921201A / B309871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	11/05/18	N.D.	mg/l	20.0	60.0

18309921202A / B309872B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	11/05/18	N.D.	mg/l	20.0	60.0

18316921201A / B316871B Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	11/12/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9881985 MS: 9881985	Batch: 18309921201A (Sample number(s): 9881985)									
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	1600	1132.	2708.	NA	99	NA	62-127	NA	NA

UNSPK: 9881984 MS: 9881984	Batch: 18309921202A (Sample number(s): 9881982-9881984, 9881986-9881987, 9881989-9881991)									
	Batch: 18309921202B (Sample number(s): 9881981)									
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	1600	1756.	3176.	NA	89	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: 9881989 DUP: 9881989	Batch: 18309005104A (Sample number(s): 9881981, 9881984-9881985, 9881989)				
Parameter	ME	Unspiked Conc Std. Units	DUP Conc Std. Units	%RPD	%RPD Limits
pH	MTR	7.68	7.71	0	4

BKG: 9881989 DUP: 9881989	Batch: 18309005104A (Sample number(s): 9881981, 9881984-9881985, 9881989)				
Parameter	ME	Unspiked Conc Degrees C	DUP Conc Degrees C	%RPD	%RPD Limits
Temperature of pH	MTR	22.72	22.99	1	5

BKG: 9881985 DUP: 9881985	Batch: 18309921201A (Sample number(s): 9881985)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	1132.	1100.	3 (1)	5

BKG: 9881984 DUP: 9881984	Batch: 18309921202A (Sample number(s): 9881982-9881984, 9881986-9881987, 9881989-9881991)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	1756.	1700.	3 (1)	5

BKG: 9881981 DUP: 9881981	Batch: 18309921202B (Sample number(s): 9881981)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	860.	926.	7* (1)	5

BKG: 9881988 DUP: 9881988	Batch: 18316921201B (Sample number(s): 9881988)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	9556.	9002.	6*	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: GEJ60
Matrix: LIQUID

Water Quality
Fraction: Wet Chemistry

LCS: P005103Q	Batch: 18309005103A (Sample number(s): 9881982-9881983, 9881986-9881988, 9881990-9881991)								
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: P005104Q	Batch: 18309005104A (Sample number(s): 9881981, 9881984-9881985, 9881989)								
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: L309871Q LCSD: L309871Y	Batch: 18309921201A (Sample number(s): 9881985)								
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	195	200	98	100	62-127	3	14

LCS: L309872Q	Batch: 18309921202A (Sample number(s): 9881982-9881984, 9881986-9881987, 9881989-9881991) Batch: 18309921202B (Sample number(s): 9881981)								
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	203	NA	102	NA	62-127	NA	NA

LCS: L316871Q	Batch: 18316921201B (Sample number(s): 9881988)								
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	196	NA	98	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 29, 2018

Ms. Hannah Cottman
Eurofins Lancaster Laboratories
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994

Re: NJ Radiochemistry Analyses
Work Order: 463530

Dear Ms. Cottman:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on November 06, 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: 2005365
Chain of Custody: 2005365
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 463530**

November 29, 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 06, 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>
463530001	MW-9
463530002	MW-7
463530003	MW-8
463530004	MW-5
463530005	MW-6
463530006	FB-20181031
463530007	MW-1
463530008	MW-4
463530009	MW-2
463530010	MW-3
463530011	FB-20181101

Case Narrative:

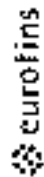
Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

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.

A handwritten signature in black ink, appearing to read 'T Cannon', with a stylized flourish at the end.

Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation



Lancaster Laboratories
Environmental

Environmental Analysis Request/Chain of Custody

Order # 2005365 Sample # 9881992-2002

Subcontractor		GEL		Site ID #		P.O. #		NA	
Project Name #		2005365							
Requestor		Hannah Cotman							
Sampler									
Phone #		717-656-2300 Ext 1896							
State where samples were collected		NJ		For Compliance		Yes		No	
Sample Identification		Collection		Date		Time		Grab	
				Time		Time		Composite	
MW-9		12/31/2018	1:05	X					
MW-7		12/31/2018	1255	X					
MW-8		12/31/2018	1235	X					
MW-5		12/31/2018	1050	X					
MW-6		12/31/2018	1420	X					
FB-2018-031		10/31/2018	1100	X					
MW-1		11/11/2018	0945	X					
MW-4		11/11/2018	1140	X					
MW-2		11/11/2018	1035	X					
MW-3		11/11/2018	1200	X					
FB-2018-101		11/11/2018	1100	X					
Turnaround Time Requested (TAT) (please check)		Standard		Rush					
(Note: TAT is subject to laboratory approval and such as ages)									
Date results are needed		Preservation Needed							
Rush results requested by (please check)		E-Mail		Phone					
E-mail Address		FNVSubcontracting@EurofinsUS.com							
Phone		717-656-2300 Ext 1896							
Data Package Options (please check if required)		Level IV DOD							
Type I (Validation-CLP)		MA MCP							
Type III (Reduced non-CLP)		CT RCP							
Type VI (Raw Data Only)		TX TRRP-13							
NJ DRQP		NYSDEC Category		A		B			
EDD Required?		Yes		No		If yes, format:		Hazard	

Analyses Requested		Preservation and Filtration Codes		Matrix		Total # of Containers		Requested by		Received by		Time	
Sample	Analysis	Code	Code	Soil	Sediment	Tissue	Water	NPDES	Other	Date	Time	Date	Time
MW-9	Radon-222 (FPA 926.2.1)	X		X			X			11-5-18	1620	11/16/18	8:55
MW-7	Radon-222 (FPA 926.2.1)	X		X			X						
MW-8	Radon-222 (FPA 926.2.1)	X		X			X						
MW-5	Radon-222 (FPA 926.2.1)	X		X			X						
MW-6	Radon-222 (FPA 926.2.1)	X		X			X						
FB-2018-031	Radon-222 (FPA 926.2.1)	X		X			X						
MW-1	Radon-222 (FPA 926.2.1)	X		X			X						
MW-4	Radon-222 (FPA 926.2.1)	X		X			X						
MW-2	Radon-222 (FPA 926.2.1)	X		X			X						
MW-3	Radon-222 (FPA 926.2.1)	X		X			X						
FB-2018-101	Radon-222 (FPA 926.2.1)	X		X			X						

Remarks	Preservation Codes
9881992	MA MCP
9881993	CT RCP
9881994	TX TRRP-13
9881995	MA MCP
9881996	MA MCP
9881997	MA MCP
9881998	MA MCP
9881999	MA MCP
9882000	MA MCP
9882001	MA MCP
9882002	MA MCP

Temperature upon receipt	°C

GEL

JL

JA

SAMPLE RECEIPT & REVIEW FORM

Client: <u>LANC</u>		SIGGARDSON Work Order: <u>463530</u>	
Received By: <u>JA</u>		Date Received: <u>11/6/18</u>	
Carrier and Tracking Number		Carrier: <u>United</u> Tracking Number: <u>5035 4245 4162</u>	
		Carrier: <u>United</u> Tracking Number: <u>5035 4245 4162</u>	
Suspected Hazard Information		If Suspected Hazard is present, sample and material "transacted" contact the Refinery Safety Group's contact information.	
Suspected Hazard Information		If Suspected Hazard is present, sample and material "transacted" contact the Refinery Safety Group's contact information.	
COG Sample container is labeled as indicated?		Max/min Net Contents Observed: <u>0</u> Liters / Gallons / Area Back ground Count: <u>0</u> CPM / MIN/Hr Classified as: Rad 1 Rad 2 Rad 3	
Is package, COG and/or samples marked HAZ?		If you select Hazardous, contact the GEL Safety Group. IFCB: <u> </u> Hazardous: <u> </u> IFCB No: <u> </u> RCRA: <u> </u> Aqueous: <u> </u> Inorganic: <u> </u> Other: <u> </u>	
Sample Receipt Criteria		Comments/Qual Gen (Required for Non-Conforming Items)	
1	Shipping container received intact and sealed?	☒	
2	Container custody documents included with shipment?	☒	
3	Samples requiring cold preservation within 6.6 h (2.0 °C)?	☒	Temperature Device: <u>Temp - 18.0 °C</u> Device: <u>18.0 °C</u> Temperature: <u>18.0 °C</u>
4	Daily check performed and proved in the temperature log?	☒	Temperature Device Serial #: <u>182-18</u> Serial for temperature control system: <u> </u>
5	Samples containers intact and sealed?	☒	
6	Samples requiring chemical preservation at proper pH?	☒	Samples requiring chemical preservation: <u>preserved all samples on arrival</u> pH: <u>18.0</u>
7	Do any samples require Volatile Analysis?	☒	If Yes, Are Encores or Soil Kits present? Yes No Do VOA vials contain acid preservation? Yes No N/A VOA vials free of headspace? Yes No N/A Sample IDs and containers attached? <u> </u>
8	Samples received within holding time?	☒	
9	Sample IDs on COG match IDs on bottles?	☒	
10	Flow & type 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 and returned, shall be preserved 30 days?	☒	
Comments, see Continuation Form to follow			

FM or PMIA/Work Order

K6

Date: 11/7/18Page: 1 of 1

GL-CPL GR-WW Rev 5

Laboratory Certifications

There are no "Data Exception Reports" associated with this analytical report.

List of current GEL Certifications as of 29 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	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 #: 463530**

Product: GFPC, Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 2

Analytical Batch: 1820404

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
463530001	MW-9
463530002	MW-7
463530003	MW-8
463530004	MW-5
463530005	MW-6
463530006	FB-20181031
463530007	MW-1
463530008	MW-4
463530009	MW-2
463530010	MW-3
463530011	FB-20181101
1204154520	Method Blank (MB)
1204154521	463530008(MW-4) Sample Duplicate (DUP)
1204154522	463530008(MW-4) Matrix Spike (MS)
1204154523	463530008(MW-4) Matrix Spike Duplicate (MSD)
1204154524	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
1204154521 (MW-4DUP)	Radium-228	RPD 134* (0.0%-100.0%) RER 2.33 (0-3)

Miscellaneous Information

Additional Comments

The matrix spike and matrix spike duplicate, 1204154522 (MW-4MS) and 1204154523 (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: 1819735

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
463530001	MW-9
463530002	MW-7
463530003	MW-8
463530004	MW-5
463530005	MW-6
463530006	FB-20181031
463530007	MW-1
463530008	MW-4
463530009	MW-2
463530010	MW-3
463530011	FB-20181101
1204152948	Method Blank (MB)
1204152949	463511005(NonSDG) Sample Duplicate (DUP)
1204152950	463511005(NonSDG) Matrix Spike (MS)
1204152951	463511005(NonSDG) Matrix Spike Duplicate (MSD)
1204152952	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, 1204152949 (Non SDG 463511005DUP), did not meet the relative percent difference requirement; however, they do meet the relative error ratio requirement with the value of 1.73.

Technical Information

Recounts

Samples 1204152948 (MB), 1204152952 (LCS), 463530003 (MW-8) and 463530009 (MW-2) were degassed and recounted to verify sample results. The second counts are reported. Sample 1204152949 (Non SDG 463511005DUP) was recounted due to high relative percent difference/relative error ratio. The recount is reported.

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: 463530 GEL Work Order: 463530

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: 29 NOV 2018

Title: Group Leader

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 29, 2018

Client Sample ID: MW-9
Sample ID: 463530001
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	0.979	+/-0.673	1.00	+/-0.723	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.405	+/-0.296	0.415	+/-0.306	1.00	pCi/L			PCW	11/13/18	0500	1819735	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"	1820404	96.8	(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

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 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-7
Sample ID: 463530002
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	1.07	+/-0.919	1.47	+/-0.965	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.28	+/-0.437	0.419	+/-0.493	1.00	pCi/L			PCW	11/13/18	0500	1819735	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"	1820404	82.6	(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	

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 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-8
Sample ID: 463530003
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	0.734	+/-0.885	1.50	+/-0.907	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.56	+/-0.534	0.454	+/-0.611	1.00	pCi/L			PCW	11/16/18	0445	1819735	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"	1820404	90	(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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Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: November 29, 2018

Client Sample ID: MW-5
Sample ID: 463530004
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	0.789	+/-0.696	1.12	+/-0.728	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.66	+/-0.535	0.547	+/-0.648	1.00	pCi/L			PCW	11/13/18	0500	1819735	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"	1820404	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	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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Lancaster, Pennsylvania 17601-5994

Report Date: November 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-6
Sample ID: 463530005
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	1.14	+/-0.784	1.19	+/-0.844	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.68	+/-0.476	0.350	+/-0.569	1.00	pCi/L			PCW	11/13/18	0500	1819735	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"	1820404	95.8	(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 29, 2018

Client Sample ID: FB-20181031
Sample ID: 463530006
Matrix: Ground Water
Collect Date: 31-OCT-18
Receive Date: 06-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	0.812	+/-0.848	1.41	+/-0.877	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.00	+/-0.207	0.438	+/-0.207	1.00	pCi/L			PCW	11/13/18	0535	1819735	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"	1820404	87.6	(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
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Lancaster, Pennsylvania 17601-5994

Report Date: November 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-1
Sample ID: 463530007
Matrix: Ground Water
Collect Date: 01-NOV-18
Receive Date: 06-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		3.49	+/-1.16	1.35	+/-1.50	3.00	pCi/L			JXC9	11/27/18	0912	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		2.65	+/-0.611	0.376	+/-0.886	1.00	pCi/L			PCW	11/13/18	0535	1819735	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"	1820404	75.6	(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: November 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-4
Sample ID: 463530008
Matrix: Ground Water
Collect Date: 01-NOV-18
Receive Date: 06-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	0.457	+/-0.687	1.19	+/-0.698	3.00	pCi/L			JXC9	11/27/18	0912	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		1.19	+/-0.464	0.503	+/-0.503	1.00	pCi/L			PCW	11/13/18	0535	1819735	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"	1820404	86.7	(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: November 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-2
Sample ID: 463530009
Matrix: Ground Water
Collect Date: 01-NOV-18
Receive Date: 06-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		4.40	+/-1.12	1.20	+/-1.64	3.00	pCi/L			JXC9	11/27/18	0911	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		2.28	+/-0.613	0.384	+/-0.764	1.00	pCi/L			PCW	11/16/18	0445	1819735	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"	1820404	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	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 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3
Sample ID: 463530010
Matrix: Ground Water
Collect Date: 01-NOV-18
Receive Date: 06-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		2.31	+/-0.959	1.25	+/-1.15	3.00	pCi/L			JXC9	11/27/18	0912	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.601	+/-0.300	0.332	+/-0.319	1.00	pCi/L			PCW	11/13/18	0535	1819735	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"	1820404	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	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 29, 2018

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: FB-20181101

Project: LANC00115

Sample ID: 463530011

Client ID: LANC006

Matrix: Ground Water

Collect Date: 01-NOV-18

Receive Date: 06-NOV-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	0.543	+/-0.658	1.11	+/-0.675	3.00	pCi/L			JXC9	11/27/18	0912	1820404	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226	U	0.0895	+/-0.175	0.330	+/-0.176	1.00	pCi/L			PCW	11/13/18	0535	1819735	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"	1820404	92.3	(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 29, 2018

Page 1 of 2

Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 463530

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1820404										
QC1204154521	463530008	DUP									
Radium-228		U	0.457	2.31	pCi/L	134*		(0% - 100%)	JXC9	11/27/1809:10	
		Uncert:	+/-0.687	+/-1.24							
		TPU:	+/-0.698	+/-1.39							
QC1204154524	LCS										
Radium-228		5.67		5.32	pCi/L		93.8	(75%-125%)	JXC9	11/27/1809:10	
		Uncert:		+/-0.625							
		TPU:		+/-1.57							
QC1204154520	MB										
Radium-228			U	-0.0158	pCi/L				JXC9	11/27/1809:10	
		Uncert:		+/-0.306							
		TPU:		+/-0.307							
QC1204154522	463530008	MS									
Radium-228		51.2	U	0.457	pCi/L		83.6	(75%-125%)	JXC9	11/27/1809:10	
		Uncert:		+/-0.687							
		TPU:		+/-0.698							
QC1204154523	463530008	MSD									
Radium-228		51.2	U	0.457	pCi/L	9.3	91.8	(0%-20%)	JXC9	11/27/1809:10	
		Uncert:		+/-0.687							
		TPU:		+/-0.698							
Rad Ra-226											
Batch	1819735										
QC1204152949	463511005	DUP									
Radium-226			2.15	1.44	pCi/L	39.2*		(0%-20%)	PCW	11/13/1808:35	
		Uncert:	+/-0.459	+/-0.341							
		TPU:	+/-0.652	+/-0.460							
QC1204152952	LCS										
Radium-226		16.2		15.4	pCi/L		94.7	(75%-125%)	PCW	11/16/1804:45	
		Uncert:		+/-1.38							
		TPU:		+/-3.70							
QC1204152948	MB										
Radium-226			U	0.00	pCi/L				PCW	11/16/1804:45	
		Uncert:		+/-0.153							
		TPU:		+/-0.153							
QC1204152950	463511005	MS									
Radium-226		26.0		23.5	pCi/L		82.3	(75%-125%)	PCW	11/13/1806:10	
		Uncert:		+/-0.459							
		TPU:		+/-0.652							
QC1204152951	463511005	MSD									
Radium-226		26.0		25.2	pCi/L	6.86	88.7	(0%-20%)	PCW	11/13/1806:10	
		Uncert:		+/-0.459							

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Workorder: 463530

Page 2 of 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	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.
- ** 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 NELAP standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 1820404 Check-list

This check-list was completed on 27-NOV-18 by Kenshalla Oston

This batch was reviewed by Kenshalla Oston on 27-NOV-18 and Nat Long on 27-NOV-18.

Batch ID:
1820404

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?		No	
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: 1820404

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: 01-DEC-2018

Package: 03-DEC-2018

SDG: 05-DEC-2018

Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units
LCS	1204154524	Radium-228 SPIKE	1810-A	.1	mL
MS	1204154522	Radium-228 SPIKE	1810-A	.1	mL
MSD	1204154523	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	463530001	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
2	463530002	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
3	463530003	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
4	463530004	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
5	463530005	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
6	463530006	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
7	463530007	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
8	463530008	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
9	463530009	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
10	463530010	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
11	463530011	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
12	463541001	15-NOV-2018	1	900	11/16/18 13:30	11/27/18 07:14
13	463646001	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
14	463646002	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
15	463646003	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
16	1204154520 MB	15-NOV-2018	1	900	11/16/18 13:30	11/27/18 07:14
17	1204154521 DUP (463530008)	15-NOV-2018	3	300	11/16/18 13:30	11/27/18 07:14
18	1204154522 MS (463530008)	15-NOV-2018	3	100	11/16/18 13:30	11/27/18 07:14
19	1204154523 MSD (463530008)	15-NOV-2018	3	100	11/16/18 13:30	11/27/18 07:14
20	1204154524 LCS	15-NOV-2018	1	900	11/16/18 13:30	11/27/18 07:14

Reagent/Solvent Lot ID	Description	Amount	Comments:
REGNT 2571685.11	2mL Cartridges	2 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 15-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	

RA1820404.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 : 1820404
Analyst : JAS02031
Prep Date : 11/15/2018
Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
Parmname : Radium-228
Required MDA : 1 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	Tracer Samp.	Count	Tracer	Tracer	
Pos.	ID	Aliquot	StDev.	Sample	Activity	Uncertainty	Activity	Uncertainty	Aliquot	Aliquot	
		L	L	Date/Time	(CPM)	(%)	(CPM)	(%)	(mL)	StDev. (mL)	
1	463530001.1	0.3000	1.8459E-05	10/31/2018 11:05	178.0	7.49%	172.3	7.62%	0.1	0.000200	
2	463530002.1	0.3000	1.8459E-05	10/31/2018 12:55	178.0	7.49%	147.0	8.25%	0.1	0.000200	
3	463530003.1	0.3000	1.8459E-05	10/31/2018 12:35	178.0	7.49%	160.3	7.90%	0.1	0.000200	
4	463530004.1	0.3000	1.8459E-05	10/31/2018 10:50	178.0	7.49%	184.5	7.36%	0.1	0.000200	
5	463530005.1	0.3000	1.8459E-05	10/31/2018 14:20	178.0	7.49%	170.5	7.66%	0.1	0.000200	
6	463530006.1	0.3000	1.8459E-05	10/31/2018 11:00	178.0	7.49%	156.0	8.01%	0.1	0.000200	
7	463530007.1	0.3000	1.8459E-05	11/1/2018 9:45	178.0	7.49%	134.7	8.62%	0.1	0.000200	
8	463530008.1	0.3000	1.8459E-05	11/1/2018 11:40	178.0	7.49%	154.3	8.05%	0.1	0.000200	
9	463530009.1	0.3000	1.8459E-05	11/1/2018 10:35	178.0	7.49%	179.9	7.46%	0.1	0.000200	
10	463530010.1	0.3000	1.8459E-05	11/1/2018 12:00	178.0	7.49%	159.3	7.92%	0.1	0.000200	
11	463530011.1	0.3000	1.8459E-05	11/1/2018 11:00	178.0	7.49%	164.4	7.80%	0.1	0.000200	
12	463541001.1	0.9000	2.0768E-05	11/1/2018 12:00	178.0	7.49%	105.5	9.74%	0.1	0.000200	
13	463646001.1	0.3000	1.8459E-05	11/5/2018 10:45	178.0	7.49%	124.4	8.97%	0.1	0.000200	
14	463646002.1	0.3000	1.8459E-05	11/5/2018 12:00	178.0	7.49%	158.2	7.95%	0.1	0.000200	
15	463646003.1	0.3000	1.8459E-05	11/5/2018 14:15	178.0	7.49%	141.3	8.41%	0.1	0.000200	
16	1204154520.1	0.9000	2.0768E-05	11/15/2018 0:00	178.0	7.49%	164.6	7.80%	0.1	0.000200	
17	1204154521.1	0.3000	1.8459E-05	11/1/2018 11:40	178.0	7.49%	147.7	8.23%	0.1	0.000200	
18	1204154522.1	0.1000	1.1370E-05	11/1/2018 11:40	178.0	7.49%	169.1	7.69%	0.1	0.000200	
19	1204154523.1	0.1000	1.1370E-05	11/1/2018 11:40	178.0	7.49%	161.2	7.88%	0.1	0.000200	
20	1204154524.1	0.9000	2.0768E-05	11/15/2018 0:00	178.0	7.49%	173.0	7.60%	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	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	1C	60	8	40	0.667	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.802	1.000	1.057	96.8%	5.35%	
2	2B	60	13	54	0.900	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.802	1.000	1.057	82.6%	5.58%	
3	3B	60	24	54	0.900	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.802	1.000	1.057	90.0%	5.45%	
4	3C	60	26	46	0.767	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.802	1.000	1.057	104%	5.26%	
5	3D	60	9	50	0.833	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	95.8%	5.36%	
6	4B	60	8	51	0.850	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	87.6%	5.49%	
7	5A	60	25	81	1.350	11/27/2018 9:12	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	75.6%	5.72%	
8	5B	60	12	34	0.567	11/27/2018 9:12	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	86.7%	5.51%	
9	9C	60	10	121	2.017	11/27/2018 9:11	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	101%	5.29%	
10	9D	60	9	71	1.183	11/27/2018 9:12	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	89.5%	5.46%	
11	10C	60	14	36	0.600	11/27/2018 9:12	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	92.3%	5.41%	
12	10D	60	17	35	0.583	11/27/2018 9:12	11/16/2018 13:30	11/27/2018 7:14	0.991	0.801	1.000	1.057	59.2%	6.15%	
13	11A	60	28	82	1.367	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.993	0.804	1.000	1.057	69.9%	5.85%	
14	11B	60	20	60	1.000	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.993	0.804	1.000	1.057	88.8%	5.47%	
15	11C	60	15	53	0.883	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.993	0.804	1.000	1.057	79.4%	5.64%	
16	11D	60	14	75	1.250	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.996	0.803	1.000	1.057	92.4%	5.41%	
17	12A	60	19	108	1.800	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.991	0.803	1.000	1.057	83.0%	5.57%	
18	12B	60	8	321	5.350	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.991	0.803	1.000	1.057	95.0%	5.37%	
19	13A	60	6	309	5.150	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.991	0.803	1.000	1.057	90.6%	5.44%	
20	13B	60	10	328	5.467	11/27/2018 9:10	11/16/2018 13:30	11/27/2018 7:14	0.996	0.803	1.000	1.057	97.2%	5.34%	

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	0.6443	0.00847	0.361	11/23/2018 16:55	1000
2	PIC	6/1/2017	5/31/2019	0.6448	0.02111	0.615	11/23/2018 16:55	1000
3	PIC	6/1/2017	5/31/2019	0.6291	0.01614	0.692	11/26/2018 9:00	500
4	PIC	6/1/2017	5/31/2019	0.6374	0.00988	0.506	11/26/2018 9:00	500
5	PIC	6/1/2017	5/31/2019	0.6255	0.02297	0.491	11/23/2018 16:56	1000
6	PIC	6/1/2017	5/31/2019	0.6410	0.01519	0.622	11/23/2018 16:56	1000
7	PIC	6/1/2017	5/31/2019	0.6766	0.00851	0.456	11/23/2018 16:56	1000
8	PIC	6/1/2017	5/31/2019	0.6547	0.00426	0.437	11/23/2018 16:56	1000
9	PIC	6/1/2017	5/31/2019	0.6373	0.00584	0.598	11/23/2018 16:54	1000
10	PIC	6/1/2017	5/31/2019	0.6494	0.02610	0.513	11/23/2018 16:54	1000
11	PIC	6/1/2017	5/31/2019	0.6584	0.00638	0.435	11/23/2018 16:54	1000
12	PIC	6/1/2017	5/31/2019	0.6578	0.00557	0.463	11/23/2018 16:54	1000
13	PIC	6/1/2017	5/31/2019	0.6648	0.01317	0.536	11/23/2018 16:49	1000
14	PIC	6/1/2017	5/31/2019	0.6620	0.00697	0.950	11/23/2018 16:49	1000
15	PIC	6/1/2017	5/31/2019	0.6578	0.01278	0.456	11/23/2018 16:50	1000
16	PIC	6/1/2017	5/31/2019	0.6802	0.01068	1.265	11/23/2018 16:50	1000
17	PIC	6/1/2017	5/31/2019	0.6732	0.01964	1.154	11/23/2018 16:50	1000
18	PIC	6/1/2017	5/31/2019	0.6361	0.01114	1.023	11/23/2018 16:50	1000
19	PIC	6/1/2017	5/31/2019	0.6527	0.00714	0.504	11/23/2018 16:50	1000
20	PIC	6/1/2017	5/31/2019	0.6463	0.00967	0.424	11/23/2018 16:50	1000

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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): 113.27
Spike Volume Added: 0.10

LCS S/N : 1810-A
LCS Exp Date : 5/23/2019
LCS Activity (dpm/ml): 113.27
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	0.5962	0.4209	3	1.0020	0.9794	35.46%	0.3057	0.1071	0.6726	0.7228		SAMPLE				
2	0.9116	0.6436	3	1.4748	1.0697	44.25%	0.2850	0.1250	0.9193	0.9651		SAMPLE				
3	0.9341	0.6595	3	1.4953	0.7337	61.80%	0.2080	0.1280	0.8849	0.9072		SAMPLE				
4	0.6852	0.4838	3	1.1189	0.7888	45.37%	0.2607	0.1174	0.6965	0.7283		SAMPLE				
5	0.7242	0.5113	3	1.1894	1.1424	35.51%	0.3423	0.1199	0.7844	0.8443		SAMPLE				
6	0.8694	0.6138	3	1.4055	0.8115	53.64%	0.2280	0.1216	0.8484	0.8767		SAMPLE				
7	0.8167	0.5766	3	1.3485	3.4914	17.91%	0.8940	0.1515	1.1597	1.5014		SAMPLE				
8	0.7215	0.5094	3	1.1949	0.4569	76.86%	0.1297	0.0994	0.6866	0.6977		SAMPLE				
9	0.7431	0.5246	3	1.2044	4.4020	14.08%	1.4187	0.1850	1.1249	1.6350		SAMPLE				
10	0.7630	0.5387	3	1.2493	2.3057	22.07%	0.6703	0.1423	0.9590	1.1501		SAMPLE				
11	0.6716	0.4742	3	1.1128	0.5425	62.15%	0.1650	0.1022	0.6584	0.6745		SAMPLE				
12	0.3604	0.2545	1	0.5944	0.2058	84.10%	0.1203	0.1009	0.3383	0.3431		SAMPLE				
13	0.9711	0.6856	3	1.5854	3.5579	19.33%	0.8307	0.1527	1.2818	1.6124		SAMPLE				
14	1.0212	0.7210	3	1.6111	0.1692	265.51%	0.0500	0.1327	0.8801	0.8813		SAMPLE				
15	0.7970	0.5627	3	1.3160	1.6287	29.40%	0.4273	0.1232	0.9203	1.0222		SAMPLE				
16	0.3664	0.2587	1	0.5699	-0.0158	991.05%	-0.0150	0.1487	0.3065	0.3065		MB				
17	1.1878	0.8386	3	1.8557	2.3064	27.95%	0.6460	0.1765	1.2351	1.3876	463530008.1	DUP	133.9%	2.3340		
18	3.1019	2.1900	3	4.8751	42.8496	8.85%	4.3270	0.3003	5.8290	12.9861	463530008.1	MS			51.2490	83.6%
19	2.2255	1.5712	3	3.6486	47.0282	8.37%	4.6460	0.2938	5.8295	14.0070	463530008.1	MSD	9.3%	0.4288	51.2490	91.8%
20	0.2126	0.1501	1	0.3528	5.3153	8.09%	5.0427	0.3025	0.6251	1.5671		LCS			5.6690	93.8%

1820404.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
463530001	1C	60	8	40	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530002	2B	60	13	54	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530003	3B	60	24	54	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530004	3C	60	26	46	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530005	3D	60	9	50	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530006	4B	60	8	51	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530007	5A	60	25	81	11/27/2018 9:12	11/27/2018 10:12	PIC	1820404
463530008	5B	60	12	34	11/27/2018 9:12	11/27/2018 10:12	PIC	1820404
463530009	9C	60	10	121	11/27/2018 9:11	11/27/2018 10:11	PIC	1820404
463530010	9D	60	9	71	11/27/2018 9:12	11/27/2018 10:12	PIC	1820404
463530011	10C	60	14	36	11/27/2018 9:12	11/27/2018 10:12	PIC	1820404
463541001	10D	60	17	35	11/27/2018 9:12	11/27/2018 10:12	PIC	1820404
463646001	11A	60	28	82	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
463646002	11B	60	20	60	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
463646003	11C	60	15	53	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
1204154520	11D	60	14	75	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
1204154521	12A	60	19	108	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
1204154522	12B	60	8	321	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
1204154523	13A	60	6	309	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404
1204154524	13B	60	10	328	11/27/2018 9:10	11/27/2018 10:10	PIC	1820404

ASSAY 19-Nov-18 15:36:03

Protocol id 8 Ba-133
Time limit
Count limit
Isotope Ba-133
Protocol date 11/19/2018
Run id. 2216

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	87	1	180.04	619.51	178.03	7.49		03:36:03
2	87	2	180.04	602.28	172.29	7.62	96.78	03:39:18
3	87	3	180.04	526.31	146.97	8.25	82.55	03:42:32
4	87	4	180.06	566.36	160.3	7.9	90.04	03:45:46
5	87	5	180.04	638.77	184.45	7.36	103.61	03:49:00
1	91	1	180.06	596.9	170.48	7.66	95.76	03:52:35
2	91	2	180.06	553.43	155.99	8.01	87.62	03:55:49
3	91	3	180.04	489.39	134.67	8.62	75.64	03:59:03
4	91	4	180.04	548.22	154.27	8.05	86.65	04:02:17
5	91	5	180.06	625.22	179.92	7.46	101.06	04:05:31
1	77	1	180.04	563.31	159.3	7.92	89.48	04:09:06
2	77	2	180.04	578.6	164.4	7.8	92.34	04:12:21
3	77	3	180.03	401.71	105.46	9.74	59.24	04:15:34
4	77	4	180.04	458.56	124.39	8.97	69.87	04:18:48
5	77	5	180.06	559.9	158.15	7.95	88.83	04:22:02
1	100	1	180.06	509.34	141.3	8.41	79.37	04:25:44
2	100	2	180.04	579.14	164.58	7.8	92.45	04:28:59
3	100	3	180.04	528.48	147.69	8.23	82.96	04:32:13
4	100	4	180.06	592.65	169.06	7.69	94.96	04:35:27
5	100	5	180.03	569.05	161.23	7.88	90.56	04:38:41
1	86	1	180.04	604.31	172.97	7.6	97.16	04:42:24

END OF ASSAY

Continuing Calibration Data

Gas Flow Proportional Counter Checks for 27-Nov-2018

Detectors LB4100 A1 through J4 and PIC 1A through 14D and G5400W 1W through 1Z

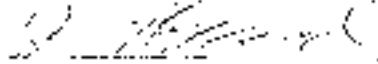
Short Name	Status	Paramname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100B2	Above	Alpha bkg	27-Nov 05:51	60	0.483	-4.24E-2	0.354	+5.02
LB4100C1	Above	Beta bkg	27-Nov 05:53	60	2.017	1.035	1.925	+3.62
LB4100C4	Above	Beta bkg	27-Nov 05:54	60	2.133	0.685	2.113	+3.09
LB4100E2	need 2nd	Beta bkg	27-Nov 05:51	60	1.933	0.251	3.241	+0.37
LB4100E3	Above	Beta bkg	27-Nov 05:51	60	2.233	0.473	2.078	+3.58
LB4100F3	need 2nd	Beta eff	27-Nov 07:23	5	15783	15700	18690	+2.83
LB4100J1	need 2nd	Alpha eff	27-Nov 06:58	5	10330	10110	11600	+2.11
LB4100J1	Below	Beta eff	27-Nov 07:15	5	35176	36170	42660	+3.92
LB4100J2	Above	Alpha bkg	27-Nov 05:51	60	0.383	-5.70E-2	0.379	+3.06
LB4100J2	Below	Beta eff	27-Nov 07:16	5	12806	14050	17090	+5.46
LB4100J3	Below	Beta eff	27-Nov 07:16	5	16524	16680	20710	+3.23
LB4100J4	Above	Alpha bkg	27-Nov 05:51	60	0.333	-4.35E-2	0.401	+2.09
LB4100J4	need 2nd	Beta eff	27-Nov 07:16	5	27687	27360	31330	+2.71
PIC1A	Above	Alpha bkg	27-Nov 05:52	60	0.317	-4.72E-2	0.389	+1.90
PIC2C	Above	Alpha bkg	27-Nov 05:53	60	0.567	-2.98E-2	0.304	+7.73
PIC4A	Above	Alpha bkg	27-Nov 05:53	60	0.450	-4.12E-2	0.369	+4.18
PIC4C	Above	Alpha bkg	27-Nov 05:53	60	0.400	-7.27E-2	0.383	+3.22
PIC5A	Above	Alpha bkg	27-Nov 06:07	60	0.400	-2.15E-2	0.405	+2.93
PIC6B	Above	Alpha bkg	27-Nov 06:07	60	1.000	-5.91E-2	0.359	+12.20
PIC6B	Above	Beta bkg	27-Nov 06:07	60	2.250	-3.32E-2	2.613	+2.00
PIC8C	Above	Alpha bkg	27-Nov 06:07	60	0.583	-2.61E-2	0.365	+5.35
PIC13D	Below	Beta eff	27-Nov 06:23	5	24608	24810	26170	+3.73

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

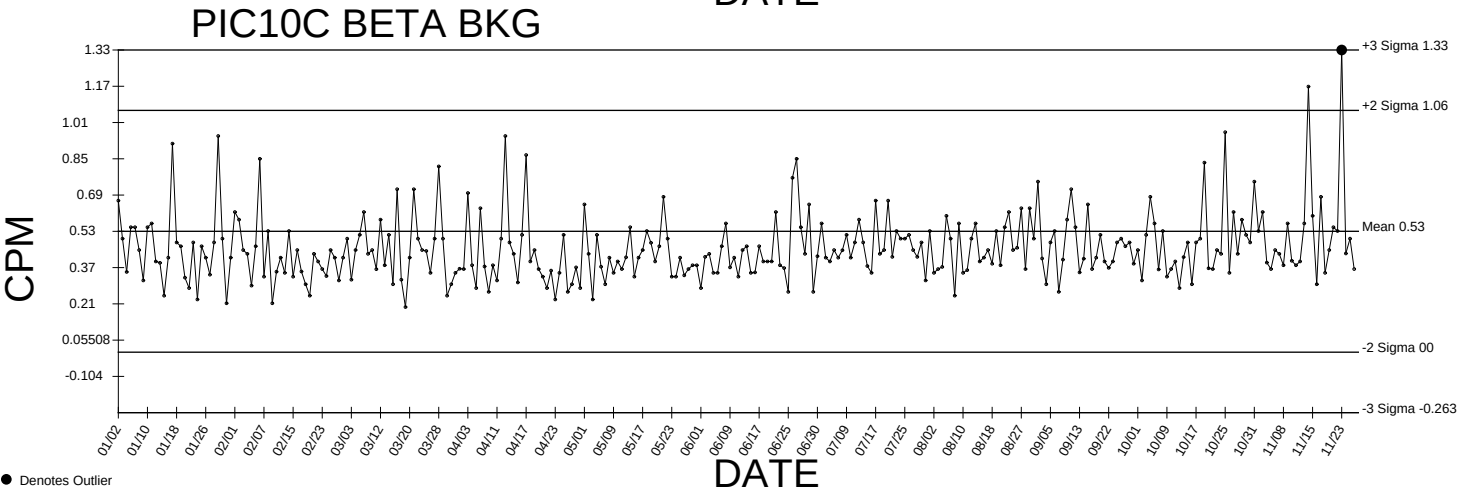
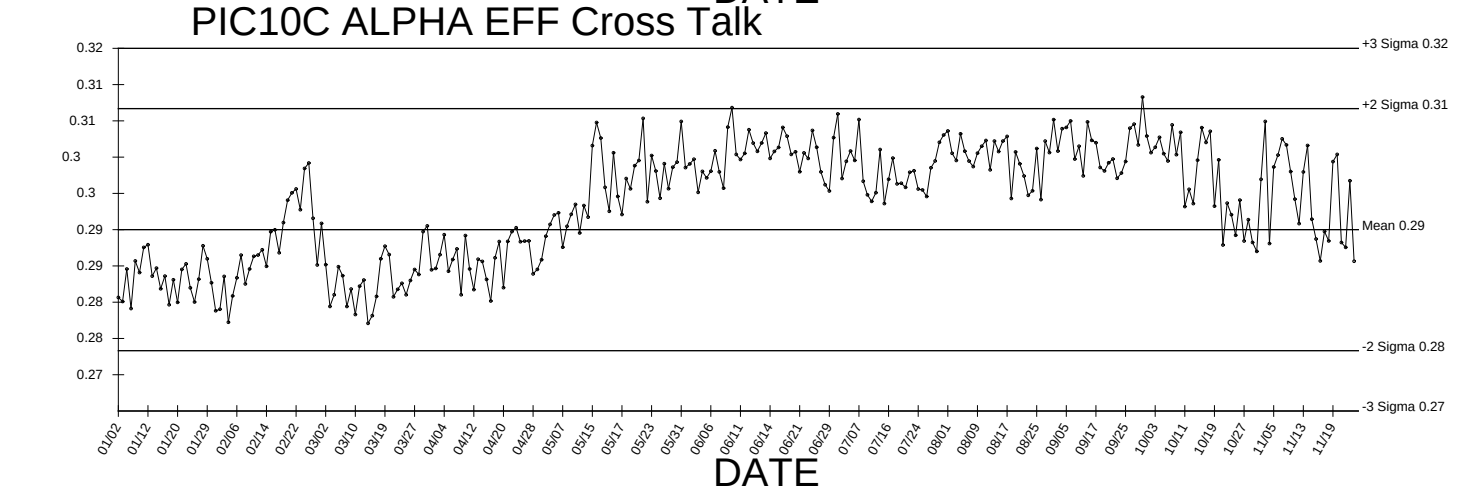
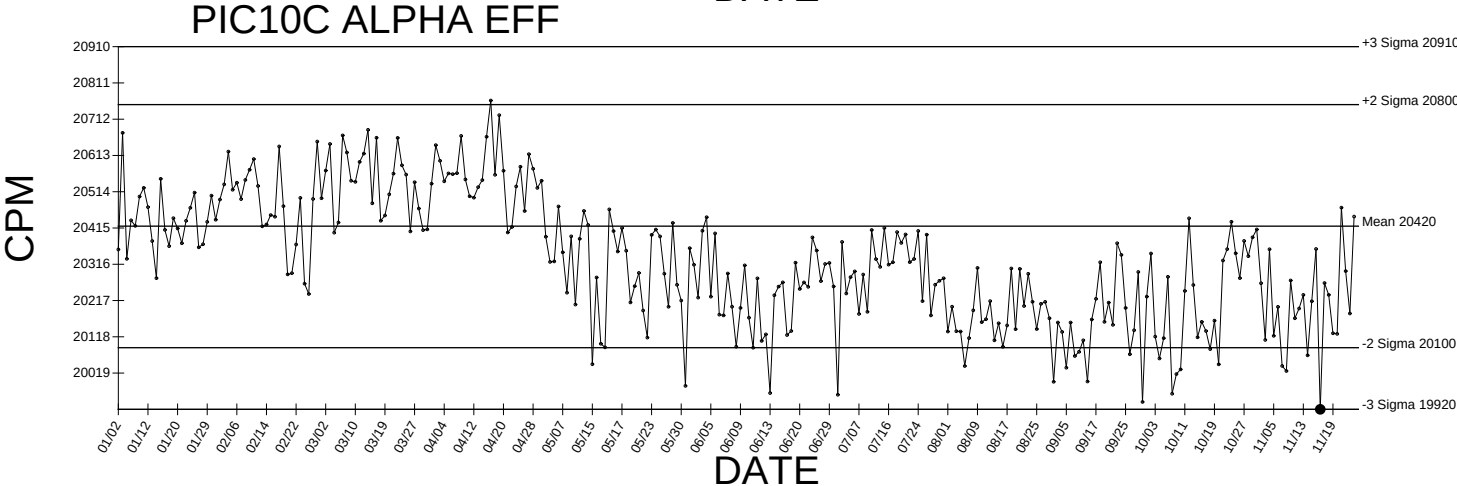
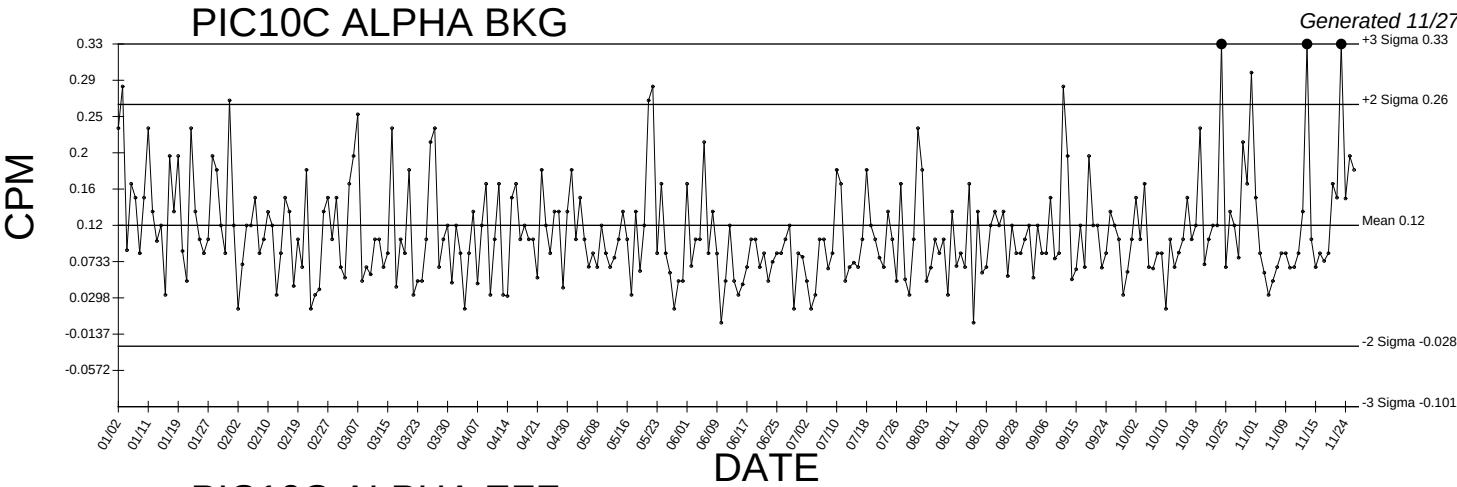
LB4100D1	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D2	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D3	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
LB4100D4	Alpha bkg, Alpha off, Alpha XTalk, Beta bkg, Beta off, Beta XTalk
PIC3A	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 11/17/14

GEL Laboratories LLC

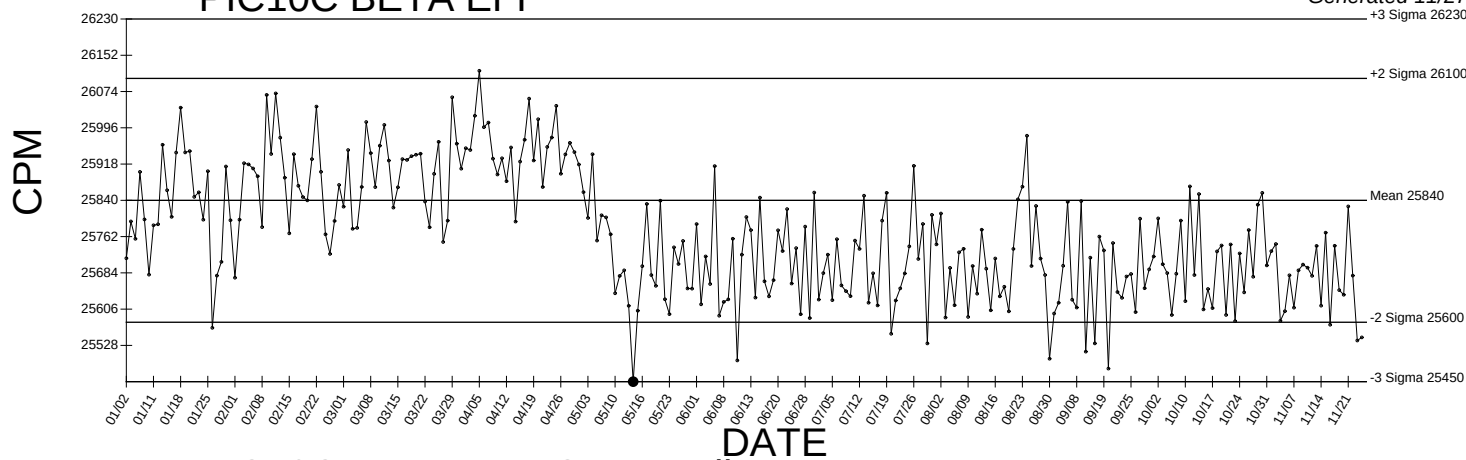
Background and Efficiency Data



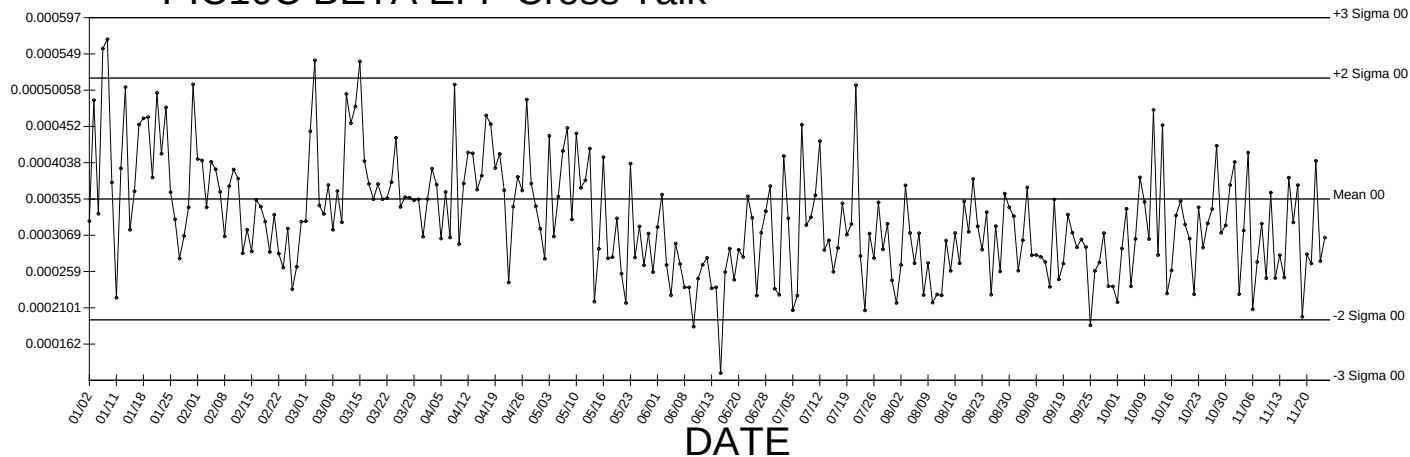
● Denotes Outlier

PIC10C BETA EFF

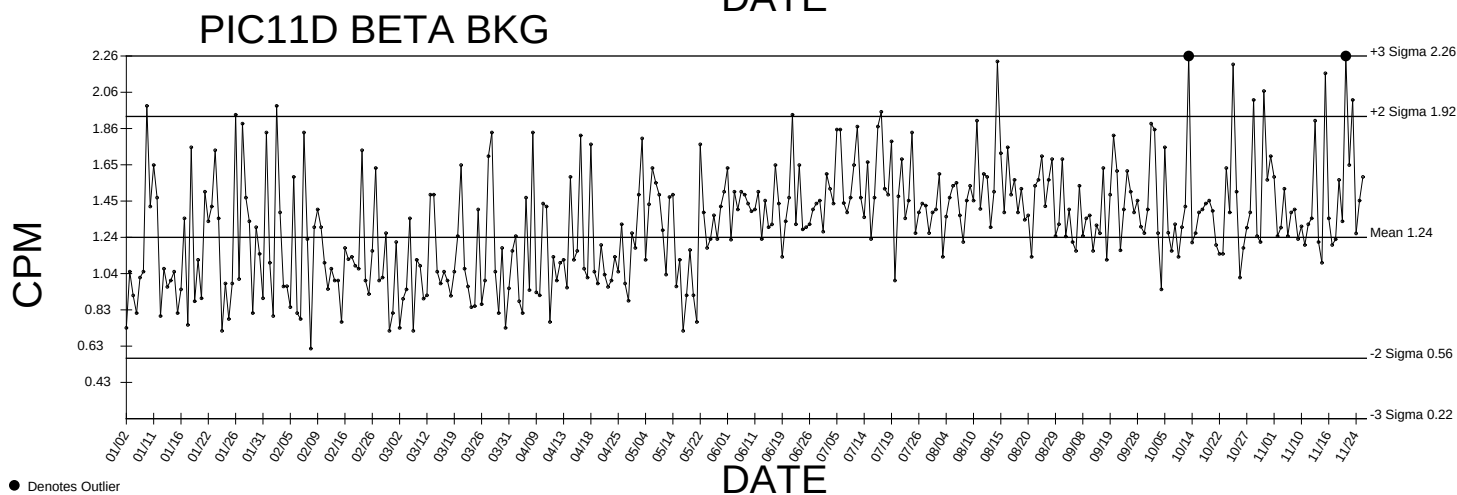
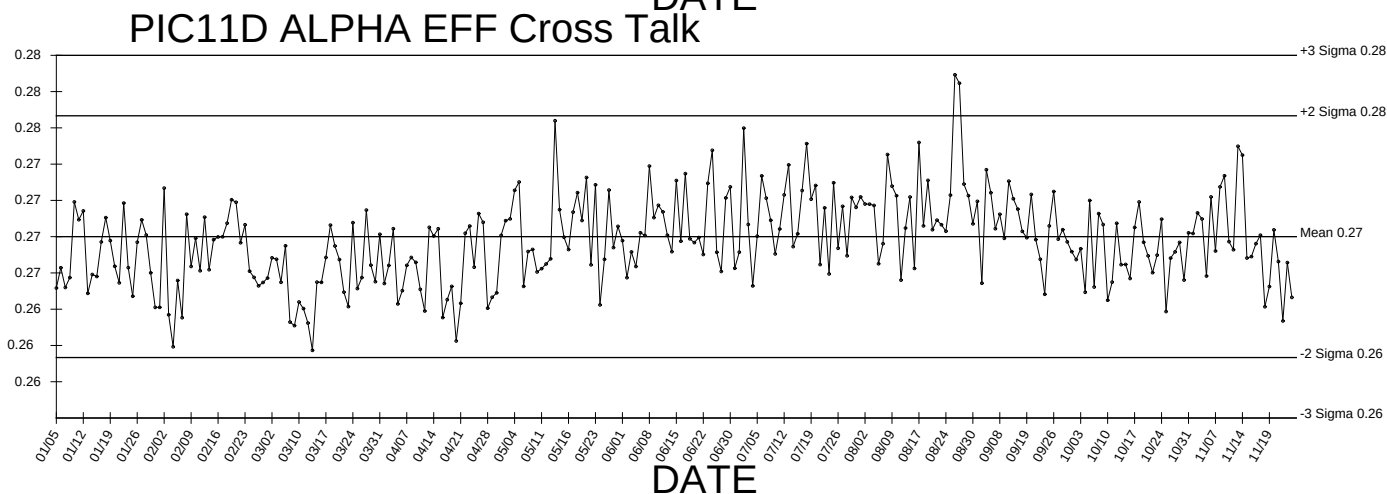
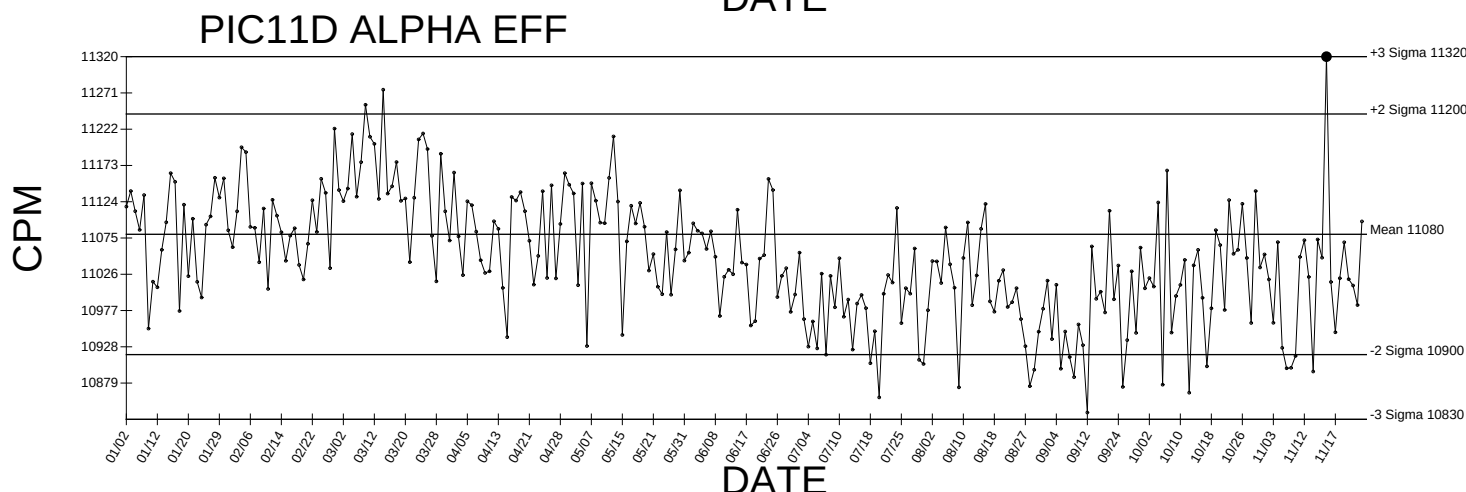
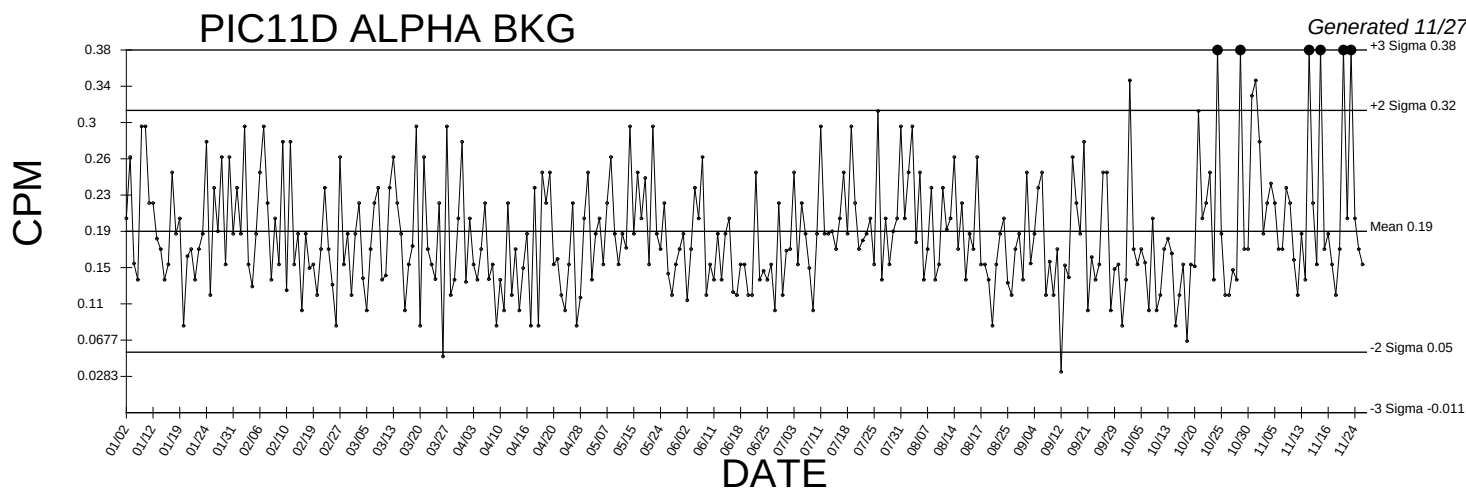
Generated 11/27/2018



PIC10C BETA EFF Cross Talk



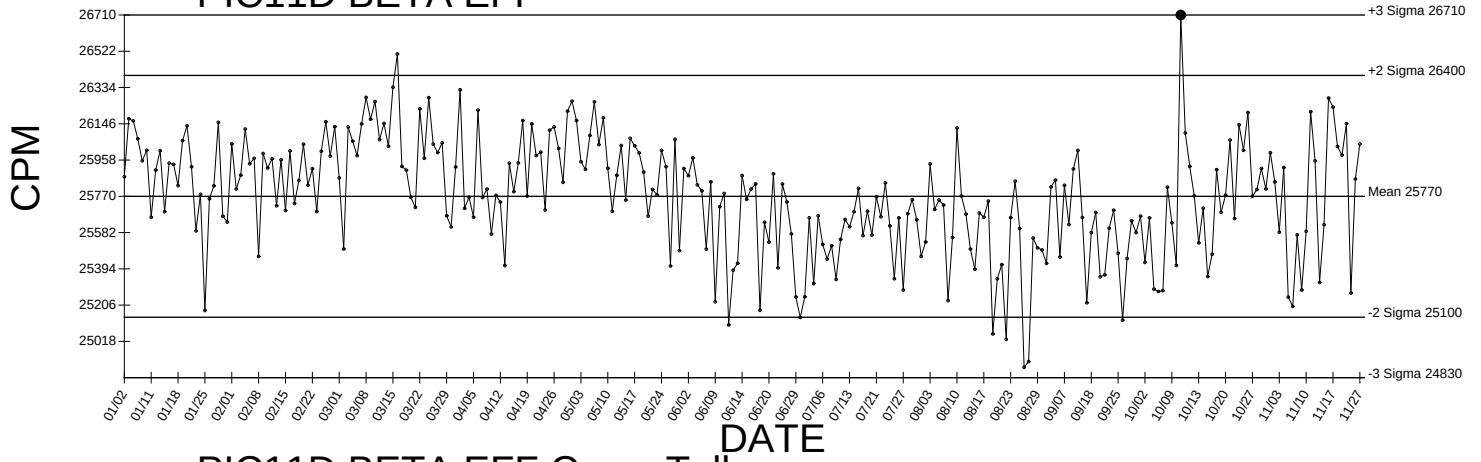
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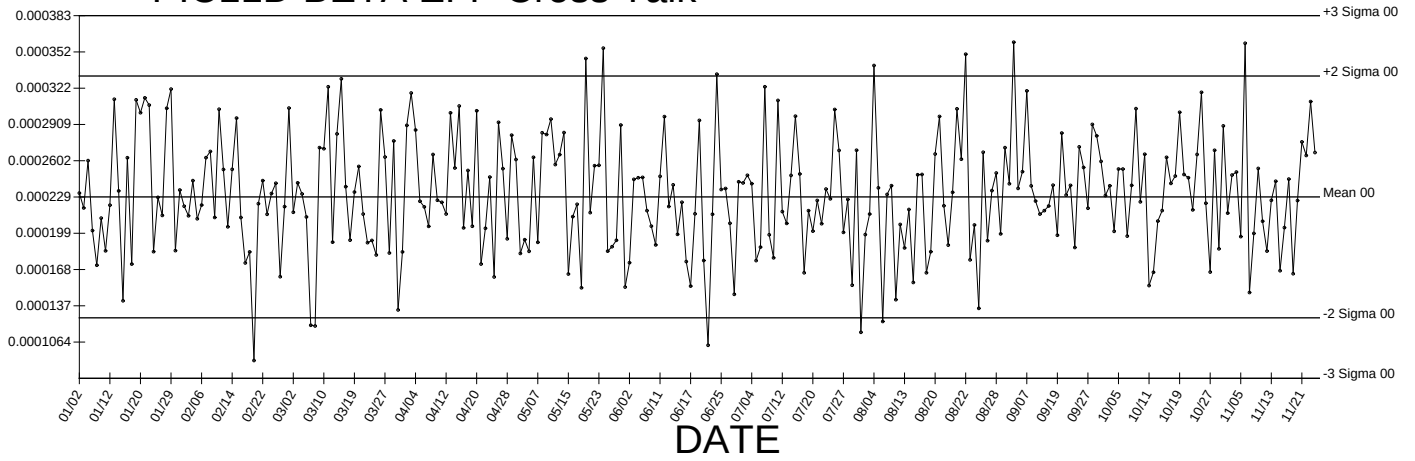
● Denotes Outlier

PIC11D BETA EFF

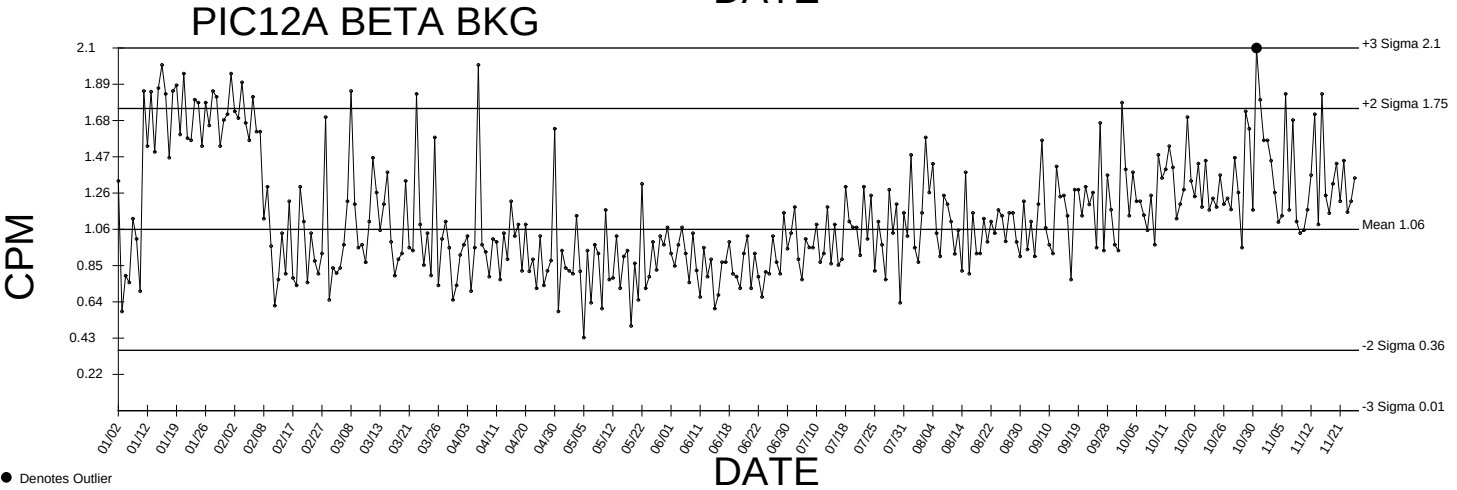
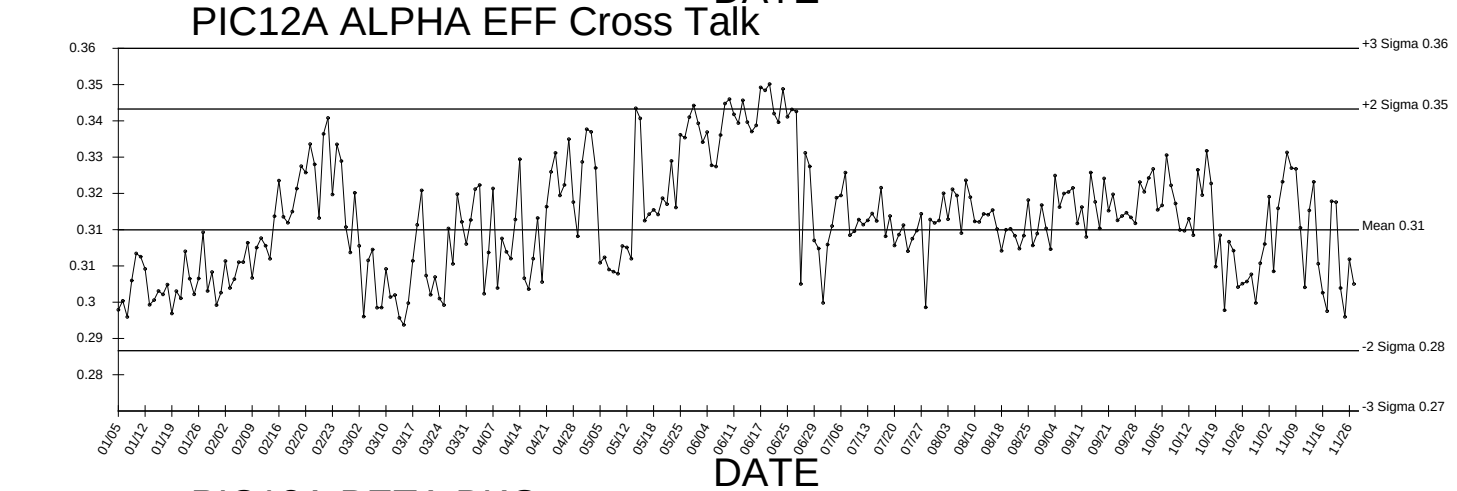
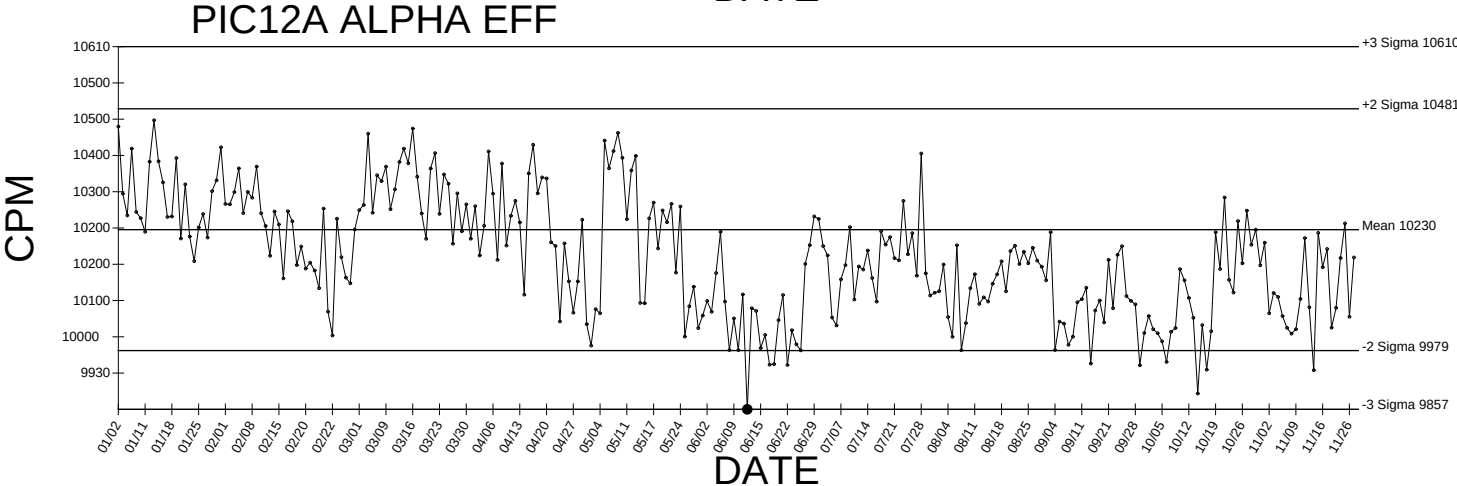
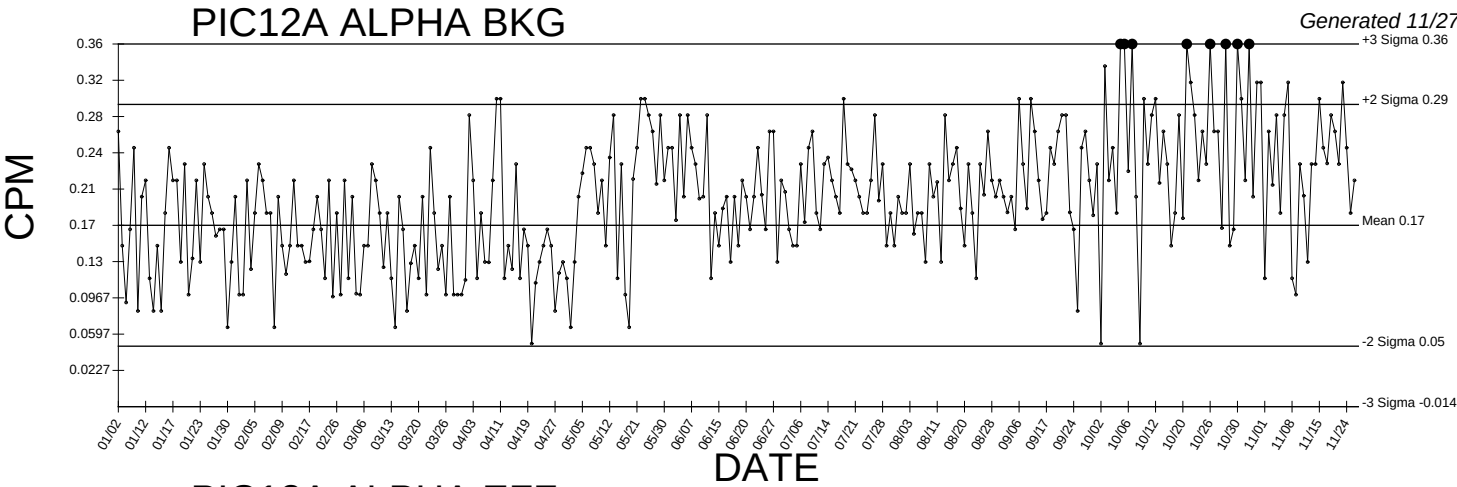
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PIC11D BETA EFF Cross Talk



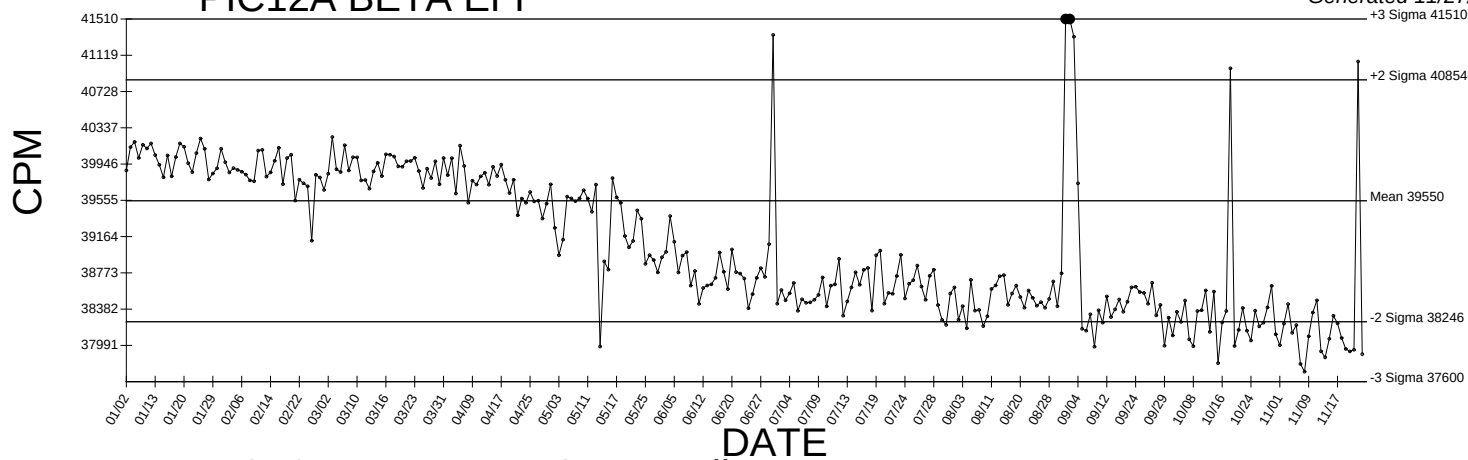
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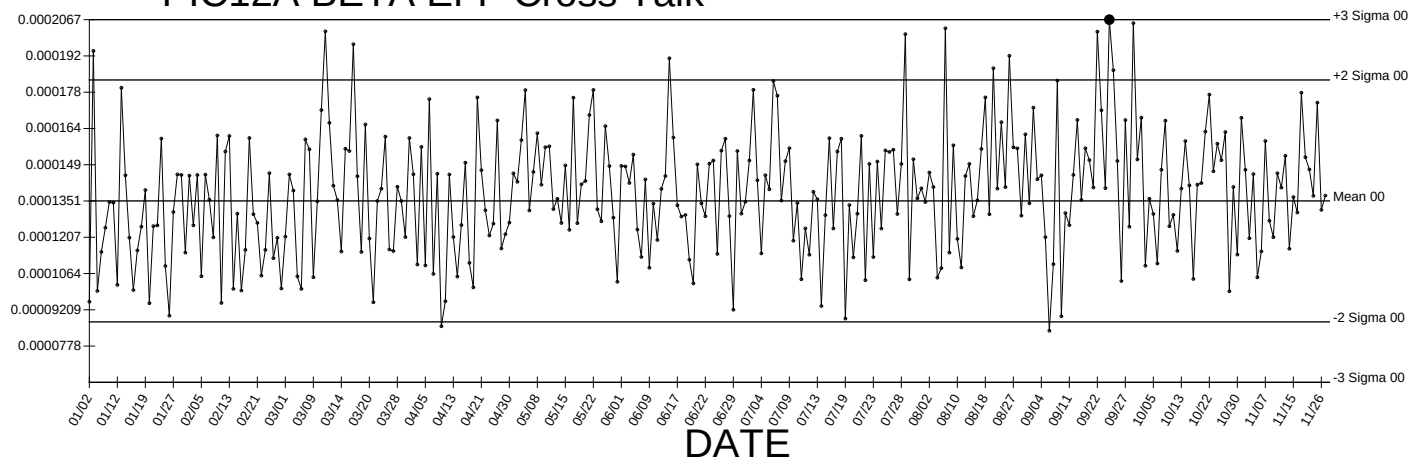
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PIC12A BETA EFF

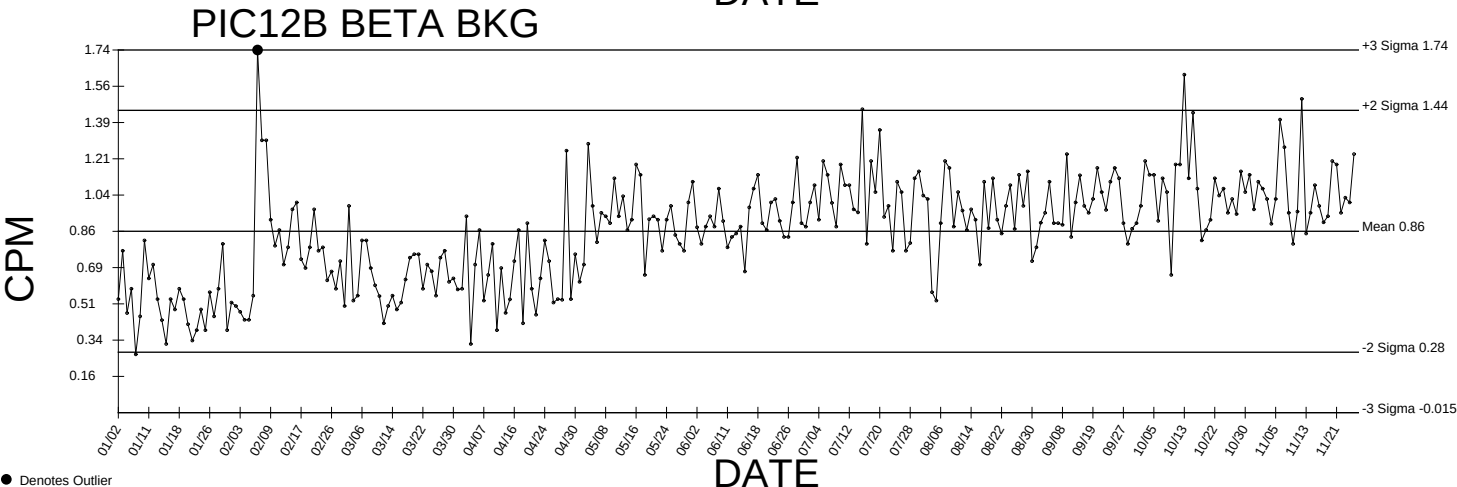
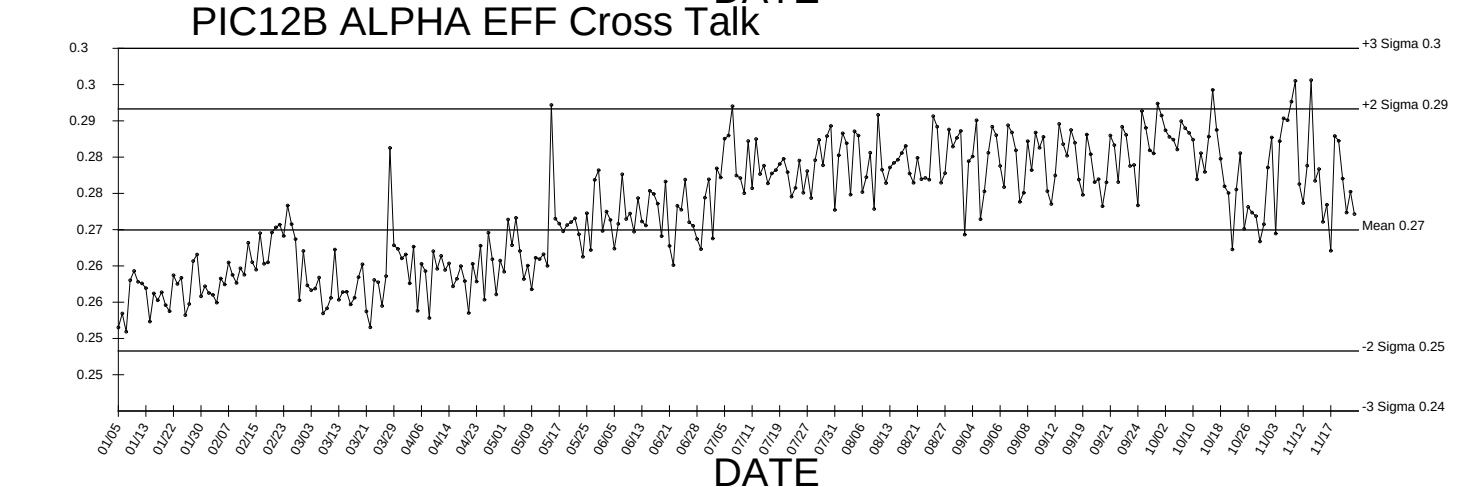
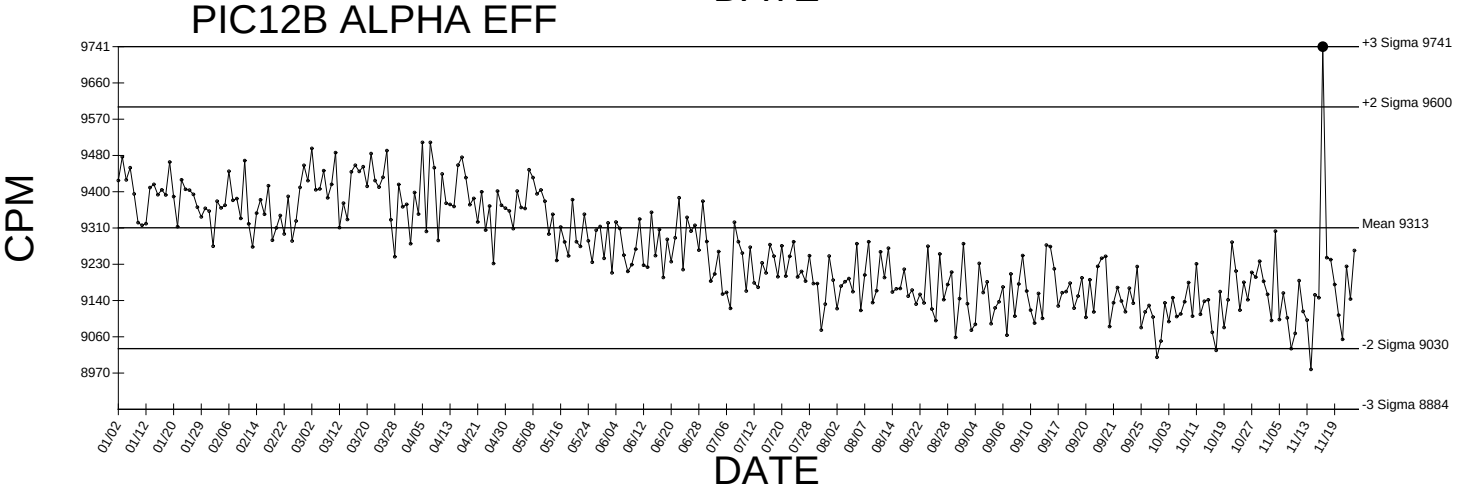
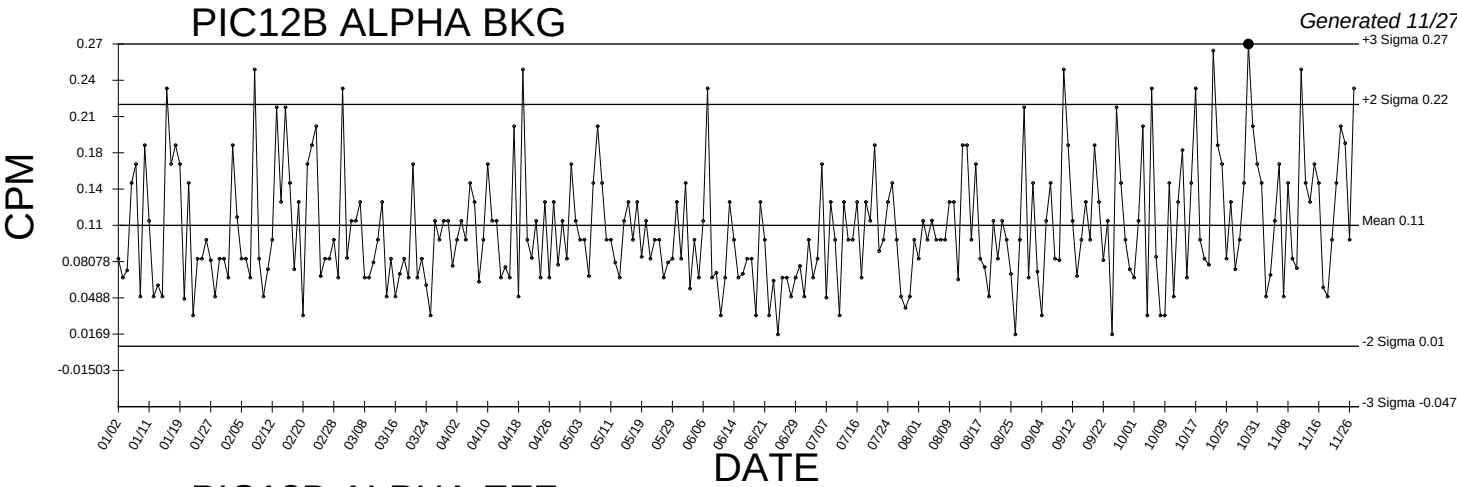
Generated 11/27/2018



PIC12A BETA EFF Cross Talk



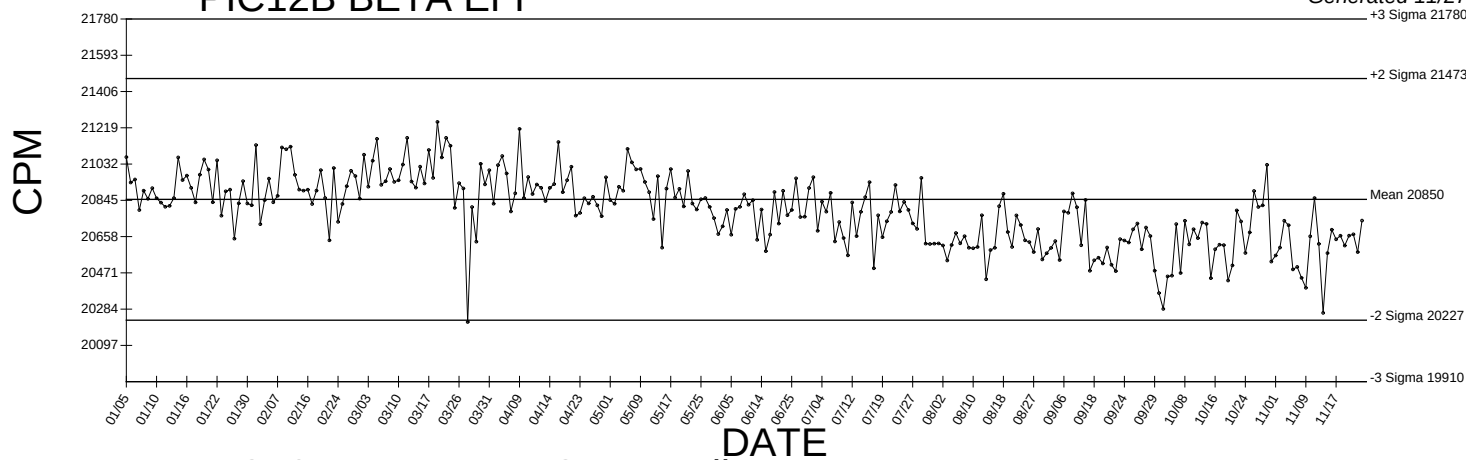
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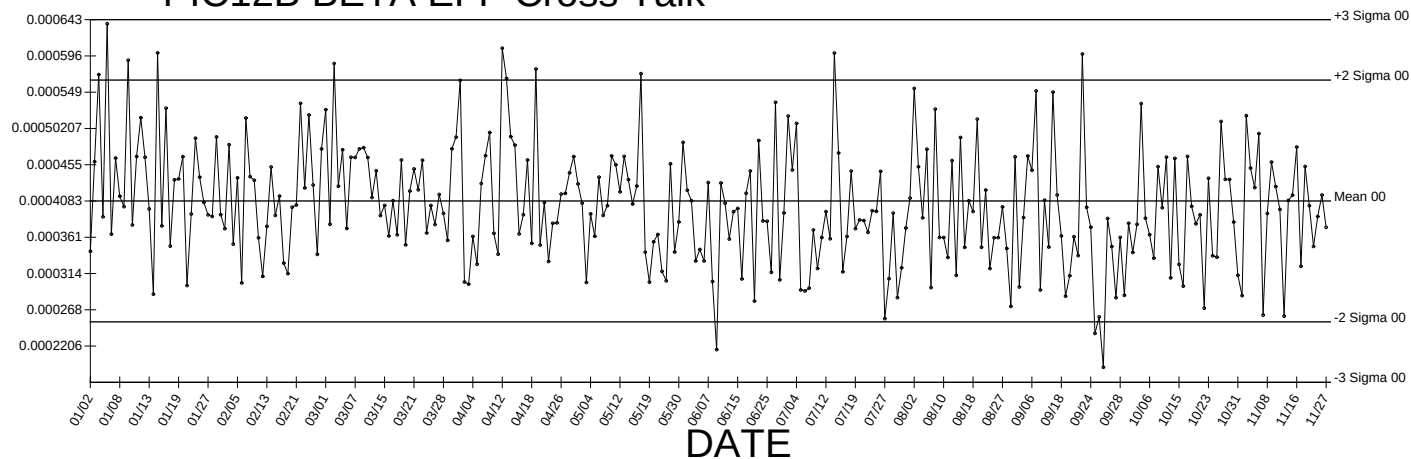
● Denotes Outlier

PIC12B BETA EFF

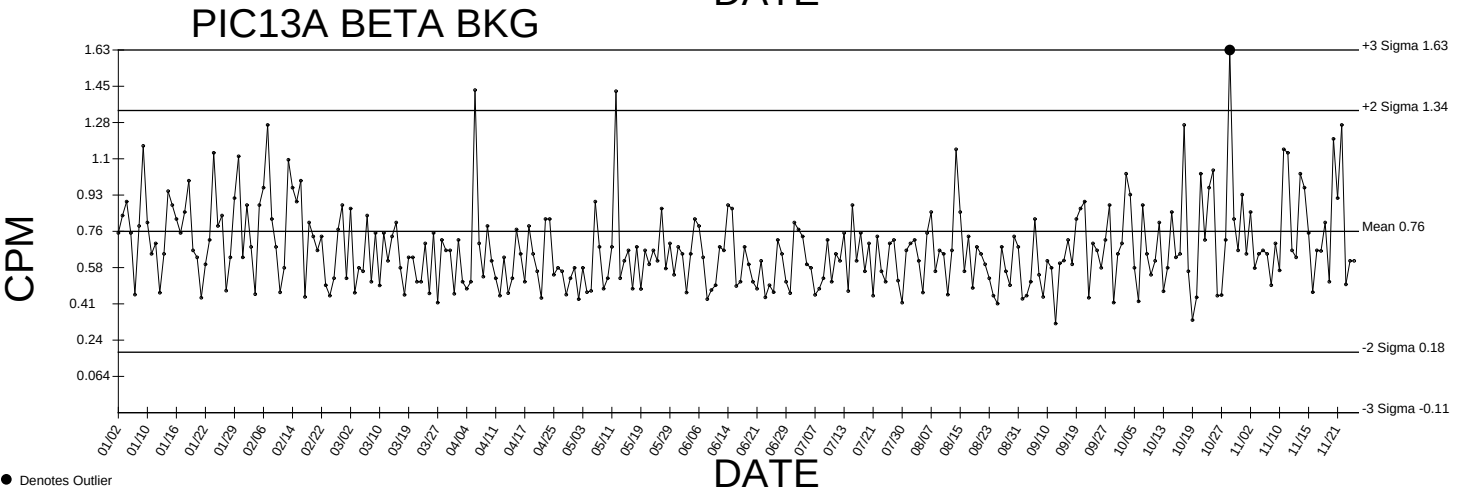
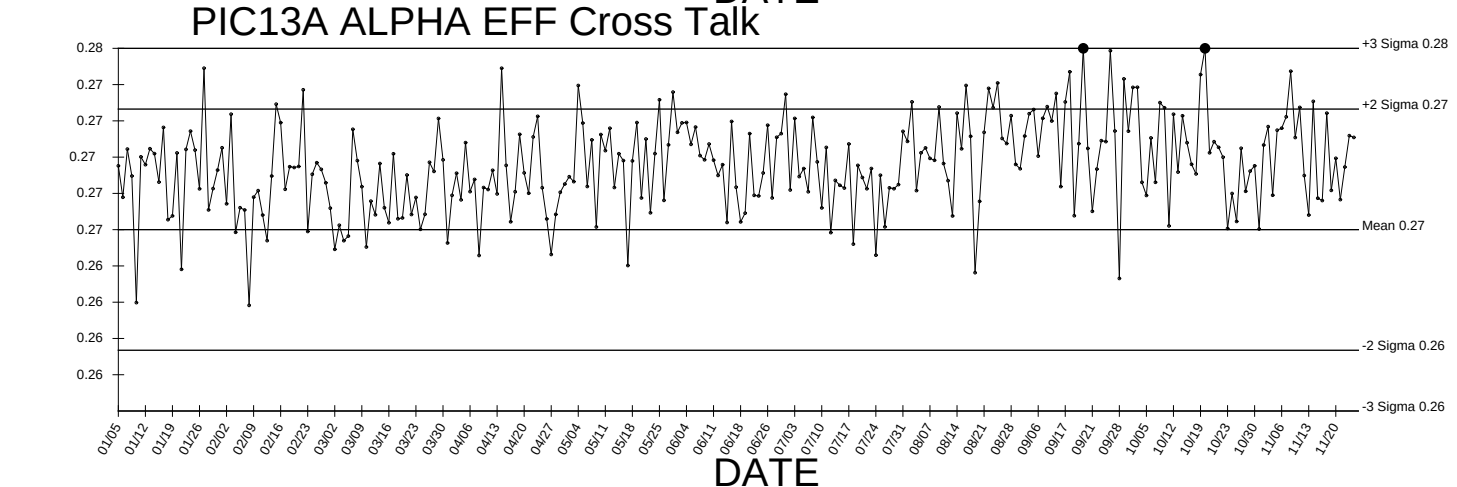
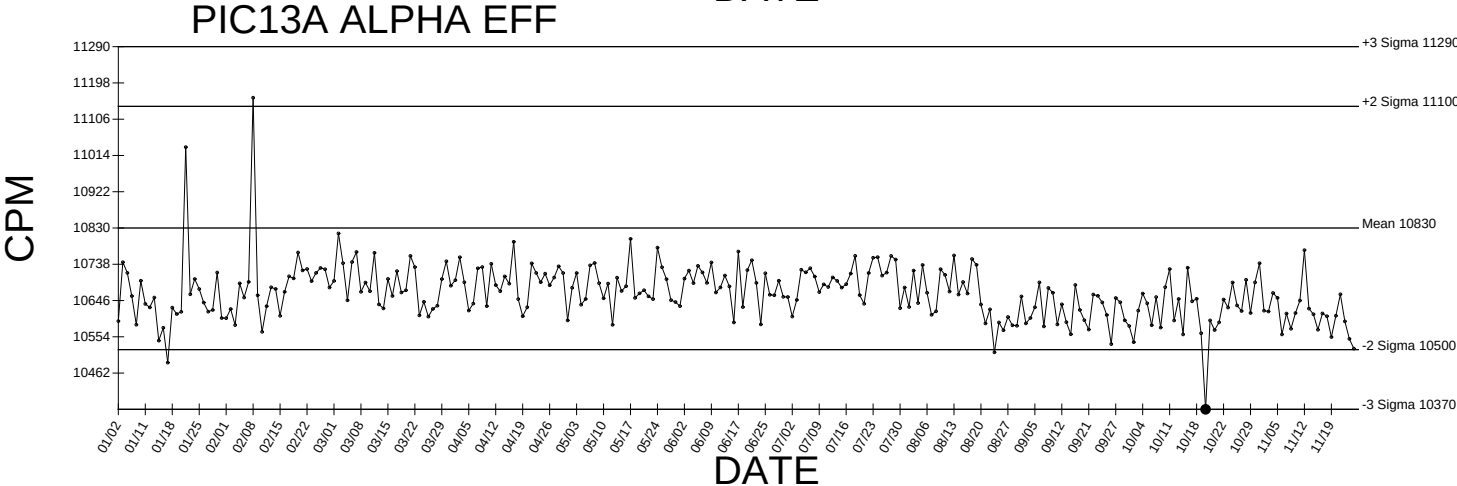
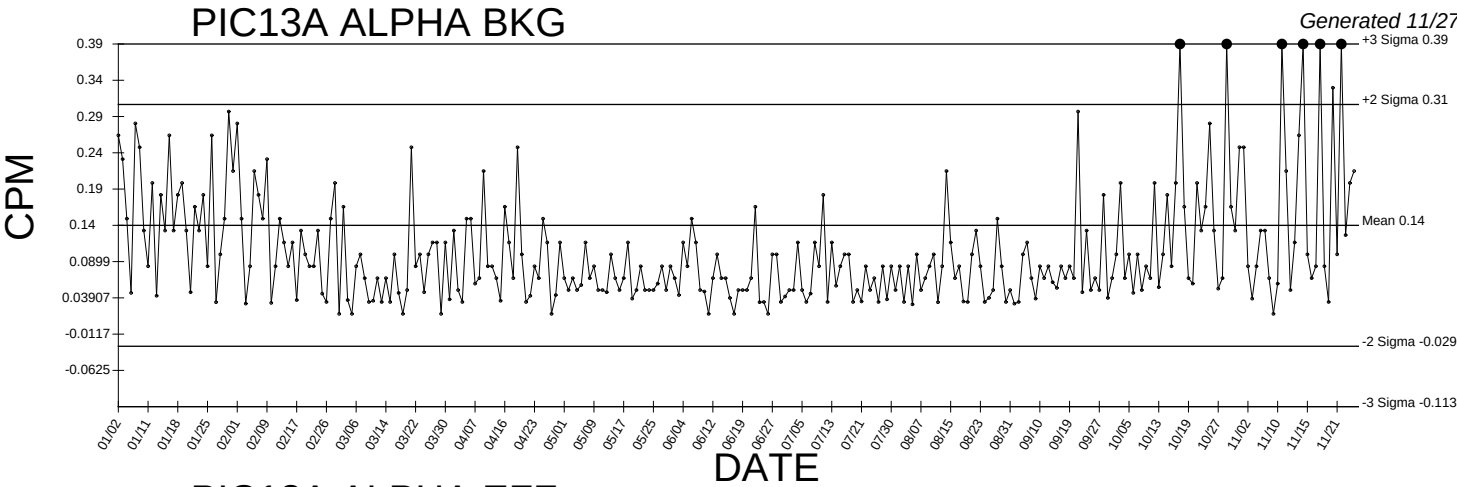
Generated 11/27/2018
+3 Sigma 21780



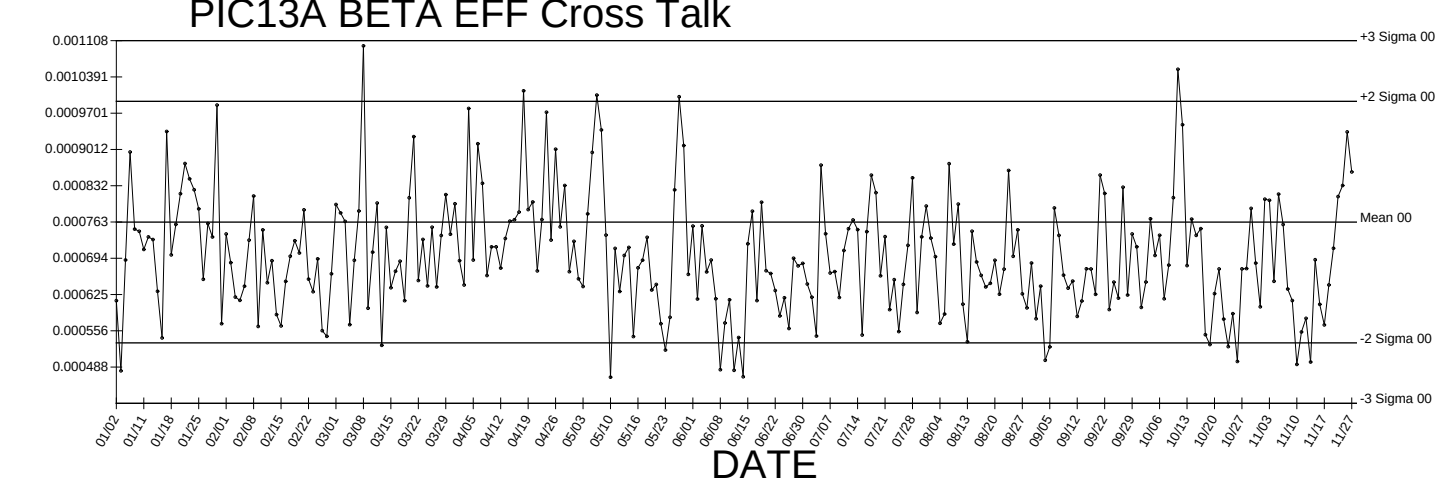
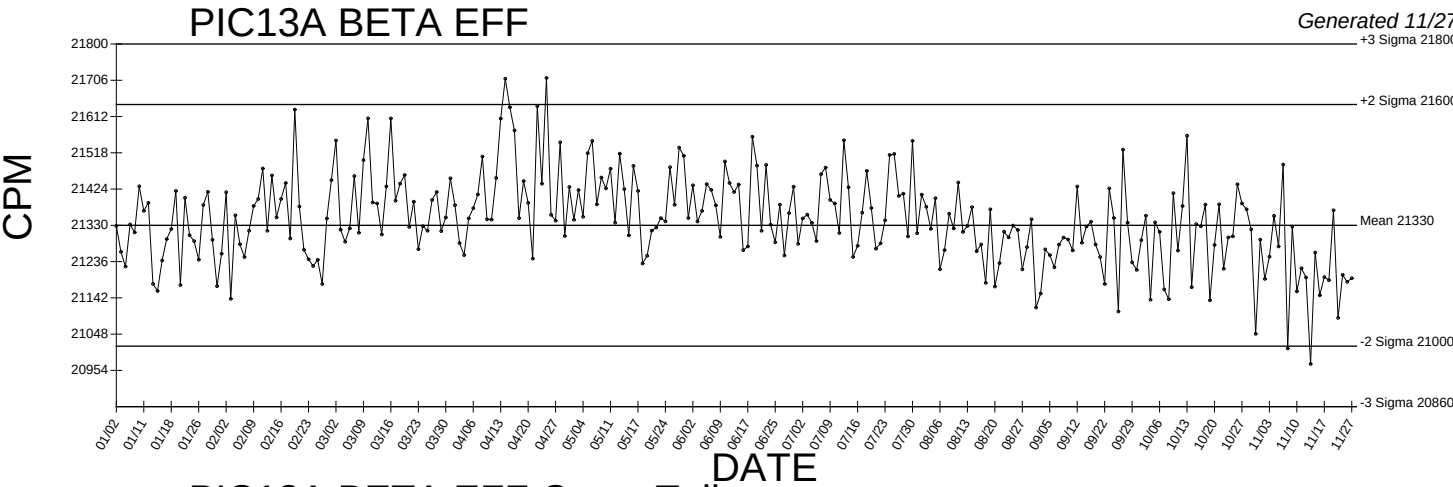
PIC12B BETA EFF Cross Talk



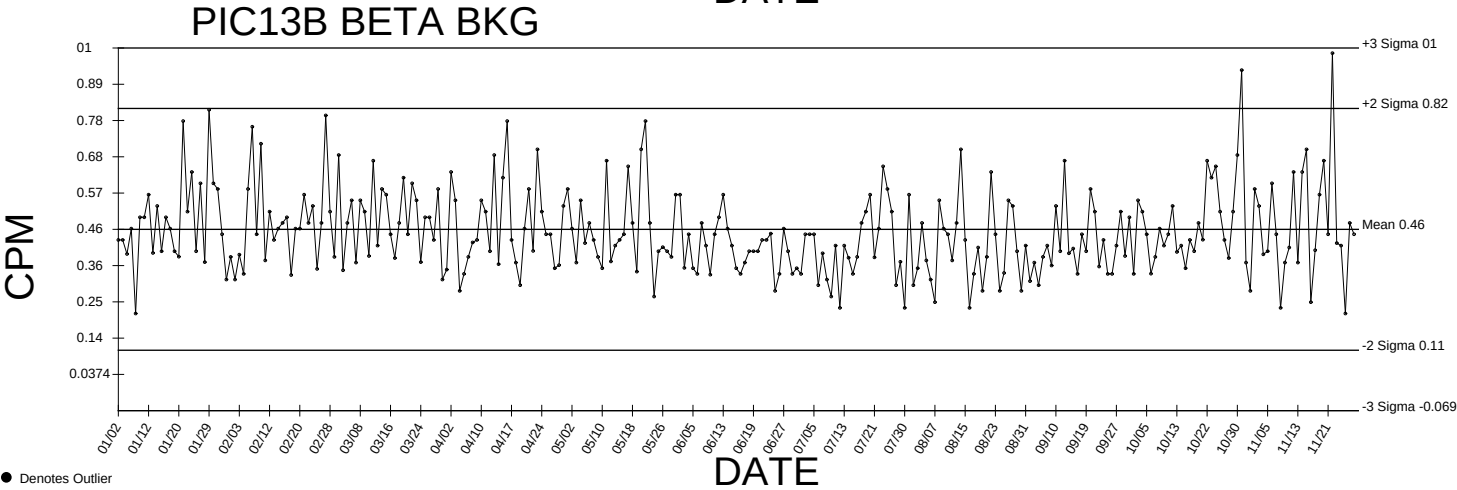
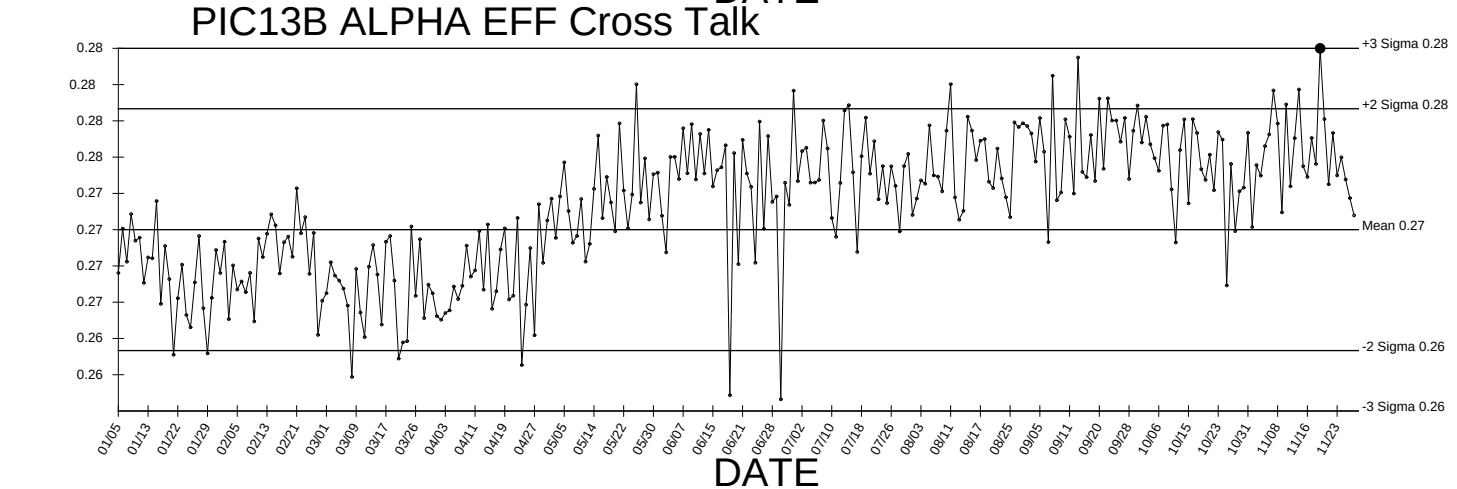
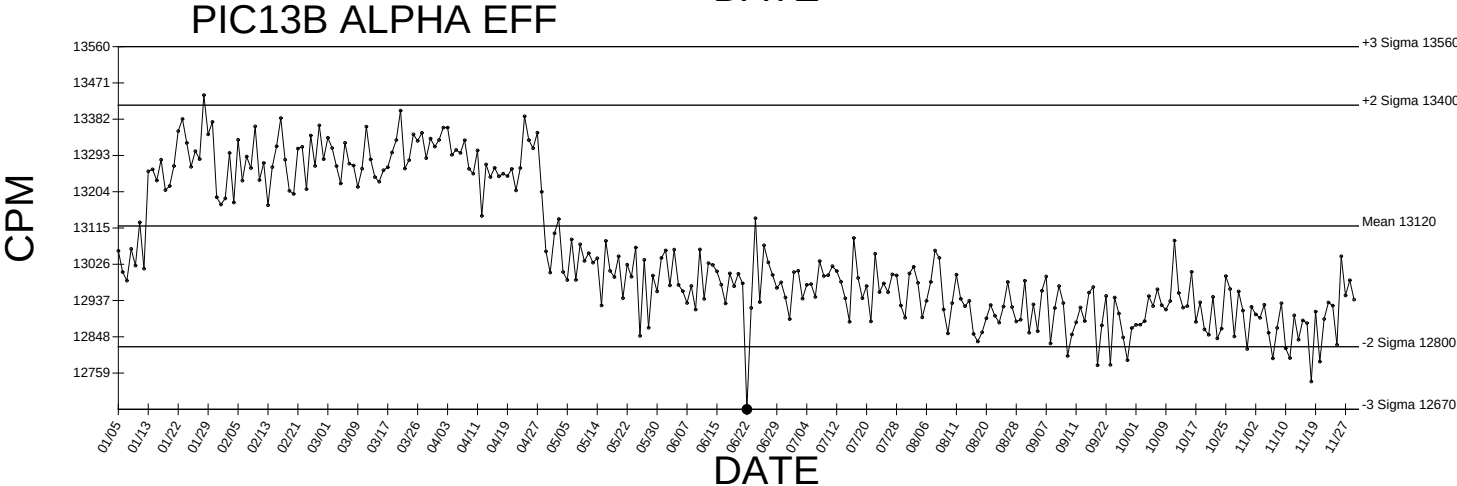
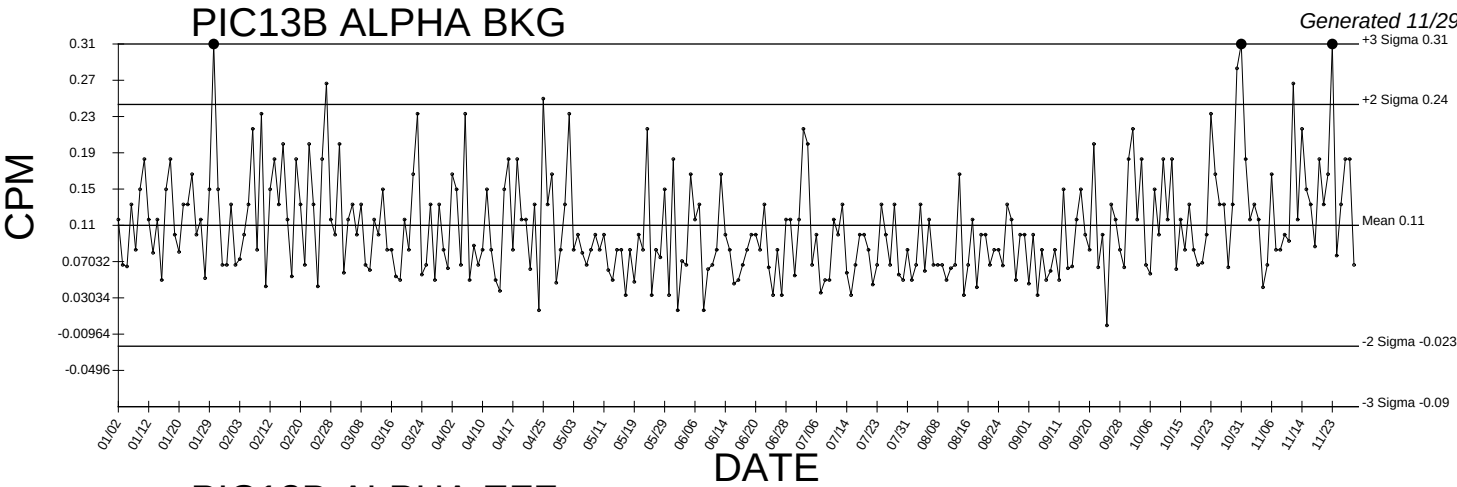
● Denotes Outlier



● Denotes Outlier



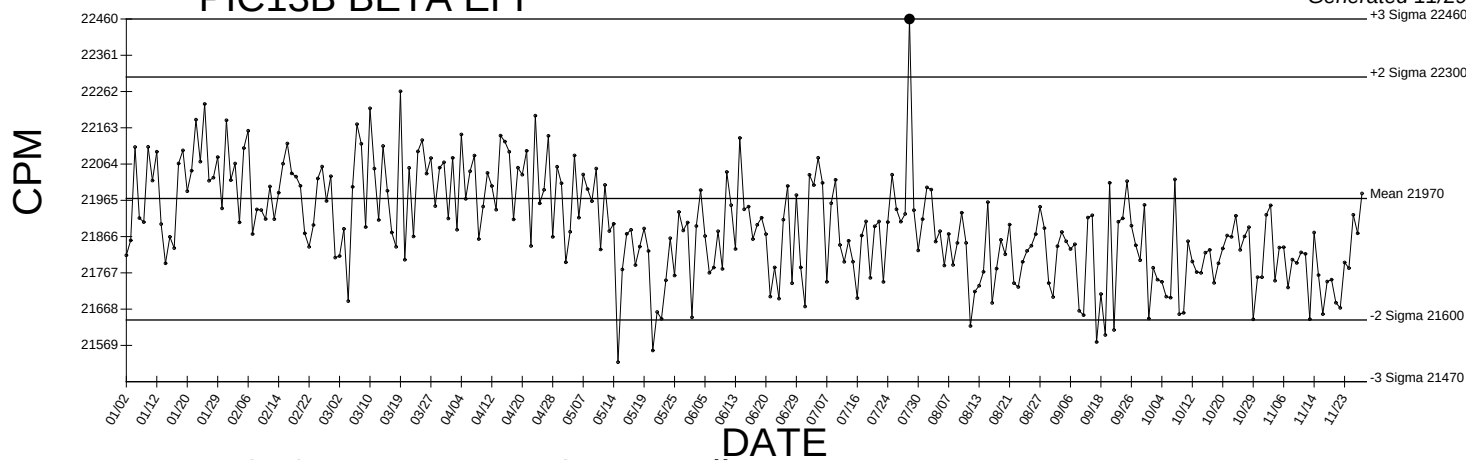
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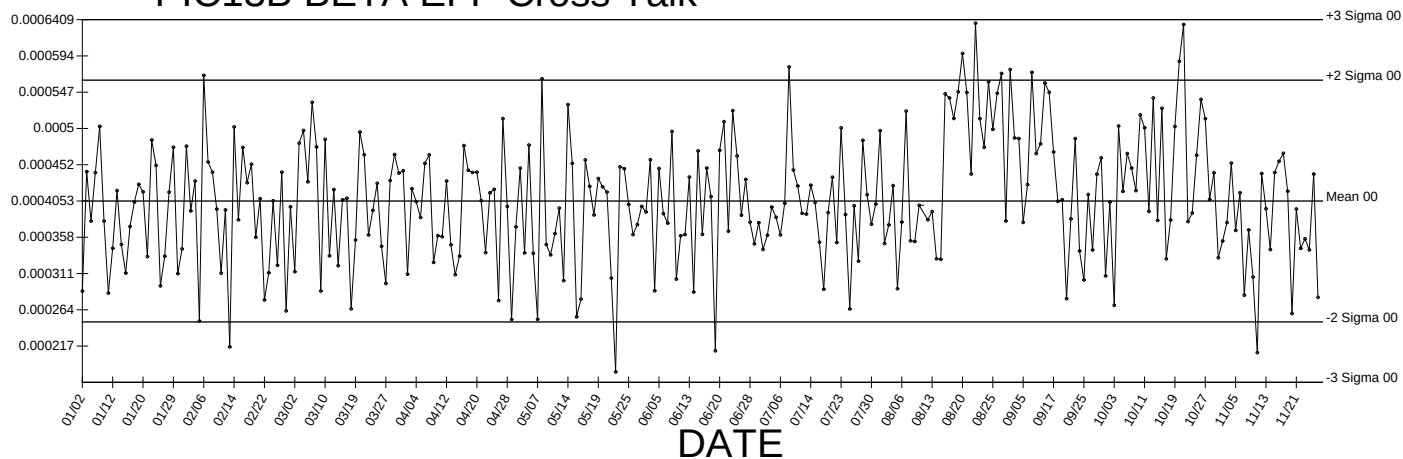
● Denotes Outlier

PIC13B BETA EFF

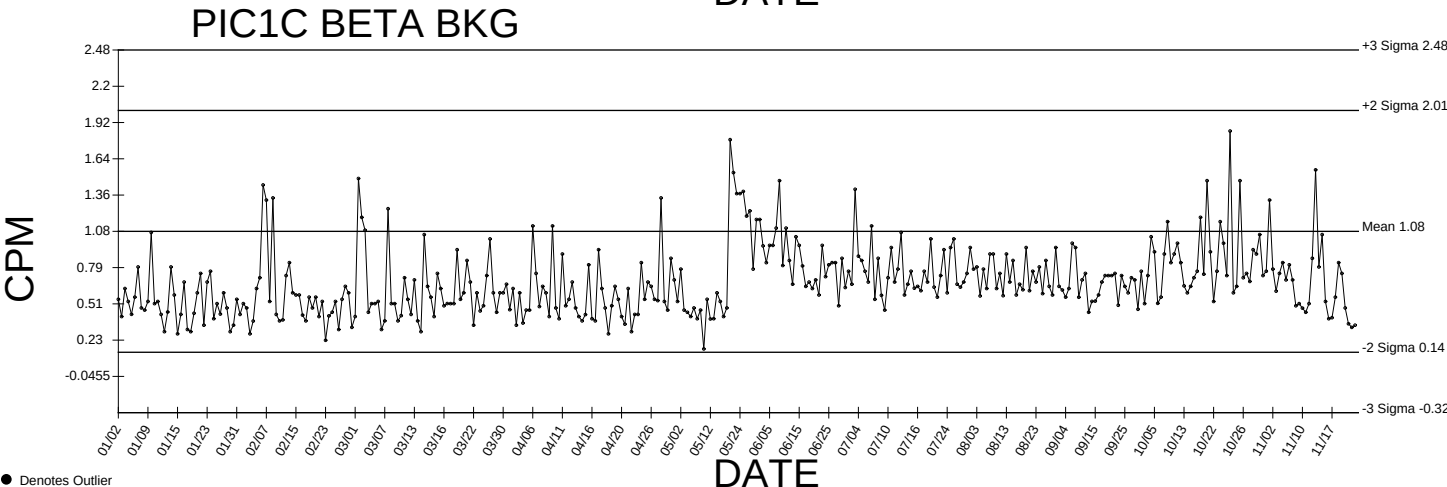
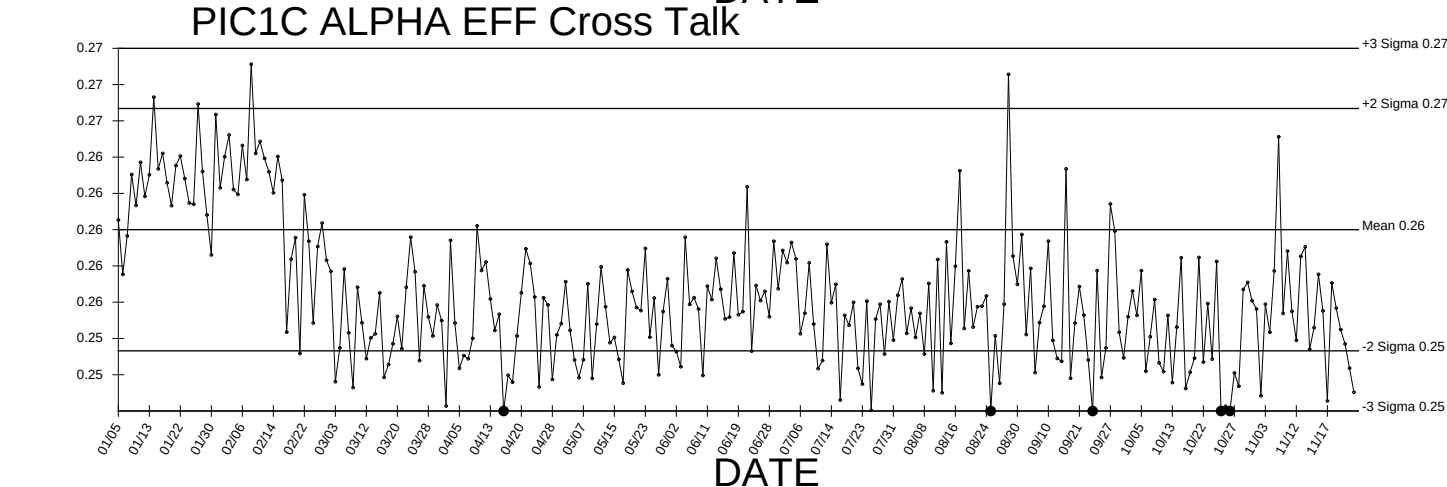
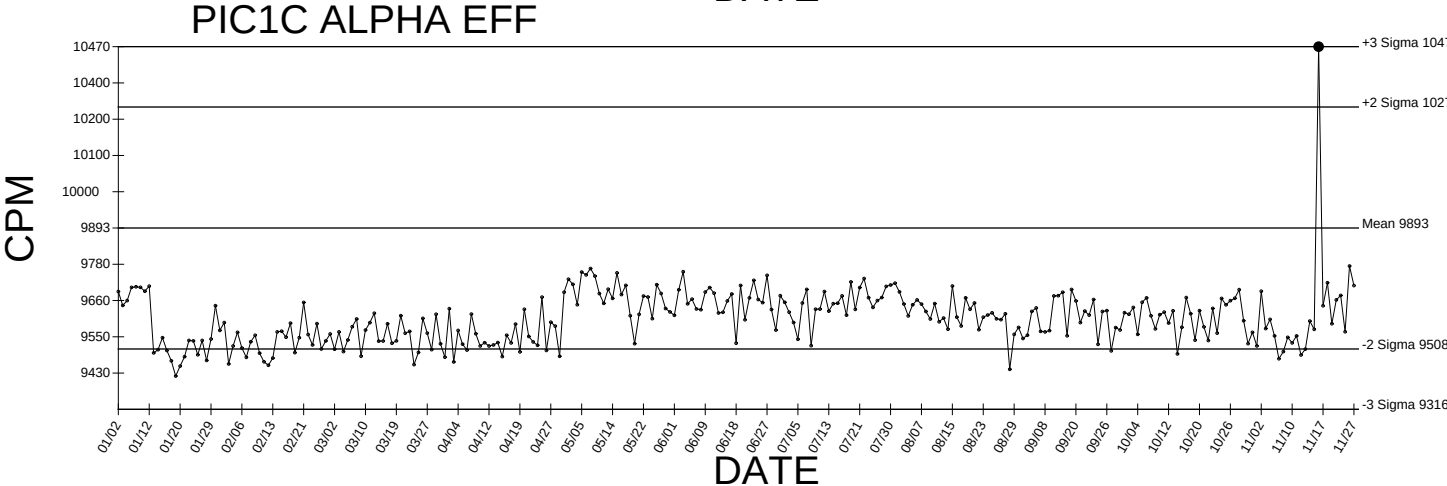
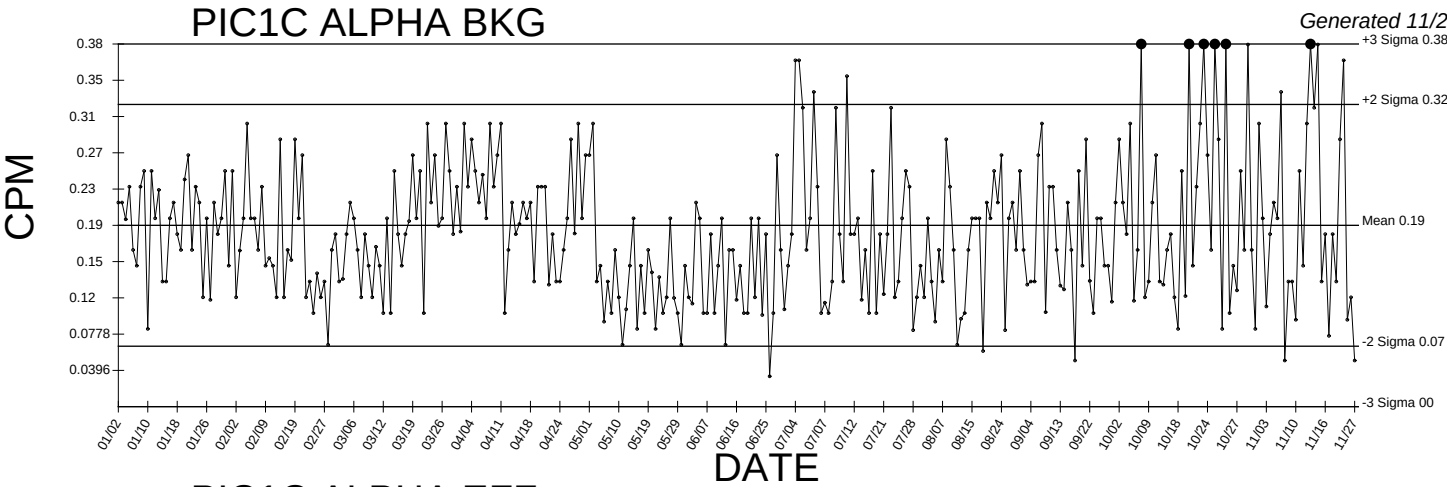
Generated 11/29/2018



PIC13B BETA EFF Cross Talk



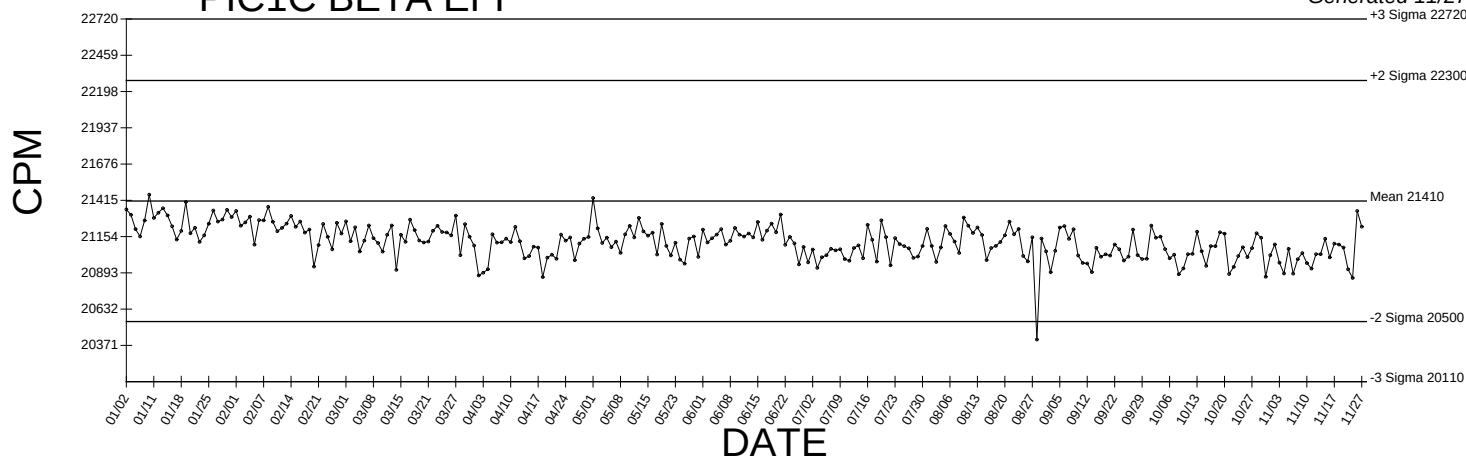
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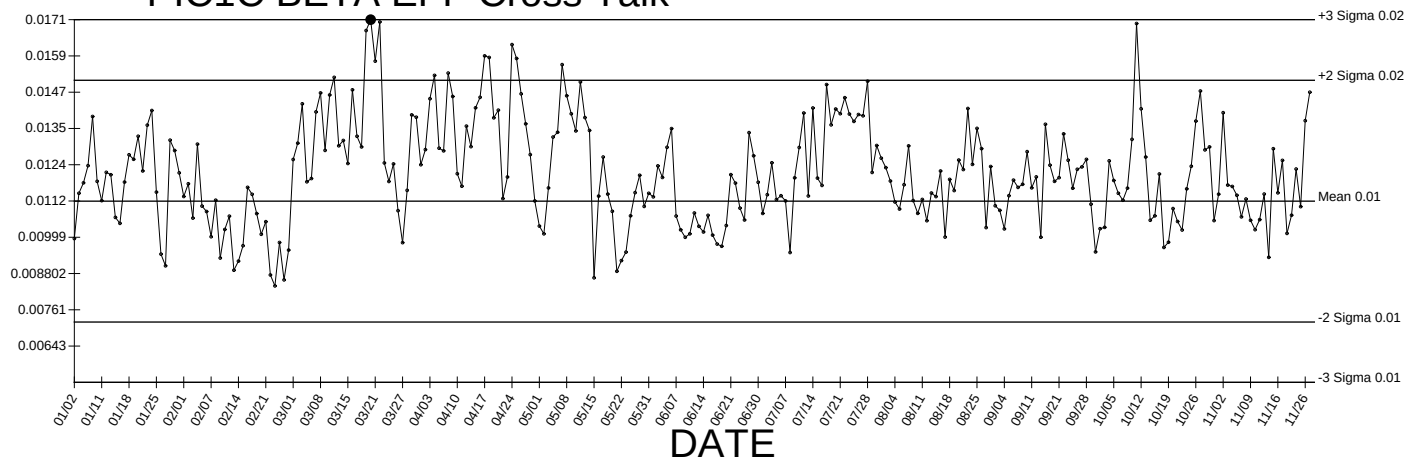
● Denotes Outlier

PIC1C BETA EFF

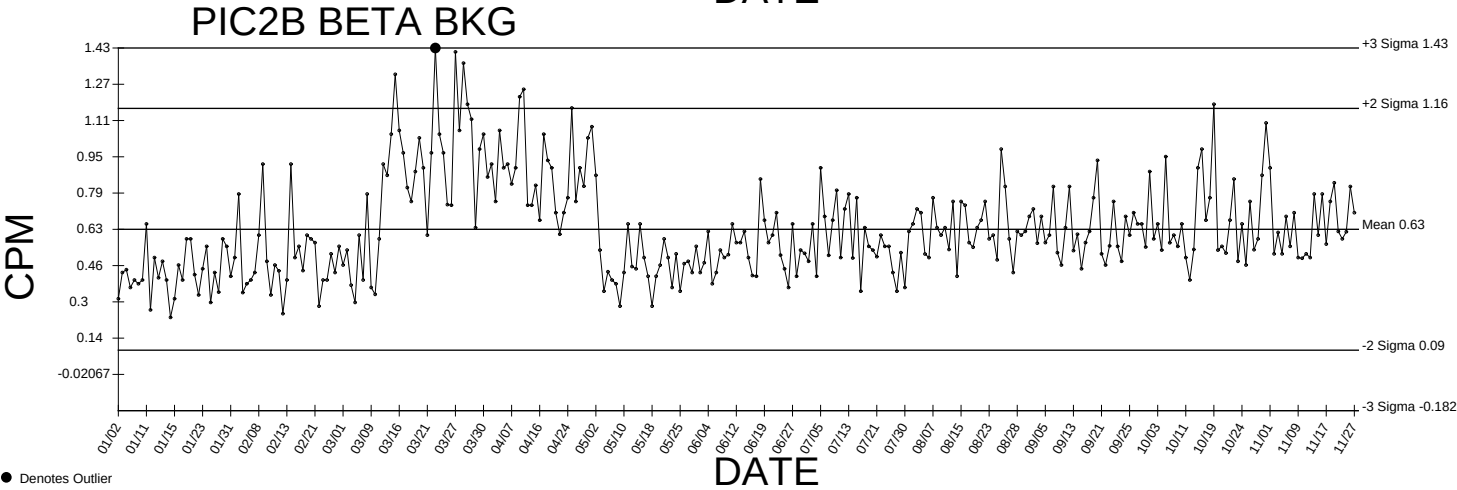
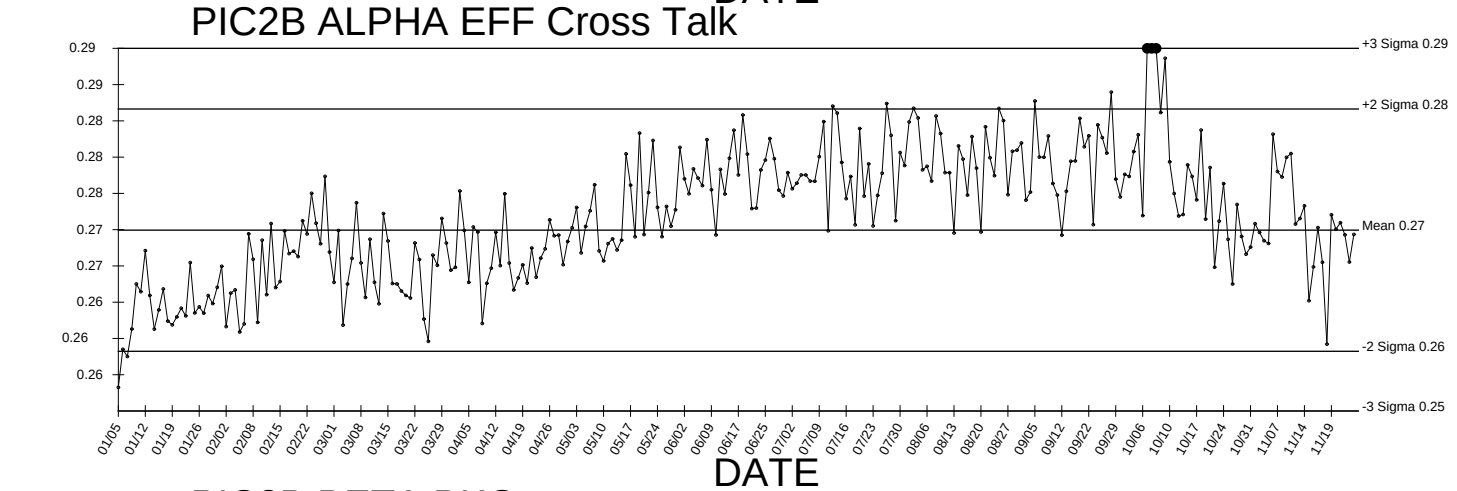
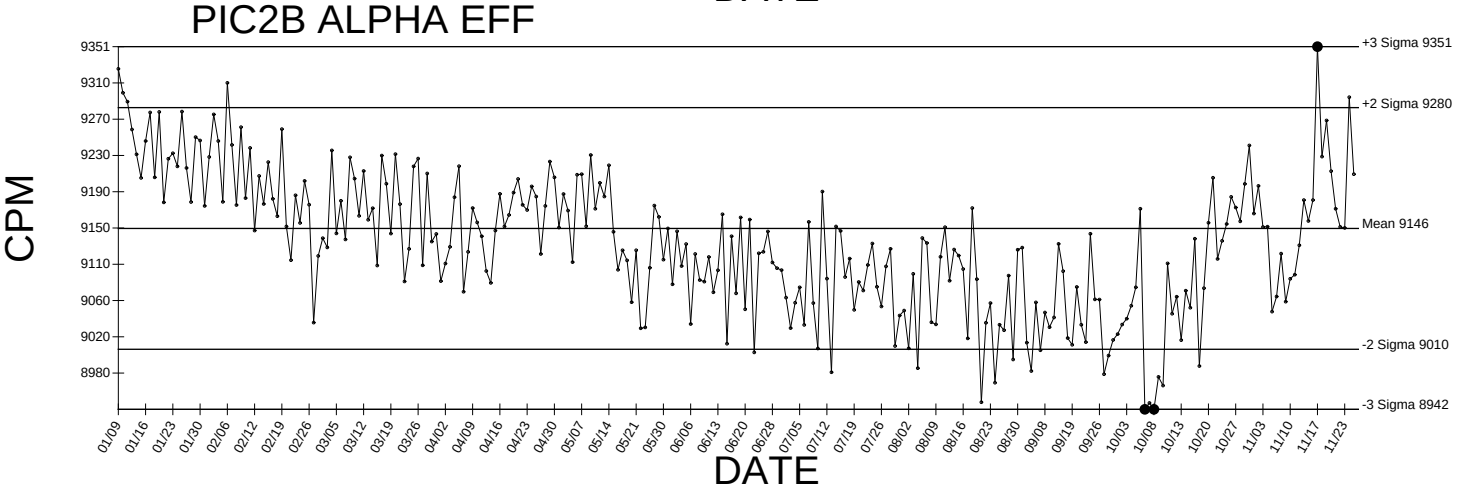
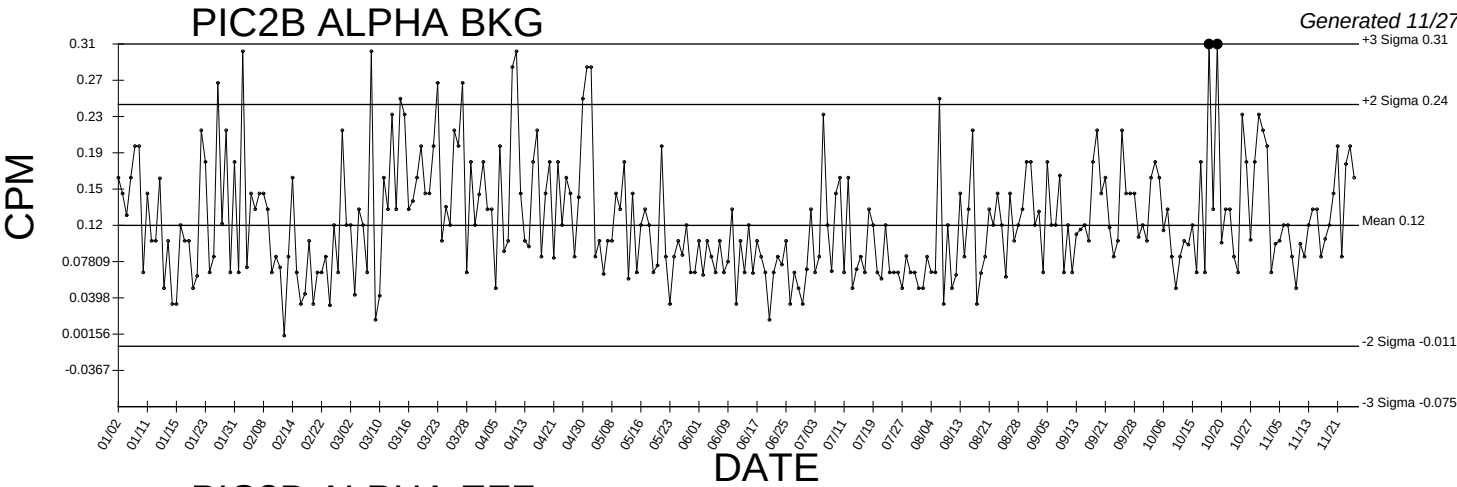
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+3 Sigma 22720



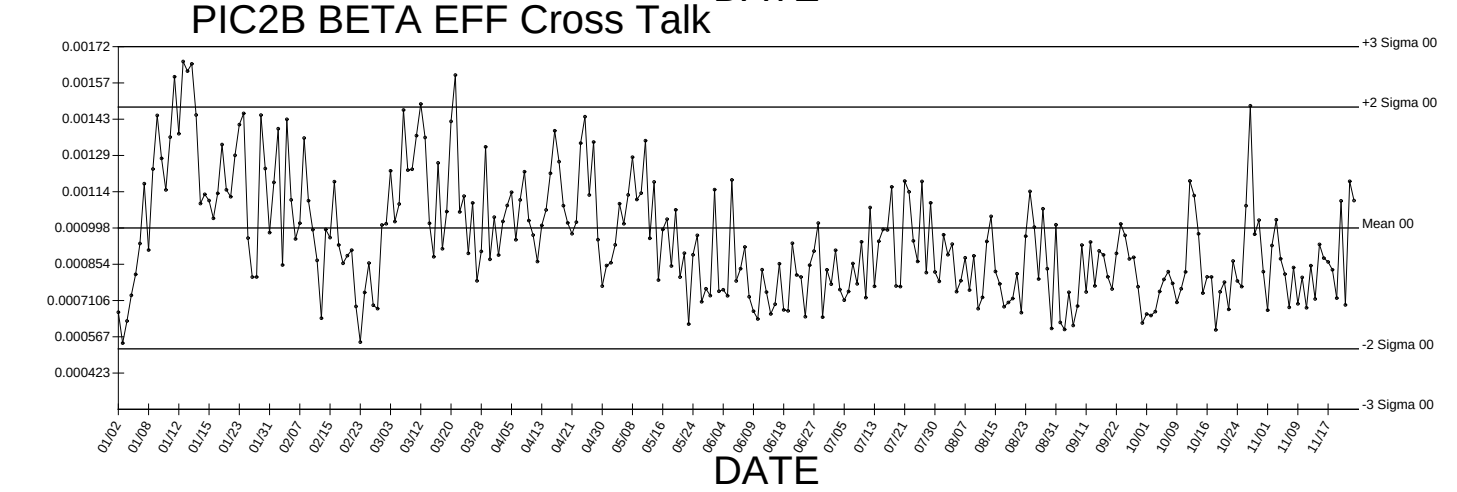
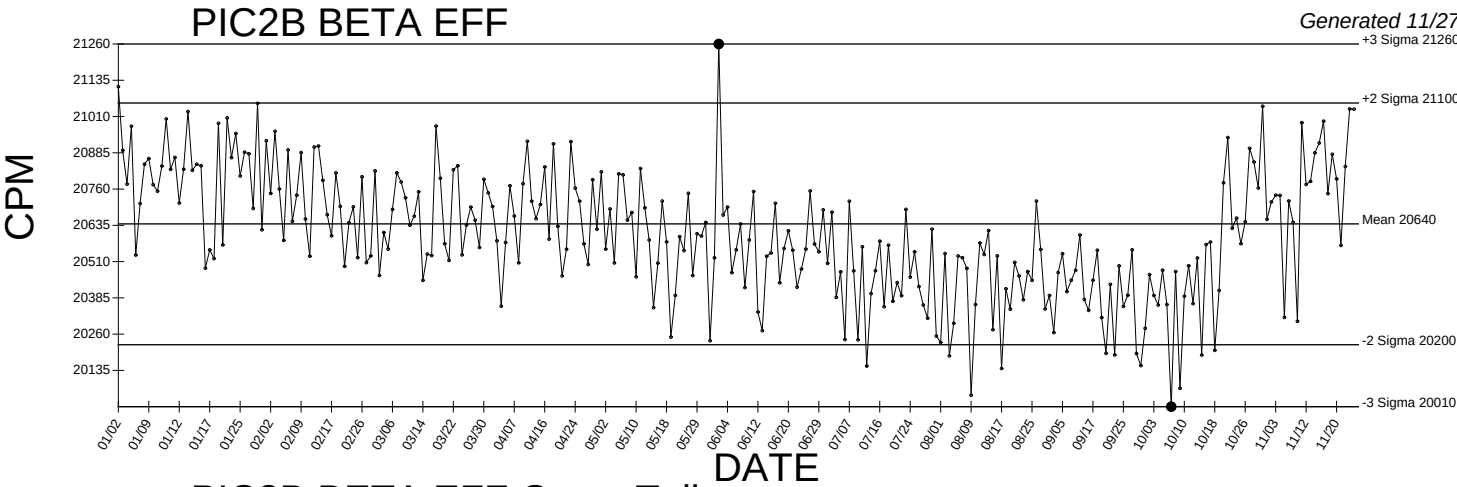
PIC1C BETA EFF Cross Talk



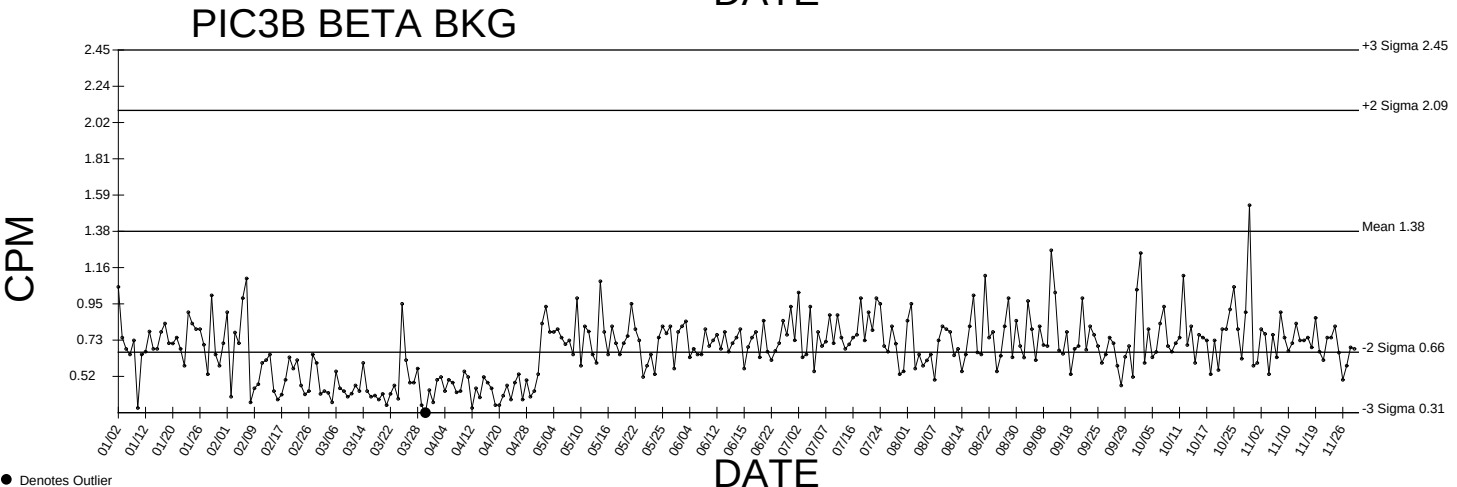
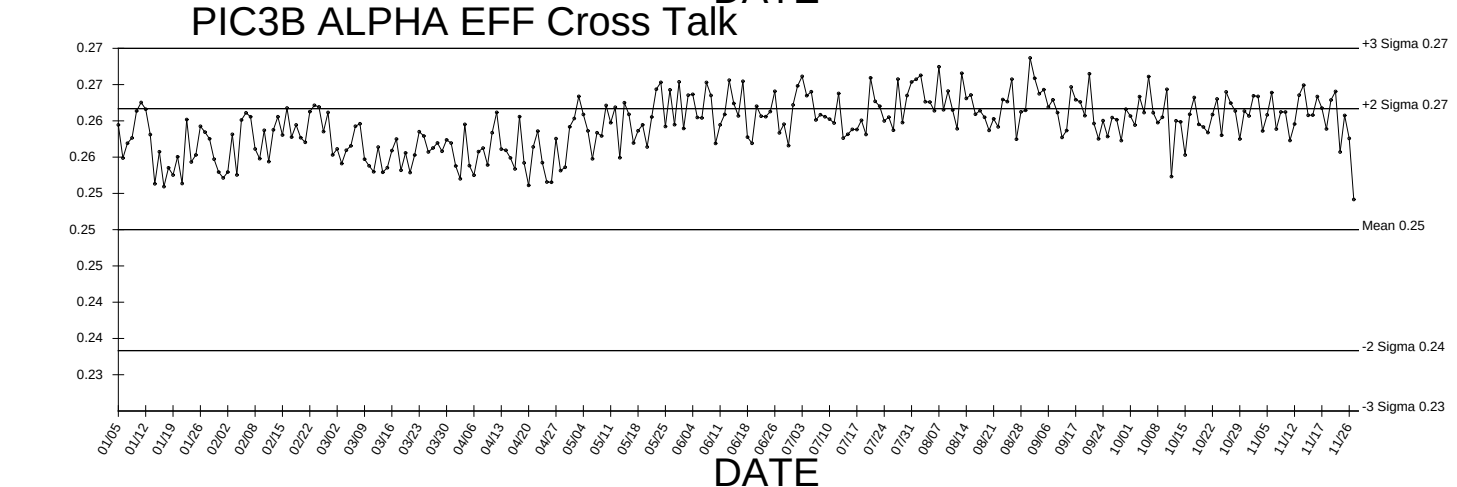
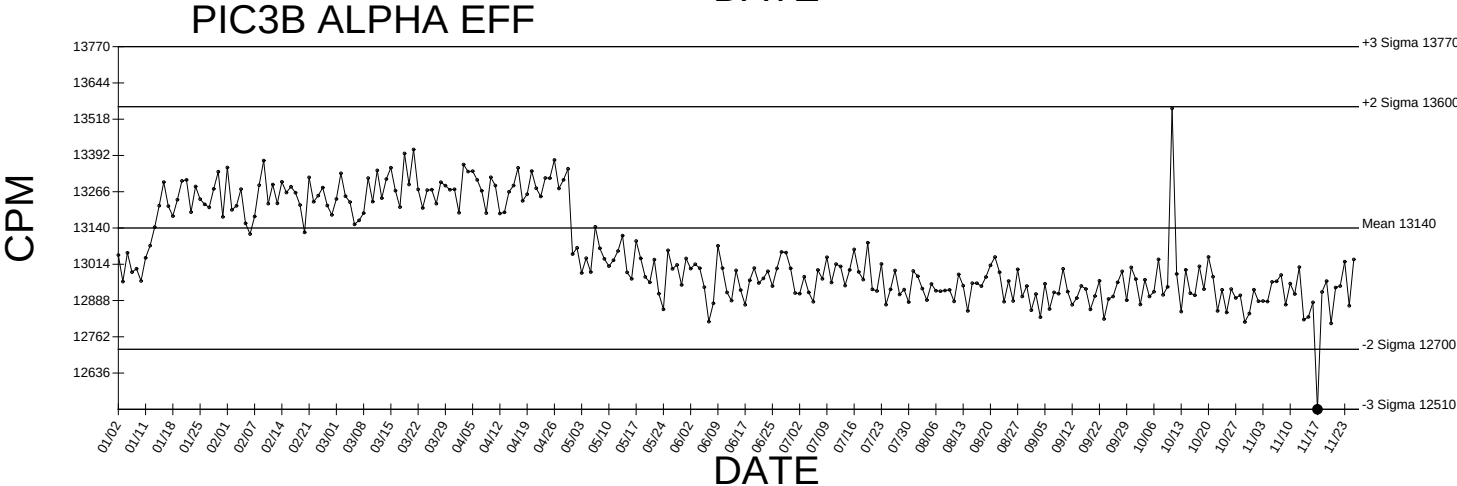
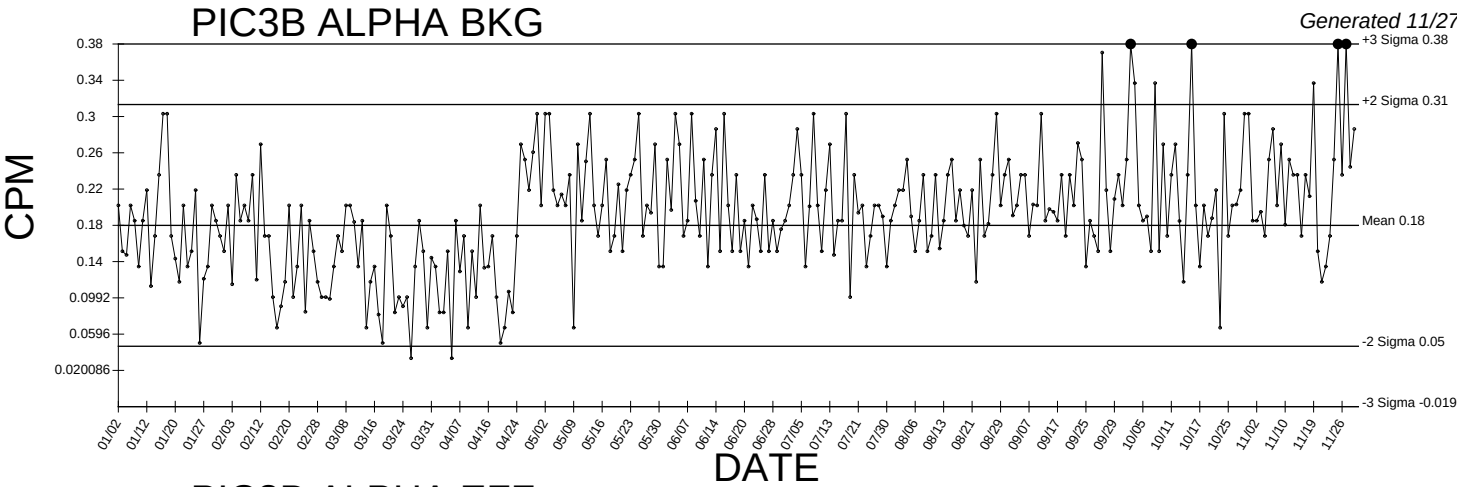
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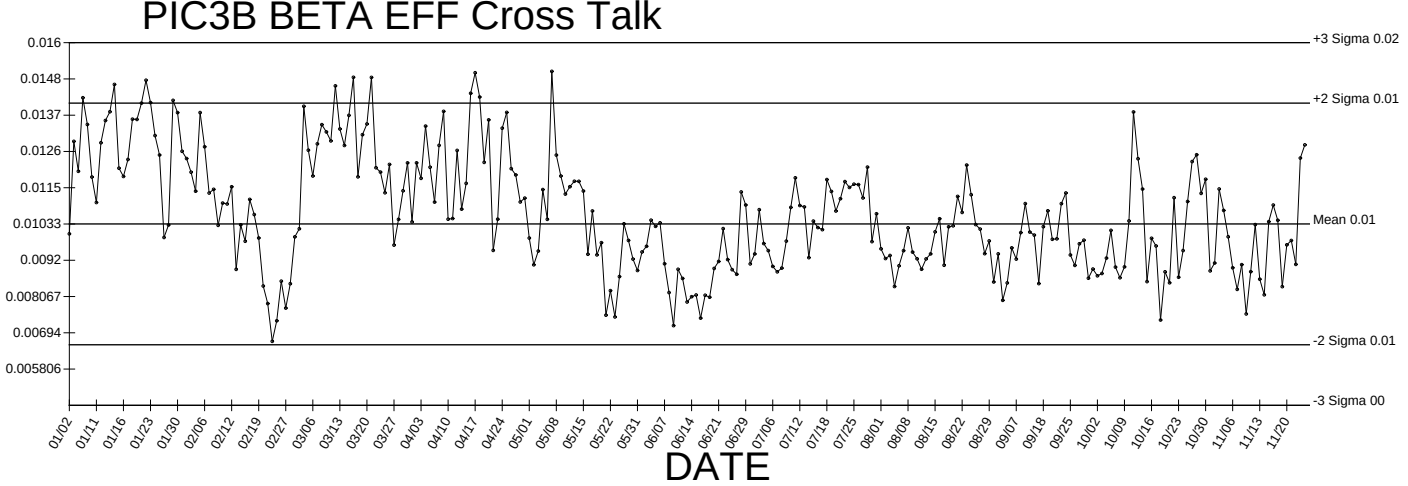
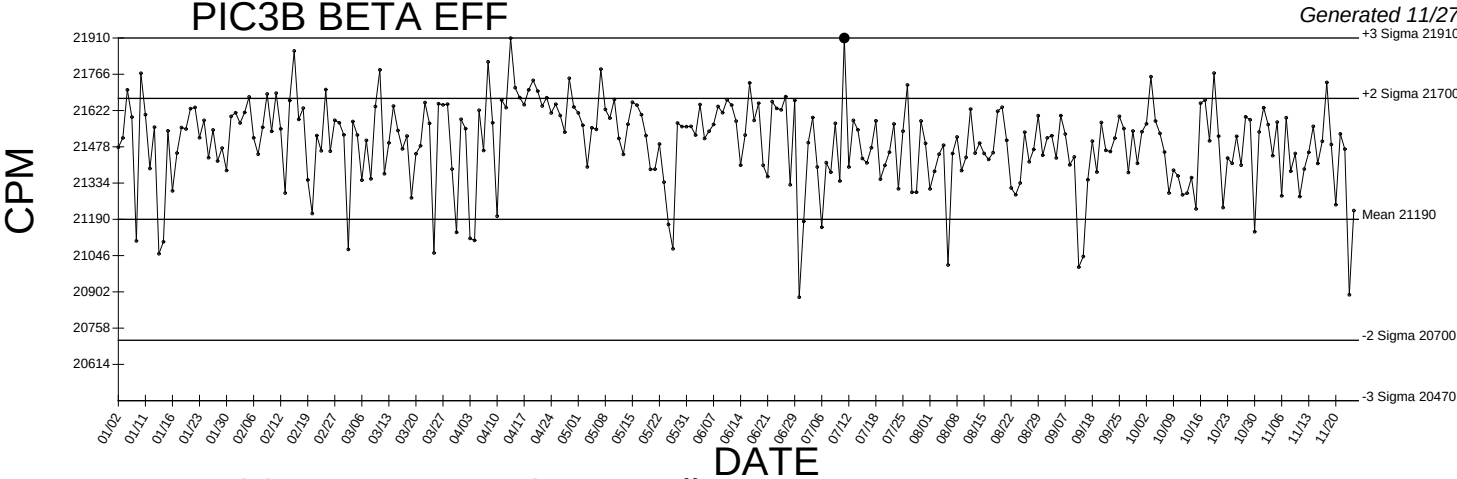
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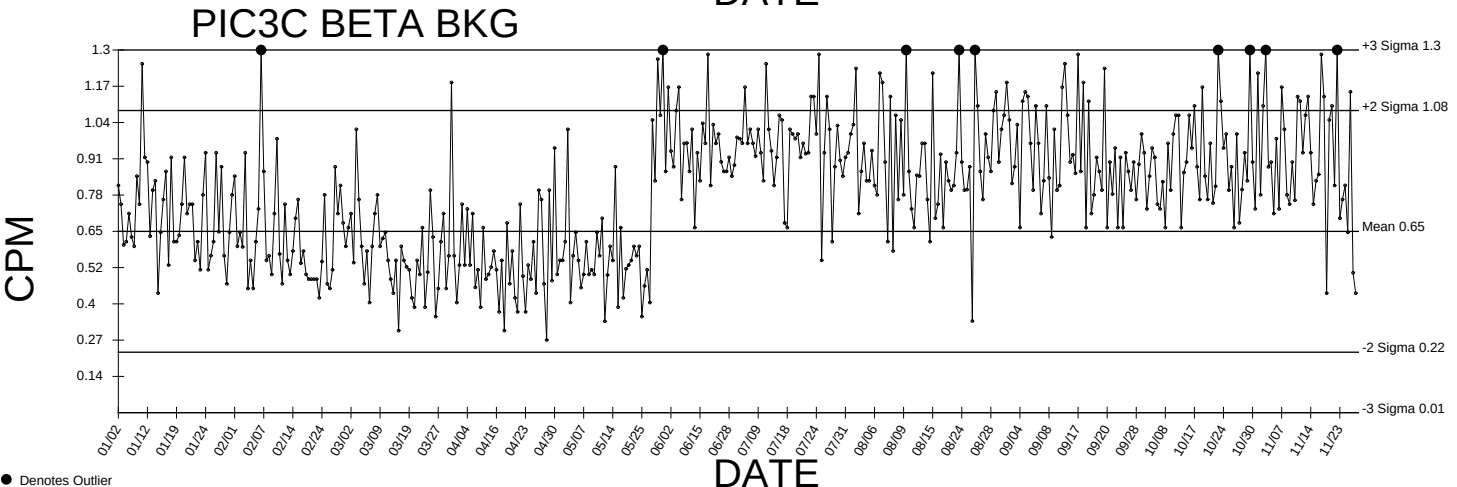
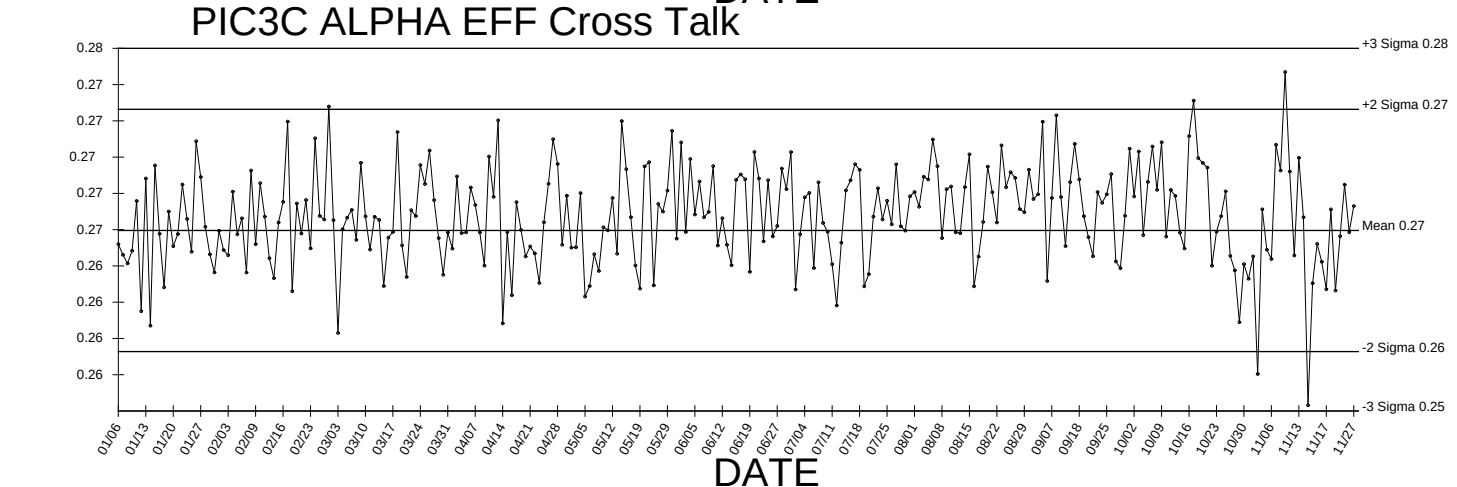
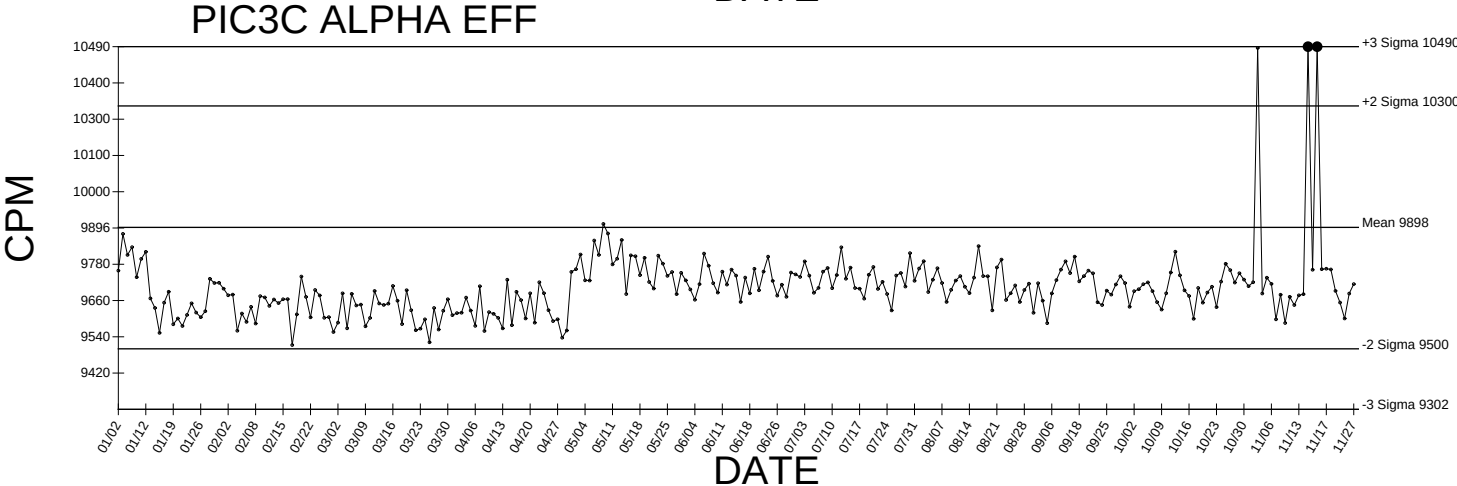
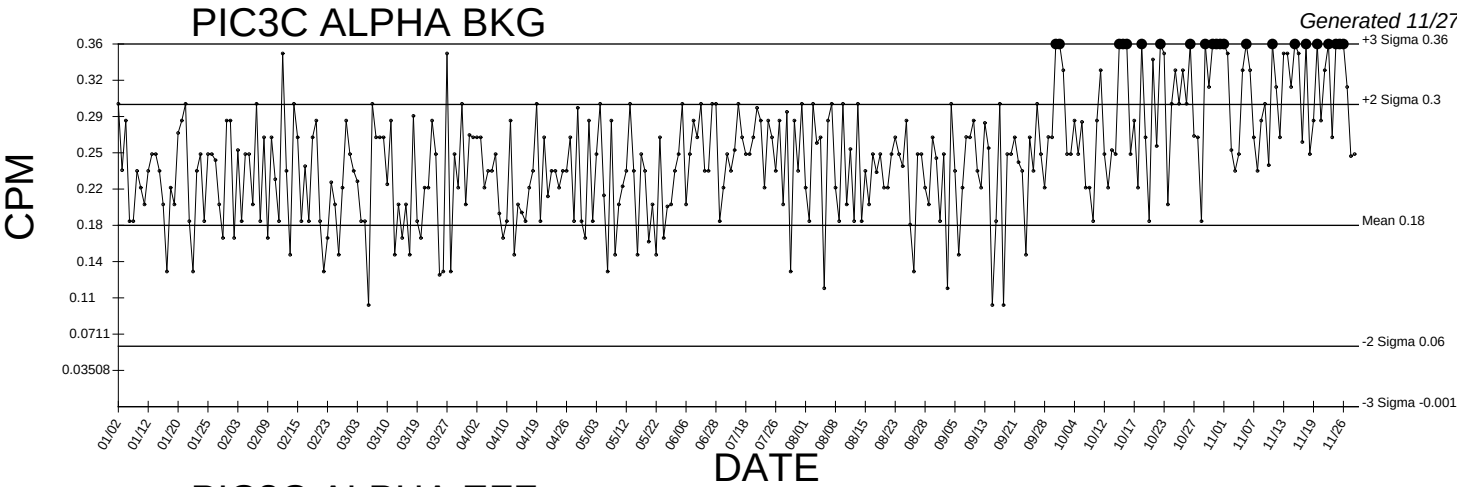
● Denotes Outlier



● Denotes Outlier



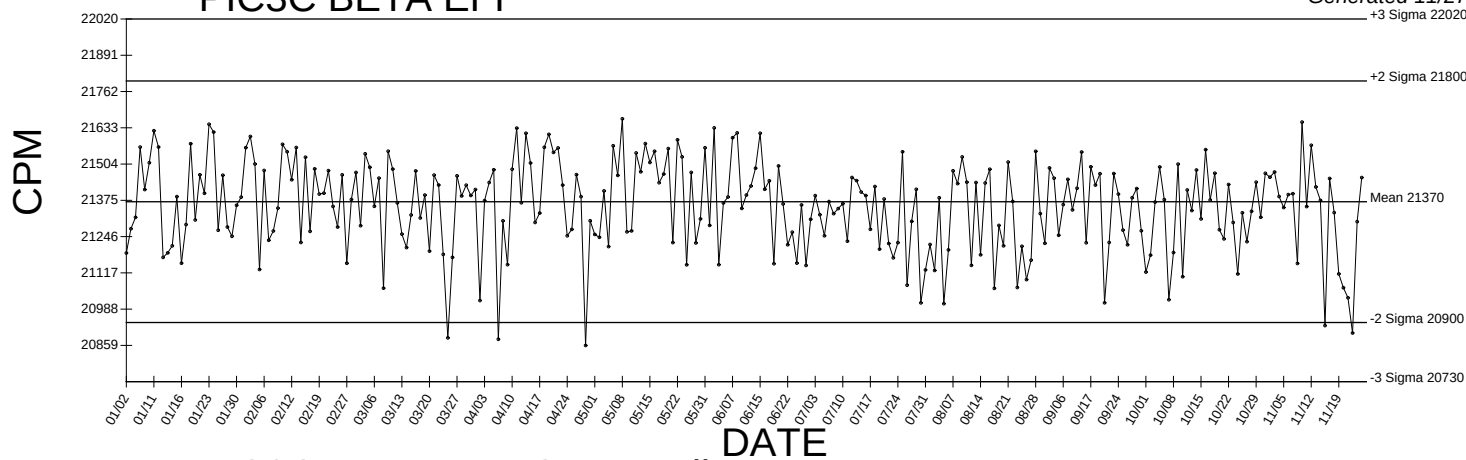
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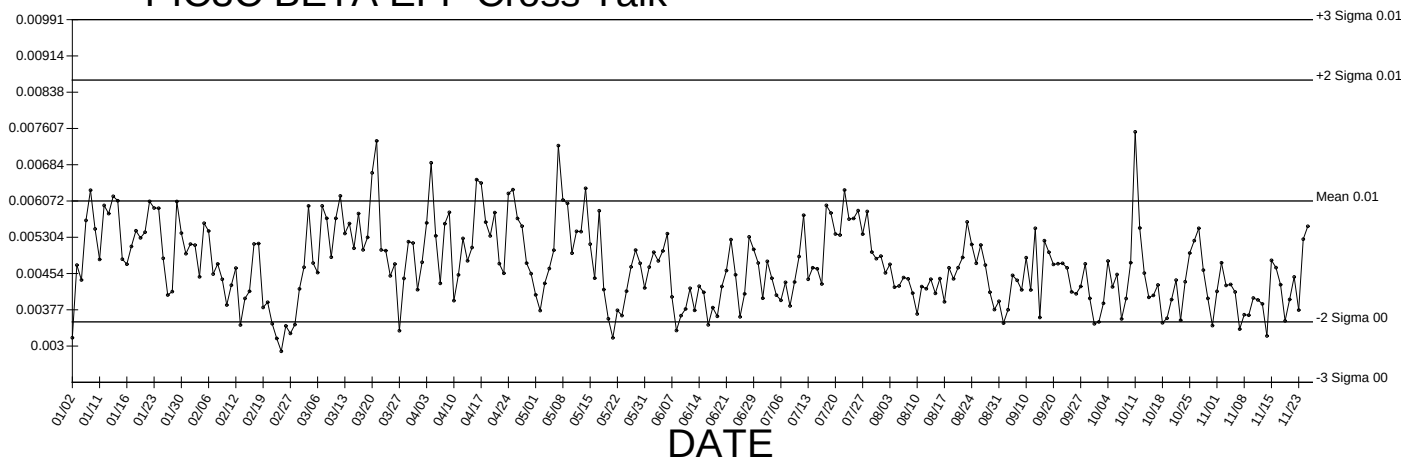
● Denotes Outlier

PIC3C BETA EFF

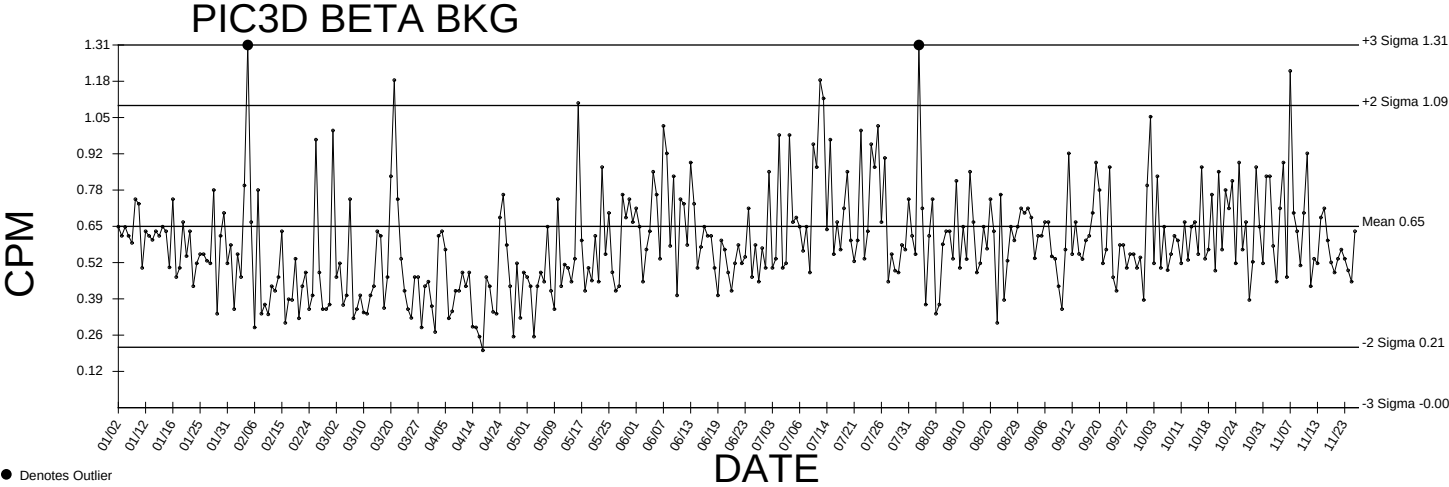
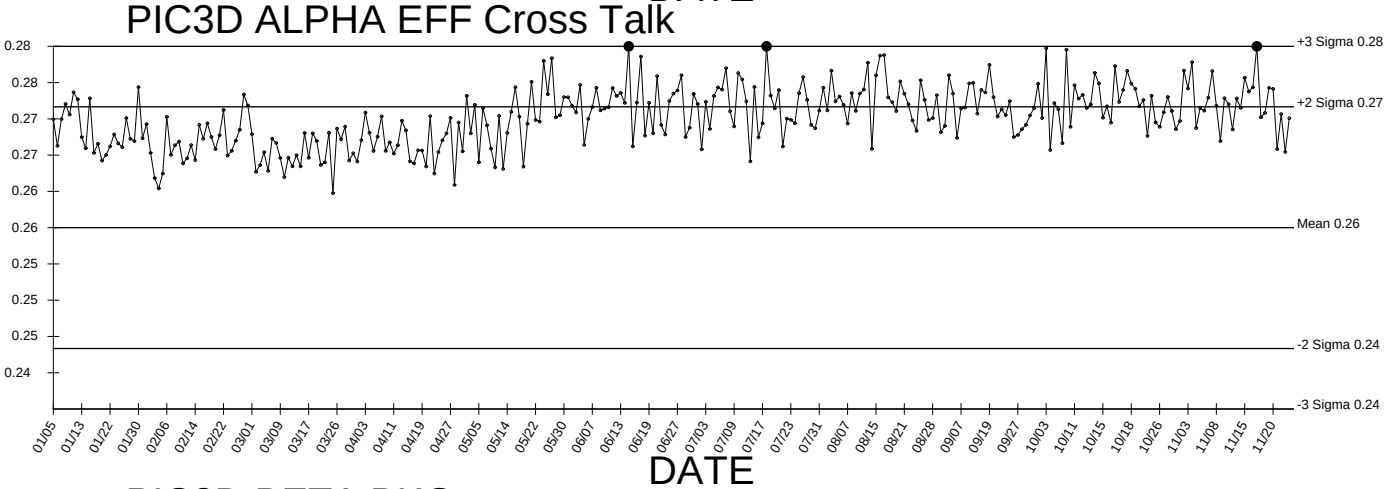
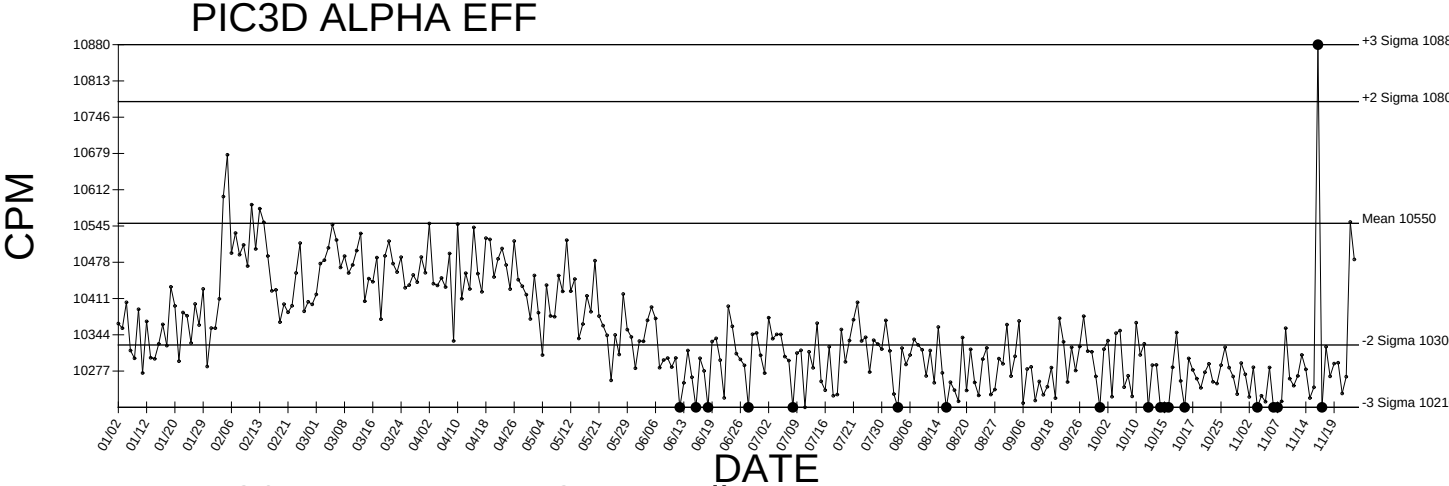
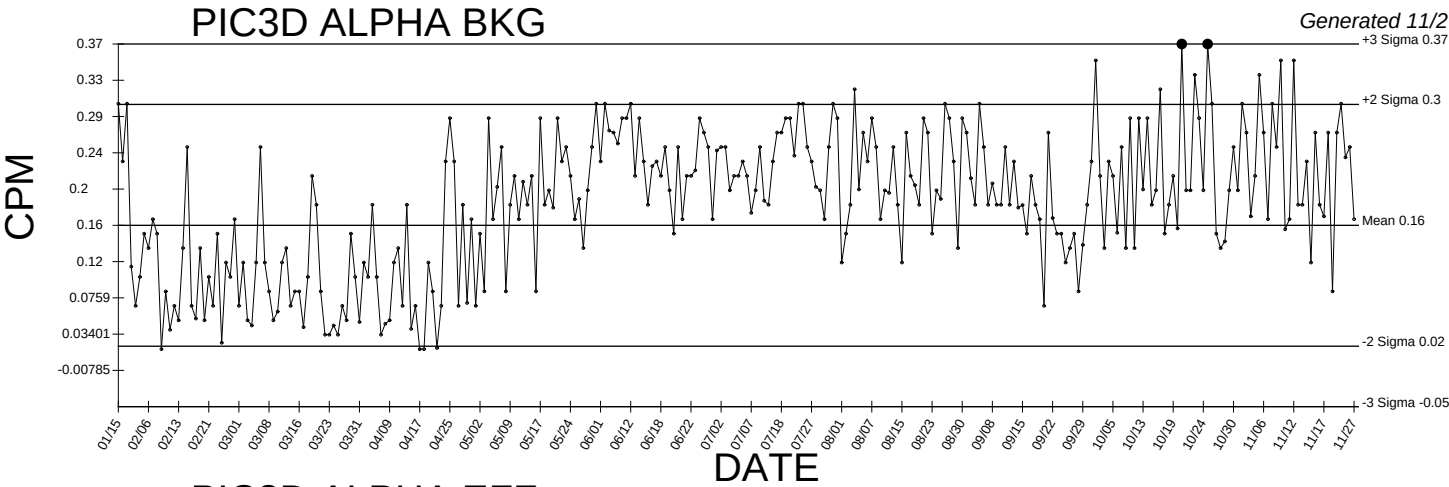
Generated 11/27/2018



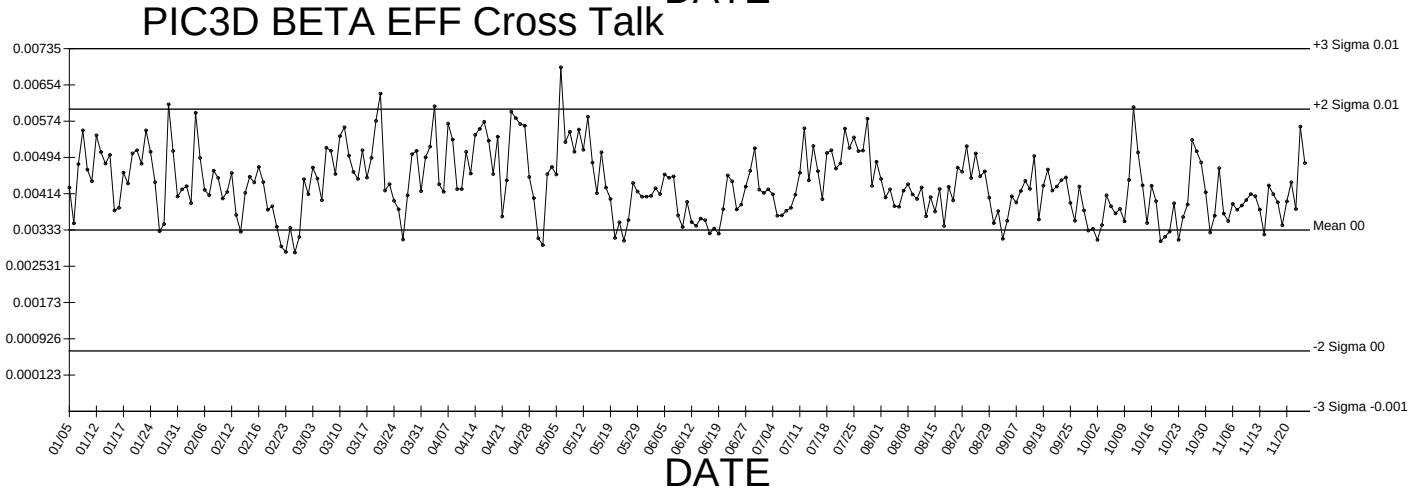
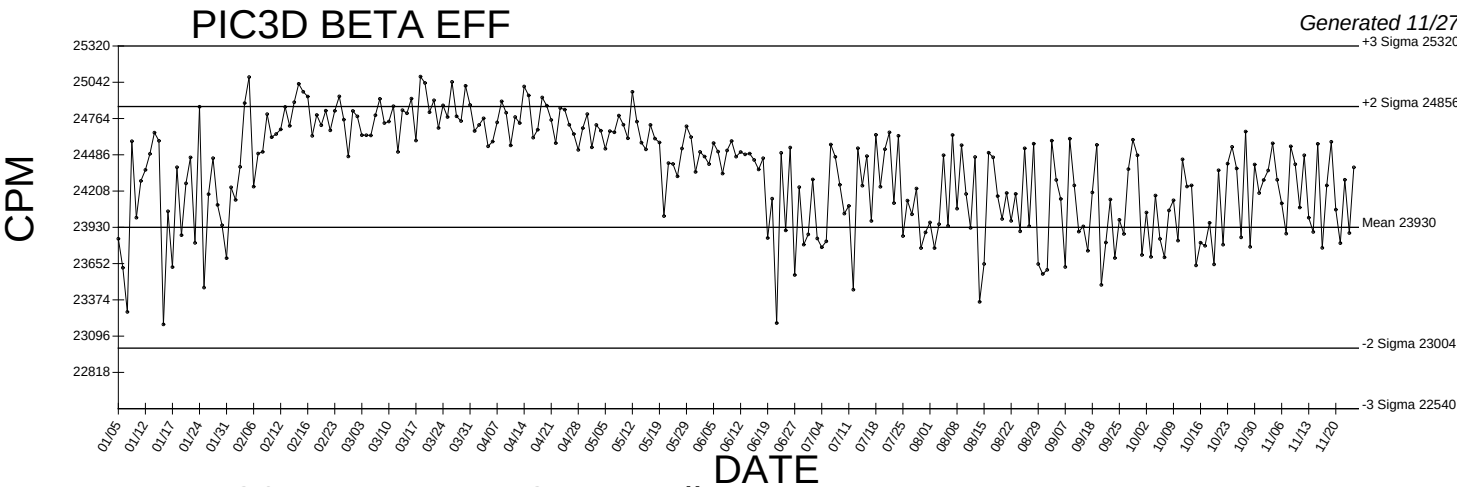
PIC3C BETA EFF Cross Talk



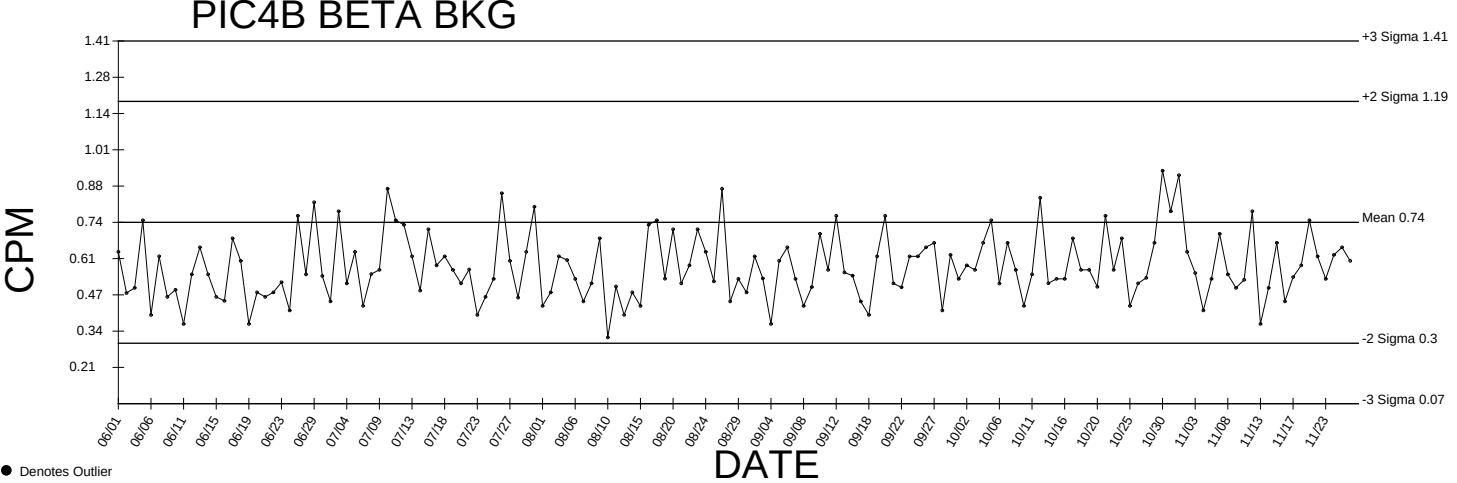
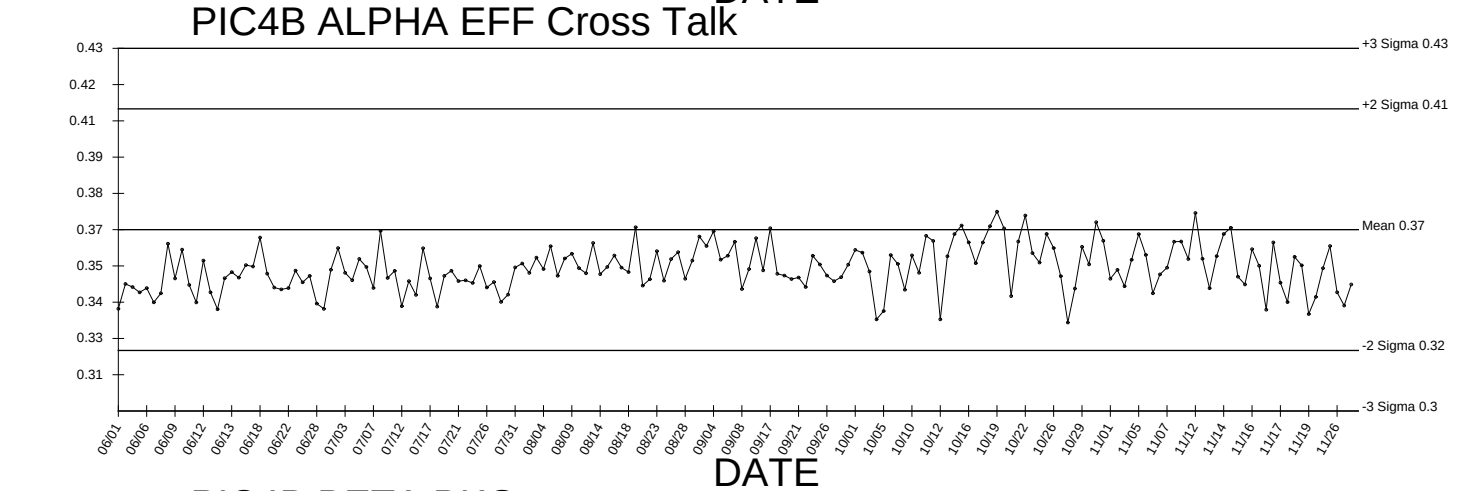
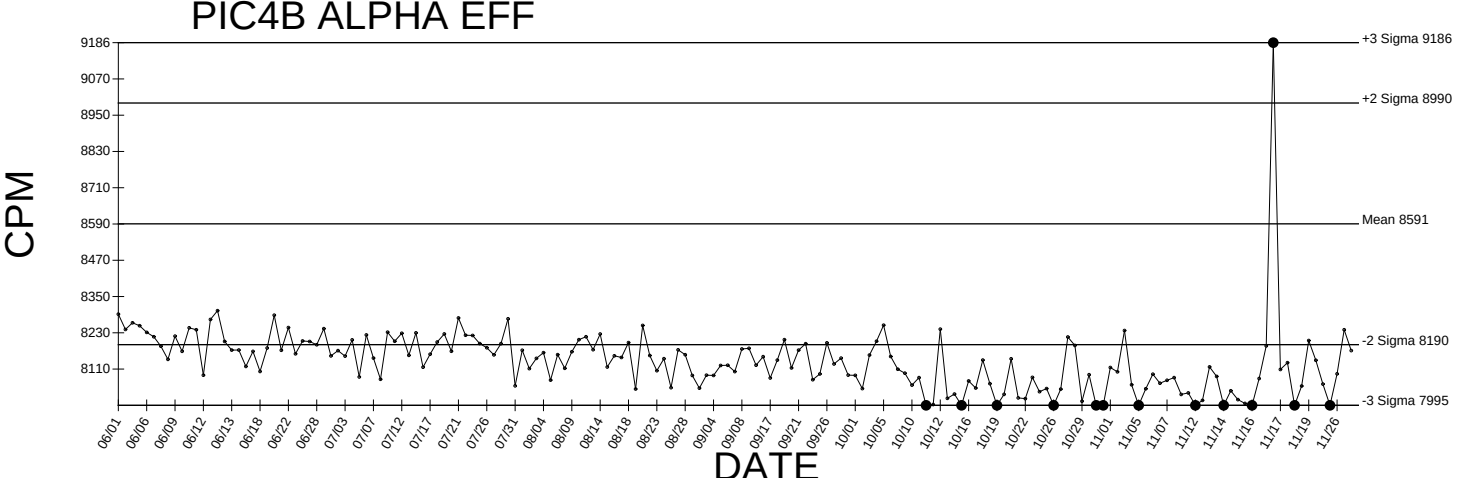
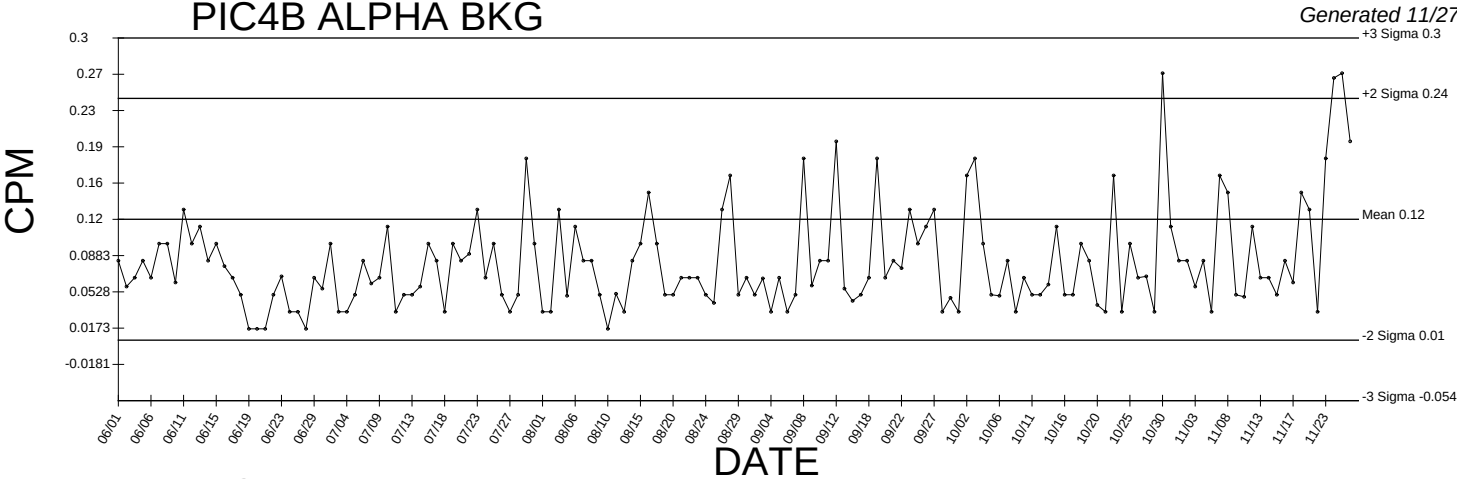
● Denotes Outlier



● Denotes Outlier



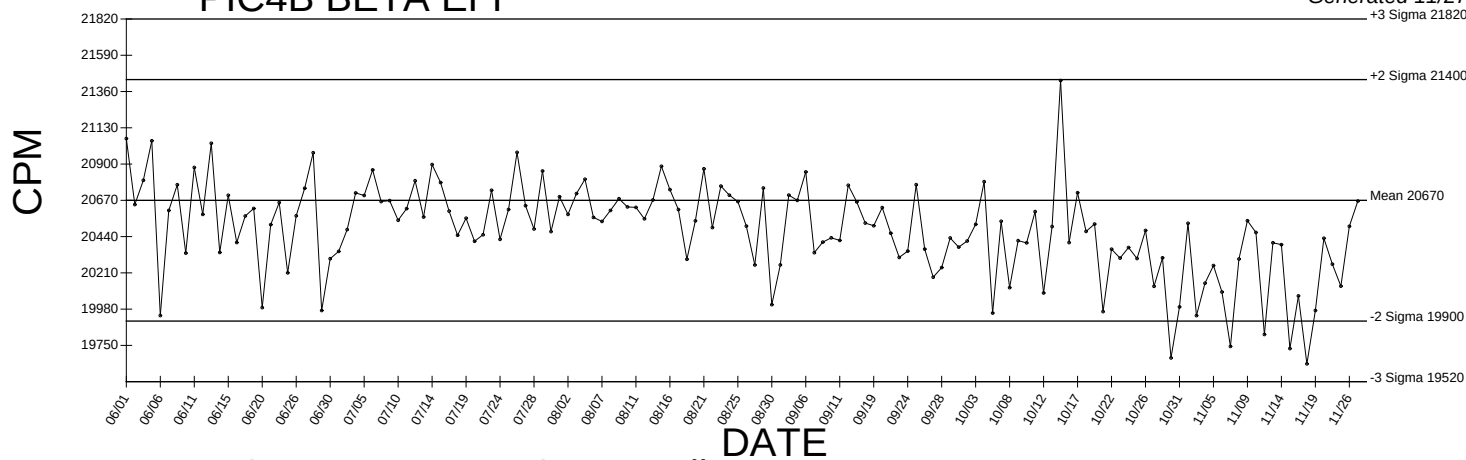
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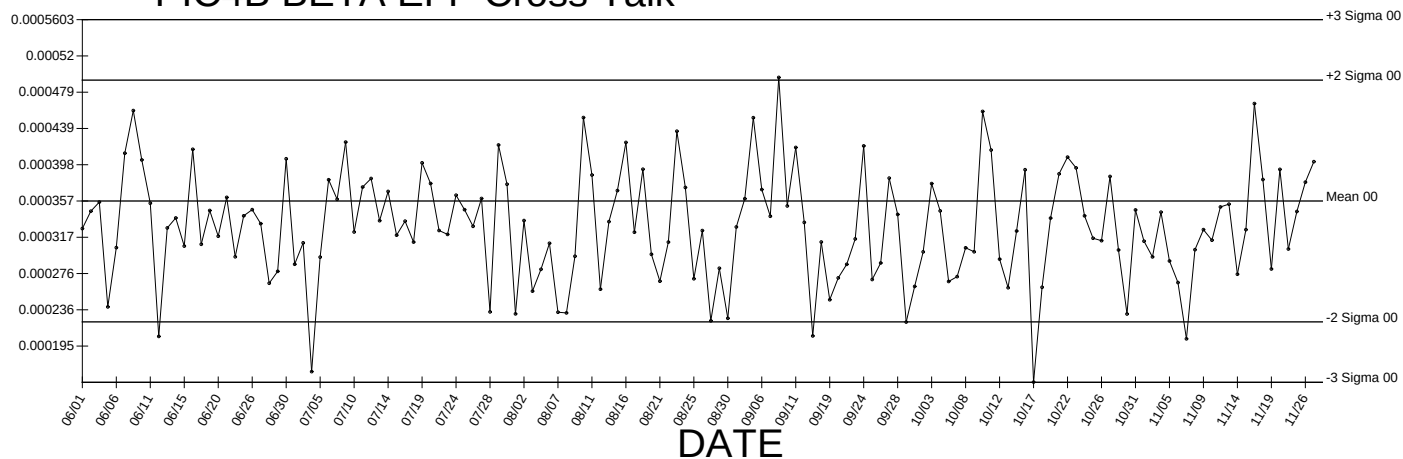
● Denotes Outlier

PIC4B BETA EFF

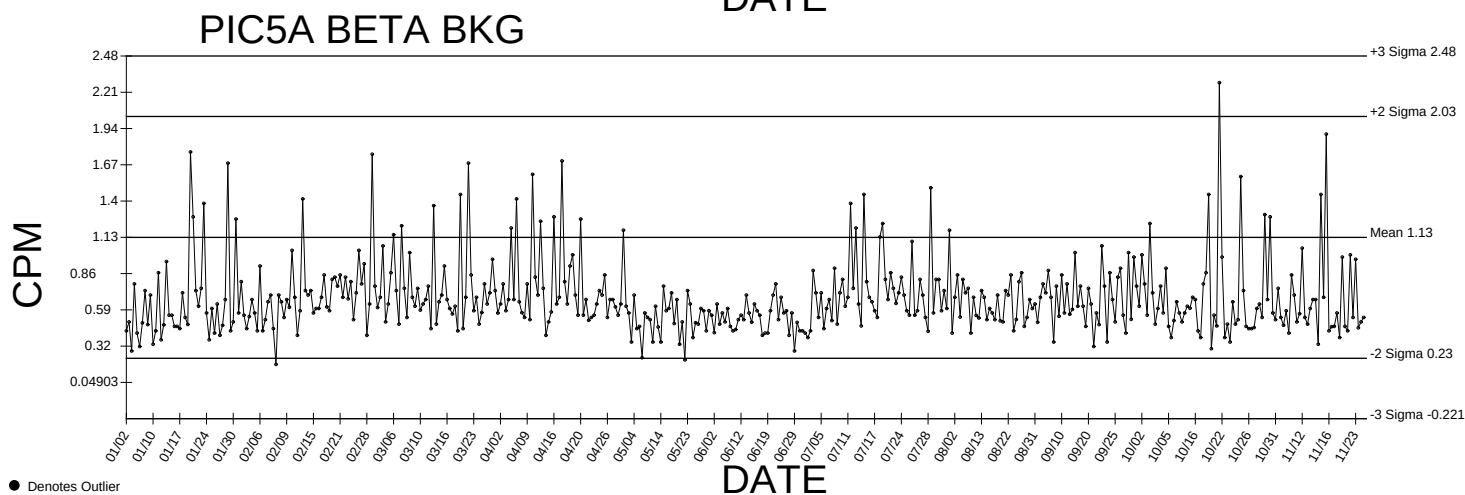
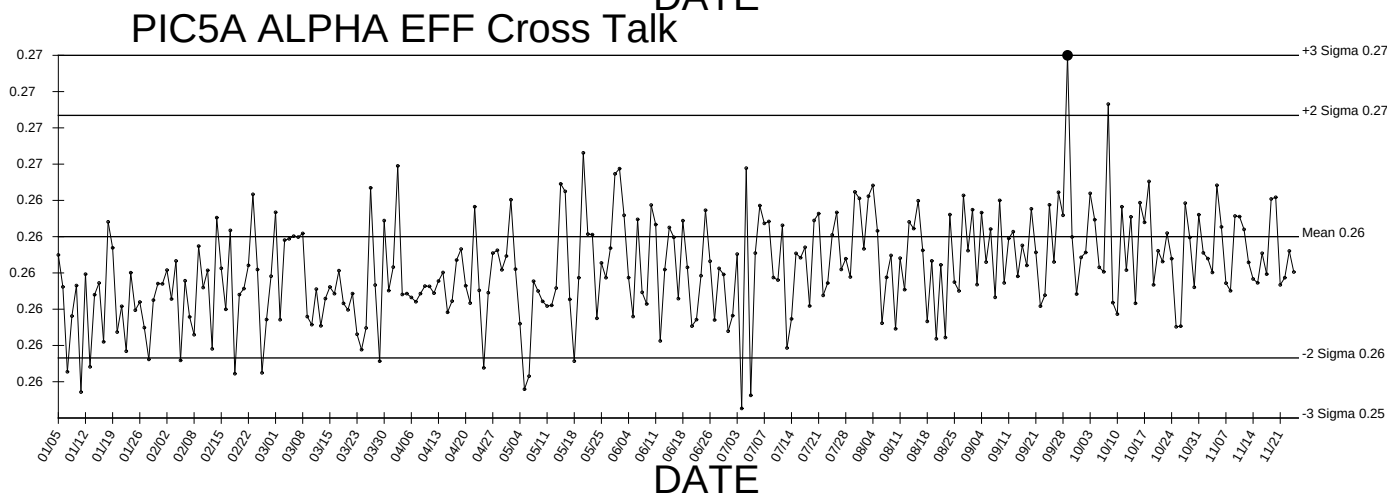
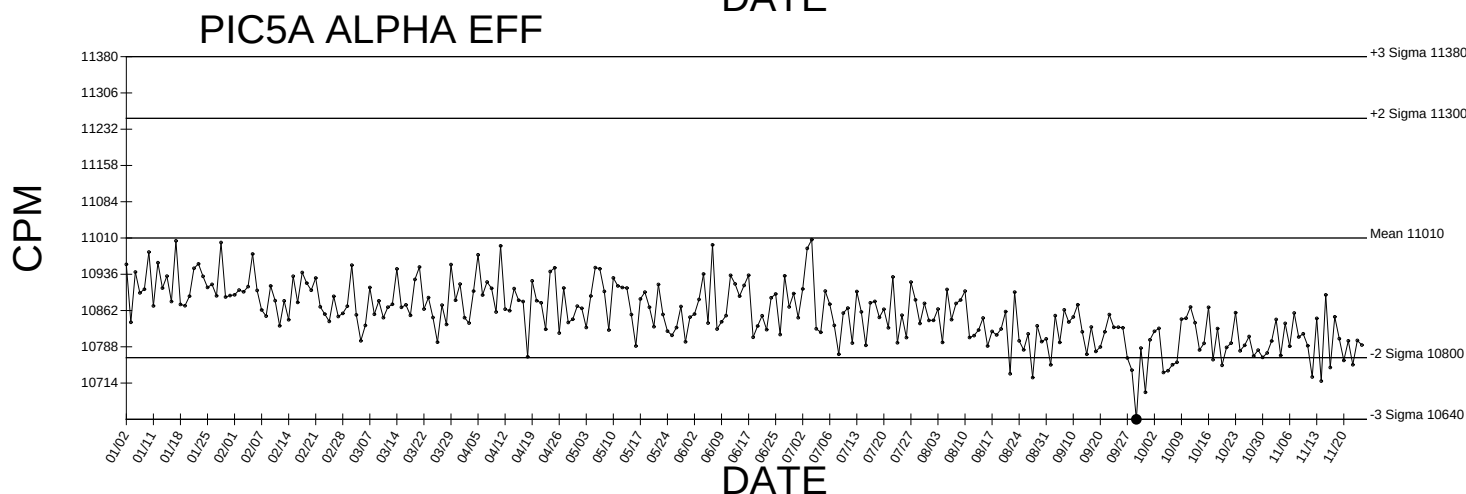
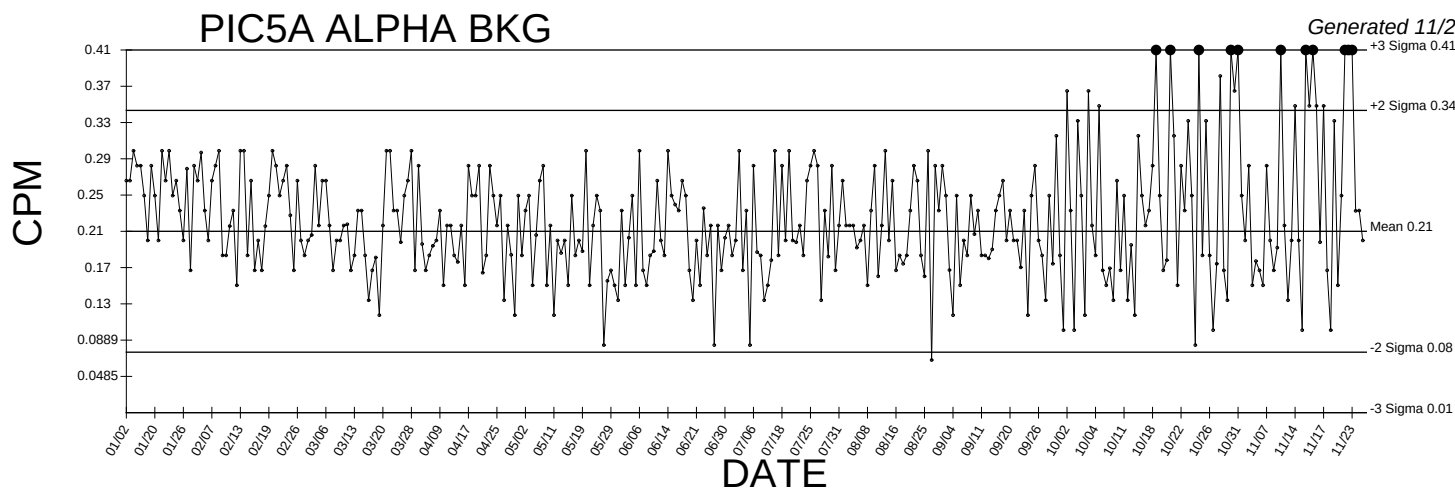
Generated 11/27/2018
+3 Sigma 21820



PIC4B BETA EFF Cross Talk



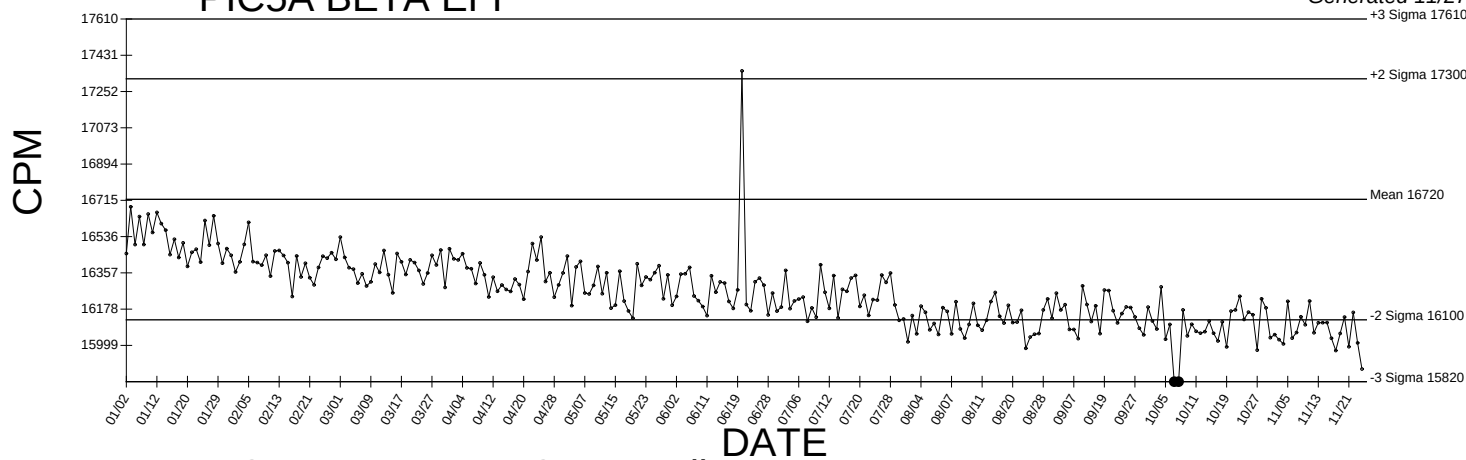
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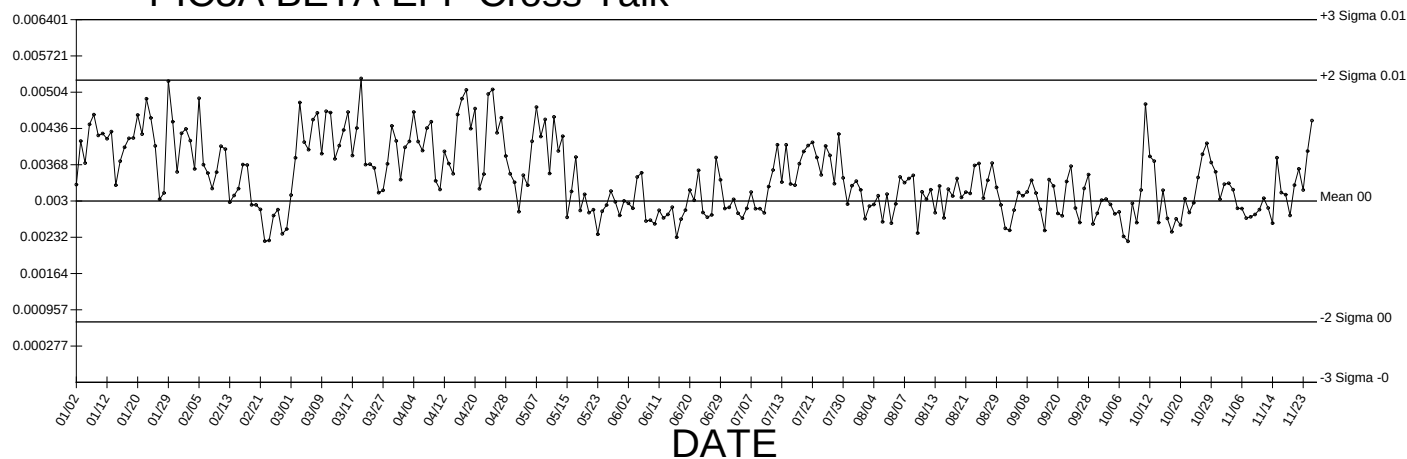
● Denotes Outlier

PIC5A BETA EFF

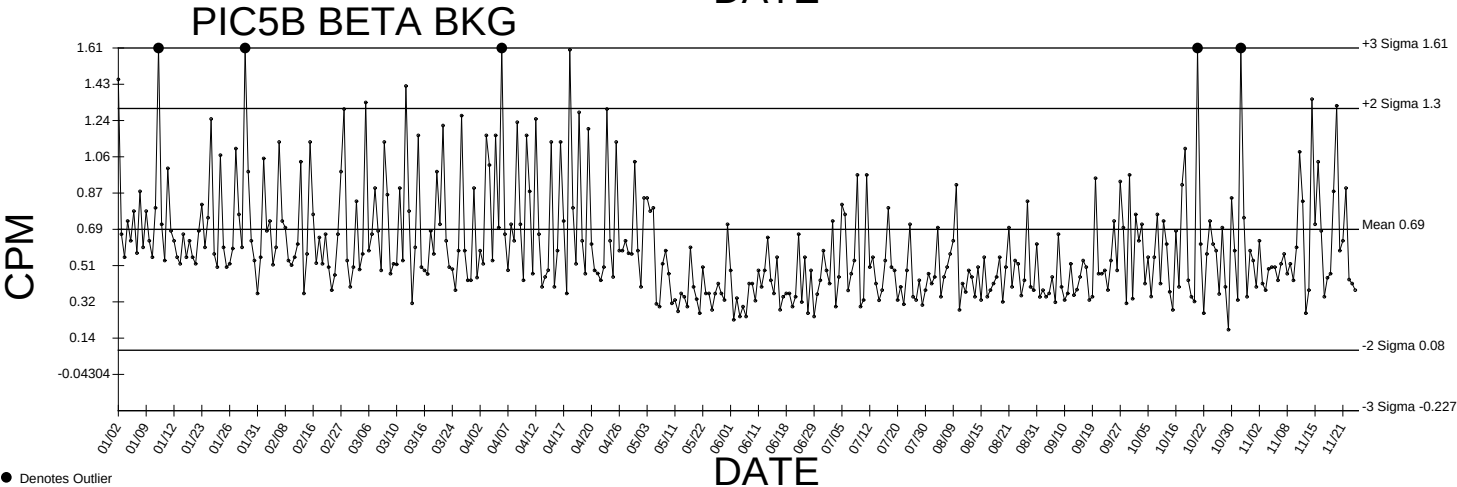
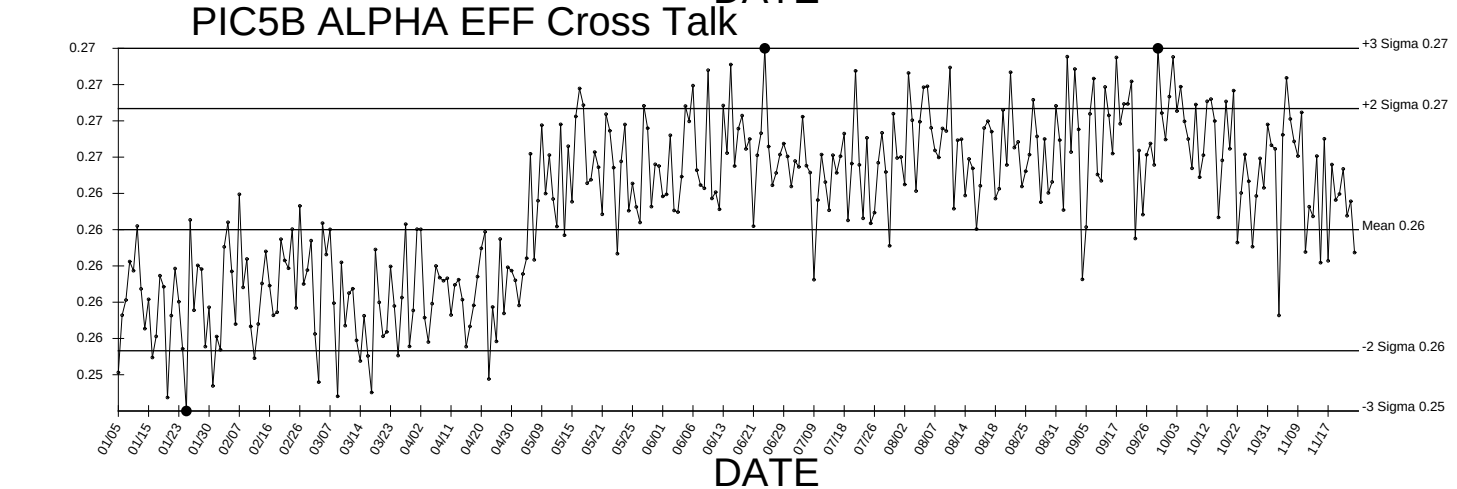
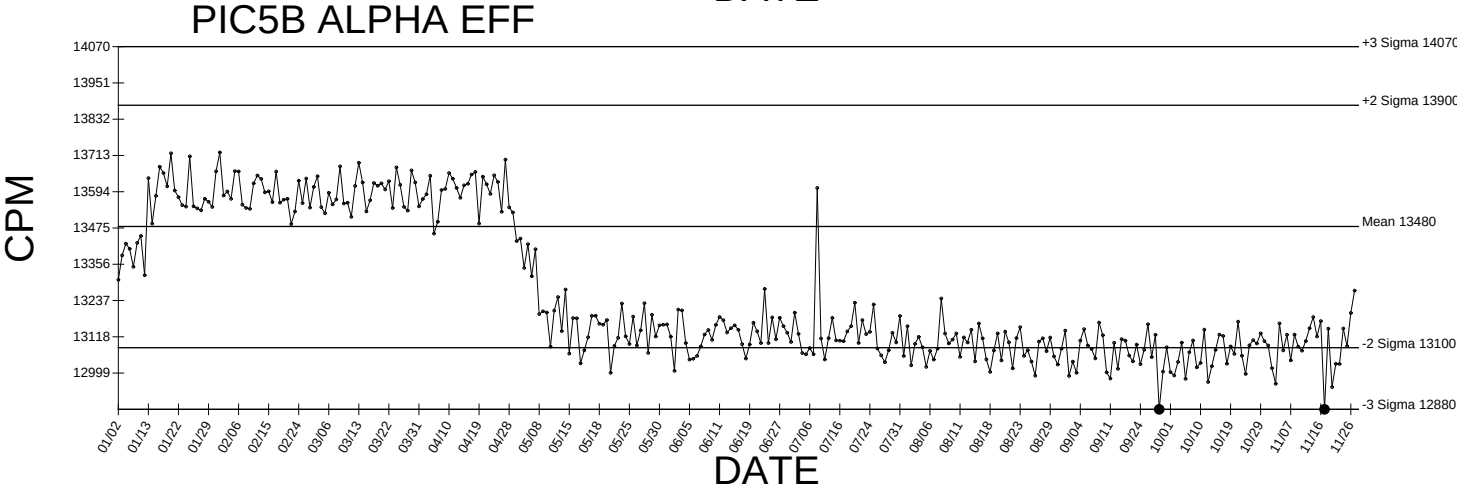
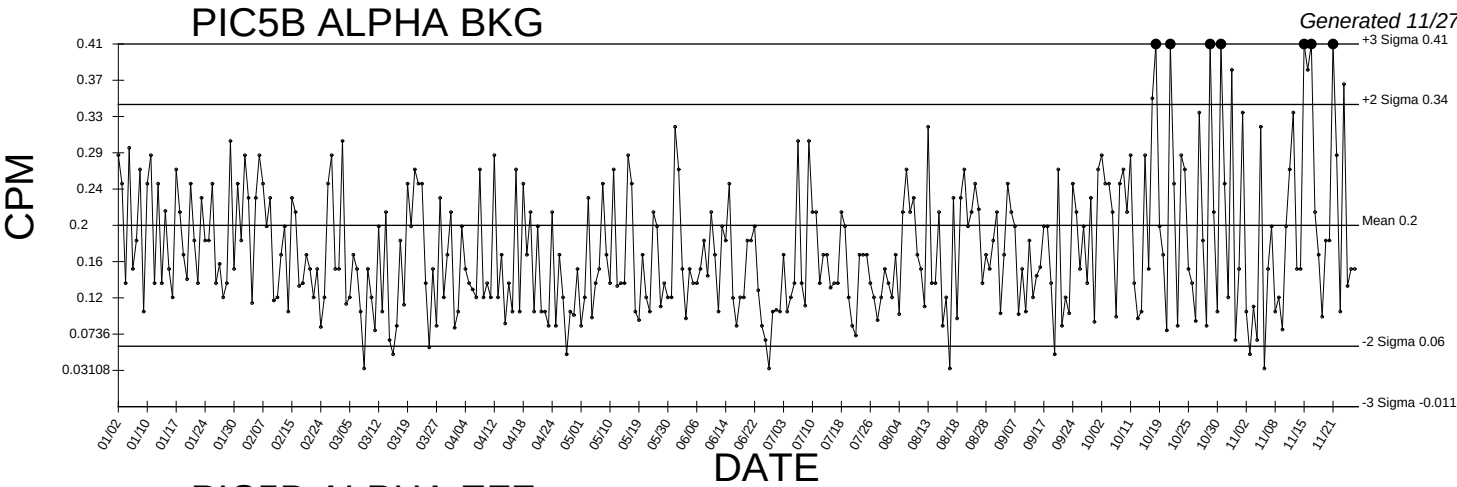
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+3 Sigma 17610



PIC5A BETA EFF Cross Talk



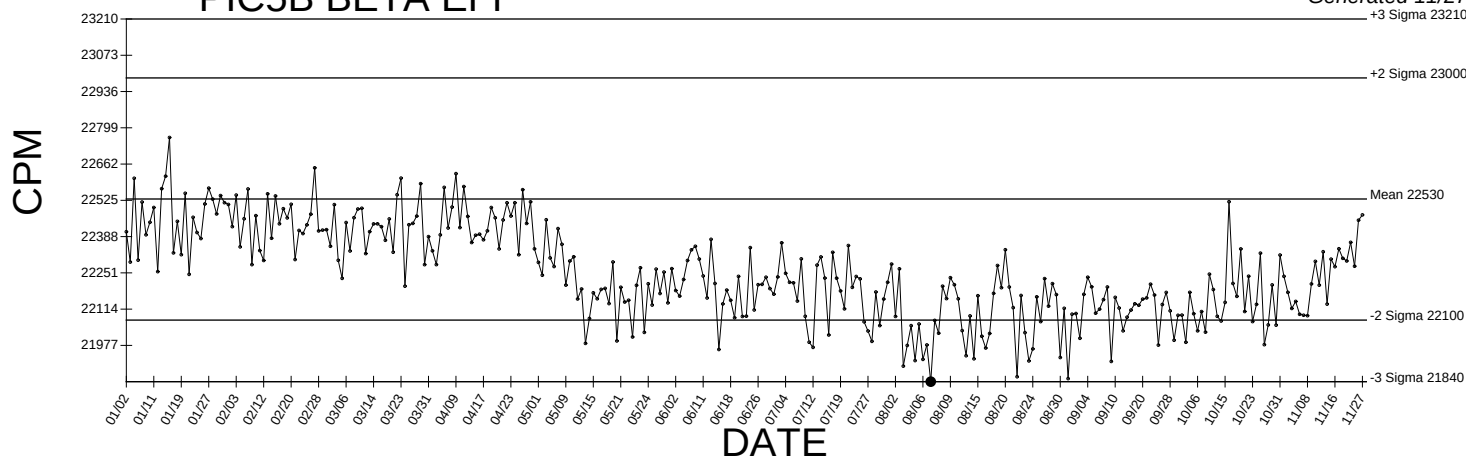
● Denotes Outlier



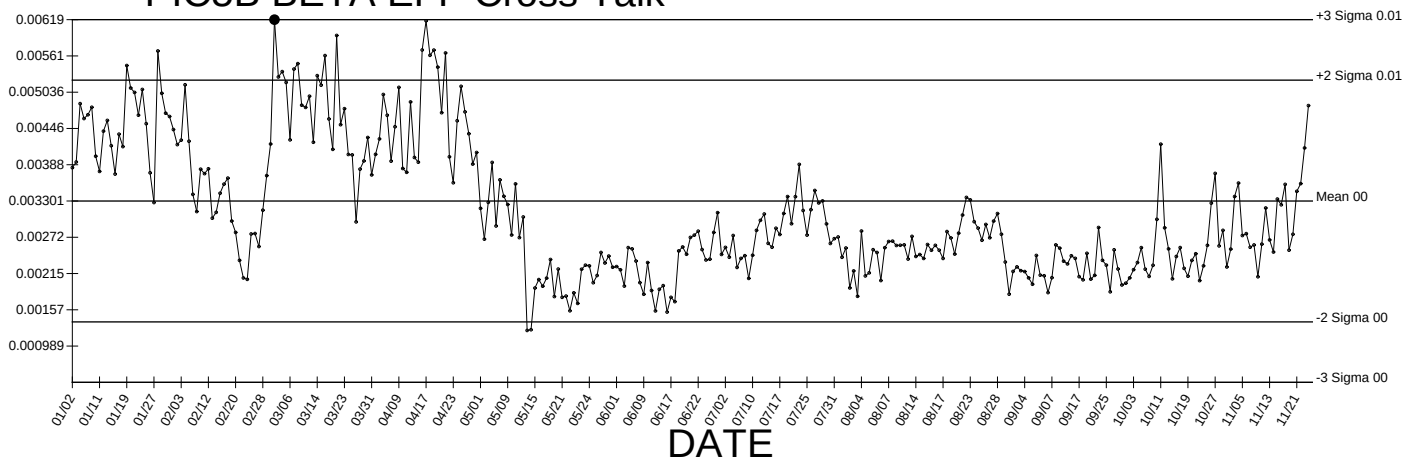
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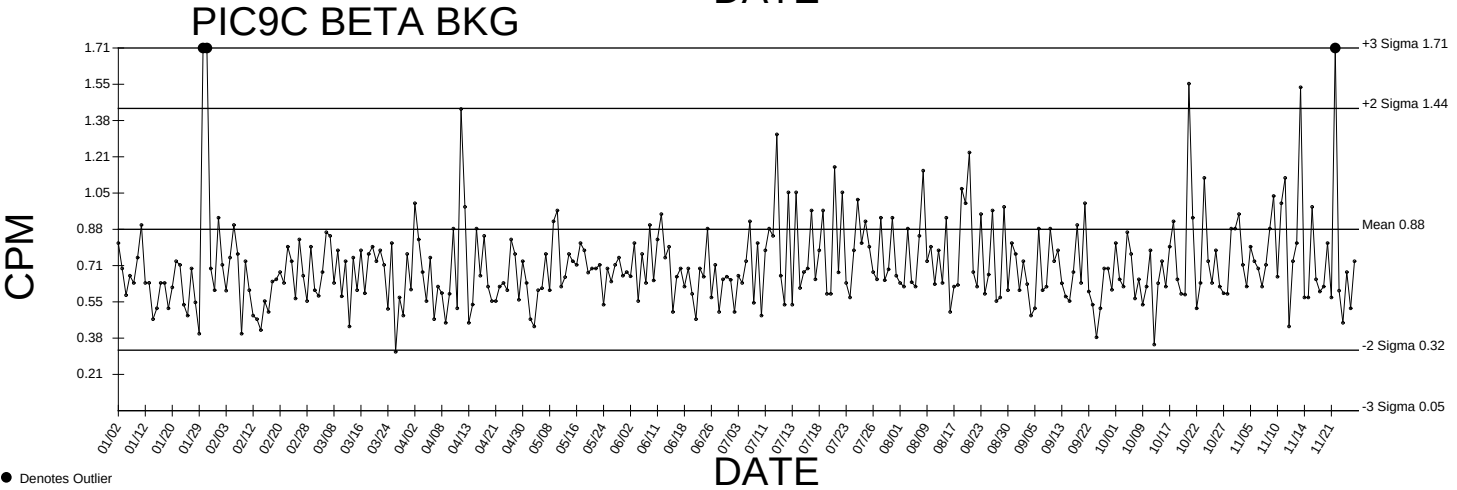
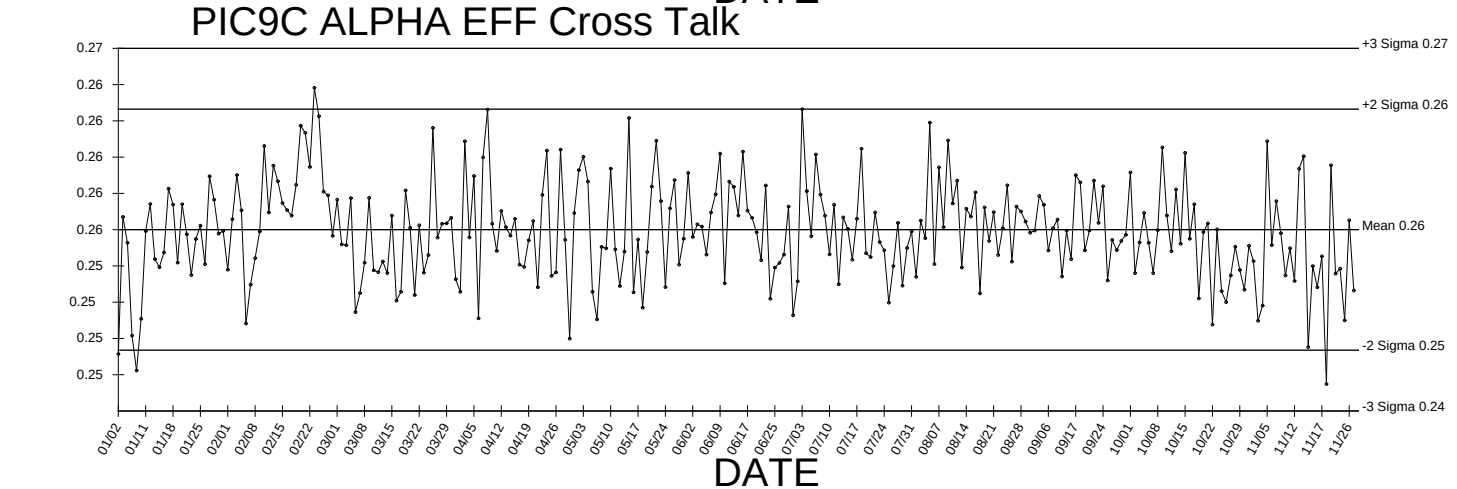
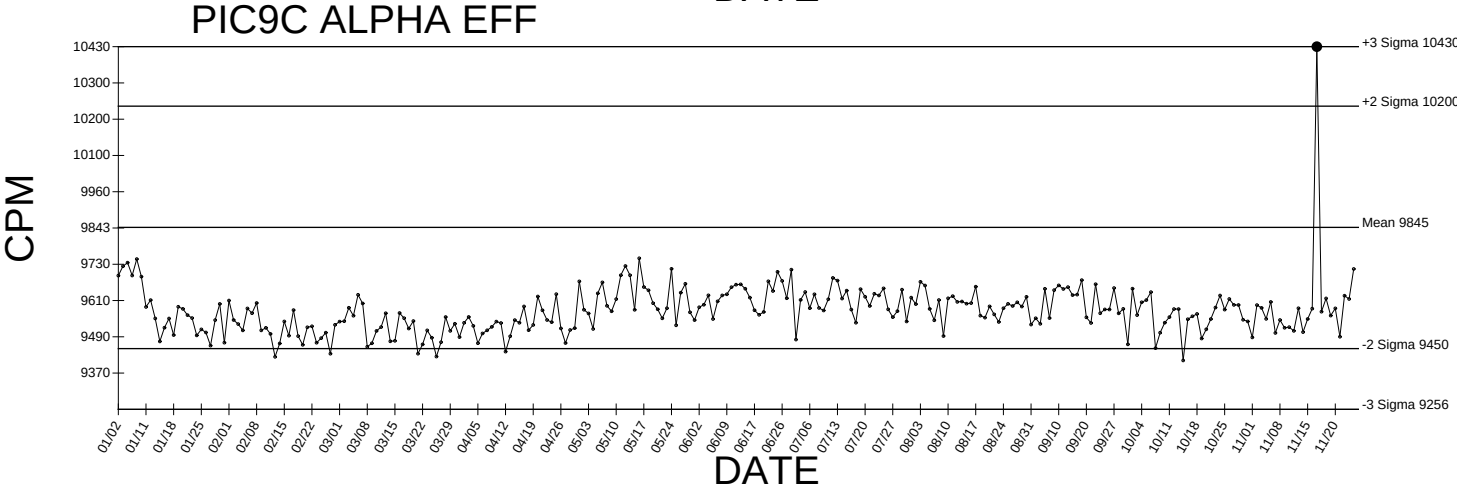
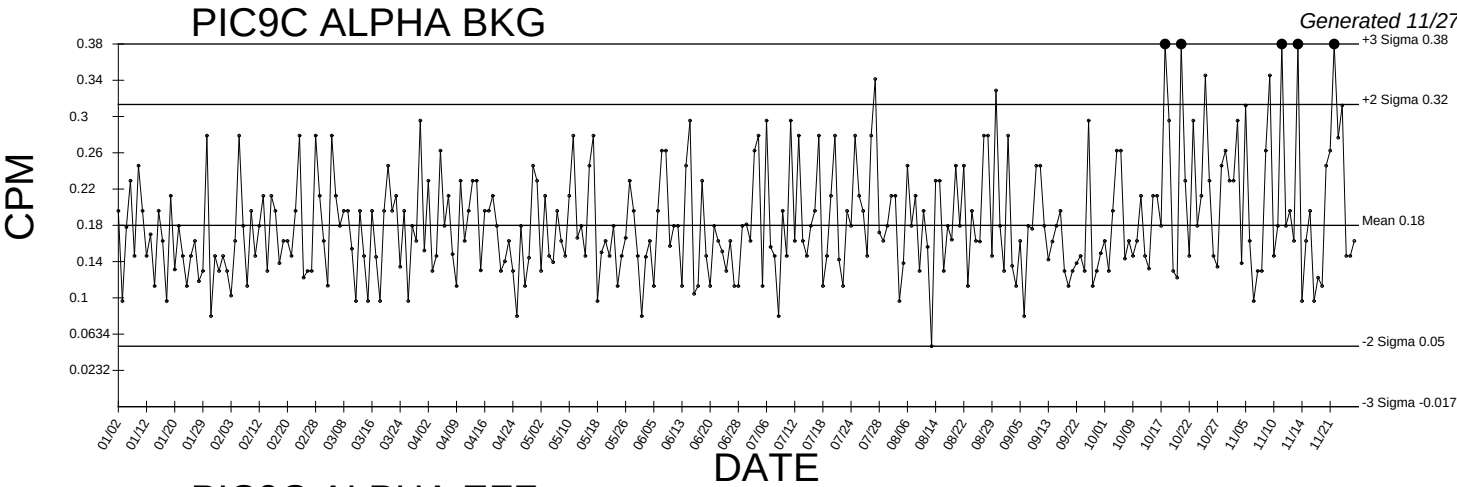
PIC5B BETA EFF

Generated 11/27/2018
+3 Sigma 23210



PIC5B BETA EFF Cross Talk

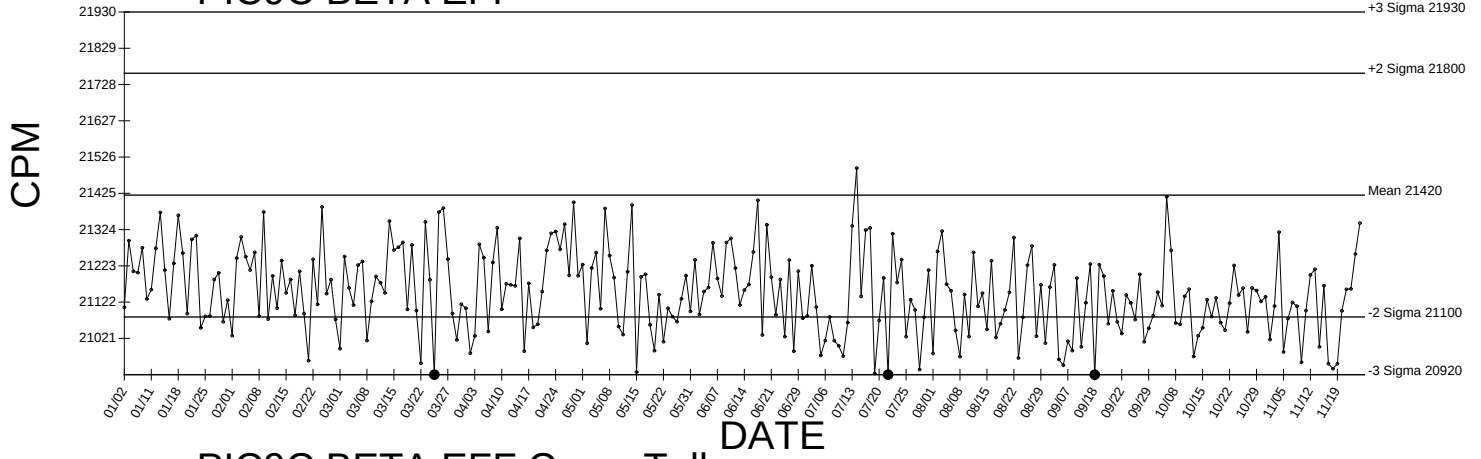




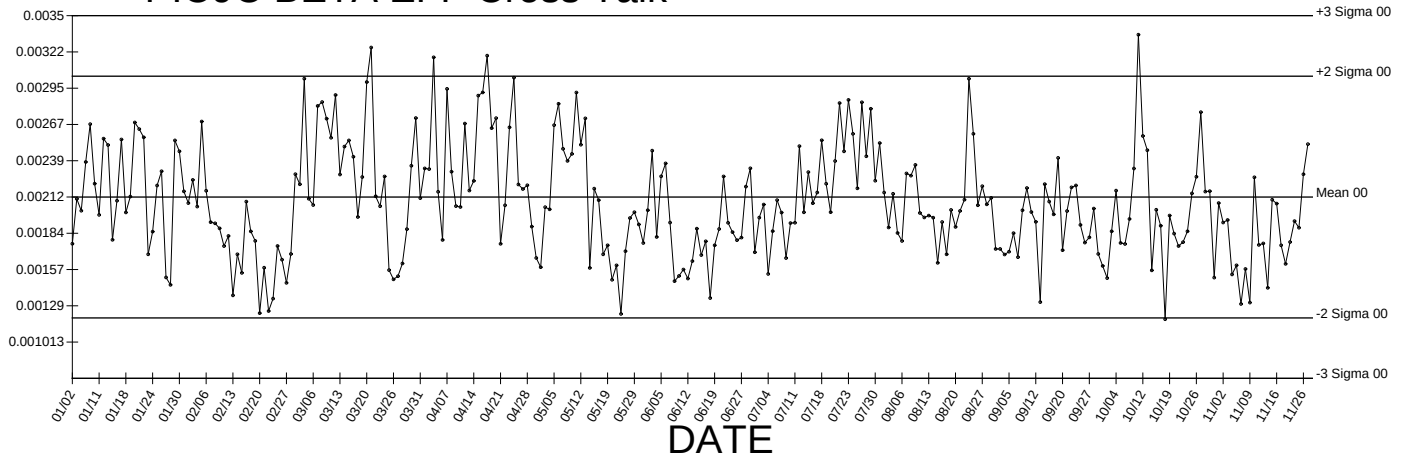
● Denotes Outlier

PIC9C BETA EFF

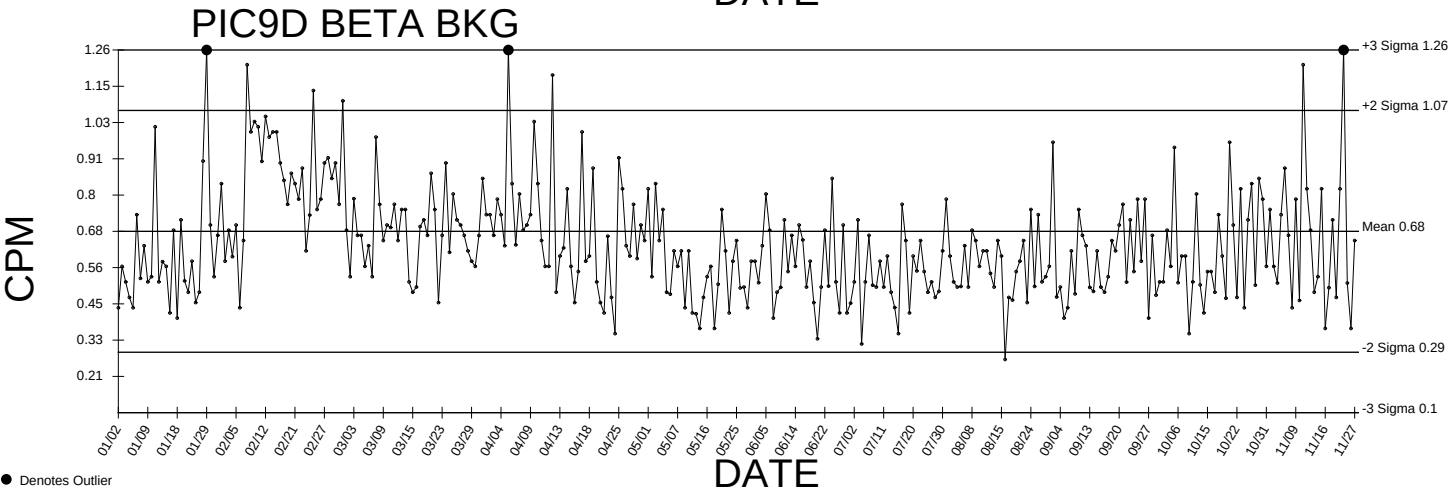
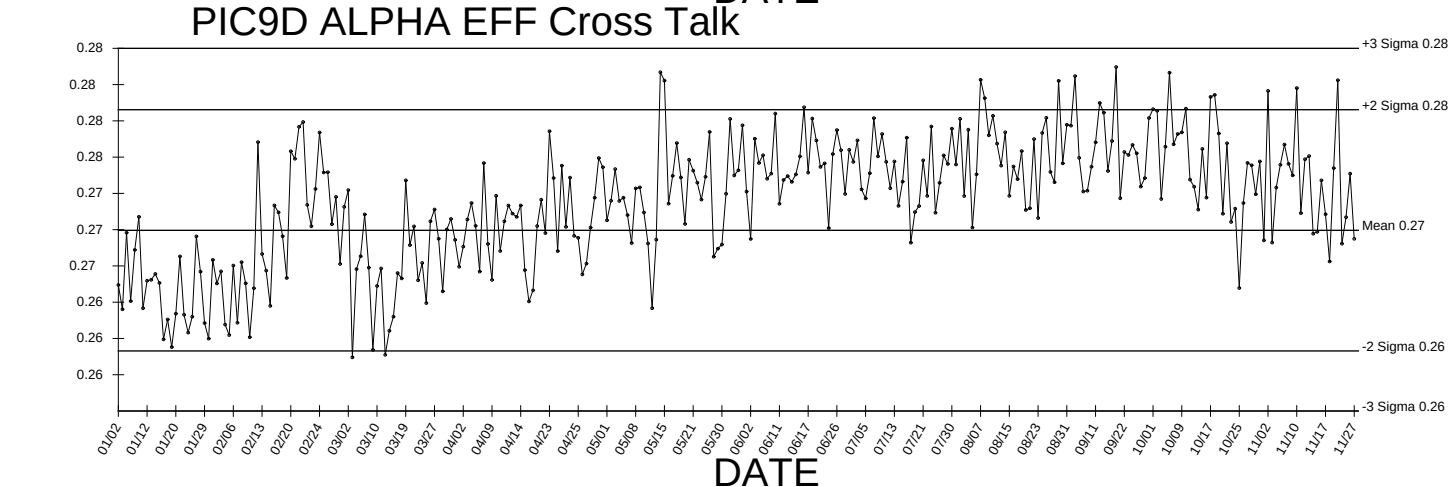
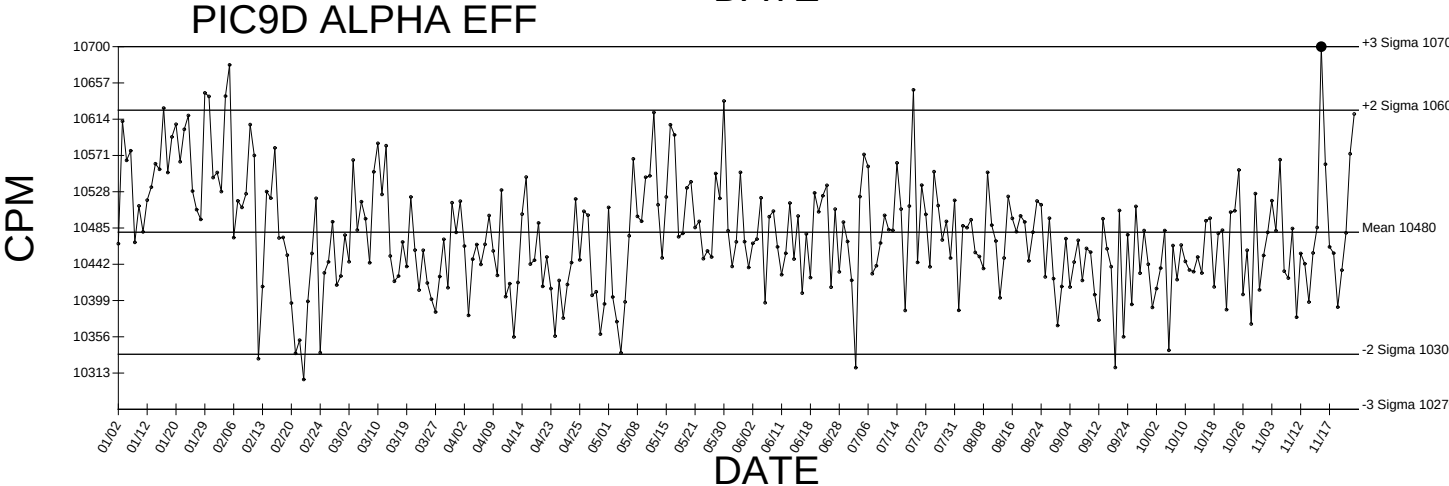
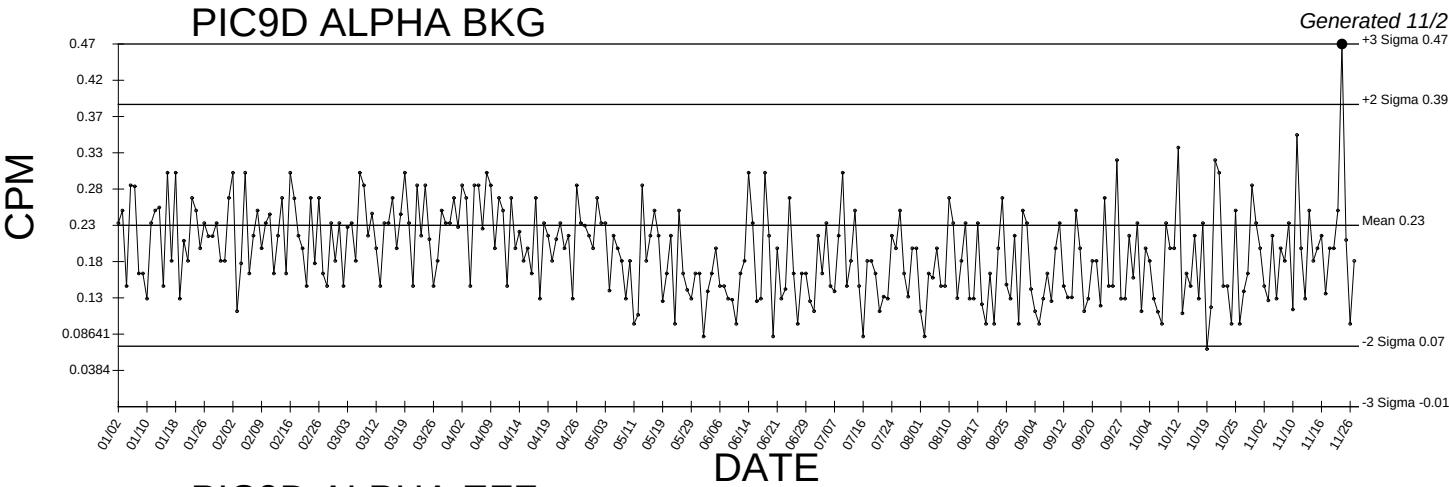
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+3 Sigma 21930



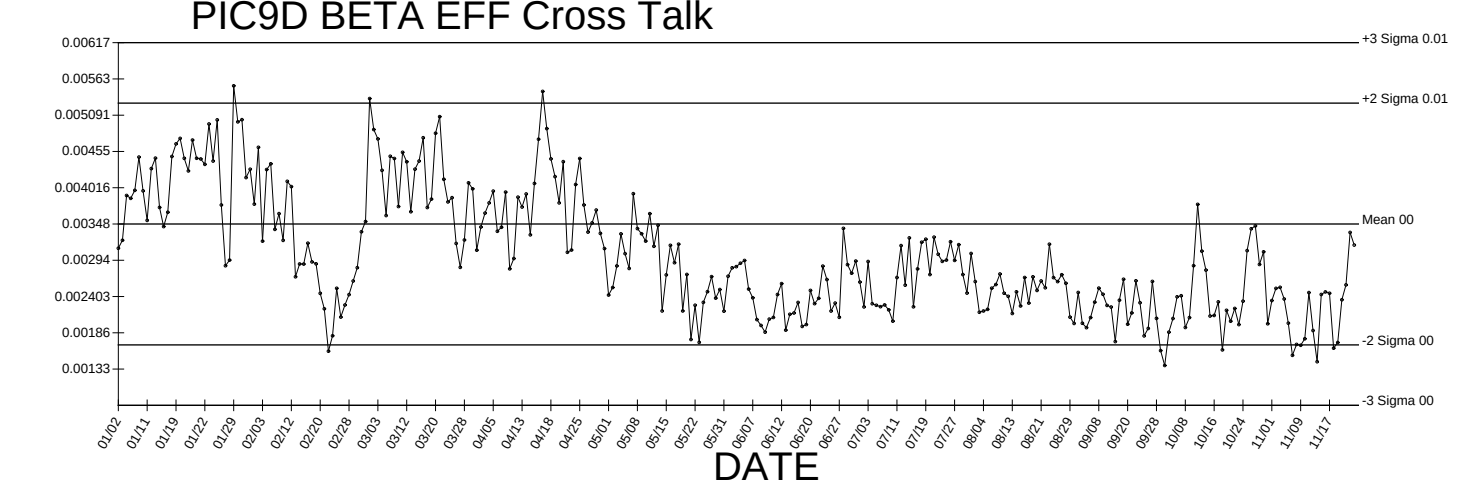
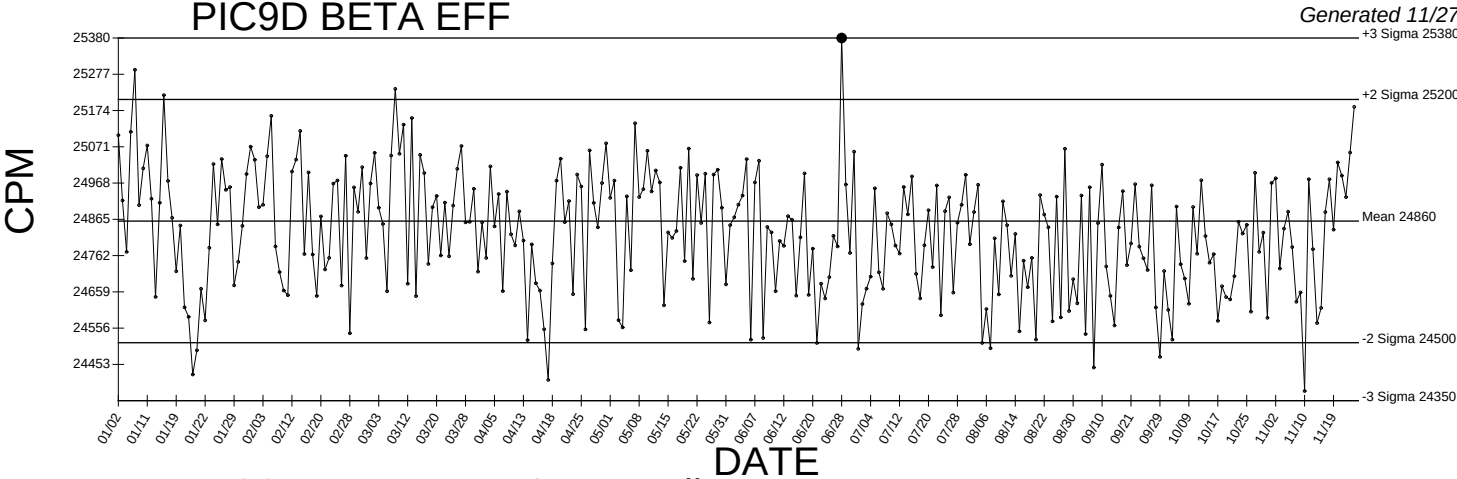
PIC9C BETA EFF Cross Talk



● Denotes Outlier



● Denotes Outlier



● 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:			
Radioisotope		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 $4\pi(\text{e}+\text{X})$ - γ -anticoincidence counting	

*Notes and references are on pages 5 and 6.

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, $u_c(y)/y$, (%)				0.26
Coverage Factor, k				$\times 2$
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 [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)	111,56121
Amount of Std (mL)	1
Standard Prep Date	10/10/2018

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	10/10/2018	79111	1700.00	17.90
2	10/10/2018	79112	1717.31	17.87
3	10/10/2018	79113	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 =	4233.43
Stdev =	62.50544344
Certificate Value*	4548.3
Two sigma =	125.011
10 % of Mean =	423.343
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 LSCHVELLO 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:

$$\text{Source dp (mL)} = (A - B) / (C - D)$$

where:

- A = Net source cpm
- B = BKG cpm
- C = System efficiency (cpm/cpm) and
- D = Volume used for standard verification

RAD-11021

Handwritten signature: B. K. P.



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 ^{1a)}	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 % ^{1b)} . 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

^{1a)} Letter A denotes evaluation by statistical methods; B denotes evaluation by other methods.

^{1b)} 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 ($s^{-1} g^{-1}$) ⁽ⁱ⁾	S_m (%) ⁽ⁱⁱ⁾
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	0.73
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	3.06	1889	0.28

(i) Grand mean for $n = 11$ determinations with three sources in three to five different detectors.

(ii) 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/grp04/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	
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	28510
Ra-228 N3	29620

Mean Value (Counting) =
Stdev =

107.165

pCi/L
pCi/L

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 is stable

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 1820404

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
463646001	SAMPLE	JXC9	PIC11A	NOV-27-18 09:10:13	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463646002	SAMPLE	JXC9	PIC11B	NOV-27-18 09:10:17	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463646003	SAMPLE	JXC9	PIC11C	NOV-27-18 09:10:22	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204154520	MB	JXC9	PIC11D	NOV-27-18 09:10:32	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204154521	DUP	JXC9	PIC12A	NOV-27-18 09:10:41	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204154522	MS	JXC9	PIC12B	NOV-27-18 09:10:45	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204154523	MSD	JXC9	PIC13A	NOV-27-18 09:10:51	DONE	CeF on 25mm Filter	01-JUN-17 00:00
1204154524	LCS	JXC9	PIC13B	NOV-27-18 09:10:54	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530001	SAMPLE	JXC9	PIC1C	NOV-27-18 09:11:33	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530002	SAMPLE	JXC9	PIC2B	NOV-27-18 09:11:37	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530003	SAMPLE	JXC9	PIC3B	NOV-27-18 09:11:41	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530004	SAMPLE	JXC9	PIC3C	NOV-27-18 09:11:46	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530005	SAMPLE	JXC9	PIC3D	NOV-27-18 09:11:51	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530009	SAMPLE	JXC9	PIC9C	NOV-27-18 09:11:56	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530006	SAMPLE	JXC9	PIC4B	NOV-27-18 09:11:57	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530010	SAMPLE	JXC9	PIC9D	NOV-27-18 09:12:00	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530007	SAMPLE	JXC9	PIC5A	NOV-27-18 09:12:01	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530011	SAMPLE	JXC9	PIC10C	NOV-27-18 09:12:06	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463530008	SAMPLE	JXC9	PIC5B	NOV-27-18 09:12:07	DONE	CeF on 25mm Filter	01-JUN-17 00:00
463541001	SAMPLE	JXC9	PIC10D	NOV-27-18 09:12:13	DONE	CeF on 25mm Filter	01-JUN-17 00:00

Lucas Cell Raw Data

Batch 1819735 Check-list

This check-list was completed on 16-NOV-18 by Heather McCarty

This batch was reviewed by Elizabeth Krouse on 16-NOV-18 and Gregory Ramsay on 16-NOV-18.

Batch ID:
1819735

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		
14	Is the Relative Error Ratio (RER) less than 2?	Yes		
Miscellaneous Information				
15	Are sample-specific MDA/MDC calculated and reported?	Yes		

Radium-226 in Liquid

Batch ID:	1819735	Due Dates for Lab: 18-NOV-2018 Package: 20-NOV-2018 SDG: 21-NOV-2018
Analyst:	Peter Wilber (PCW)	Lab SOP: GL-RAD-A-008 REV# 15
Instrument:	GPC-18150253	Method: EPA 903.1 Modified

Item #	Part #	Part Name	Unit Price	Quantity	Total Price	Tax	Total
1	1000000000	1000000000	1.00	1	1.00	0.00	1.00
2	1000000000	1000000000	1.00	1	1.00	0.00	1.00
3	1000000000	1000000000	1.00	1	1.00	0.00	1.00
4	1000000000	1000000000	1.00	1	1.00	0.00	1.00
5	1000000000	1000000000	1.00	1	1.00	0.00	1.00
6	1000000000	1000000000	1.00	1	1.00	0.00	1.00
7	1000000000	1000000000	1.00	1	1.00	0.00	1.00
8	1000000000	1000000000	1.00	1	1.00	0.00	1.00
9	1000000000	1000000000	1.00	1	1.00	0.00	1.00
10	1000000000	1000000000	1.00	1	1.00	0.00	1.00
11	1000000000	1000000000	1.00	1	1.00	0.00	1.00
12	1000000000	1000000000	1.00	1	1.00	0.00	1.00
13	1000000000	1000000000	1.00	1	1.00	0.00	1.00
14	1000000000	1000000000	1.00	1	1.00	0.00	1.00
15	1000000000	1000000000	1.00	1	1.00	0.00	1.00
16	1000000000	1000000000	1.00	1	1.00	0.00	1.00
17	1000000000	1000000000	1.00	1	1.00	0.00	1.00
18	1000000000	1000000000	1.00	1	1.00	0.00	1.00
19	1000000000	1000000000	1.00	1	1.00	0.00	1.00
20	1000000000	1000000000	1.00	1	1.00	0.00	1.00
21	1000000000	1000000000	1.00	1	1.00	0.00	1.00
22	1000000000	1000000000	1.00	1	1.00	0.00	1.00
23	1000000000	1000000000	1.00	1	1.00	0.00	1.00
24	1000000000	1000000000	1.00	1	1.00	0.00	1.00
25	1000000000	1000000000	1.00	1	1.00	0.00	1.00
26	1000000000	1000000000	1.00	1	1.00	0.00	1.00
27	1000000000	1000000000	1.00	1	1.00	0.00	1.00
28	1000000000	1000000000	1.00	1	1.00	0.00	1.00
29	1000000000	1000000000	1.00	1	1.00	0.00	1.00
30	1000000000	1000000000	1.00	1	1.00	0.00	1.00
31	1000000000	1000000000	1.00	1	1.00	0.00	1.00
32	1000000000	1000000000	1.00	1	1.00	0.00	1.00
33	1000000000	1000000000	1.00	1	1.00	0.00	1.00
34	1000000000	1000000000	1.00	1	1.00	0.00	1.00
35	1000000000	1000000000	1.00	1	1.00	0.00	1.00
36	1000000000	1000000000	1.00	1	1.00	0.00	1.00
37	1000000000	1000000000	1.00	1	1.00	0.00	1.00
38	1000000000	1000000000	1.00	1	1.00	0.00	1.00
39	1000000000	1000000000	1.00	1	1.00	0.00	1.00
40	1000000000	1000000000	1.00	1	1.00	0.00	1.00
41	1000000000	1000000000	1.00	1	1.00	0.00	1.00
42	1000000000	1000000000	1.00	1	1.00	0.00	1.00
43	1000000000	1000000000	1.00	1	1.00	0.00	1.00

Agalyticul Corp. reg. 11.04-2004

Radium-226 Queue Sheet

16-NOV-18

GEJ Laboratories, Radiochemistry Division

Batch #: 1819735

Analyst: PCW

First Client Due Date: 11/21/2018

Internal Due Date: 11/08/2018

Spike Isotope: Radium-226

Spike Code: ---

Expiration Date: ---

Vol: ---

End Initial/Degas Date/Time: 11/15/18

LCS Isotope: Radium-226

LCS Code: 11750

Expiration Date: 12/18/18

Vol: 2.5

End LN Degas Date: 11/14/18

Prep Date: 11/14/18

Deg Count Time: 12.5 (Min)

Sample Count Time: 3.5 (Min)

Start Count Date: 11/14/18

Initials: PCW

Witness: ---

Balance ID: 236557

Balance ID: ---

Initials: ---

Witness: ---

Sample #	Client Description	Type	Hazard Code	Matrix	Min (g/g)	Client	Position (Label)	Aliquot (mL or g)	End LN	Start Count Time	Cell #	Det #	Blk counts	Total Counts
463427001-1	Leachate	SAMPLE		WATER	1 pCi/L	LANC000	1							
463510005-1	CSS140005-05	SAMPLE		WATER	1 pCi/L	LANC000	2							
463510001-1	NW-9	SAMPLE		WATER	1 pCi/L	LANC006	3							
463510002-1	NW-7	SAMPLE		WATER	1 pCi/L	LANC006	4							
463510003-1	NW-4	SAMPLE		WATER	1 pCi/L	LANC006	5	5.00	01/15/18	3:37	3	3	3	3
463510004-1	NW-2	SAMPLE		WATER	1 pCi/L	LANC006	6							
463510005-1	NW-6	SAMPLE		WATER	1 pCi/L	LANC006	7							
463510006-1	FR-201811031	SAMPLE		WATER	1 pCi/L	LANC006	8							
463510007-1	NW-3	SAMPLE		WATER	1 pCi/L	LANC006	9							
463510008-1	NW-4	SAMPLE		WATER	1 pCi/L	LANC006	10							
463510009-1	NW-2	SAMPLE		WATER	1 pCi/L	LANC006	11	5.00	01/15/18	4:08	4	4	4	4
463510010-1	NW-3	SAMPLE		WATER	1 pCi/L	LANC006	12							
463510011-1	FR-201811031	SAMPLE		WATER	1 pCi/L	LANC006	13							
463510012-1	133K0059-01	SAMPLE		WATER	1 pCi/L	LANC006	14							
463510013-1	FN-2-110518	SAMPLE		WATER	1 pCi/L	LANC006	15							
463510014-1	FN-3-110518	SAMPLE		WATER	1 pCi/L	LANC006	16							
463510015-1	FN-4-110518	SAMPLE		WATER	1 pCi/L	LANC006	17	5.00	01/15/18	5:07	5	5	5	5
463510016-1	BV180009-05	SAMPLE		WATER	1 pCi/L	LANC006	18	5.00	01/15/18	6:44	6	6	6	6
2204152918-1	MIL for batch 180735	MIL		WATER	1 pCi/L	QC ACCIDENT	19	5.00	01/15/18	7:06	7	7	7	7
1204152918-1	CSS170065-05463511051810	BUP		WATER	1 pCi/L	QC ACCIDENT	20							
1204152918-1	CSS170065-05463511051810	MIL		WATER	1 pCi/L	QC ACCIDENT	21							
1204152918-1	CSS170065-05463511051810	MIL		WATER	1 pCi/L	QC ACCIDENT	22							
1204152918-1	CSS170065-05463511051810	MIL		WATER	1 pCi/L	QC ACCIDENT	23	5.00	01/15/18	8:05	8	8	8	8

Comments: VZ.001-1A-100

Data Reviewed By: ---

Page 1 of 1

RA1819735R2.xls

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.3.2

Batch : 1819735
Analyst : PETE049
Prep Date : 11/8/2018
Ra-226 Method Uncertainty : 0.073648

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 0.5 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	463427001.1	0.4000	1.9669E-05	10/30/2018 11:00	206	30	9	0.300	3	0.100	30	1.9170
2	463511005.1	0.8000	2.0861E-05	11/5/2018 9:49	301	30	106	3.533	8	0.267	30	1.8290
3	463530001.1	0.5000	2.0256E-05	10/31/2018 11:05	408	30	16	0.533	4	0.133	30	1.8510
4	463530002.1	0.5000	2.0256E-05	10/31/2018 12:55	507	30	46	1.533	5	0.167	30	1.9970
5	463530003.1	0.5000	2.0256E-05	10/31/2018 12:35	307	30	41	1.367	3	0.100	30	1.8050
6	463530004.1	0.5000	2.0256E-05	10/31/2018 10:50	704	30	57	1.900	8	0.267	30	1.8450
7	463530005.1	0.5000	2.0256E-05	10/31/2018 14:20	806	30	56	1.867	3	0.100	30	1.9730
8	463530006.1	0.5000	2.0256E-05	10/31/2018 11:00	105	30	6	0.200	6	0.200	30	2.0440
9	463530007.1	0.5000	2.0256E-05	11/1/2018 9:45	203	30	81	2.700	3	0.100	30	1.8290
10	463530008.1	0.5000	2.0256E-05	11/1/2018 11:40	306	30	40	1.333	6	0.200	30	1.7820
11	463530009.1	0.5000	2.0256E-05	11/1/2018 10:35	408	30	59	1.967	2	0.067	30	1.8510
12	463530010.1	0.5000	2.0256E-05	11/1/2018 12:00	501	30	23	0.767	3	0.100	30	2.0710
13	463530011.1	0.5000	2.0256E-05	11/1/2018 11:00	603	30	6	0.200	3	0.100	30	2.0850
14	463541001.1	0.5000	2.0256E-05	11/1/2018 12:00	705	30	14	0.467	5	0.167	30	1.8350
15	463646001.1	0.5000	2.0256E-05	11/5/2018 10:45	802	30	21	0.700	8	0.267	30	1.6450
16	463646002.1	0.5000	2.0256E-05	11/5/2018 12:00	101	30	43	1.433	3	0.100	30	1.5100
17	463646003.1	0.5000	2.0256E-05	11/5/2018 14:15	503	30	29	0.967	1	0.033	30	1.9410
18	463661005.1	0.8000	2.0861E-05	11/5/2018 13:30	604	30	60	2.000	1	0.033	30	2.0460
19	1204152948.1	0.8000	2.0861E-05	11/8/2018 0:00	706	30	5	0.167	5	0.167	30	1.8720
20	1204152949.1	0.8000	2.0861E-05	11/5/2018 9:49	503	30	72	2.400	1	0.033	30	1.9410
21	1204152950.1	0.5000	2.0256E-05	11/5/2018 9:49	606	30	742	24.733	5	0.167	30	1.9430
22	1204152951.1	0.5000	2.0256E-05	11/5/2018 9:49	701	30	718	23.933	7	0.233	30	1.7770
23	1204152952.1	0.8000	2.0861E-05	11/8/2018 0:00	808	30	478	15.933	1	0.033	30	1.4380

RA1819735R2.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	
6.600%	8/1/2018	7/31/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 5:00	0.495	0.973	1.002	1.000
8.200%	3/1/2018	2/28/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 8:35	0.495	0.947	1.002	1.000
7.000%	3/1/2018	2/28/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 5:00	0.495	0.973	1.002	1.000
5.300%	6/1/2018	5/31/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 5:00	0.495	0.973	1.002	1.000
6.300%	3/1/2018	2/28/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	0.976	1.002	1.000
8.500%	11/1/2018	10/31/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 5:00	0.495	0.973	1.002	1.000
6.000%	3/1/2018	2/28/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 5:00	0.495	0.973	1.002	1.000
9.300%	5/1/2018	4/30/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
9.900%	8/1/2018	7/31/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
3.900%	3/1/2018	2/28/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
7.000%	3/1/2018	2/28/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	0.976	1.002	1.000
5.400%	6/1/2018	5/31/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
6.700%	7/1/2018	6/30/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
1.800%	11/1/2018	10/31/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
5.600%	3/1/2018	2/28/2019	11/9/2018 6:48	11/13/2018 1:52	11/13/2018 5:35	0.497	0.972	1.002	1.000
5.300%	5/1/2018	4/30/2019	11/9/2018 6:48	11/13/2018 2:22	11/13/2018 6:10	0.499	0.972	1.002	1.000
8.100%	6/1/2018	5/31/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	0.976	1.002	1.000
1.700%	7/1/2018	6/30/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	0.976	1.002	1.000
2.200%	11/1/2018	10/31/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	0.976	1.002	1.000
8.100%	6/1/2018	5/31/2019	11/9/2018 6:48	11/13/2018 2:22	11/13/2018 8:35	0.499	0.954	1.002	1.000
2.400%	7/1/2018	6/30/2019	11/9/2018 6:48	11/13/2018 2:22	11/13/2018 6:10	0.499	0.972	1.002	1.000
6.300%	11/1/2018	10/31/2019	11/9/2018 6:48	11/13/2018 1:22	11/13/2018 6:10	0.495	0.964	1.002	1.000
8.700%	3/1/2018	2/28/2019	11/13/2018 2:22	11/16/2018 1:31	11/16/2018 4:45	0.416	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): 288.42

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	0.2323	0.1640	1	0.4501	0.2442	58.11%	0.2000	0.1155	0.2763	0.2804		SAMPLE				
2	0.2042	0.1442	0.5	0.3541	2.1475	13.64%	3.2667	0.3559	0.4586	0.6523		SAMPLE				
3	0.2222	0.1569	1	0.4149	0.4046	37.92%	0.4000	0.1491	0.2956	0.3064		SAMPLE				
4	0.2303	0.1626	1	0.4189	1.2814	18.21%	1.3667	0.2380	0.4375	0.4933		SAMPLE				
5	0.2345	0.1655	1	0.4543	1.5612	18.56%	1.2667	0.2211	0.5341	0.6109		SAMPLE				
6	0.3153	0.2226	1	0.5467	1.6576	18.52%	1.6333	0.2687	0.5346	0.6475		SAMPLE				
7	0.1805	0.1275	1	0.3498	1.6766	15.69%	1.7667	0.2560	0.4763	0.5695		SAMPLE				
8	0.2457	0.1735	1	0.4382	0.000E+00	0.00%	0.0000	0.1155	0.2067	0.2068		SAMPLE				
9	0.1941	0.1371	1	0.3762	2.6533	15.36%	2.6000	0.3055	0.6111	0.8861		SAMPLE				
10	0.2818	0.1990	1	0.5026	1.1871	20.33%	1.1333	0.2261	0.4641	0.5030		SAMPLE				
11	0.1867	0.1318	1	0.3838	2.2836	15.39%	1.9000	0.2603	0.6133	0.7635		SAMPLE				
12	0.1715	0.1210	1	0.3322	0.6008	26.06%	0.6667	0.1700	0.3002	0.3189		SAMPLE				
13	0.1703	0.1202	1	0.3300	0.0895	100.22%	0.1000	0.1000	0.1755	0.1763		SAMPLE				
14	0.2498	0.1764	1	0.4545	0.3051	48.47%	0.3000	0.1453	0.2897	0.2932		SAMPLE				
15	0.3525	0.2489	1	0.6112	0.4917	41.80%	0.4333	0.1795	0.3992	0.4090		SAMPLE				
16	0.2344	0.1655	1	0.4542	1.6429	17.76%	1.3333	0.2261	0.5460	0.6192		SAMPLE				
17	0.1259	0.0889	1	0.2924	1.0697	21.17%	0.9333	0.1826	0.4101	0.4700		SAMPLE				
18	0.0746	0.0527	0.5	0.1734	1.3365	13.35%	1.9667	0.2603	0.3468	0.3993		SAMPLE				
19	0.1824	0.1288	0.5	0.3319	0.000E+00	0.00%	0.0000	0.1054	0.1535	0.1535		MB				
20	0.0670	0.0473	0.5	0.1556	1.4440	14.51%	2.3667	0.2848	0.3406	0.4604	463511005.1	DUP	39.2%	1.7270		
21	0.2352	0.1660	0.5	0.4278	23.5243	4.42%	24.5667	0.9110	1.7099	3.9597	463511005.1	MS			25.9836	82.3%
22	0.3089	0.2181	0.5	0.5425	25.1942	7.35%	23.7000	0.8975	1.8701	5.1382	463511005.1	MSD	6.9%	0.5045	25.9836	88.7%
23	0.1062	0.0750	0.5	0.2467	15.3740	9.84%	15.9000	0.7295	1.3826	3.7026		LCS			16.2397	94.7%

Continuing Calibration Data



Ludlum Alpha Scintillation Counter Checks for 13-NOV-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	04:20	1	1.30E+05	129559	0.01		
LUCAS2	EFF	04:20	1	1.35E+05	134779	2.8		
LUCAS3	EFF	04:20	1	1.42E+05	142192	0.6		
LUCAS4	EFF	04:20	1	1.31E+05	130524	-1.1		
LUCAS5	EFF	04:20	1	1.36E+05	136044	1.56		
LUCAS6	EFF	04:20	1	1.32E+05	132176	-2.61		
LUCAS7	EFF	04:20	1	1.43E+05	142939	1.31		
LUCAS8	EFF	04:20	1	1.43E+05	142732	1.28		

Reviewed by:

Elizabeth Krouse

Date: 13-NOV-18

GEL Laboratories LLC



Ludlum Alpha Scintillation Counter Checks for 16-NOV-2018

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	04:00	1	1.28E+05	128174	-1.07		
LUCAS2	EFF	04:00	1	1.34E+05	133843	2.35		
LUCAS3	EFF	04:00	1	1.38E+05	137563	-1.63		
LUCAS4	EFF	04:00	1	1.30E+05	130407	-1.21		
LUCAS5	EFF	04:00	1	1.34E+05	133824	0.09		
LUCAS6	EFF	04:00	1	1.34E+05	133891	-0.83		
LUCAS7	EFF	04:00	1	1.43E+05	142608	0.9		
LUCAS8	EFF	04:00	1	1.31E+05	130563	-2.95		

Reviewed by:

Elizabeth Krouse

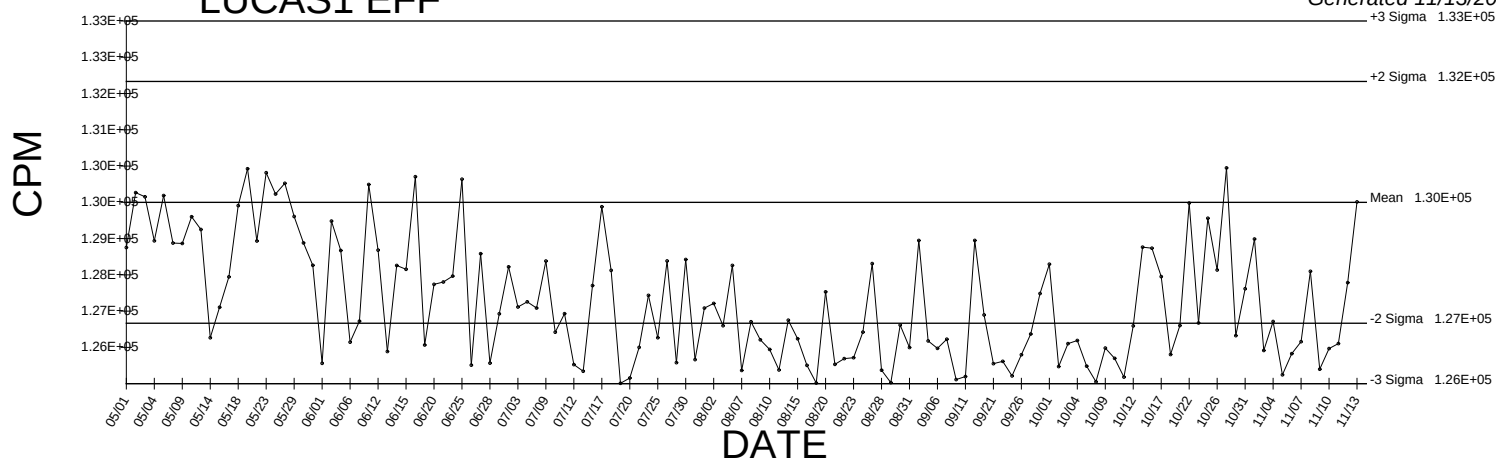
Date: 16-NOV-18

GEL Laboratories LLC

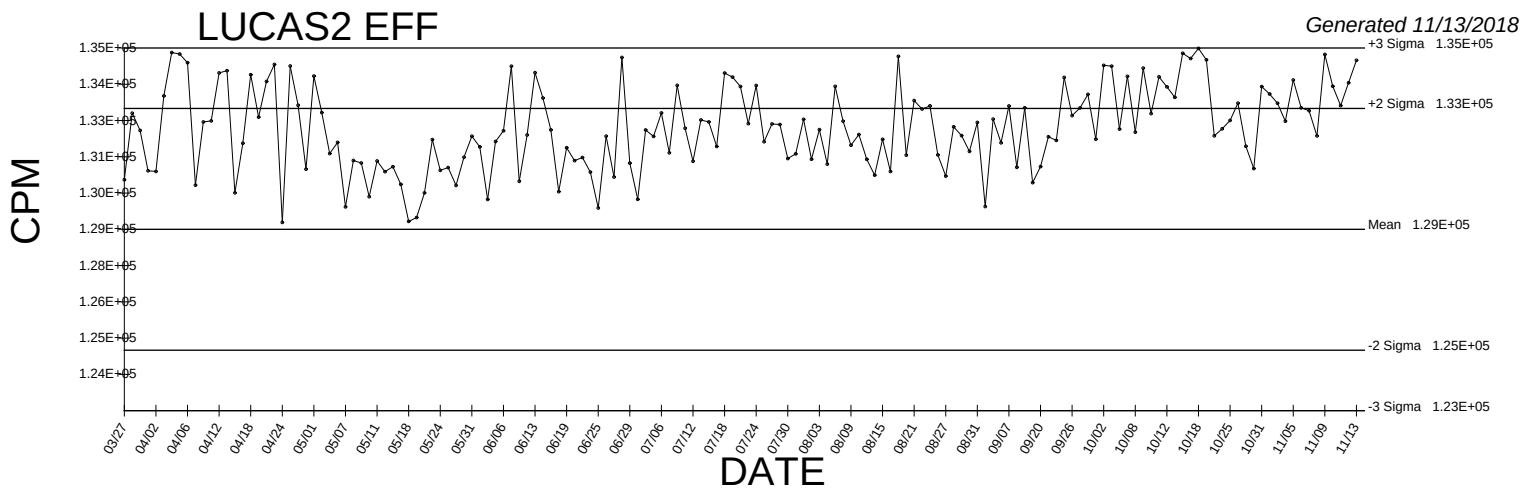
Efficiency Data

LUCAS1 EFF

Generated 11/13/2018



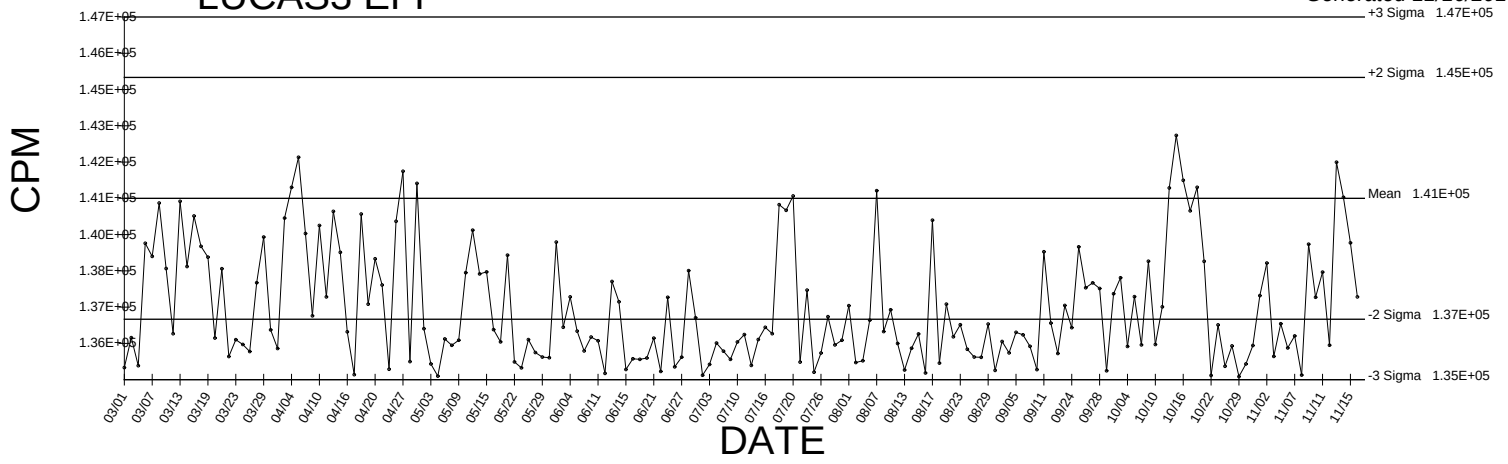
● Denotes Outlier



● Denotes Outlier

LUCAS3 EFF

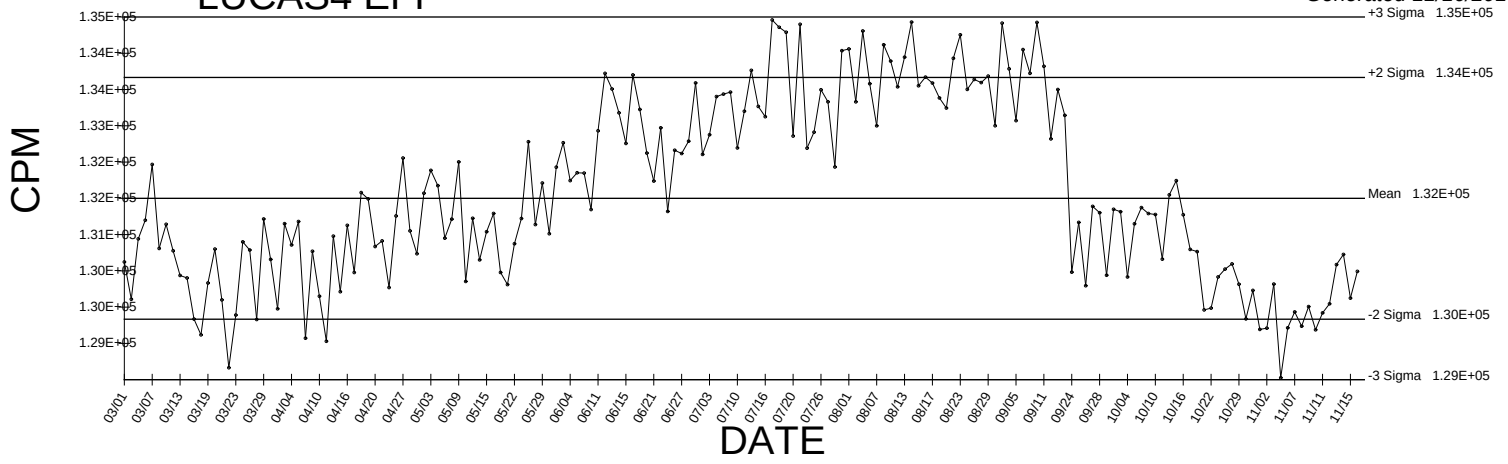
Generated 11/16/2018



● Denotes Outlier

LUCAS4 EFF

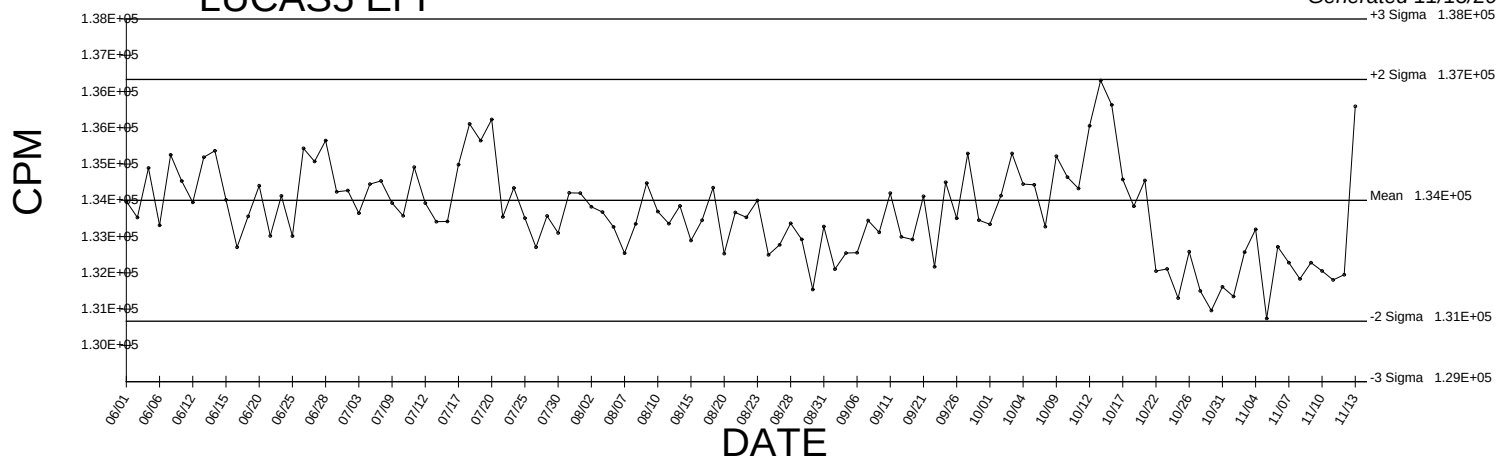
Generated 11/16/2018



● Denotes Outlier

LUCAS5 EFF

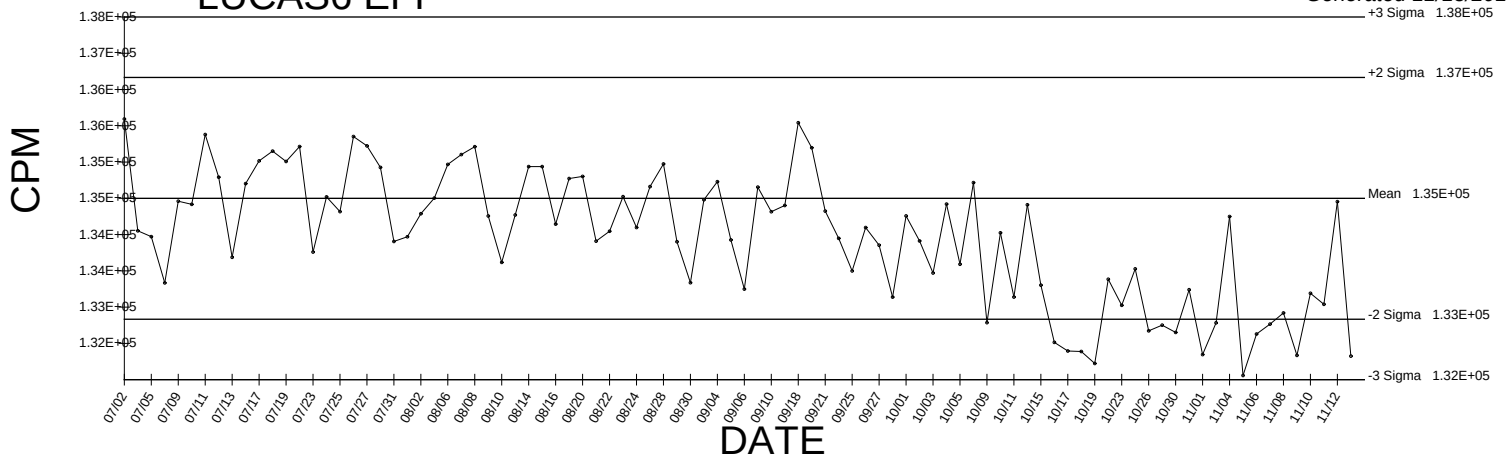
Generated 11/13/2018



● Denotes Outlier

LUCAS6 EFF

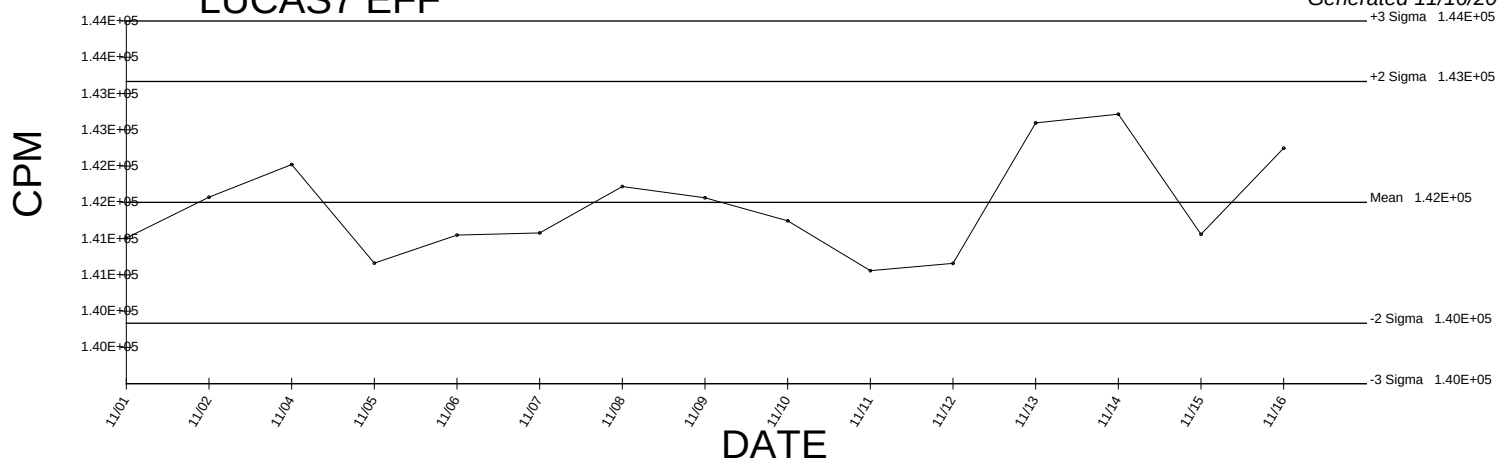
Generated 11/13/2018



● Denotes Outlier

LUCAS7 EFF

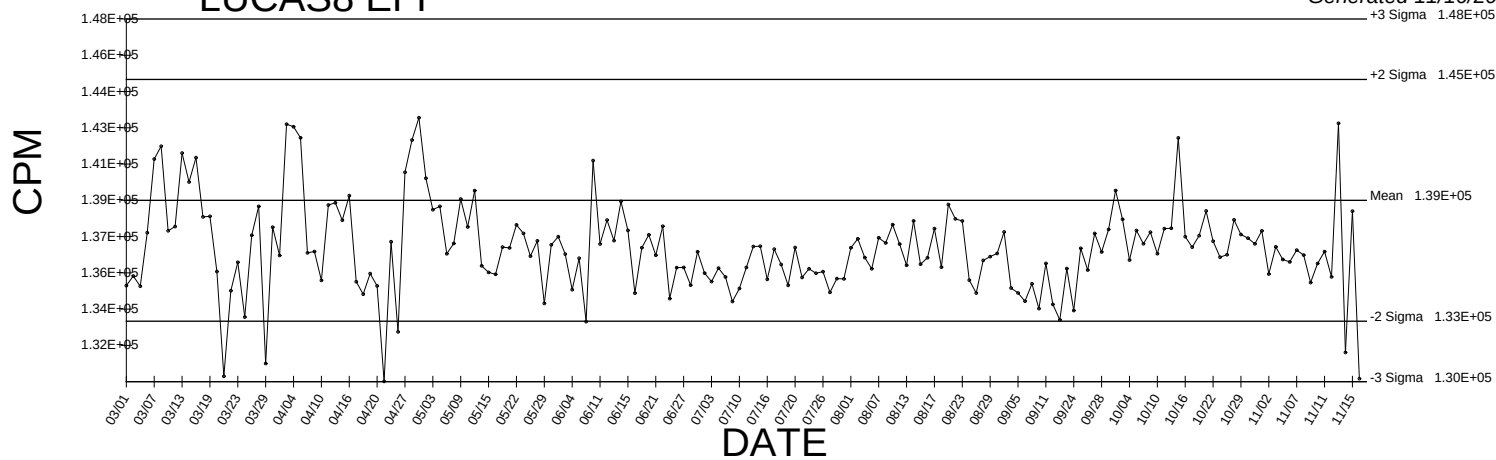
Generated 11/16/2018



● Denotes Outlier

LUCAS8 EFF

Generated 11/16/2018



● 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 μ g/g Ba carrier.

Source Prepared by:

R. Ormsby, Radiochemist

QC Approved:

L. Trivette, Nuclear Metrologist

Date: 9 Sep 14

1100 Peachard Industrial Blvd.





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

10/2

Instrument	Yellow
Analyst	CXR
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	05/02/2003

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	12/18/2013	173.43	173.40	173.40
2	12/18/2013	174.10	174.10	174.10
3	12/18/2013	174.28	174.28	174.28

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/mL	Measured dpm
1	59.40	0.422167	286.41	140.71
2	59.70	0.422167	286.83	141.42
3	62.30	0.422167	296.15	147.68

dpm/mL
 286.47
 0.95642063
 Mean Value =
 Stdev =
 Certificate Value* = 286.5
 Two sigma = 15.111
 10 % of Mean = 28.647
 Rule A (Pass/Fail) Pass
 % Recovery 59.73%
 Rule B (Pass/Fail) Pass
 Expiration Date 12/19/2013

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: 1819735

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
463427001	SAMPLE	PCW	LUCAS2	NOV-13-18 05:00:00	DONE	Lucas Cell	01-AUG-18 00:00
463530001	SAMPLE	PCW	LUCAS4	NOV-13-18 05:00:00	DONE	Lucas Cell	01-MAR-18 00:00
463530002	SAMPLE	PCW	LUCAS5	NOV-13-18 05:00:00	DONE	Lucas Cell	01-JUN-18 00:00
463530004	SAMPLE	PCW	LUCAS7	NOV-13-18 05:00:00	DONE	Lucas Cell	01-NOV-18 00:00
463530005	SAMPLE	PCW	LUCAS8	NOV-13-18 05:00:00	DONE	Lucas Cell	01-MAR-18 00:00
463530006	SAMPLE	PCW	LUCAS1	NOV-13-18 05:35:00	DONE	Lucas Cell	01-MAY-18 00:00
463530007	SAMPLE	PCW	LUCAS2	NOV-13-18 05:35:00	DONE	Lucas Cell	01-AUG-18 00:00
463530008	SAMPLE	PCW	LUCAS3	NOV-13-18 05:35:00	DONE	Lucas Cell	01-MAR-18 00:00
463530010	SAMPLE	PCW	LUCAS5	NOV-13-18 05:35:00	DONE	Lucas Cell	01-JUN-18 00:00
463530011	SAMPLE	PCW	LUCAS6	NOV-13-18 05:35:00	DONE	Lucas Cell	01-JUL-18 00:00
463541001	SAMPLE	PCW	LUCAS7	NOV-13-18 05:35:00	DONE	Lucas Cell	01-NOV-18 00:00
463646001	SAMPLE	PCW	LUCAS8	NOV-13-18 05:35:00	DONE	Lucas Cell	01-MAR-18 00:00
463646002	SAMPLE	PCW	LUCAS1	NOV-13-18 06:10:00	DONE	Lucas Cell	01-MAY-18 00:00
1204152950	MS	PCW	LUCAS6	NOV-13-18 06:10:00	DONE	Lucas Cell	01-JUL-18 00:00
1204152951	MSD	PCW	LUCAS7	NOV-13-18 06:10:00	DONE	Lucas Cell	01-NOV-18 00:00
463511005	SAMPLE	PCW	LUCAS3	NOV-13-18 08:35:00	DONE	Lucas Cell	01-MAR-18 00:00
1204152949	DUP	PCW	LUCAS5	NOV-13-18 08:35:00	DONE	Lucas Cell	01-JUN-18 00:00
463530003	SAMPLE	PCW	LUCAS3	NOV-16-18 04:45:00	DONE	Lucas Cell	01-MAR-18 00:00
463530009	SAMPLE	PCW	LUCAS4	NOV-16-18 04:45:00	DONE	Lucas Cell	01-MAR-18 00:00
463646003	SAMPLE	PCW	LUCAS5	NOV-16-18 04:45:00	DONE	Lucas Cell	01-JUN-18 00:00
463661005	SAMPLE	PCW	LUCAS6	NOV-16-18 04:45:00	DONE	Lucas Cell	01-JUL-18 00:00
1204152948	MB	PCW	LUCAS7	NOV-16-18 04:45:00	DONE	Lucas Cell	01-NOV-18 00:00
1204152952	LCS	PCW	LUCAS8	NOV-16-18 04:45:00	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 Hudson
Groundwater and Water Samples
Collected on 12/03/18-12/04/18

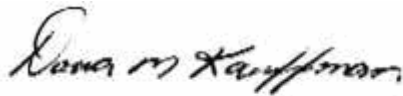
SDG# GEJ61

GROUP	SAMPLE NUMBERS
2016606	9931001-9931010

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: 12/31/2018

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 GEJ61
with a Data Package Type of III****07701 - GEI Consultants, Inc.**

Project: PSEG Hudson

Lab Sample Number	Client Sample ID	Collection Date	Date Received
9931001	MW-1	12/03/2018 11:15	12/07/2018 19:30
9931002	MW-2	12/03/2018 12:40	12/07/2018 19:30
9931003	MW-3	12/03/2018 11:20	12/07/2018 19:30
9931004	MW-4	12/03/2018 13:05	12/07/2018 19:30
9931005	MW-5	12/04/2018 09:55	12/07/2018 19:30
9931006	MW-6	12/04/2018 10:35	12/07/2018 19:30
9931007	MW-7	12/04/2018 13:55	12/07/2018 19:30
9931008	MW-8	12/04/2018 12:30	12/07/2018 19:30
9931009	MW-9	12/04/2018 12:15	12/07/2018 19:30
9931010	FB-20181203	12/03/2018 12:00	12/07/2018 19:30

Sample pH Log

SDG: GEJ61

<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>
9931001	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:34:08AM	12616
9931001	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:13:08PM	12665
9931001	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:15:12PM	12665
9931001	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:16:28AM	12616
9931001	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:13:04PM	12665
9931001	089B	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:55:27PM	12665
9931001	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:34:08AM	12616
9931001	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:34:08AM	12616
9931002	004A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:38:59AM	12616
9931002	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:16:28PM	12665
9931002	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:21:12PM	12665
9931002	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:16:44AM	12616
9931002	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:29:48PM	12665
9931002	330A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:38:59AM	12616
9931002	332A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:38:59AM	12616
9931003	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:57AM	12616
9931003	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 8:00:20PM	12665
9931003	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:14:55PM	12665
9931003	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:14:28AM	12616
9931003	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:05:18PM	12665
9931003	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:57AM	12616
9931003	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:57AM	12616
9931004	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:44:48AM	12616
9931004	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:19:38PM	12665
9931004	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:20:36PM	12665
9931004	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:11:23AM	12616
9931004	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:19:36PM	12665
9931004	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:44:48AM	12616
9931004	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:44:48AM	12616
9931005	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:45:42AM	12616
9931005	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:17:40PM	12665
9931005	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:16:03PM	12665
9931005	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:15:57AM	12616
9931005	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:54:04PM	12665
9931005	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:45:42AM	12616
9931005	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:45:42AM	12616
9931006	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:37:57AM	12616
9931006	055A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 7:59:05PM	12665

<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>
9931006	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:15:29PM	12665
9931006	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:16:15AM	12616
9931006	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:11:46PM	12665
9931006	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:37:57AM	12616
9931006	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:37:57AM	12616
9931007	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:41:21AM	12616
9931007	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:20:06PM	12665
9931007	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:20:55PM	12665
9931007	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:17:41AM	12616
9931007	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:29:24PM	12665
9931007	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:41:21AM	12616
9931007	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:41:21AM	12616
9931008	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:11AM	12616
9931008	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:19:50PM	12665
9931008	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:18:25PM	12665
9931008	070A	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:14:47AM	12616
9931008	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 9:50:45PM	12665
9931008	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:11AM	12616
9931008	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:42:11AM	12616
9931009	004A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:43:54AM	12616
9931009	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:19:08PM	12665
9931009	055B	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:20:19PM	12665
9931009	070A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:11:47AM	12616
9931009	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:03:19PM	12665
9931009	330A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:43:54AM	12616
9931009	332A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:43:54AM	12616
9931010	004A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:39:52AM	12616
9931010	055A	6	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 9:18:52PM	12665
9931010	055B	7	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/9/2018 8:00:05PM	12665
9931010	070A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 11:16:54AM	12616
9931010	089A	<2	<2	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/12/2018 10:26:24PM	12665
9931010	330A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:39:52AM	12616
9931010	332A	5	5-9	PK	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	12/10/2018 10:39:52AM	12616

<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

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 28, 2018 11:34

Project: PSEG Hudson

Account #: 07701
Group Number: 2016606
SDG: GEJ61
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 Date/Time</u>	<u>ELLE#</u>
MW-1 Grab Groundwater	12/03/2018 11:15	9931001
MW-2 Grab Groundwater	12/03/2018 12:40	9931002
MW-3 Grab Groundwater	12/03/2018 11:20	9931003
MW-4 Grab Groundwater	12/03/2018 13:05	9931004
MW-5 Grab Groundwater	12/04/2018 09:55	9931005
MW-6 Grab Groundwater	12/04/2018 10:35	9931006
MW-7 Grab Groundwater	12/04/2018 13:55	9931007
MW-8 Grab Groundwater	12/04/2018 12:30	9931008
MW-9 Grab Groundwater	12/04/2018 12:15	9931009
FB-20181203 Grab Water	12/03/2018 12:00	9931010

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

Sampling Date(s): 12/03/18 - 12/04/18

Laboratory Sample ID(s): 9931001-9931010

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.		



Christiane S. Sweigart
Senior Specialist

12/28/2018



Project Name: PSEG Hudson
ELLE Group #: 2016606

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: 9931001-9931010

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: 9931001, 9931002, 9931003, 9931004, 9931005, 9931006, 9931007, 9931008, 9931009, 9931010

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, Metals Dissolved

Sample #s: 9931001, 9931002, 9931003, 9931004, 9931005, 9931006, 9931007, 9931008, 9931009, 9931010

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

EPA 300.0, Wet Chemistry

Sample #s: 9931004

The chloride value being higher than the Total Dissolved Solids result was confirmed by reanalysis for chloride.

SM 2540 C-2011, Wet Chemistry

Batch #: 18344921203A (Sample number(s): 9931001-9931005, 9931007-9931010 UNSPK: 9931008 BKG: 9931006, 9931008)

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931001
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 11:15
SDG#: GEJ61-01

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	0.748	0.0010	0.0050	1
08014	Boron	7440-42-8	1.14	0.0120	0.0500	1
01750	Calcium	7440-70-2	390	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0056	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.239	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	0.00076 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0020 J	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	0.0027	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	7,490	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	117	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	10,800	400	1,200	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931001
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 11:15
SDG#: GEJ61-01

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 21.8	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.2	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 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 07:34	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:11	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:34	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:34	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 12:47	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:34	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:34	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:11	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 08:57	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:23	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 08:57	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:23	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:23	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:23	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 08:39	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931001
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 11:15
SDG#: GEJ61-01

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	12/17/2018 23:36	Clinton M Wilson	2000
01504	Fluoride	EPA 300.0	1	18348120315B	12/15/2018 03:15	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315B	12/15/2018 03:32	Hallie A Burnett	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:16	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:16	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931002
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 12:40
SDG#: GEJ61-02

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	2.24	0.0010	0.0050	1
08014	Boron	7440-42-8	0.927	0.0120	0.0500	1
01750	Calcium	7440-70-2	467	0.165	2.50	5
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0041 J	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0709	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	0.0045	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	0.0032	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	7,660	400	800	2000
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	14.1	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	10,600	400	1,200	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 Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931002
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/03/2018 12:40**SDG#:** GEJ61-02

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 22.3	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.2	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 07:37	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:15	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:26	Cindy M Gehman	5
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:37	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 12:50	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:15	Cindy M Gehman	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:37	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:15	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:12	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:27	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:12	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:27	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:27	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:27	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 08:52	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931002
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 12:40
SDG#: GEJ61-02

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	2	18348120315A	12/14/2018 17:47	Hallie A Burnett	2000
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 17:30	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 17:30	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:21	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:21	Jeremy L Bolf	1

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

Sample Description: MW-3 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931003
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/03/2018 11:20**SDG#:** GEJ61-03

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	0.0322	0.0010	0.0050	1
08014	Boron	7440-42-8	0.206	0.0120	0.0500	1
01750	Calcium	7440-70-2	56.8	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	0.0013 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0036	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	0.0070	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	123	10.0	20.0	50
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	46.9	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	524	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-3 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931003
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submission Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/03/2018 11:20**SDG#:** GEJ61-03

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 21.8	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 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 07:46	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:29	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:46	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:46	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:29	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:46	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:46	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:29	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:14	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:35	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:14	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:35	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:35	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:35	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 08:54	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931003
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 11:20
SDG#: GEJ61-03

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	18348120315A	12/14/2018 18:21	Hallie A Burnett	50
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 18:04	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 18:04	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 19:55	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 19:55	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931004
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 13:05
SDG#: GEJ61-04

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	0.229	0.0010	0.0050	1
08014	Boron	7440-42-8	0.967	0.0120	0.0500	1
01750	Calcium	7440-70-2	81.6	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	0.0760	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	0.00050 J	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	0.0063	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	3,360	200	400	1000
The chloride value being higher than the Total Dissolved Solids result was confirmed by reanalysis for chloride.						
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	221	15.0	50.0	50
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	3,280	400	1,200	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931004
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 13:05
SDG#: GEJ61-04

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 22.2	Degrees C 0.010	Degrees C 0.010	1
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 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 07:49	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:33	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:49	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:49	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:33	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:49	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:49	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:33	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:17	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:37	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:17	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:37	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:37	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:37	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 08:56	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931004
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 13:05
SDG#: GEJ61-04

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	18348120315A	12/14/2018 19:44	Hallie A Burnett	1000
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 19:27	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/17/2018 23:19	Clinton M Wilson	50
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 19:50	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 19:50	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931005
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 09:55
SDG#: GEJ61-05

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	0.0870	0.0010	0.0050	1
08014	Boron	7440-42-8	0.364	0.0120	0.0500	1
01750	Calcium	7440-70-2	99.5	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	N.D. K1	0.0015	0.0050	1
01756	Lithium	7439-93-2	0.0270 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	0.00078 J	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	623	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	4.7 J	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,640	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-5 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931005
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30
Collection Date/Time: 12/04/2018 09:55
SDG#: GEJ61-05

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 22.4	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 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 07:53	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:36	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:53	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:53	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:36	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:53	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:53	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:36	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:19	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:38	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:19	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:38	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:38	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:38	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 08:58	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 Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931005
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 09:55
SDG#: GEJ61-05

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	18348120315A	12/14/2018 20:17	Hallie A Burnett	500
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 20:01	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 20:01	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 21:10	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 21:10	Jeremy L Bolf	1

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

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

GEI Consultants, Inc.
ELLE Sample #: GW 9931006
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 10:35
SDG#: GEJ61-06

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	0.0580	0.0010	0.0050	1
08014	Boron	7440-42-8	0.481	0.0120	0.0500	1
01750	Calcium	7440-70-2	95.4	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	0.0155 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	0.00094 J	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	0.0022	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	368	100	200	500
01504	Fluoride	16984-48-8	0.43 J	0.25	0.50	5
00228	Sulfate	14808-79-8	29.6	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	900	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-6 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931006
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/04/2018 10:35**SDG#:** GEJ61-06

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 22.0	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.2	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 07:56	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:40	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:56	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:56	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:40	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:56	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:56	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:40	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:21	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:40	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:21	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:40	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:40	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:40	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:00	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-6 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931006
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 10:35
SDG#: GEJ61-06

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	18348120315A	12/14/2018 20:51	Hallie A Burnett	500
01504	Fluoride	EPA 300.0	2	18348120315A	12/21/2018 16:25	Ashlynn M Cornelius	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 20:34	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203B	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:44	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:44	Jeremy L Bolf	1

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

Sample Description: MW-7 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931007
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/04/2018 13:55**SDG#:** GEJ61-07

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	0.0185	0.0010	0.0050	1
08014	Boron	7440-42-8	0.0848	0.0120	0.0500	1
01750	Calcium	7440-70-2	19.9	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	0.0055	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	17.8	1.0	2.0	5
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	6.2	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	141	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-7 Grab Groundwater
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931007
ELLE Group #: 2016606
Matrix: Groundwater**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/04/2018 13:55**SDG#:** GEJ61-07

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 21.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.5	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 07:59	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:43	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:59	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:59	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:43	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:59	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 07:59	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:43	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:24	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:42	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:24	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:42	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:42	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:42	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:02	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-7 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931007
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 13:55
SDG#: GEJ61-07

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	18348120315A	12/14/2018 21:08	Hallie A Burnett	5
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 21:08	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 21:08	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:25	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:25	Jeremy L Bolf	1

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

Sample Description: MW-8 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931008
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:30
SDG#: GEJ61-08

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	0.0427	0.0010	0.0050	1
08014	Boron	7440-42-8	0.247	0.0120	0.0500	1
01750	Calcium	7440-70-2	23.1	0.0330	0.500	1
07051	Chromium	7440-47-3	N.D.	0.0053	0.0150	1
07052	Cobalt	7440-48-4	0.0081	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	0.0023	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	0.0015	0.00015	0.0010	1
06035	Lead	7439-92-1	N.D.	0.0011	0.0030	1
06038	Molybdenum	7439-98-7	0.0025	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	380	100	200	500
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	32.3	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	722	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-8 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931008
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:30
SDG#: GEJ61-08

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 7.0	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.

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 08:02	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:47	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:02	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:02	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/20/2018 12:54	Lisa J Cooke	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:02	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:02	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:47	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:26	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:43	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:26	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:43	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:43	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:43	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:04	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-8 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931008
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:30
SDG#: GEJ61-08

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	18348120315A	12/14/2018 22:31	Hallie A Burnett	500
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 21:41	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 21:41	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 19:59	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 19:59	Jeremy L Bolf	1

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

Sample Description: MW-9 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931009
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:15
SDG#: GEJ61-09

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	0.0289	0.0010	0.0050	1
08014	Boron	7440-42-8	0.132	0.0120	0.0500	1
01750	Calcium	7440-70-2	64.4	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	0.0011 J	0.00041	0.0020	1
06025	Arsenic	7440-38-2	0.0019 J	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	0.0028	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	20.0	40.0	100
01504	Fluoride	16984-48-8	N.D.	0.25	0.50	5
00228	Sulfate	14808-79-8	30.9	1.5	5.0	5
	SM 2540 C-2011		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	401	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-9 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931009
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submission Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:15
SDG#: GEJ61-09

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 22.2	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 7.2	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 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 08:04	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:50	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:04	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:04	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:50	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:04	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:04	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:50	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:29	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:45	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:29	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:45	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:45	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:45	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:11	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-9 Grab Groundwater
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931009
ELLE Group #: 2016606
Matrix: Groundwater

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/04/2018 12:15
SDG#: GEJ61-09

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	18348120315A	12/21/2018 16:43	Ashlynn M Cornelius	100
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 22:48	Hallie A Burnett	5
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 22:48	Hallie A Burnett	5
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:11	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:11	Jeremy L Bolf	1

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

Sample Description: FB-20181203 Grab Water
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931010
ELLE Group #: 2016606
Matrix: Water**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/03/2018 12:00**SDG#:** GEJ61-10FB

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	0.0708 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-20181203 Grab Water
PSEG Hudson / 1504710**GEI Consultants, Inc.**
ELLE Sample #: GW 9931010
ELLE Group #: 2016606
Matrix: Water**Project Name:** PSEG Hudson**Submittal Date/Time:** 12/07/2018 19:30**Collection Date/Time:** 12/03/2018 12:00**SDG#:** GEJ61-10FB

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 21.9	Degrees C 0.010	Degrees C 0.010	1
Wet Chemistry						
12152	pH	SM 4500-H+ B-2011 n.a.	Std. Units 6.3	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 08:07	Lisa J Cooke	1
08014	Boron	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:53	Cindy M Gehman	1
01750	Calcium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:07	Lisa J Cooke	1
07051	Chromium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:07	Lisa J Cooke	1
07052	Cobalt	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:53	Cindy M Gehman	1
01756	Lithium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:07	Lisa J Cooke	1
07036	Selenium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 08:07	Lisa J Cooke	1
07022	Thallium	SW-846 6010D Rev.4, July 2014	1	183481404402	12/18/2018 23:53	Cindy M Gehman	1
06024	Antimony	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:05	Choon Y Tian	1
06025	Arsenic	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:31	Choon Y Tian	1
06027	Beryllium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/21/2018 09:05	Choon Y Tian	1
06028	Cadmium	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:31	Choon Y Tian	1
06035	Lead	SW-846 6020B Rev.2, July 2014	1	183511404702A	12/20/2018 18:31	Choon Y Tian	1
06038	Molybdenum	SW-846 6020B Rev.2, July 2014	1	183511404702C	12/20/2018 18:31	Choon Y Tian	1
00259	Mercury	SW-846 7470A	1	183470571303	12/15/2018 09:13	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-20181203 Grab Water
PSEG Hudson / 1504710

GEI Consultants, Inc.
ELLE Sample #: GW 9931010
ELLE Group #: 2016606
Matrix: Water

Project Name: PSEG Hudson

Submittal Date/Time: 12/07/2018 19:30
Collection Date/Time: 12/03/2018 12:00
SDG#: GEJ61-10FB

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	18348120315A	12/14/2018 23:21	Hallie A Burnett	1
01504	Fluoride	EPA 300.0	1	18348120315A	12/14/2018 23:21	Hallie A Burnett	1
00228	Sulfate	EPA 300.0	1	18348120315A	12/14/2018 23:21	Hallie A Burnett	1
00212	Total Dissolved Solids	SM 2540 C-2011	1	18344921203A	12/10/2018 15:57	Amy L Hankins	1
12151	Temperature of pH	SM 2550 B-2010	1	18344003101A	12/10/2018 20:03	Jeremy L Bolf	1
12152	pH	SM 4500-H+ B-2011	1	18344003101A	12/10/2018 20:03	Jeremy L Bolf	1

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

Quality Control Summary

Client Name: GEI Consultants, Inc.
Reported: 12/28/2018 11:34

Group Number: 2016606

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): 9931001-9931010		
Mercury	N.D.	0.000050	0.00020
Batch number: 183481404402	Sample number(s): 9931001-9931010		
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): 9931001-9931010		
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): 9931001-9931010		
Molybdenum	N.D.	0.00031	0.0020
Batch number: 18348120315A	Sample number(s): 9931002-9931010		
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): 9931001		
Chloride	N.D.	0.20	0.40
Fluoride	N.D.	0.050	0.10
Sulfate	N.D.	0.30	1.0
Batch number: 18344921203A	Sample number(s): 9931001-9931005,9931007-9931010		
Total Dissolved Solids	N.D.	20.0	60.0
Batch number: 18344921203B	Sample number(s): 9931006		
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: 12/28/2018 11:34

Group Number: 2016606

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): 9931001-9931010 0.00100	0.000846			85		80-120		
Batch number: 183481404402	Sample number(s): 9931001-9931010								
Barium	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	Sample number(s): 9931001-9931010								
Antimony	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): 9931001-9931010 0.0500	0.0528	0.0500	0.0518	106	104	80-120	2	20
	mg/l	mg/l	mg/l	mg/l					
Batch number: 18348120315A	Sample number(s): 9931002-9931010								
Chloride	3.00	3.06			102		90-110		
Fluoride	0.750	0.704			94		90-110		
Sulfate	7.50	7.76			104		90-110		
Batch number: 18348120315B	Sample number(s): 9931001								
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: 18344921203A Total Dissolved Solids	Sample number(s): 9931001-9931005,9931007-9931010 200	198			99		62-127		
Batch number: 18344921203B Total Dissolved Solids	Sample number(s): 9931006 200	198			99		62-127		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 18344003101A pH	Sample number(s): 9931001-9931010 7.00	7.00			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: 12/28/2018 11:34

Group Number: 2016606

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: 183470571303 Mercury	Sample number(s): 9931001-9931010 UNSPK: 9931001 N.D.	0.00100	0.000811	0.00100	0.000826	81	83	75-125	2	20
	mg/l	mg/l	mg/l	mg/l	mg/l					
Batch number: 18344921203A Total Dissolved Solids	Sample number(s): 9931001-9931005,9931007-9931010 UNSPK: 9931008 722	800	1528			101		62-127		
Batch number: 18344921203B Total Dissolved Solids	Sample number(s): 9931006 UNSPK: 9931008 722	800	1528			101		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: 183470571303 Mercury	Sample number(s): 9931001-9931010 BKG: 9931001 N.D.	N.D.	0 (1)	20
	mg/l	mg/l		
Batch number: 18344921203A Total Dissolved Solids	Sample number(s): 9931001-9931005,9931007-9931010 BKG: 9931008 722	788	9* (1)	5
Batch number: 18344921203B Total Dissolved Solids	Sample number(s): 9931006 BKG: 9931006 900	884	2 (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

Acc # 7701

For Eurofins Lancaster Laboratories Environmental use only

Group # 201606 Sample # 973101-10

COC # 571678

Client Information				Matrix		Analysis Requested												For Lab Use Only			
Client		Account #		Soil ☐ Sediment ☐ Tissue ☐	Water ☐ Potable ☐ Ground ☐ NPDES ☐ Surface ☐	Other: <u>Hydrocarbons</u>	Total # of Containers	Preservation and Filtration Codes												FSC	SCR#
Project Name		Invoice #																			
Project Manager		Phone #																			
Sample ID		Location																			
Date when sample was collected		Time when sample was collected																			
Sample Identification		Collected		Grab	Composite	Soil	Water	Other	Total # of Containers	Metals	Mercury	Chloride	Fluoride	Sulfate	pH	TDS	Raw 226 228	Metals GC			
		Date	Time																		
MW-1		12-3-18	11:55	/					1	/	/	/	/	/	/	/	/				
MW-2		12-3-18	12:40	/					1	/	/	/	/	/	/	/	/				
MW-3		12-3-18	1:20	/					1	/	/	/	/	/	/	/	/				
MW-4		12-3-18	1:30:5	/					1	/	/	/	/	/	/	/	/				
MW-5		12-4-18	09:55	/					1	/	/	/	/	/	/	/	/				
MW-6		12-4-18	10:35	/					1	/	/	/	/	/	/	/	/				
MW-7		12-4-18	13:55	/					1	/	/	/	/	/	/	/	/				
MW-8		12-4-18	13:30	/					1	/	/	/	/	/	/	/	/				
MW-9		12-4-18	15:15	/					1	/	/	/	/	/	/	/	/				
FB 2051203		12-3-18	12:00	/					1	/	/	/	/	/	/	/	/				

Turnaround Time (TAT) Requested (please circle)		Date		Time		Signature		Date		Time		Signature		Date		Time	
Standard		11-30-18		12:00		[Signature]		11-30-18		12:00		[Signature]		11-30-18		12:00	
Rush																	
Requested TAT in business days																	
E-mail address		JKohl@GECConsultants.com															
Data Package Options (if not required)		Type I (EPA Level 3)		Type VI (Raw Data Only)													
		Equivalent (non-G.P.)															
Type III (Reduced non-G.P.)		AJDKOP		TX TRRP-13													
NYSDOC Category A or B		MA MCF		CT RCP													
EDD Required?		Yes		No													
Site-Specific QC (MS/MSD/Dup)?		Yes		No													
Relinquished by Commercial Carrier		UPS		FedEx		Other											
Temperature upon receipt		12-31-18															

Sample Administration
Receipt Documentation Log

Doc Log ID: 235522


 Group Number(s) 201606
Client: GEI Consultants, Inc.

Delivery and Receipt Information

Delivery Method	<u>ELLE Courier</u>	Arrival Timestamp	<u>12/07/2018 19:30</u>
Number of Packages:	<u>4</u>	Number of Projects:	<u>2</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 $\geq$ 5mm:	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	Connected Temp	Therm. Type	Ice Type	Ice Preserved	Ice Contained	Elevated Temp?
1	DT42-02	1.2	DT	Wet	Y	Bagged	N
2	DT42-02	1.4	DT	Wet	Y	Bagged	N
3	DT42-02	1.8	DT	Wet	Y	Bagged	N
4	DT42-02	1.2	DT	Wet	Y	Bagged	N

General Comments: Both 1000 mL bottles for MW-3 were half full.

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: GEJ61

ICP Metals

Fraction: Metals in Liquid

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9931001	MW-1	X		
9931002	MW-2	X		
9931003	MW-3	X		
9931004	MW-4	X		
9931005	MW-5	X		
9931006	MW-6	X		
9931007	MW-7	X		
9931008	MW-8	X		
9931009	MW-9	X		
9931010	FB-20181203	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:

All QC is within specification.

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: GEJ61

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): 9931001-9931010)

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): 9931001-9931010: 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): 9931001-9931010: 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): 9931001-9931010: 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
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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931001, 9931001BKG

% Solids: 0.0

Concentration Units: UG/L

Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.76	B		MS
7440-38-2	Arsenic	2.0	B		MS
7440-39-3	Barium	748			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	1140			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	390000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	5.6			P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	239			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931002
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	4.5			MS
7440-39-3	Barium	2240			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	927			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	467000			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	4.1	B		P
7439-92-1	Lead	1.1	U		MS
7439-93-2	Lithium	70.9			P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	3.2			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931003
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.3	B		MS
7440-38-2	Arsenic	3.6			MS
7440-39-3	Barium	32.2			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	206			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	56800			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	7.0			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931004
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	0.50	B		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	967			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	81600			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	76.0			P
7439-97-6	Mercury	0.050	U		CV
7439-98-7	Molybdenum	6.3			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931005
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	0.78	B		MS
7440-39-3	Barium	87.0			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	364			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	99500			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	27.0	B		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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931006
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	0.94	B		MS
7440-39-3	Barium	58.0			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	481			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	95400			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	15.5	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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931007
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	18.5			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	84.8			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	19900			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	5.5			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931008
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	2.3			MS
7440-39-3	Barium	42.7			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	247			P
7440-43-9	Cadmium	1.5			MS
7440-70-2	Calcium	23100			P
7440-47-3	Chromium	5.3	U		P
7440-48-4	Cobalt	8.1			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	2.5			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931009
Concentration Units: UG/L

% Solids: 0.0
Date Received: 12/07/2018

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.1	B		MS
7440-38-2	Arsenic	1.9	B		MS
7440-39-3	Barium	28.9			P
7440-41-7	Beryllium	0.091	U		MS
7440-42-8	Boron	132			P
7440-43-9	Cadmium	0.15	U		MS
7440-70-2	Calcium	64400			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	2.8			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.: GEJ61

Matrix: WATER Level (low/med): LOW

Lab Sample ID: 9931010
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	70.8	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.: GEJ61

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Barium	183481404402	9931001
Boron		9931002
Calcium		9931003
Chromium		9931004
Cobalt		9931005
Lithium		9931006
Selenium		9931007
Thallium		9931008
		9931009
		9931010
		*31026BKG
		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.: GEJ61

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Antimony	183511404702	9931001BKG
Arsenic		9931002
Beryllium		9931003
Cadmium		9931004
Lead		9931005
Molybdenum		9931006
		9931007
		9931008
		9931009
		9931010
		P35104BB
		P35104BQ
		P35104BY

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.: GEJ61

Matrix: WATER

<u>Analyte</u>	<u>Batch Number</u>	<u>Lab Sample ID</u>
Mercury	183470571303	9931001BKG
		9931001MS
		9931001MSD
		9931001DUP
		9931002
		9931003
		9931004
		9931005
		9931006
		9931007
		9931008
		9931009
		9931010
		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.: GEJ61

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.: GEJ61

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.: GEJ61

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		30000.0	30301.13	101.0	25000.0	25321.35	101.3	25000.0	25322.31	101.3
Chromium										
Cobalt		600.0	606.97	101.2	500.0	508.53	101.7	500.0	514.80	103.0
Lithium		600.0	620.48	103.4	500.0	517.23	103.4	500.0	524.23	104.8
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.: GEJ61

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					25000.0	25203.49	100.8	25000.0	24842.10	99.4
Chromium										
Cobalt					500.0	520.97	104.2	500.0	519.57	103.9
Lithium					500.0	520.03	104.0			
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.: GEJ61

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.: GEJ61

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.: GEJ61

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.: GEJ61

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.: GEJ61

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			
Beryllium										
Cadmium	111				25.0	27.14	108.6			
Lead	208				25.0	25.54	102.2			
Molybdenum	98				25.0	25.77	103.1			

(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



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QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ61

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.: GEJ61

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.: GEJ61

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.: GEJ61

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.: GEJ61

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
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QUALITY ASSURANCE SUMMARY
FORM 2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION
SDG No.: GEJ61

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.: GEJ61

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



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ61

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		500.0	509.39	101.9		
Chromium						
Cobalt		5.0	6.93	138.6		
Lithium		50.0	55.24	110.5		
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



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ61

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

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

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



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QUALITY ASSURANCE SUMMARY
FORM 2B
LOW LEVEL CHECK STANDARD
SDG No.: GEJ61

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



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Environmental

QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ61

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	Mass		C	Batch Number
Barium		0.33	U	0.33	U	0.33	U	0.33	U		1.000	U	183481404402
Boron													
Calcium		33.4	U	33.4	U	33.4	U	33.4	U		33.000	U	183481404402
Chromium		0.96	U	0.96	U	0.96	U	0.96	U		5.300	U	183481404402
Cobalt													
Lithium		9.6	U	9.6	U	10.0	B	9.6	U		11.000	U	183481404402
Selenium		8.4	U	8.4	U	8.4	U	8.4	U		21.000	U	183481404402
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
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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ61

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						
Boron											
Calcium				75.6	B						
Chromium				0.96	U						
Cobalt											
Lithium				9.6	U						
Selenium				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



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QUALITY ASSURANCE SUMMARY

FORM 3

BLANKS

SDG No.: GEJ61

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	Mass	Batch Number
Barium											
Boron		8.4U		8.4U		8.4U		8.4U		12.000U	183481404402
Calcium		33.4U		33.4U		-37.7B		62.0B			
Chromium											
Cobalt		3.2B		0.82B		0.54B		0.54U		1.500U	183481404402
Lithium		9.6U		9.6U		9.6U		9.6U			
Selenium											
Thallium		3.8U		3.8U		3.8U		3.8U		14.000U	183481404402

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.: GEJ61

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							
Calcium			33.4	U							
Chromium											
Cobalt			0.54	U							
Lithium											
Selenium											
Thallium			3.8	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 3
BLANKS
SDG No.: GEJ61

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		0.54U	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.: GEJ61

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
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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ61

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	0.14U		0.14U		0.14U		0.14U		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
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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ61

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



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QUALITY ASSURANCE SUMMARY
FORM 3
BLANKS
SDG No.: GEJ61

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.: GEJ61

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	Mass		C	Batch Number
Mercury		0.050U		0.050U		0.050U		0.050U			0.050U	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.: GEJ61

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	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.: GEJ61

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		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.: GEJ61

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.: GEJ61

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	0		5							
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.: GEJ61

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%



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 5A (MS/MSD)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SDG No.: GEJ61

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9931001BKG Matrix Spike Lab Sample ID: 9931001MS Matrix Spike Duplicate Lab Sample ID: 9931001MSD

Batch Number(s): 183470571303

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	0.8107		0.8257		1.0000	1.0000	UG/L	81		83		2		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.: GEJ61

Matrix: WATER Level (low/med): LOW

Background Lab Sample ID: 9931001BKG

9931001DUP

Batch Number(s): 1834705713

03

Concentration Units: UG/L

Analyte	Mass	Control Limit	Samples (S)	C	Duplicate (D)	C	RPD	Max RPD	Q	M
Mercury			0.0500	U	0.0500	U			CV	

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.: GEJ61
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.: GEJ61

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 9

SERIAL DILUTIONS

SDG No.: GEJ61

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: *31026BKG

Serial Dilution Lab Sample ID: *31026L

Batch Number(s): 183481404402

Concentration Units: UG/L

Analyte	Mass	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Diff.	Q	M
Barium		211.2600		203.4500		4		P
Boron		156.5100		170.8000	B	9		P
Calcium		38500.6600		37868.8000		2		P
Chromium		5.3000	U	26.5000	U			P
Cobalt		2.4300	B	7.5000	U	100		P
Lithium		15.0200	B	55.0000	U	100		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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 9

SERIAL DILUTIONS

SDG No.: GEJ61

Matrix: WATER

Level (low/med): LOW

Background Lab Sample ID: 9931001BKG

Serial Dilution Lab Sample ID: 9931001L

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

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	317.93		33.4
Chromium			
Cobalt	228.62		0.54
Lithium	670.78		6.9
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			
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			
Beryllium	9		0.067
Cadmium			
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.: GEJ61
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.: GEJ61
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.: GEJ61
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.: GEJ61
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.: GEJ61
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

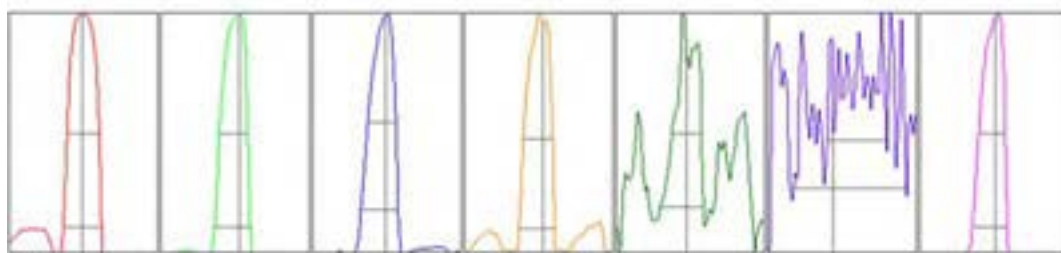
Mass	Conc. [ug/l]	Count	CPS	Resp (Required) [cps/ug/l]	Resp (Flag)	RSD%	RSD% (Required)
7	10.00	1129	11290.75			1.263	5.000
89	10.00	2194	21935.38			0.683	5.000
205	10.00	581	5806.88			0.857	5.000
70	1.00	39	388.73	0.00		8.088	
156	1.00	5	46.00	0.00		10.398	
220	1.00	2	22.40	0.00		14.672	
140	10.00	1440	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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ61

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									
9931001BKG	18:23	94		95									
9931001A	18:24	98		97									
9931001L	18:26	104		101									
9931002	18:27	96		98									
9931004	18:29												
9931010	18:31	100		96									
CCV	18:32	103		98									
CCB	18:34	98		94									
9931003	18:35	108		104									
9931004	18:37	99		96									
9931005	18:38	103		101									
9931006	18:40	100		98									
9931007	18:42	104		101									
9931008	18:43	106		106									
9931009	18:45	104		101									
ZZZZZZ	18:46												
ZZZZZZ	18:48												
ZZZZZZ	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.: GEJ61

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									

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY

FORM 16

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

SDG No.: GEJ61

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									
9931001BKG	08:57	100		85									
9931001A	09:00	104		90									
9931001L	09:02	111		99									
9931010	09:05	110		99									
CCV	09:07	110		100									
CCB	09:09	106		96									
9931002	09:12	105		96									
9931003	09:14	113		101									
9931004	09:17	110		92									
9931005	09:19	112		98									
9931006	09:21	110		102									
9931007	09:24	109		100									
9931008	09:26	107		97									
9931009	09:29	108		103									
ZZZZZZ	09:31												
ZZZZZZ	09:34												

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.: GEJ61

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									
ZZZZZZ	09:46												
ZZZZZZ	09:48												
ZZZZZZ	09:50												
ZZZZZZ	09:53												
ZZZZZZ	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

Preparation and Run Logs

Metals in Liquid



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 13
PREPARATION LOG
SDG No.: GEJ61

Method: P

Batch Number: 183481404402

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931001	12/17/2018	50.00	50
9931002	12/17/2018	50.00	50
9931003	12/17/2018	50.00	50
9931004	12/17/2018	50.00	50
9931005	12/17/2018	50.00	50
9931006	12/17/2018	50.00	50
9931007	12/17/2018	50.00	50
9931008	12/17/2018	50.00	50
9931009	12/17/2018	50.00	50
9931010	12/17/2018	50.00	50
*31026BKG	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)
9931002	12/18/2018	50.00	50
9931003	12/18/2018	50.00	50
9931004	12/18/2018	50.00	50
9931005	12/18/2018	50.00	50
9931006	12/18/2018	50.00	50
9931007	12/18/2018	50.00	50
9931008	12/18/2018	50.00	50
9931009	12/18/2018	50.00	50
9931010	12/18/2018	50.00	50
9931001BKG	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

Method: CV
Batch Number: 183470571303

Lab Sample ID	Date	Initial Volume(ml)	Final Volume(ml)
9931002	12/14/2018	40.00	40
9931003	12/14/2018	40.00	40
9931004	12/14/2018	40.00	40
9931005	12/14/2018	40.00	40
9931006	12/14/2018	40.00	40
9931007	12/14/2018	40.00	40
9931008	12/14/2018	40.00	40
9931009	12/14/2018	40.00	40
9931010	12/14/2018	40.00	40
9931001BKG	12/14/2018	40.00	40
9931001DUP	12/14/2018	40.00	40
9931001MSD	12/14/2018	40.00	40
9931001MS	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.: GEJ61

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														
*31026BKG	1.00	07:16			X				X	X			X			X														
ZZZZZZ	1.00	07:19																												
ZZZZZZ	1.00	07:22																												
ZZZZZZ	1.00	07:25																												
ZZZZZZ	1.00	07:28																												
*31026L	5.00	07:31			X				X	X			X			X														
9931001	1.00	07:34			X				X	X			X			X														
9931002	1.00	07:37			X					X						X														
CCV	1.00	07:41			X				X	X			X			X														
CCB	1.00	07:44			X				X	X			X			X														
9931003	1.00	07:46			X				X	X			X			X														
9931004	1.00	07:49			X				X	X			X			X														
9931005	1.00	07:53			X				X	X			X			X														
9931006	1.00	07:56			X				X	X			X			X														
9931007	1.00	07:59			X				X	X			X			X														
9931008	1.00	08:02			X				X	X			X			X														
9931009	1.00	08:04			X				X	X			X			X														
9931010	1.00	08:07			X				X	X			X			X														
ZZZZZZ	1.00	08:10																												
ZZZZZZ	1.00	08:13																												

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.: GEJ61

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														

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.: GEJ61

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	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	21:49					X		X		X		X				X													
S	1.00	21:52							X																					
S	1.00	21:55					X				X		X				X													
S	1.00	21:59																												
ICV	1.00	22:02					X		X		X		X				X													
ICB	1.00	22:06					X		X		X		X				X													
LLC	1.00	22:09					X		X		X		X				X													
ICSA	1.00	22:12					X		X		X		X				X													
CCV	1.00	22:16					X		X		X		X				X													
CCB	1.00	22:19					X		X		X		X				X													
LRS2	1.00	22:22					X		X		X		X				X													
LRS4	1.00	22:26					X		X		X		X				X													
LRS3	1.00	22:30					X		X		X		X				X													
LRS5	1.00	22:34					X		X		X		X				X													
CCV	1.00	22:37					X		X		X		X				X													
CCB	1.00	22:40					X		X		X		X				X													
P34804BB	1.00	22:44					X				X						X													
P34804BQ	1.00	22:47					X				X						X													
*31026BKG	1.00	22:51					X										X													
ZZZZZZ	1.00	22:54																												
ZZZZZZ	1.00	22:57																												
ZZZZZZ	1.00	23:01																												
ZZZZZZ	1.00	23:04																												
*31026L	5.00	23:08					X										X													
9931001	1.00	23:11					X										X													
9931002	1.00	23:15					X						X				X													
CCV	1.00	23:19					X		X		X		X				X													
CCB	1.00	23:22					X		X		X		X				X													
9931002	5.00	23:26							X																					
9931003	1.00	23:29					X				X						X													
9931004	1.00	23:33					X				X						X													
9931005	1.00	23:36					X				X						X													
9931006	1.00	23:40					X				X						X													
9931007	1.00	23:43					X				X						X													
9931008	1.00	23:47					X										X													
9931009	1.00	23:50					X				X						X													
9931010	1.00	23:53					X				X						X													
ZZZZZZ	1.00	23:57																												

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.: GEJ61

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	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													
CCV	1.00	00:00					X		X		X						X													
CCB	1.00	00:04					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.: GEJ61

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																	
*31026BKG	1.00	12:35									X																	
ZZZZZZ	1.00	12:38																										
ZZZZZZ	1.00	12:41																										
*31026L	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.: GEJ61

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 E	C D	C A	C R	C O	P B	L I	H G	M O	S E	T L													
9931001	1.00	12:47									X																			
9931002	1.00	12:50									X																			
9931008	1.00	12:54									X																			
ZZZZZZ	1.00	12:57																												
ZZZZZZ	1.00	13:00																												
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.: GEJ61

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	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	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															
9931001BKG	1.00	18:23	X				X					X			X															
9931001A	1.00	18:24																												
9931001L	5.00	18:26	X				X					X			X															
9931002	1.00	18:27	X				X					X			X															
9931004	20.00	18:29																												
9931010	1.00	18:31	X				X					X			X															
CCV	1.00	18:32	X				X					X			X															
CCB	1.00	18:34	X				X					X			X															
9931003	1.00	18:35	X				X					X			X															
9931004	1.00	18:37	X				X					X			X															
9931005	1.00	18:38	X				X					X			X															
9931006	1.00	18:40	X				X					X			X															
9931007	1.00	18:42	X				X					X			X															
9931008	1.00	18:43	X				X					X			X															
9931009	1.00	18:45	X				X					X			X															
ZZZZZZ	1.00	18:46																												
ZZZZZZ	20.00	18:48																												
ZZZZZZ	50.00	18:50																												
CCV	1.00	18:51	X				X					X			X															
CCB	1.00	18:53	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.: GEJ61

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											
			B	S	A	E		D	A	R	O	B	I	G	O	E	L											
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																										
9931001BKG	1.00	08:57	X			X																						
9931001A	1.00	09:00																										
9931001L	5.00	09:02	X			X																						
9931010	1.00	09:05	X			X																						
CCV	1.00	09:07	X			X																						
CCB	1.00	09:09	X			X																						
9931002	1.00	09:12	X			X																						
9931003	1.00	09:14	X			X																						
9931004	1.00	09:17	X			X																						
9931005	1.00	09:19	X			X																						
9931006	1.00	09:21	X			X																						
9931007	1.00	09:24	X			X																						
9931008	1.00	09:26	X			X																						
9931009	1.00	09:29	X			X																						
ZZZZZZ	1.00	09:31																										
ZZZZZZ	1.00	09:34																										
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																										
ZZZZZZ	1.00	09:46																										

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.: GEJ61

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													
ZZZZZZ	1.00	09:48																												
ZZZZZZ	1.00	09:50																												
ZZZZZZ	1.00	09:53																												
ZZZZZZ	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.: GEJ61

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



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ61

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																										
9931001BKG	1.00	08:39													X													
CCV	1.00	08:41													X													
CCB	1.00	08:43													X													
9931001DUP	1.00	08:46													X													
9931001MS	1.00	08:48													X													
9931001MSD	1.00	08:50													X													
9931002	1.00	08:52													X													
9931003	1.00	08:54													X													

METHODS:

P = ICP Atomic Emission Spectrometer
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MSD = Matrix Spike Duplicate
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Y = Laboratory Control Sample Duplicate



Lancaster Laboratories
Environmental

QUALITY ASSURANCE SUMMARY
FORM 14
ANALYSIS RUN LOG
SDG No.: GEJ61

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													
9931004	1.00	08:56												X																
9931005	1.00	08:58												X																
9931006	1.00	09:00												X																
9931007	1.00	09:02												X																
9931008	1.00	09:04												X																
CCV	1.00	09:06												X																
CCB	1.00	09:08												X																
9931009	1.00	09:11												X																
9931010	1.00	09:13												X																
ZZZZZZ	1.00	09:15																												
ZZZZZZ	1.00	09:17																												
ZZZZZZ	1.00	09:19																												
ZZZZZZ	1.00	09:21																												
ZZZZZZ	1.00	09:23																												
ZZZZZZ	1.00	09:25																												
ZZZZZZ	1.00	09:27																												
CRA	1.00	09:29												X																
CCV	1.00	09:31												X																
CCB	1.00	09:33												X																

METHODS:

P = ICP Atomic Emission Spectrometer
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CV = Cold Vapor
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LEGEND:

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Instrumental Wet Chemistry Data

Case Narrative/Conformance Summary

Instrumental Wet Chemistry

Case Narrative/Conformance Summary

CLIENT: GEI Consultants, Inc.
SDG: GEJ61

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Sample #	Client ID	Matrix		Comments
		Liquid	Solid	
9931001	MW-1	X		
9931002	MW-2	X		
9931003	MW-3	X		
9931004	MW-4	X		
9931005	MW-5	X		
9931006	MW-6	X		
9931007	MW-7	X		
9931008	MW-8	X		
9931009	MW-9	X		
9931010	FB-20181203	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: GEJ61

Instrumental Water Quality

Fraction: Instrumental Wet Chemistry

Samples	Chloride	Fluoride	Sulfate
9931001	DF2000	DF5	DF50
9931002	DF2000	DF5	DF5
9931003	DF50	DF5	DF5
9931004	DF1000	DF5	DF50
9931005	DF500	DF5	DF5
9931006	DF500	DF5	DF5
9931007	DF5	DF5	DF5
9931008	DF500	DF5	DF5
9931009	DF100	DF5	DF5
9931010	DF1	DF1	DF1

(Sample number(s): 9931004: Analysis: 00224)

The chloride value being higher than the Total Dissolved Solids result was confirmed by reanalysis for chloride.

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

Quality Control and Calibration Summary Forms

Instrumental Wet Chemistry

Quality Control Reference List Instrumental Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ61

Fraction: Instrumental Wet Chemistry

Batch Number	Sample Number	Analysis Date	Chloride	Fluoride	Sulfate
18348120315A	9931002	12/14/2018 17:30:00		X	X
	9931002	12/14/2018 17:47:00	X		
	9931003	12/14/2018 18:04:00		X	X
	9931003	12/14/2018 18:21:00	X		
	9931004	12/14/2018 19:27:00		X	
	9931004	12/14/2018 19:44:00	X		
	9931004	12/17/2018 23:19:00			X
	9931005	12/14/2018 20:01:00		X	X
	9931005	12/14/2018 20:17:00	X		
	9931006	12/14/2018 20:34:00			X
	9931006	12/14/2018 20:51:00	X		
	9931006	12/21/2018 16:25:00		X	
	9931007	12/14/2018 21:08:00	X	X	X
	9931008	12/14/2018 21:41:00		X	X
	9931008	12/14/2018 22:31:00	X		
	9931009	12/14/2018 22:48:00		X	X
	9931009	12/21/2018 16:43:00	X		
	9931010	12/14/2018 23:21:00	X	X	X
	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	9931001	12/15/2018 03:15:00		X	
	9931001	12/15/2018 03:32:00			X
	9931001	12/17/2018 23:36:00	X		

Fraction: Instrumental Wet Chemistry

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

Instrumental Water Quality
Fraction: Instrumental Wet Chemistry

LCS: P34820OQ	Batch: 18348120315A (Sample number(s): 9931002-9931010)								
	Batch: 18348120315B (Sample number(s): 9931001)								
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: GEJ61

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: 18348120315A, 18348120315B
Run Start Dates: 12/14/2018
Run Names: 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

* = Out of Specifications



Lancaster Laboratories
Environmental

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

SDG: GEJ61

Instrument ID: 12115
Calibration Date: 12/10/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	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

Concentration units: mg/L

Batch Numbers: 18348120315A, 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	3.0740	102	7.5	7.8824	105	0.75	0.8115	108
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	3.1120	104	7.5	7.9732	106	0.75	0.8176	109
CCB	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				7.5	8.1649	109	0.75	0.8590	115
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: GEJ61

Instrument ID: 24811
Calibration Date: 12/10/2018

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.669903	1.347072	3.341072	7.218949	10.919385	0.9997	0.9998
Fluoride	0.119335	0.487393	1.299083	2.860626	4.676210	0.9992	0.9996

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

Concentration units: mg/L

Batch Numbers: 18348120315A
Run Start Dates: 12/20/2018
Run Names: 1835401D17

Sample	Chloride			Fluoride		
	True	Result	%Rec	True	Result	%Rec
ICV	3	2.7522	92	0.75	0.7535	100
ICB	0	ND	NA	0	ND	NA
CCV2	3	2.8217	94	0.75	0.7670	102
CCB	0	ND	NA	0	ND	NA
CCV2	3	2.8374	95	0.75	0.7685	102
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: GEJ61

Instrument ID: 17694
Calibration Date: 12/13/2018

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

Analysis	AUTO CAL1	AUTO CAL2	AUTO CAL3	AUTO CAL4	AUTO CAL5	R ²	CC
Chloride	0.399180	0.922045	2.029498	4.095948	6.251883	0.9993	0.9996
Fluoride	0.086588	0.309096	0.877335	1.942084	3.111997	0.9998	0.9999
Sulfate	0.214959	0.447837	1.242362	2.644147	4.082716	0.9997	0.9998

Concentration units: mg/L

Batch Numbers: 18348120315A, 18348120315B
Run Start Dates: 12/17/2018
Run Names: 1835101D09

Sample	Chloride			Sulfate			Fluoride		
	True	Result	%Rec	True	Result	%Rec	True	Result	%Rec
ICV	3	2.8664	96	7.5	7.3557	98	0.75	0.7353	98
ICB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2							0.75	0.7092	95
CCB							0	ND	NA
CCV2	3	2.9282	98	7.5	7.4801	100	0.75	0.7442	99
CCB	0	ND	NA	0	ND	NA	0	ND	NA
CCV2	3	2.7450	92	7.5	7.1970	96			
CCB	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: GEJ61

Water Quality

Fraction: Wet Chemistry

Sample #	Client ID	Matrix		DF	Comments
		Liquid	Solid		
9931001	MW-1	X		1	
9931002	MW-2	X		1	
9931003	MW-3	X		1	
9931004	MW-4	X		1	
9931005	MW-5	X		1	
9931006	MW-6	X		1	
9931007	MW-7	X		1	
9931008	MW-8	X		1	
9931009	MW-9	X		1	
9931010	FB-20181203	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#: 18344921203A (Sample number(s): 9931001-9931005, 9931007-9931010, UNSPK: 9931008, BKG: 9931006, 9931008)

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: GEJ61

Water Quality

Fraction: Wet Chemistry

SAMPLE ANALYSIS:

(Sample number(s): 9931001-9931010: 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



Lancaster Laboratories
Environmental

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ61

Fraction: Wet Chemistry

Analysis	Batch Number	Sample Number	Analysis Date
Total Dissolved Solids	18344921203A	B344873B	12/10/2018 15:57
		L344873Q	12/10/2018 15:57
		9931001	12/10/2018 15:57
		9931002	12/10/2018 15:57
		9931003	12/10/2018 15:57
		9931004	12/10/2018 15:57
		9931005	12/10/2018 15:57
		9931007	12/10/2018 15:57
		9931008 UNSPK/BKG,MS,DUP	12/10/2018 15:57
		9931009	12/10/2018 15:57
		9931010	12/10/2018 15:57
Total Dissolved Solids	18344921203B	9931006 BKG,DUP	12/10/2018 15:57

Quality Control Reference List Water Quality

CLIENT: GEI Consultants, Inc.
SDG: GEJ61

Fraction: Wet Chemistry

Batch Number	Sample Number	Analysis Date	pH	Temperature of pH
18344003101A	9931001	12/10/2018 20:16:00	X	X
	9931002	12/10/2018 20:21:00	X	X
	9931003	12/10/2018 19:55:00	X	X
	9931004	12/10/2018 19:50:00	X	X
	9931005	12/10/2018 21:10:00	X	X
	9931006	12/10/2018 20:44:00	X	X
	9931007	12/10/2018 20:25:00	X	X
	9931008	12/10/2018 19:59:00	X	X
	9931009	12/10/2018 20:11:00	X	X
	9931010	12/10/2018 20:03:00	X	X
	P003101Q	12/10/2018 19:22:00	X	

Fraction: Wet Chemistry

18344921203A / B344873B						
Parameter	ME	Analysis Date	Blank Results	Units	MDL	LOQ
Total Dissolved Solids	G	12/10/18	N.D.	mg/l	20.0	60.0

Water Quality

Fraction: Wet Chemistry

UNSPK: 9931008 MS: 9931008	Batch: 18344921203A (Sample number(s): 9931001-9931005, 9931007-9931010)									
	Batch: 18344921203B (Sample number(s): 9931006)									
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	722.	1528.	NA	101	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: 9931008 DUP: 9931008	Batch: 18344921203A (Sample number(s): 9931001-9931005, 9931007-9931010)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	722.	788.	9* (1)	5

BKG: 9931006 DUP: 9931006	Batch: 18344921203B (Sample number(s): 9931006)				
Parameter	ME	Unspiked Conc mg/l	DUP Conc mg/l	%RPD	%RPD Limits
Total Dissolved Solids	G	900.	884.	2 (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.

Water Quality
Fraction: Wet Chemistry

LCS: P003101Q	Batch: 18344003101A (Sample number(s): 9931001-9931010)								
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: L344873Q	Batch: 18344921203A (Sample number(s): 9931001-9931005, 9931007-9931010)								
	Batch: 18344921203B (Sample number(s): 9931006)								
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	198	NA	99	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: 466630

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: 2016607
Enclosures

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Case Narrative

**Receipt Narrative
for
Eurofins Lancaster Laboratories
SDG: 466630**

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>
466630001	MW-1
466630002	MW-2
466630003	MW-3
466630004	MW-4
466630005	MW-5
466630006	MW-6
466630007	MW-7
466630008	MW-8
466630009	MW-9
466630010	FB-20181203

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.

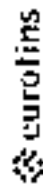
The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

A handwritten signature in black ink, appearing to read 'T. Cannon'.

Taylor Cannon for
Julie Robinson
Project Manager

Chain of Custody and Supporting Documentation

Environmental Analysis Request/Chain of Custody



Lancaster Laboratories
Environmental

446630

Acct # _____ Group # 2016607 Sample # 9931011-20

Subcontractor		GEL		Analyses Requested		For Lab Use Only	
Project Name/ID	2016607	Site ID #		Preservation and Filtration Codes		SF #	
Requestor	Hannah Costman	P.O. #				SDR #	
Sampler		PWSID #					
Phone #	717-556-7383	Quote #					
State where samples were collected		NJ		For Compliance		Yes ☒ No ☐	
Sample Identification		Collection		Matrix		Retention Time	
		Date	Time				
MW-1		12/3/2018	1115	X	X	9931011	
MW-2		12/3/2018	1240	X	X	9931012	
MW-3		12/3/2018	1120	X	X	9931013	
MW-4		12/3/2018	1305	X	X	9931014	
MW-5		12/4/2018	0955	X	X	9931015	
MW-6		12/4/2018	1035	X	X	9931016	
MW-7		12/4/2018	1355	X	X	9931017	
MW-8		12/4/2018	1230	X	X	9931018	
MW-9		12/4/2018	1215	X	X	9931019	
GB-20181203		12/3/2018	1200	X	X	9931020	
Turnaround Time Requested (TAT) (please check)		Standard ☒ Rush ☐		Retained by		Received by	
(Rush TAT is subject to laboratory approval and surcharges)				Date		Date	
Date results are needed		Preservation Needed		Time		Time	
Rush results requested by (please check)		E-Mail ☐ Phone ☐		Date		Date	
E-mail Address		ELLE_Subcontracting@eurofins.com		Time		Time	
Phone		717-556-7383		Date		Date	
Data Package Options (please check if required)		Level IV DOD ☐		Time		Time	
Type I (Validation Non-CLP) ☐		MA MCP ☐		Date		Date	
Type III (Reduced non-CLP) ☐		CT RCP ☐		Time		Time	
Type VI (Raw Data Only) ☐		YX TRAP-3 ☐		Date		Date	
NJ DOD ☒		NYSDEC Category ☐ A or ☐ B		Time		Time	
EDD Required? Yes ☒ No ☐		If yes, format ☒ HazMat		Date		Date	
Retained by		Retained by		Temperature upon receipt		°C	
UPS ☐ FedEx ☐ Other ☐		Retained by		Date		Date	
Retained by		Retained by		Time		Time	
Retained by		Retained by		Date		Date	
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Retained by		Retained by		Date			



Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: LANC		SDG/AM/COC/Work Order: 416600	
Received By: STALY BOONE		Date Received: 12/11/18 JR	
Carrier and Tracking Number		Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 5035 4245 5798 - 66 5035 4245 5802 - 66	
Suspected Hazard Information ☐ ☒	☐ ☒	*If Not Counted: 1000cpm or samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
Shipped as a DOT Hazardous?	☒	Hazard Class Shipped: UN311	
COC/Samples marked or classified as radioactive?	☒	Maximum Net Counts Observed* (Observed Counts - Area Background Count): ☒ CPM: 10000 Classified as: Rad 1 Rad 2 Rad 3	
In package, COC, and/or Samples marked ILL27	☒	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Radium Other	
Sample Receipt Criteria		Comments/Qualifiers (Required for Non-Contaminating 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 monitoring Celsius TEMP: 10000	
4 Daily check performed and passed on IR temperature gun?	☒	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, date:	
7 Do any samples require Volatile Analysis?	☒	IF Yes, Are Encaps or Soil Kats present? Yes ___ No ___ (If yes, take no VOA Preserved) 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 sections?	☒		
Comments (Use Optimization Form if needed):			

PM (or PMA) review Initials: **TWC** Date: **12/12/18** Page: **1** of **1**

GL-C14-SR-001 Rev 5

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 #: 466630**

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>
466630001	MW-1
466630002	MW-2
466630003	MW-3
466630004	MW-4
466630005	MW-5
466630006	MW-6
466630007	MW-7
466630008	MW-8
466630009	MW-9
466630010	FB-20181203
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. Samples 1204178240 (MW-8DUP) and 466630008 (MW-8) were recounted due to high relative percent difference/relative error ratio. The recounts are 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>
466630001	MW-1
466630002	MW-2
466630003	MW-3
466630004	MW-4
466630005	MW-5
466630006	MW-6
466630007	MW-7
466630008	MW-8
466630009	MW-9
466630010	FB-20181203
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.

GEL LABORATORIES LLC

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Qualifier Definition Report for

LANC006 Eurofins Lancaster Laboratories

Client SDG: 466630 GEL Work Order: 466630

The Qualifiers in this report are defined as follows:

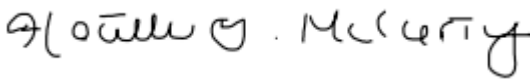
- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

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

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: January 4, 2019

Client Sample ID: MW-1
Sample ID: 466630001
Matrix: Water
Collect Date: 03-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		3.26	+/-1.11	1.33	+/-1.42	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1

Rad Radium-226

Lucas Cell, Ra226, liquid "As Received"

Radium-226	U	0.0651	+/-0.180	0.360	+/-0.181	1.00	pCi/L			PCW	12/23/18	0400	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	83.2	(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

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: 466630002
Matrix: Water
Collect Date: 03-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		2.83	+/-1.20	1.73	+/-1.42	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		2.00	+/-0.475	0.219	+/-0.592	1.00	pCi/L			PCW	12/23/18	0400	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	97.4	(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	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: January 4, 2019

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-3
Sample ID: 466630003
Matrix: Water
Collect Date: 03-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	0.188	+/-0.606	1.13	+/-0.608	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	0.031	+/-0.161	0.343	+/-0.161	1.00	pCi/L			PCW	12/23/18	0400	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	93.8	(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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Lancaster, Pennsylvania 17601-5994

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Report Date: January 4, 2019

Client Sample ID: MW-4
Sample ID: 466630004
Matrix: Water
Collect Date: 03-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	-0.394	+/-0.942	1.82	+/-0.942	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.459	+/-0.302	0.404	+/-0.309	1.00	pCi/L			PCW	12/23/18	0400	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	91.3	(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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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-5
Sample ID: 466630005
Matrix: Water
Collect Date: 04-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	0.641	+/-0.607	0.979	+/-0.631	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	0.293	+/-0.321	0.527	+/-0.325	1.00	pCi/L			PCW	12/23/18	0400	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	100	(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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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: 466630006
Matrix: Water
Collect Date: 04-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		1.49	+/-0.874	1.30	+/-0.964	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	0.0586	+/-0.141	0.281	+/-0.141	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	97.1	(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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Company : Eurofins Lancaster Laboratories
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Lancaster, Pennsylvania 17601-5994

Report Date: January 4, 2019

Contact: Ms. Hannah Cottman

Project: NJ Radiochemistry Analyses

Client Sample ID: MW-7
Sample ID: 466630007
Matrix: Water
Collect Date: 04-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		2.91	+/-1.08	1.36	+/-1.34	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.592	+/-0.316	0.363	+/-0.346	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	83.8	(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

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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-8
Sample ID: 466630008
Matrix: Water
Collect Date: 04-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	0.530	+/-0.916	1.61	+/-0.928	3.00	pCi/L			JXC9	12/27/18	1337	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		2.06	+/-0.576	0.309	+/-0.659	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	96.6	(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	

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: January 4, 2019

Client Sample ID: MW-9
Sample ID: 466630009
Matrix: Water
Collect Date: 04-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	-0.667	+/-0.632	1.40	+/-0.632	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	-0.069	+/-0.166	0.425	+/-0.166	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	93.8	(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	

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: January 4, 2019

Client Sample ID: FB-20181203

Sample ID: 466630010

Matrix: Water

Collect Date: 03-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	-0.327	+/-0.516	1.12	+/-0.516	3.00	pCi/L			JXC9	12/27/18	1139	1830755	1
Rad Radium-226														
<i>Lucas Cell, Ra226, liquid "As Received"</i>														
Radium-226		0.427	+/-0.249	0.251	+/-0.269	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	95.4	(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

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

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Client : Eurofins Lancaster Laboratories
2425 New Holland Pike

Lancaster, Pennsylvania

Contact: Ms. Hannah Cottman

Workorder: 466630

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: 466630

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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 Ostons 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	

RA1830755r1.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 : 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.	Count	Tracer Samp.	Count	Tracer	Tracer	
Pos.	ID	Aliquot	StDev.	Sample	Activity	Uncertainty	Activity	Uncertainty	Aliquot	Aliquot	
		L	L	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 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	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

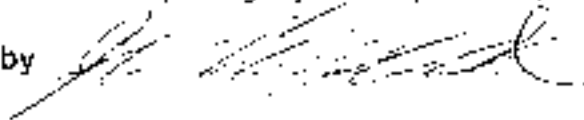
Short Name	Status	Paramname	Run Time	Count Time	CPM or dec	Low Limit	High Limit	Stdev
LB4100B2	Above	Alpha bkg	27-Dec 10:59	60	0.357	-4.24E-2	0.357	+3.24
LB4100B2	Below	Alpha eff	27-Dec 09:21	5	7948	8093	10940	-3.28
LB4100B2	need 2nd	Alpha XTalk	27-Dec 09:21	5	0.289	0.207	0.293	+2.78
LB4100C1	need 2nd	Beta bkg	27-Dec 07:16	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	0.489	0.318	0.505	+2.80
LB4100G1	Above	Beta bkg	27-Dec 07:15	60	2.150	0.338	1.748	+4.71
LB4100I4	Above	Beta bkg	27-Dec 07:16	60	2.767	0.363	1.365	+1.39
LB4100J2	Above	Alpha bkg	27-Dec 07:16	60	0.363	-6.70E-2	0.379	+3.06
LB4100J4	Above	Alpha bkg	27-Dec 10:20	60	0.367	-4.35E-2	0.401	+2.54
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	52480	51390	55150	-1.25
PIC4C	Above	Alpha bkg	27-Dec 10:09	60	0.383	-7.27E-2	0.383	+3.00
PIC6B	Above	Alpha bkg	27-Dec 10:36	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
PIC73C	Alpha bkg, Alpha eff, Alpha XTalk, Beta bkg, Beta eff, Beta XTalk

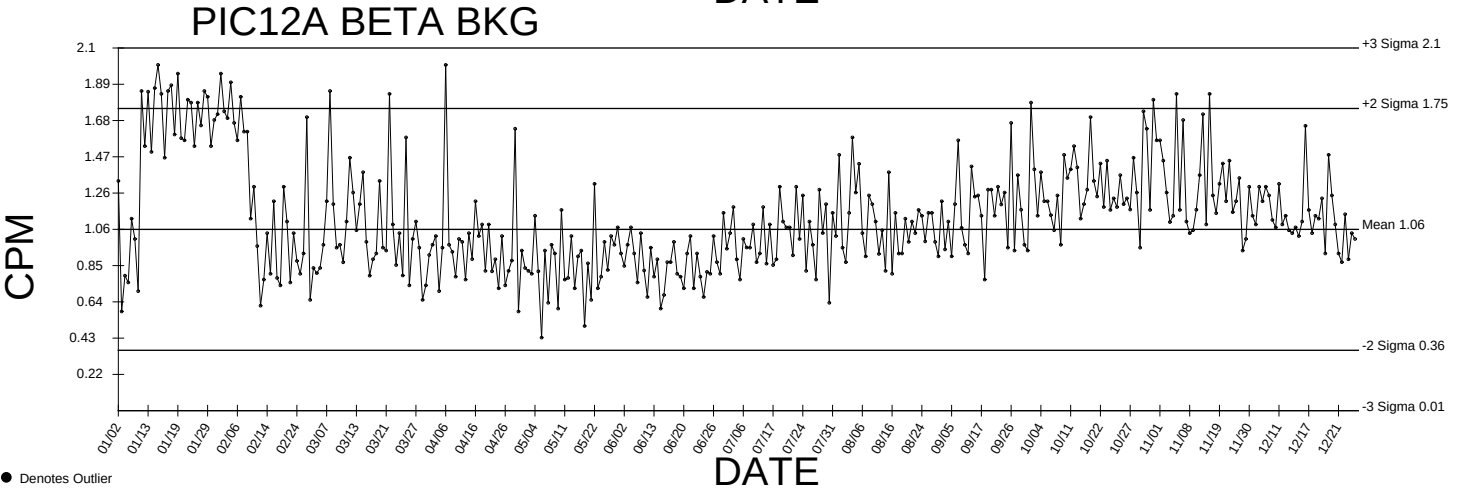
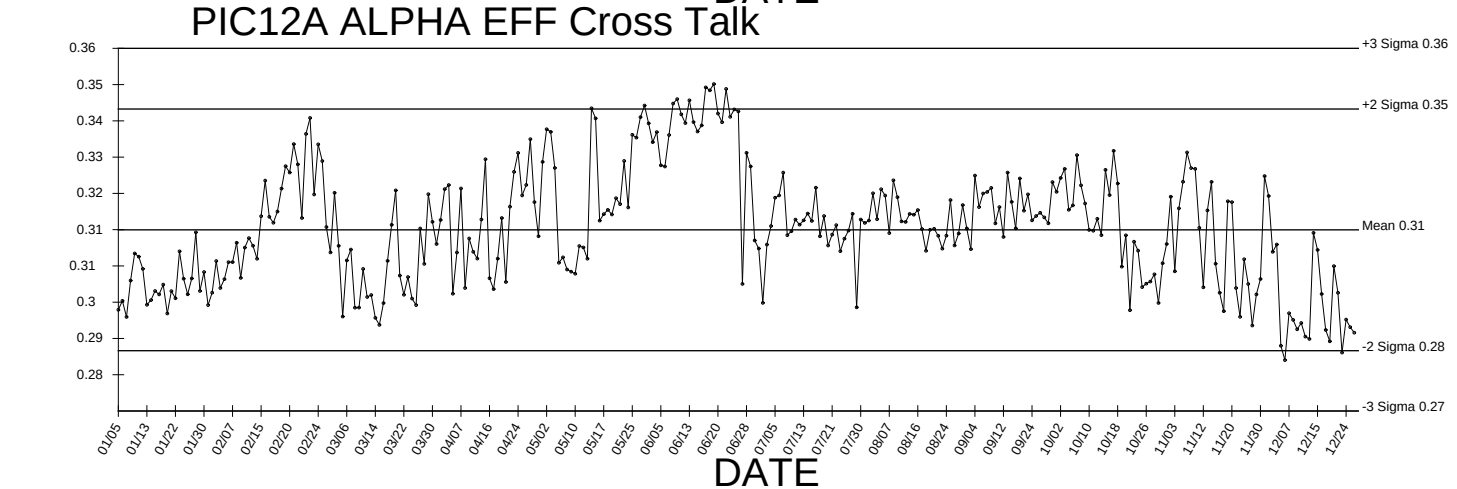
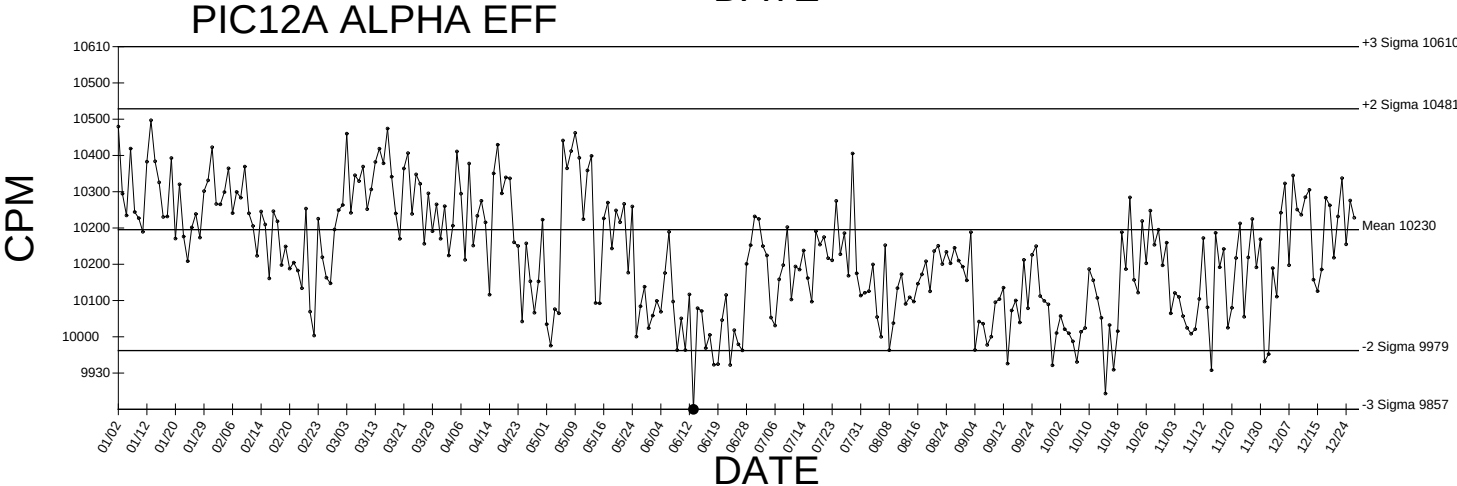
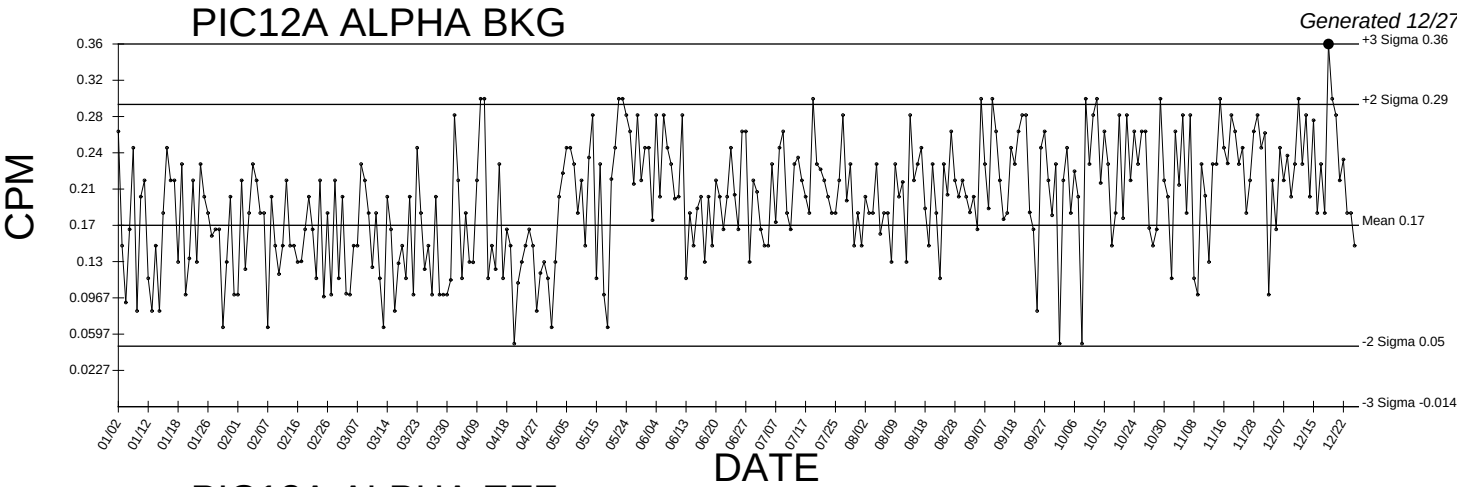
Reviewed by



Date 12/6/18

GEL Laboratories LLC

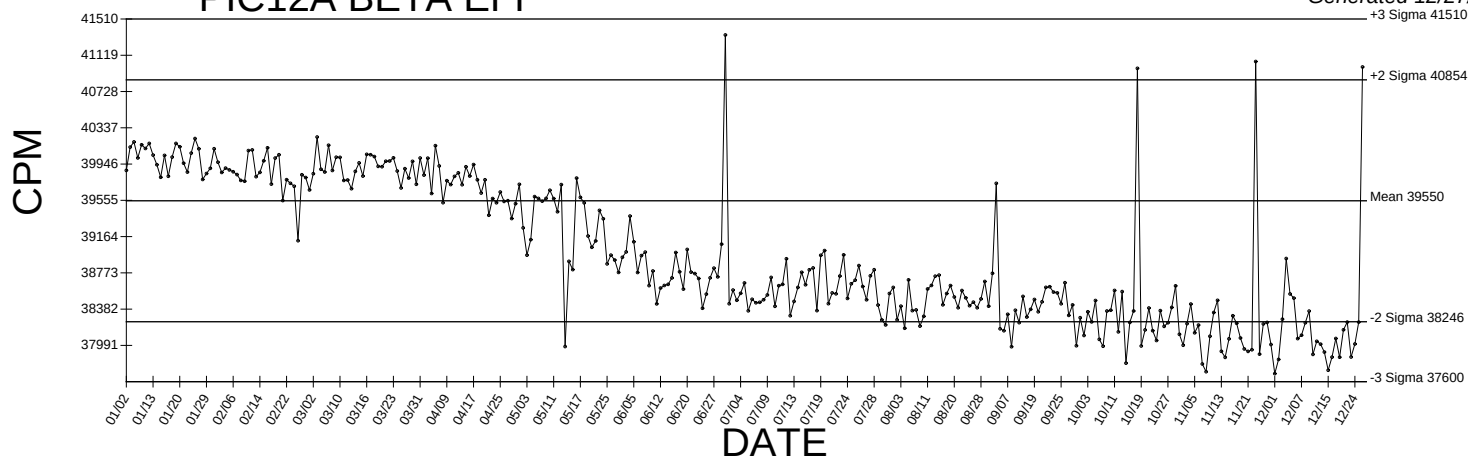
Background and Efficiency Data



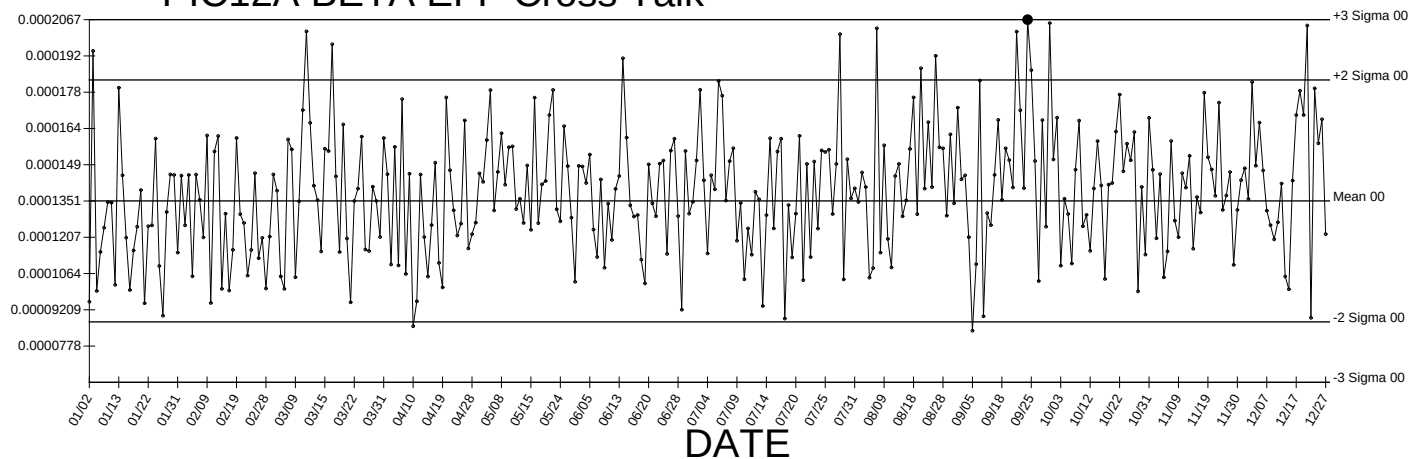
● Denotes Outlier

PIC12A BETA EFF

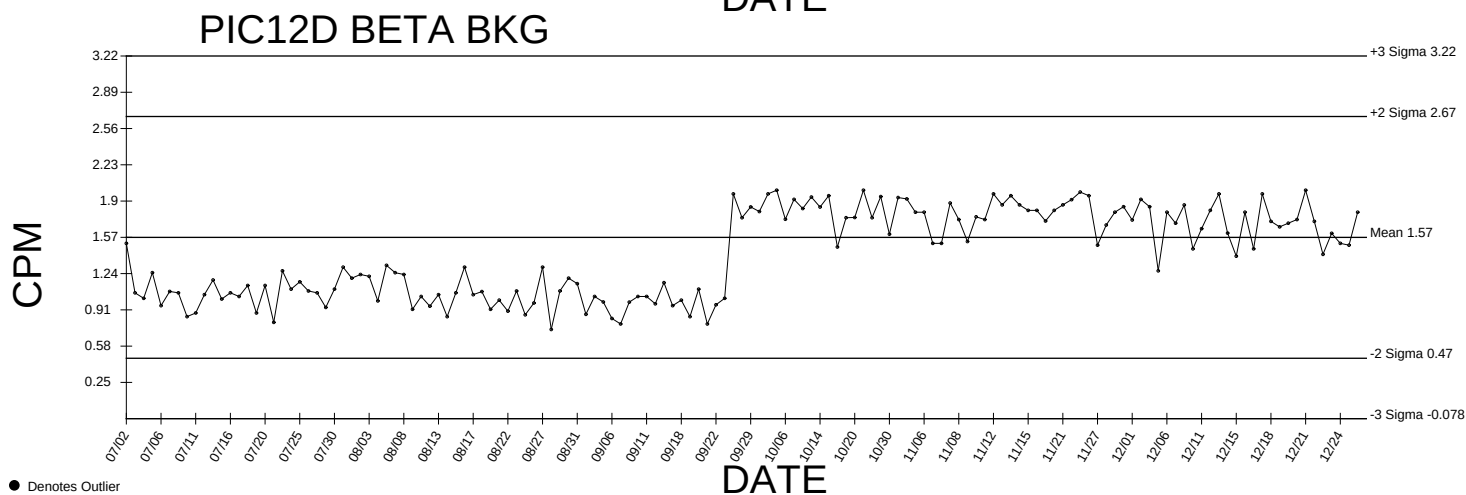
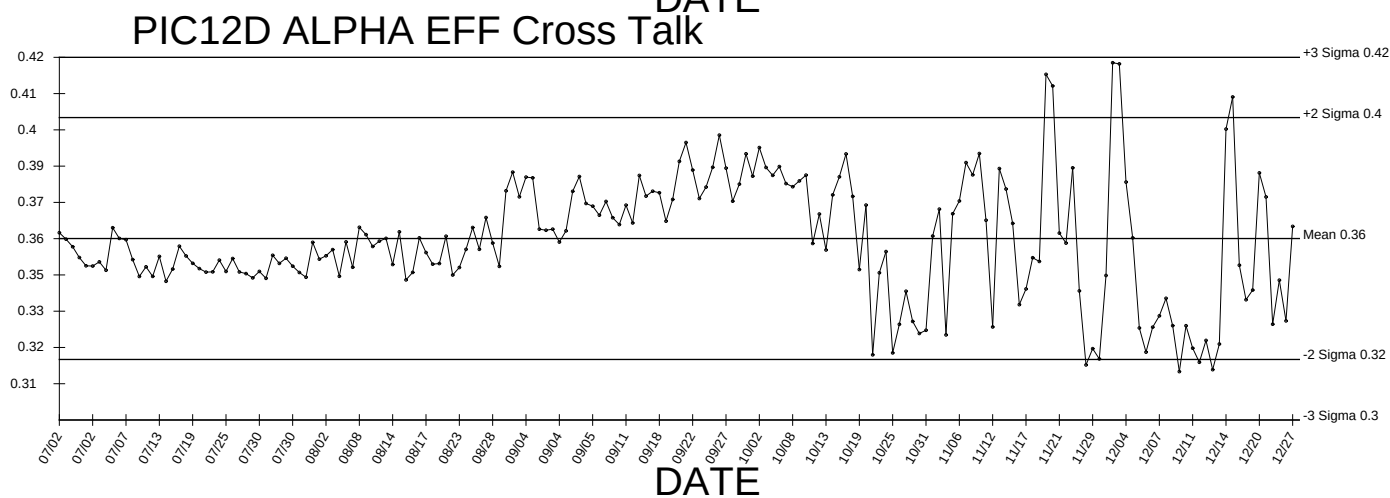
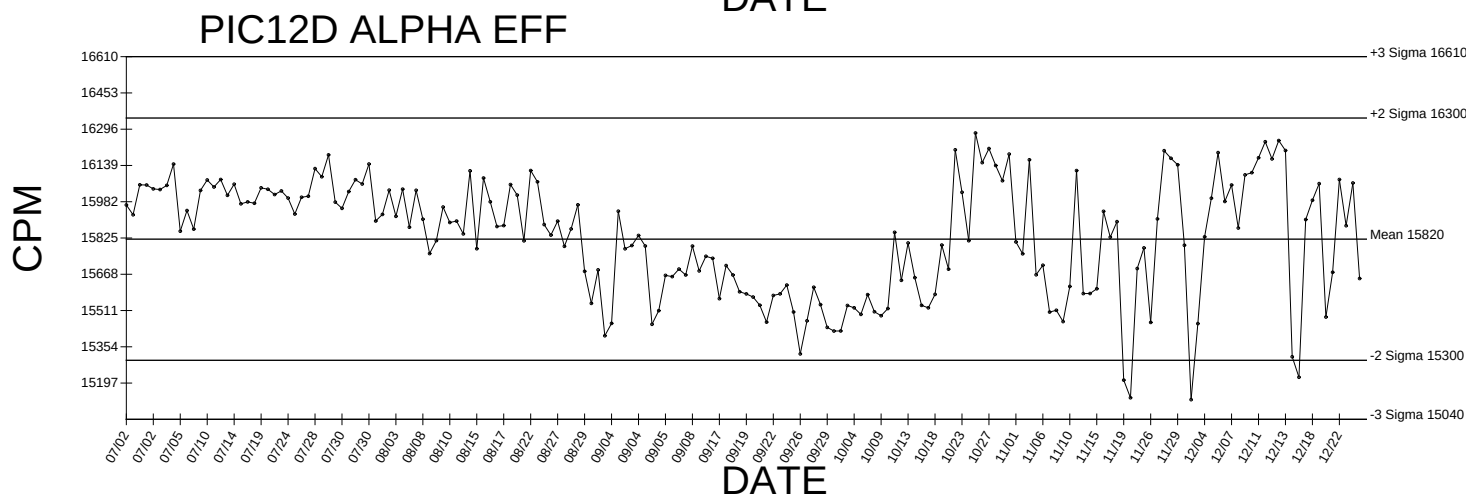
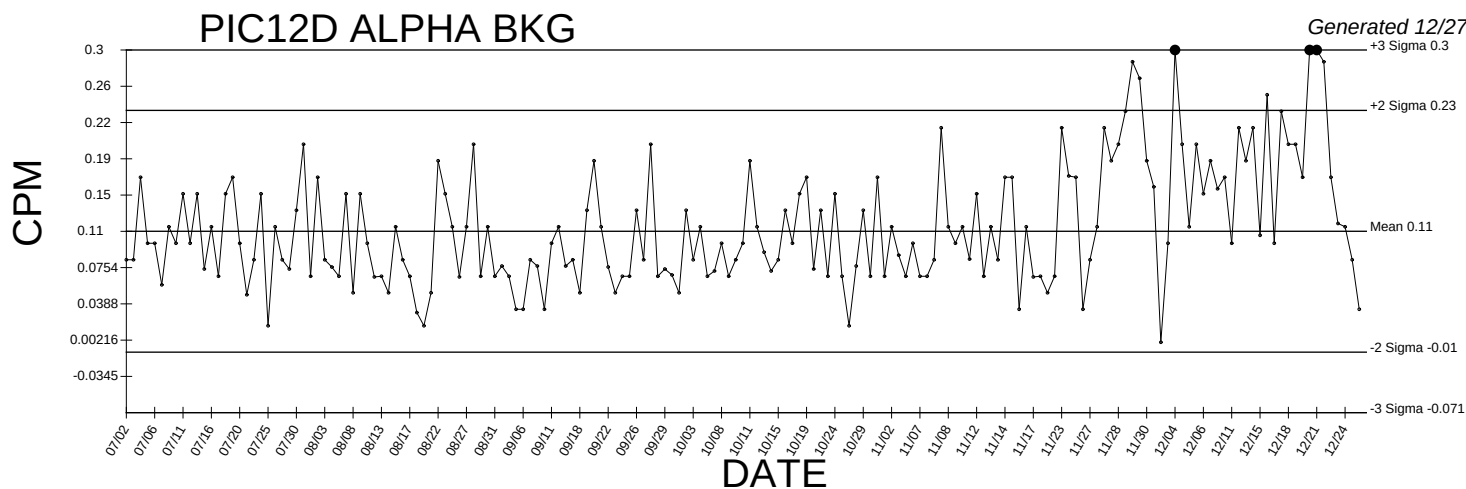
Generated 12/27/2018
+3 Sigma 41510



PIC12A BETA EFF Cross Talk



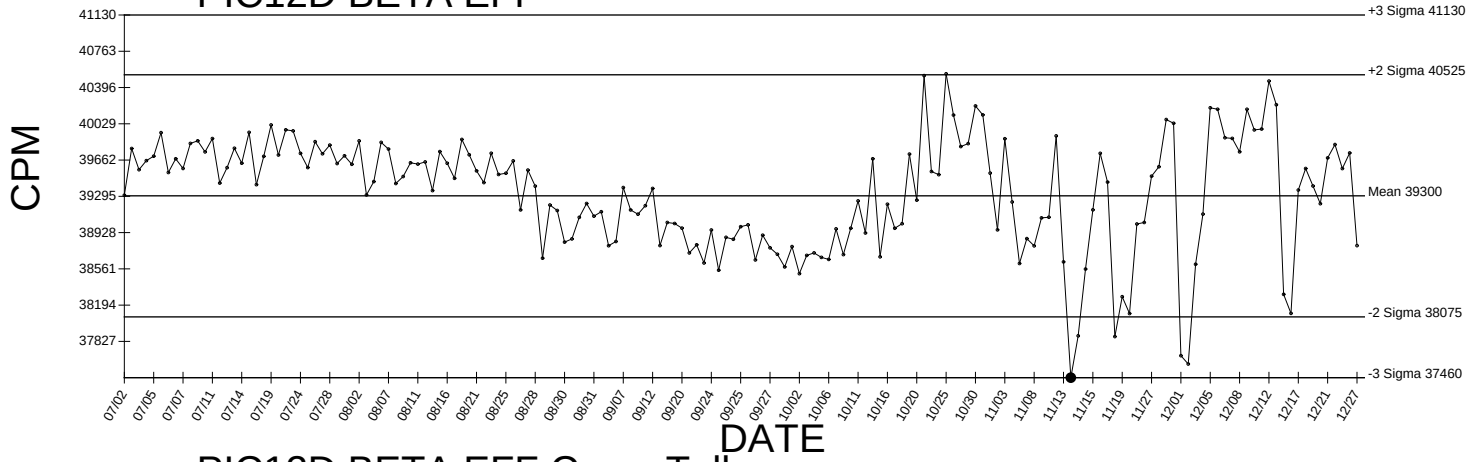
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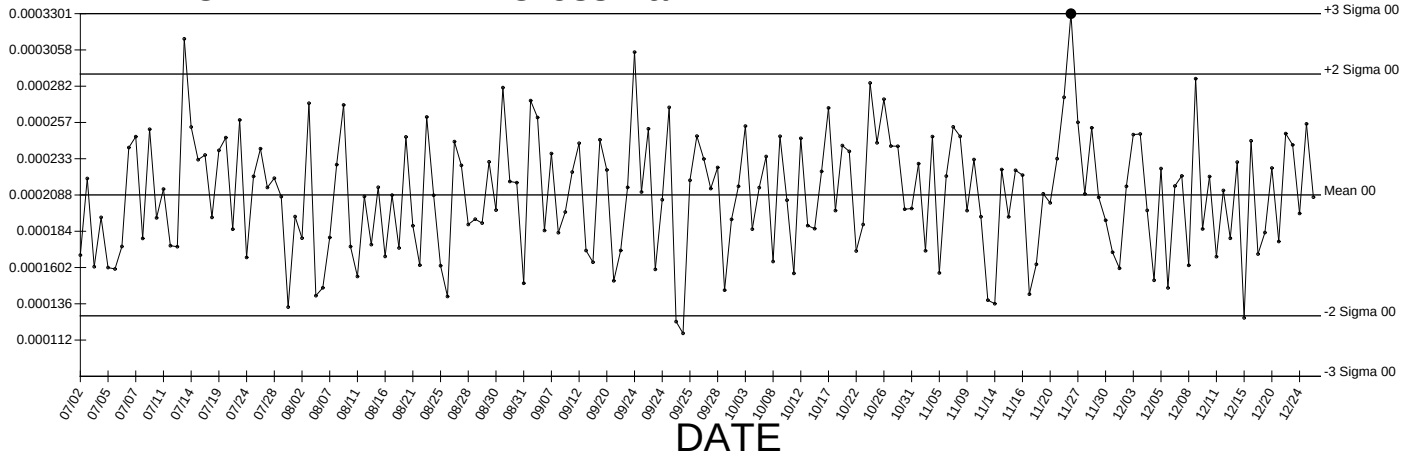
● Denotes Outlier

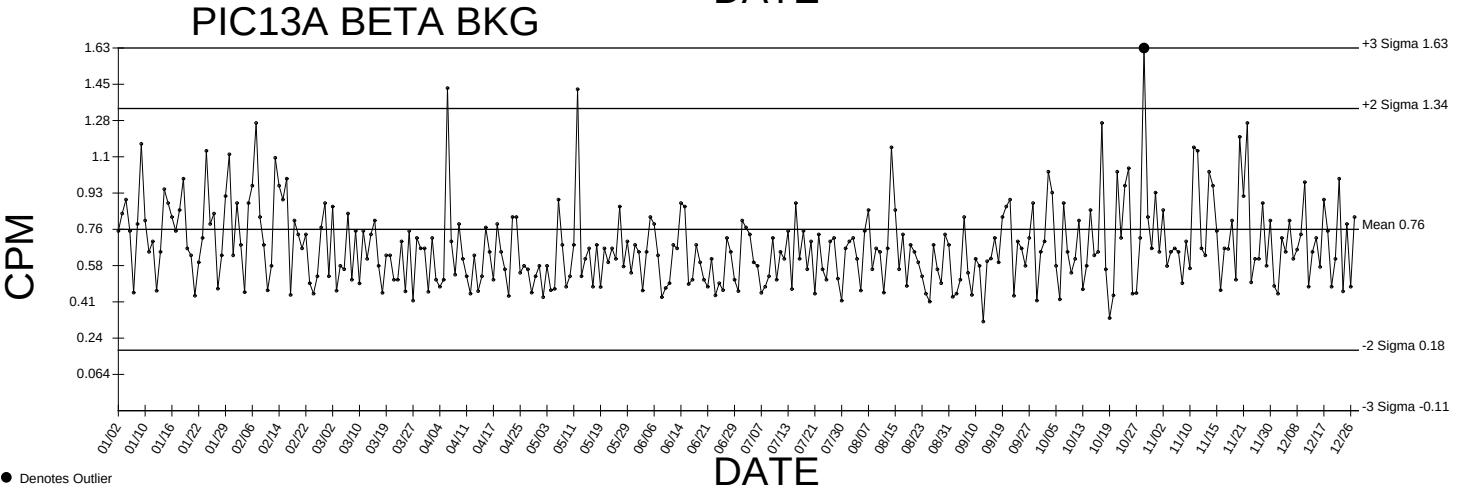
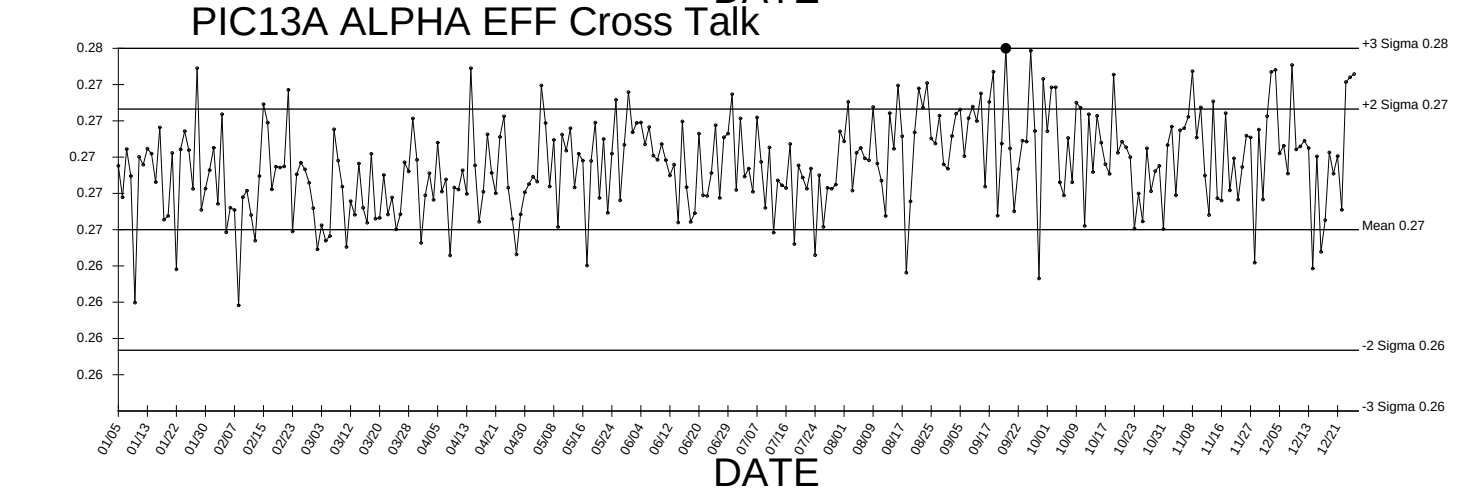
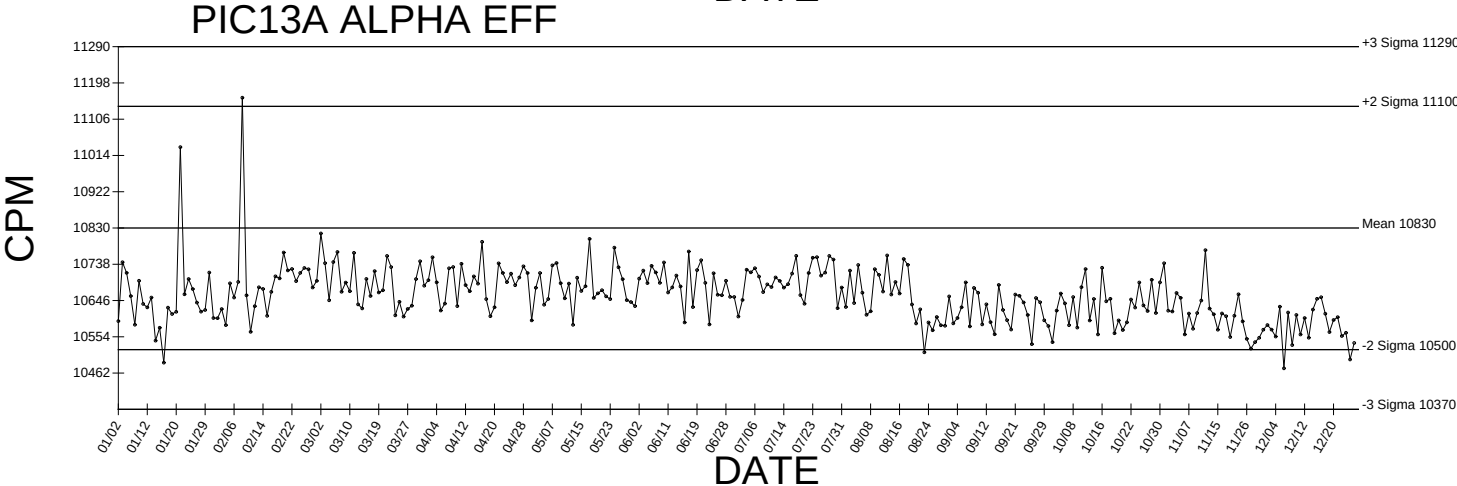
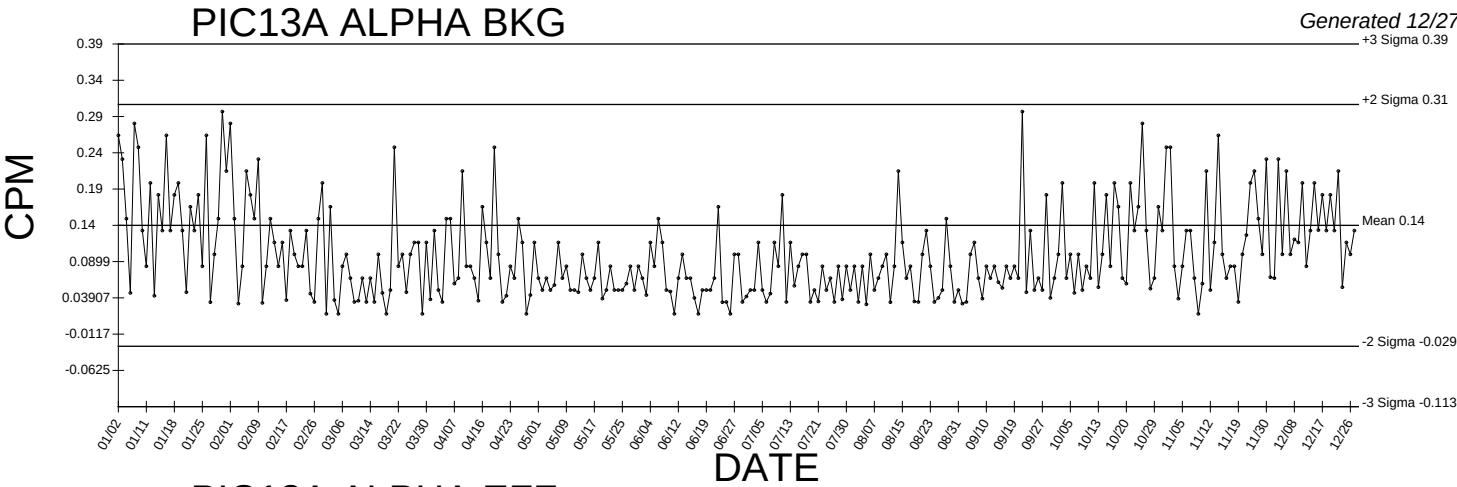
PIC12D BETA EFF

Generated 12/27/2018
+3 Sigma 41130

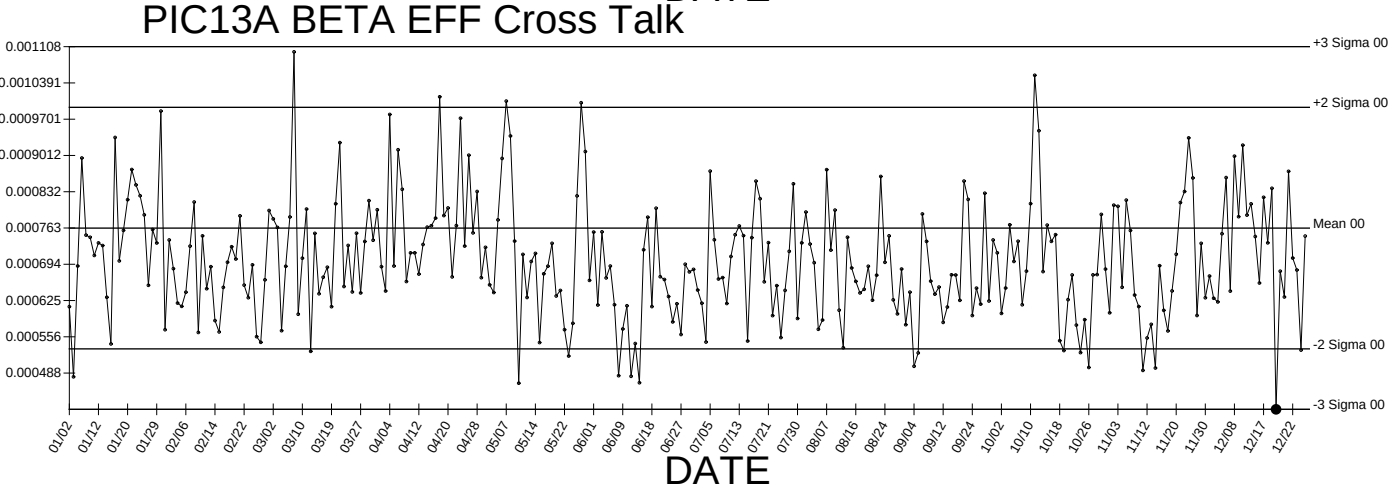
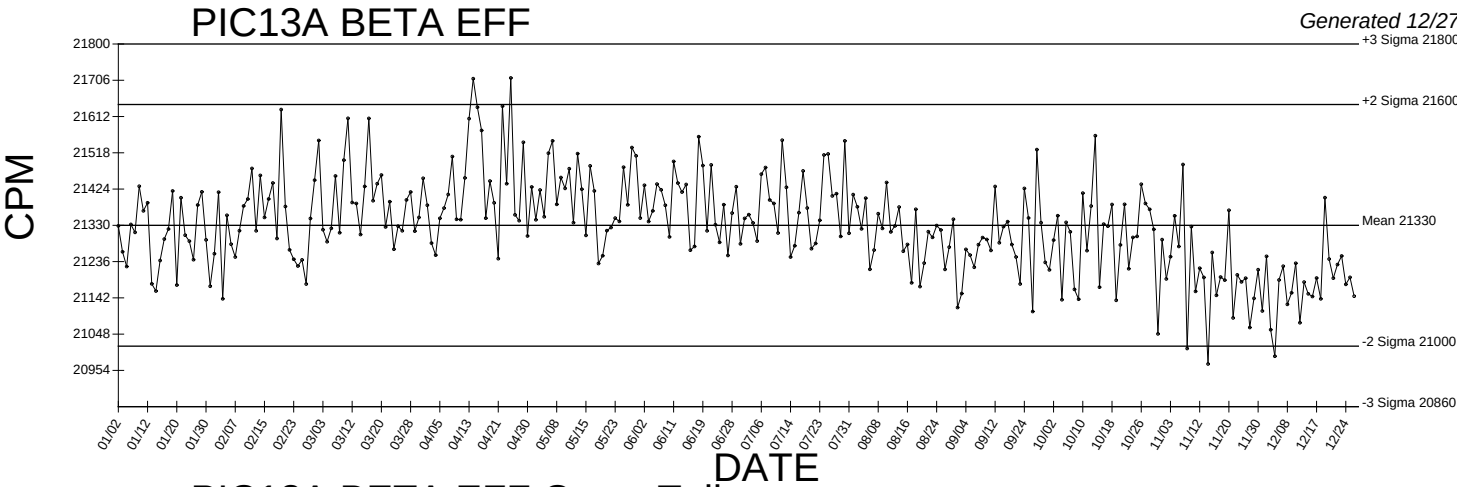


PIC12D BETA EFF Cross Talk

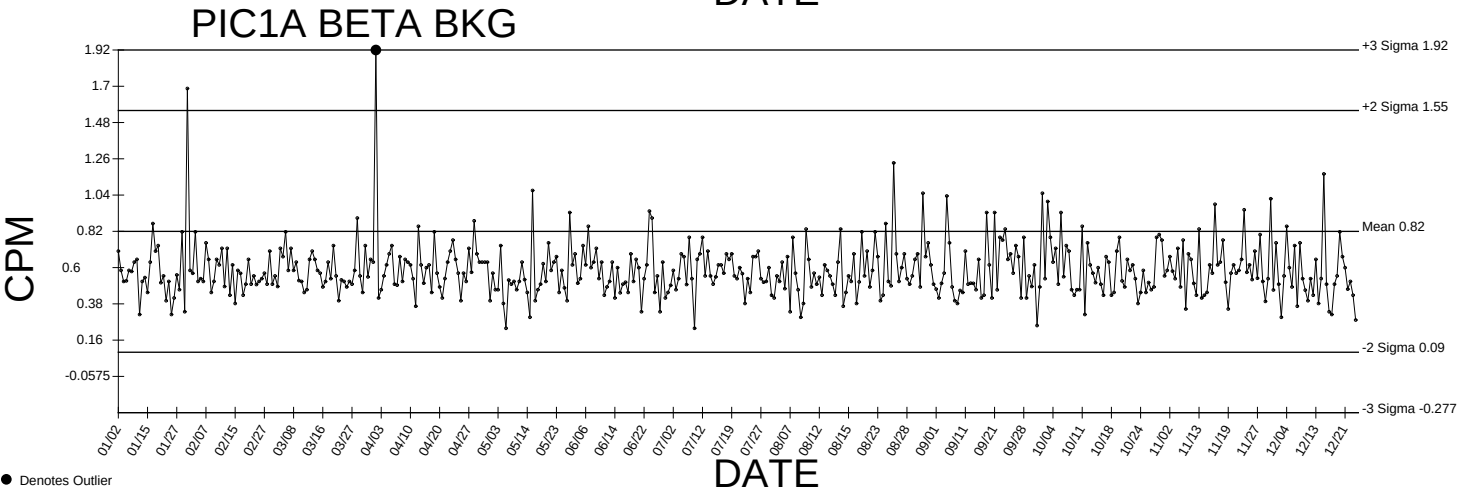
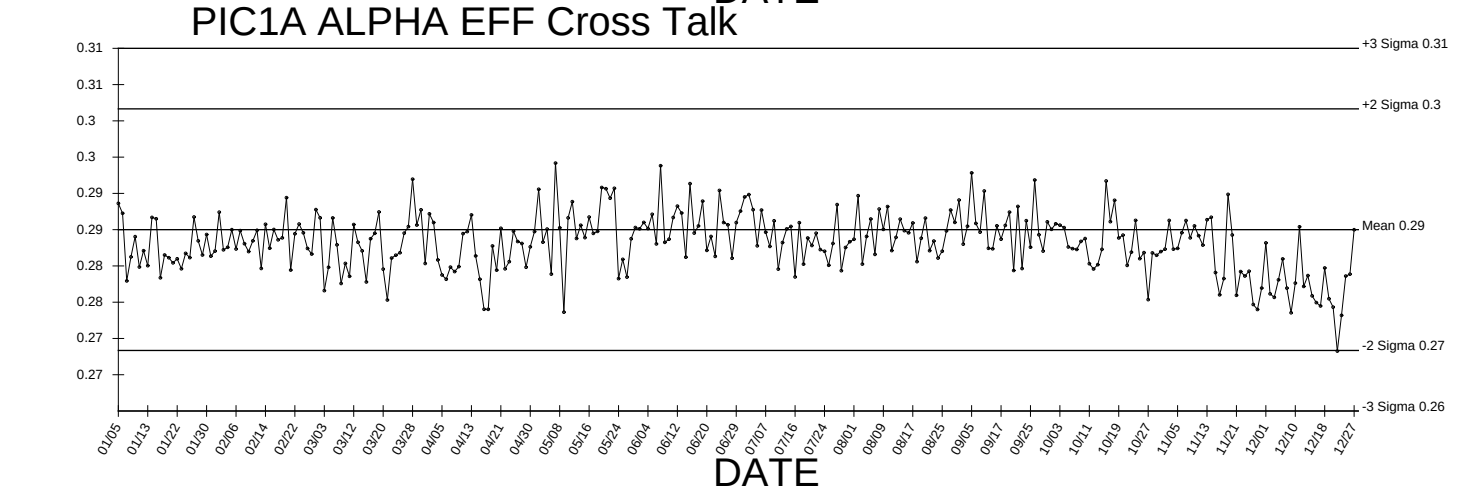
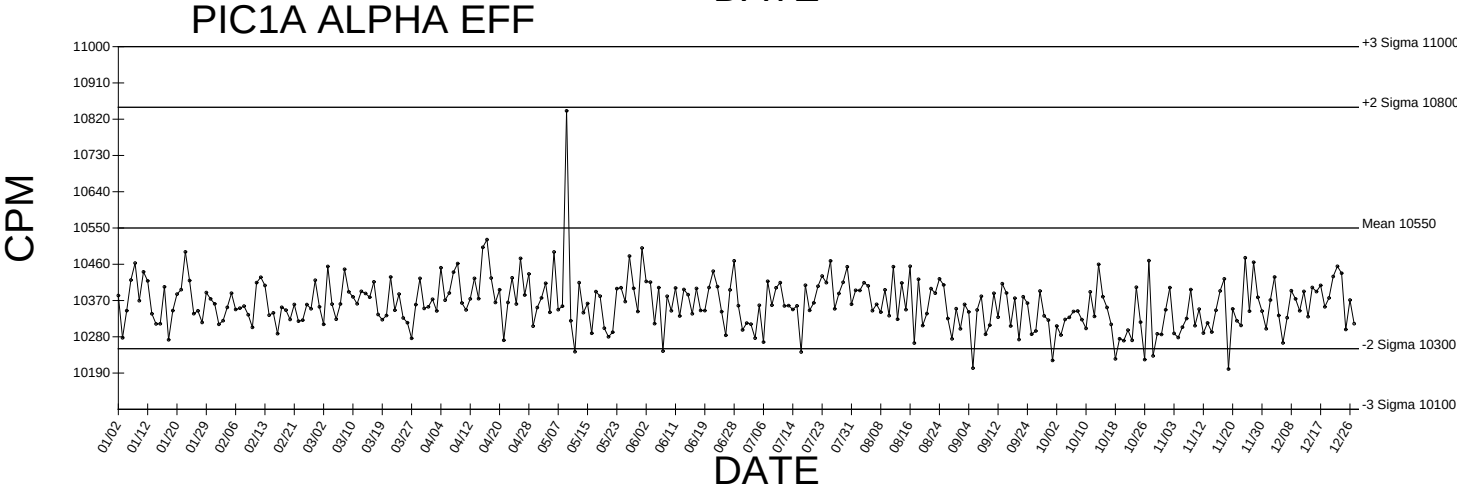
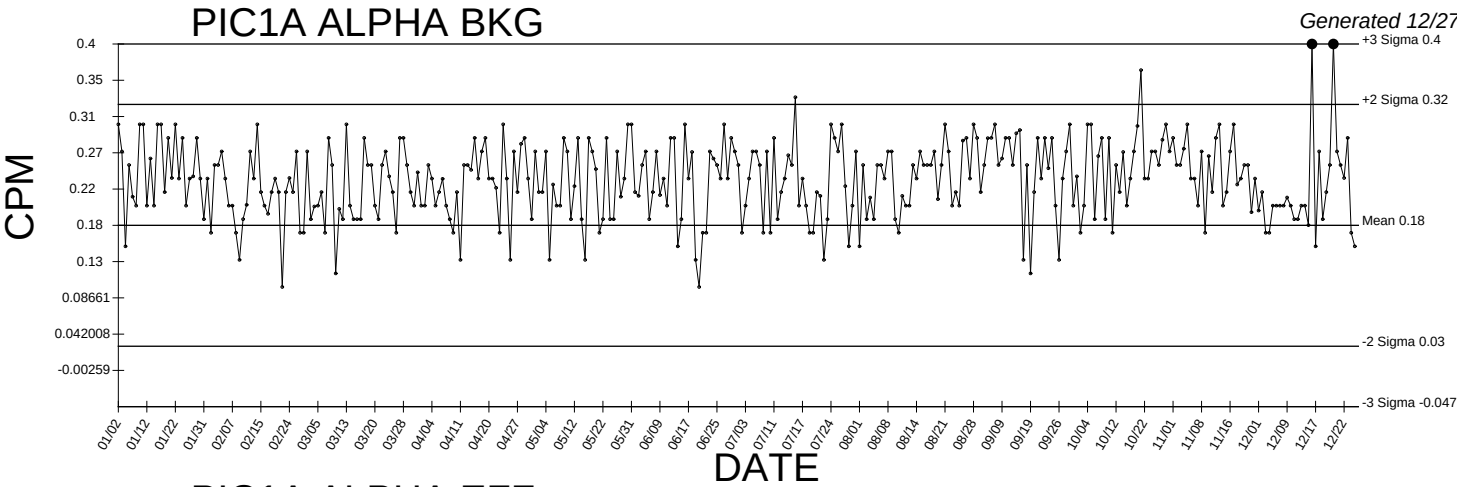




● Denotes Outlier



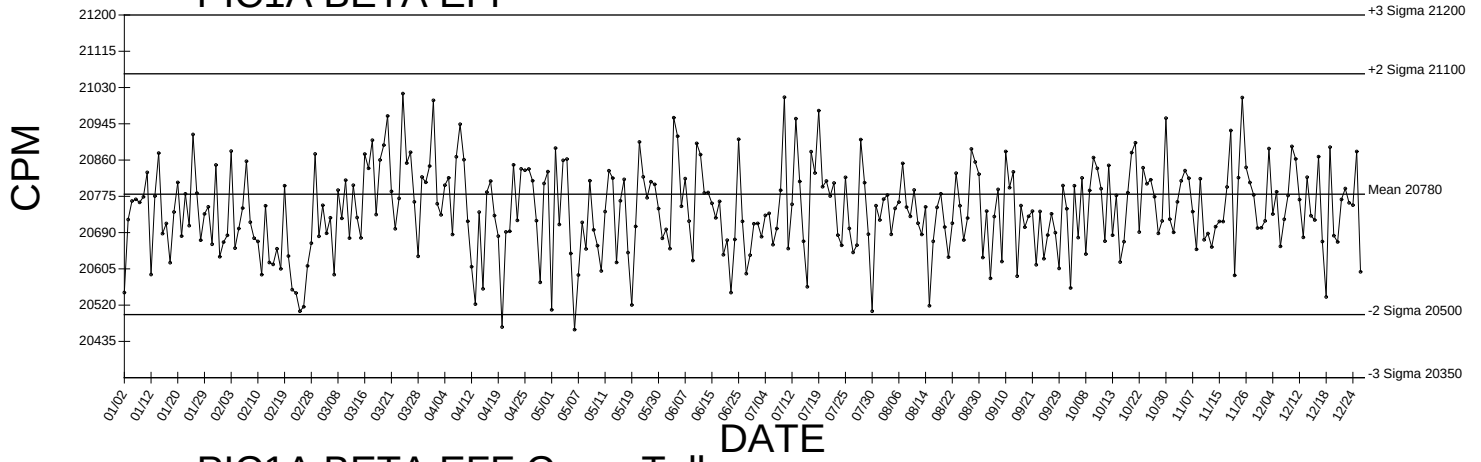
● Denotes Outlier



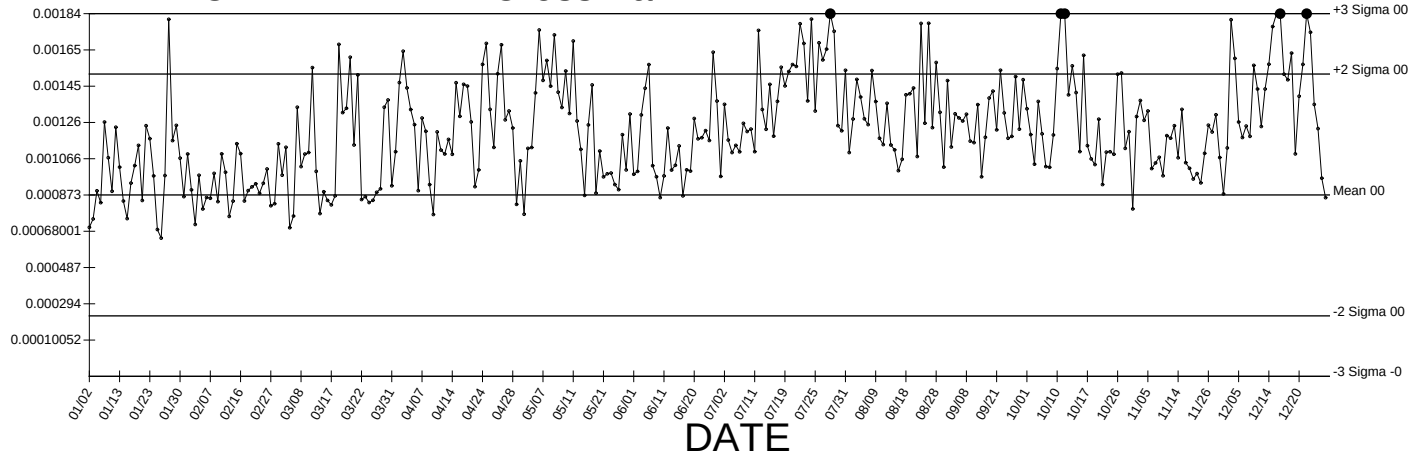
● Denotes Outlier

PIC1A BETA EFF

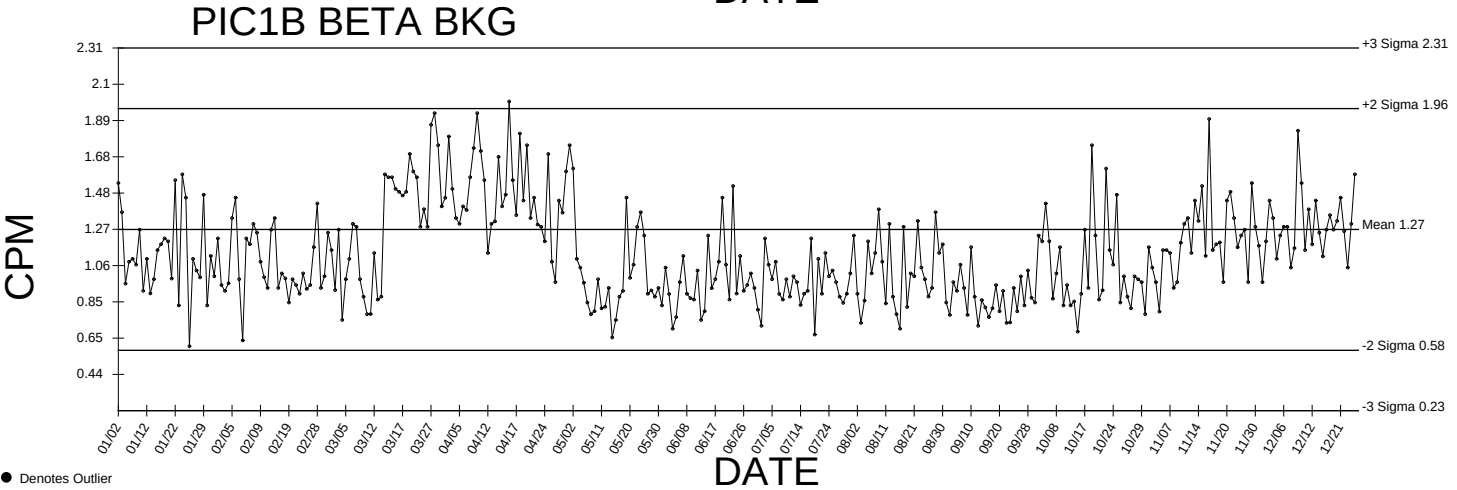
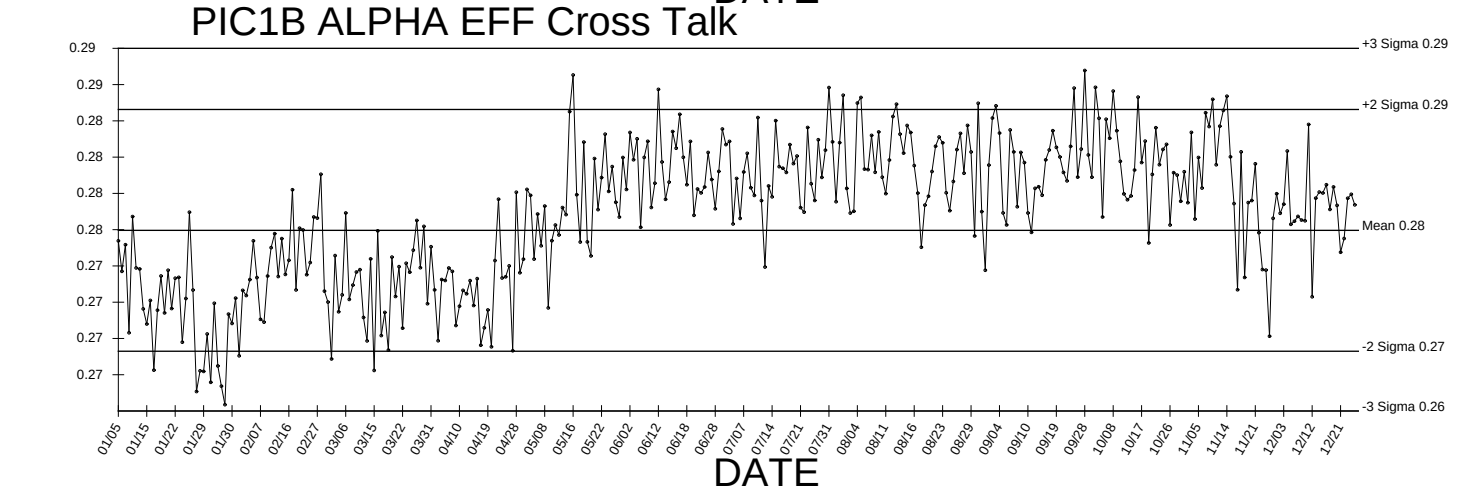
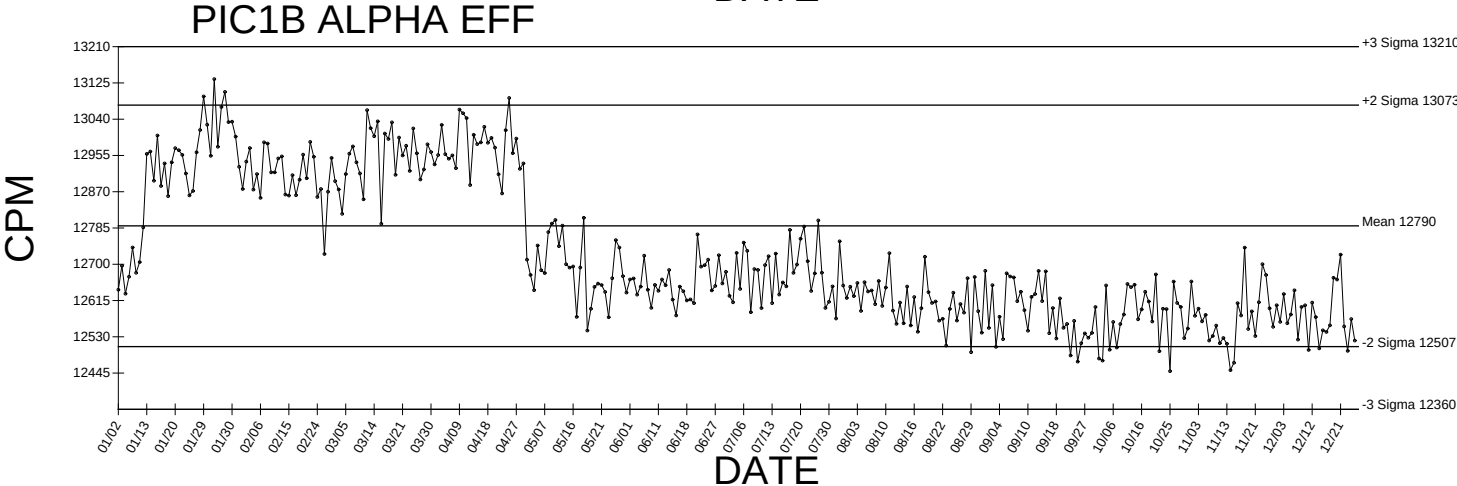
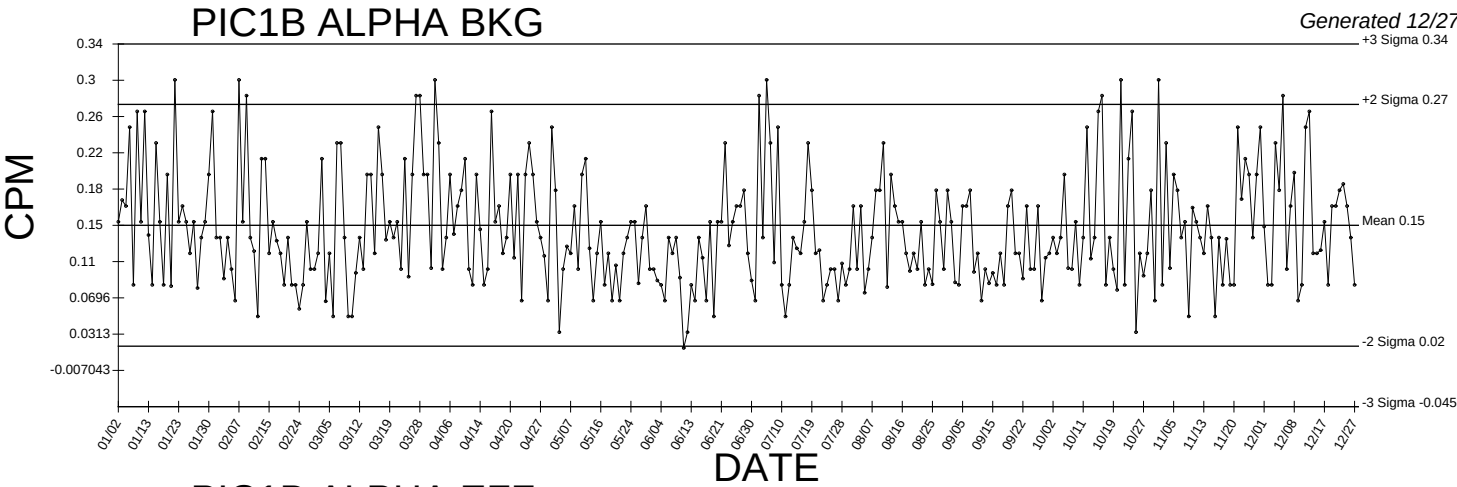
Generated 12/27/2018



PIC1A BETA EFF Cross Talk



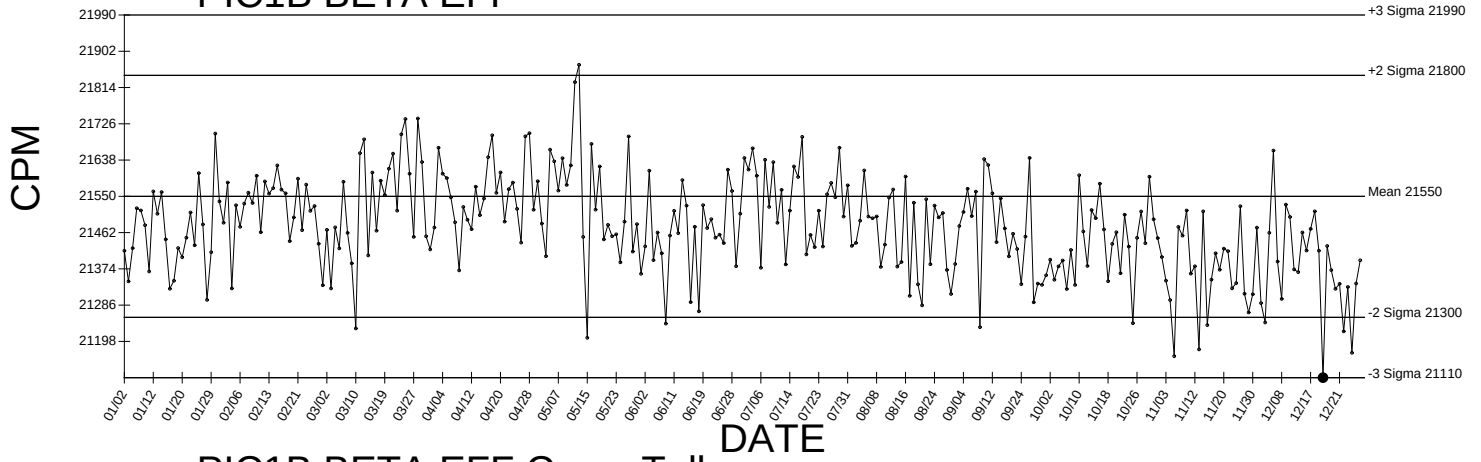
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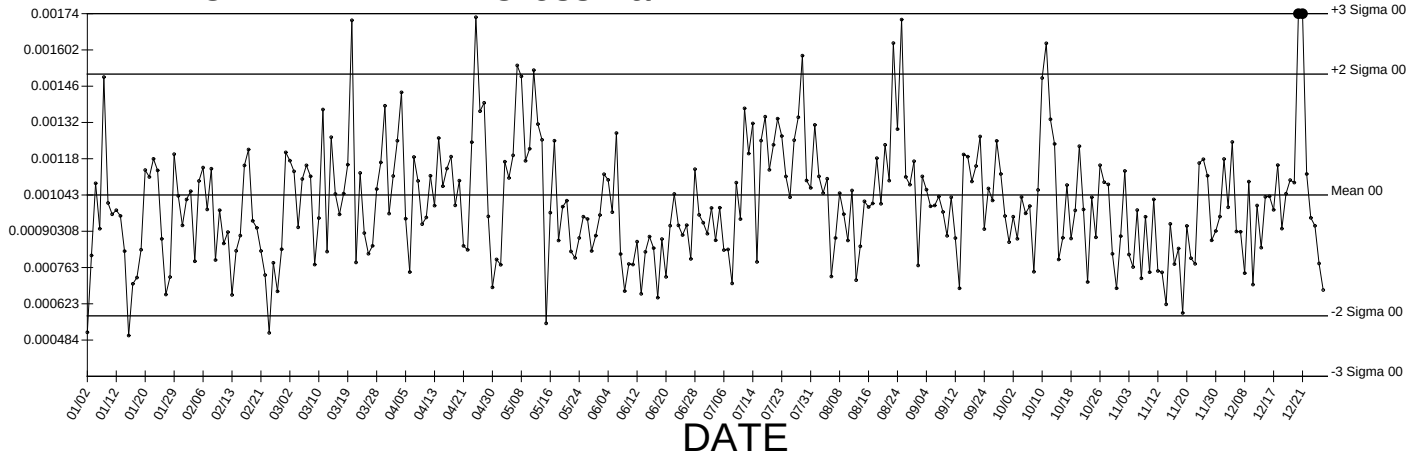
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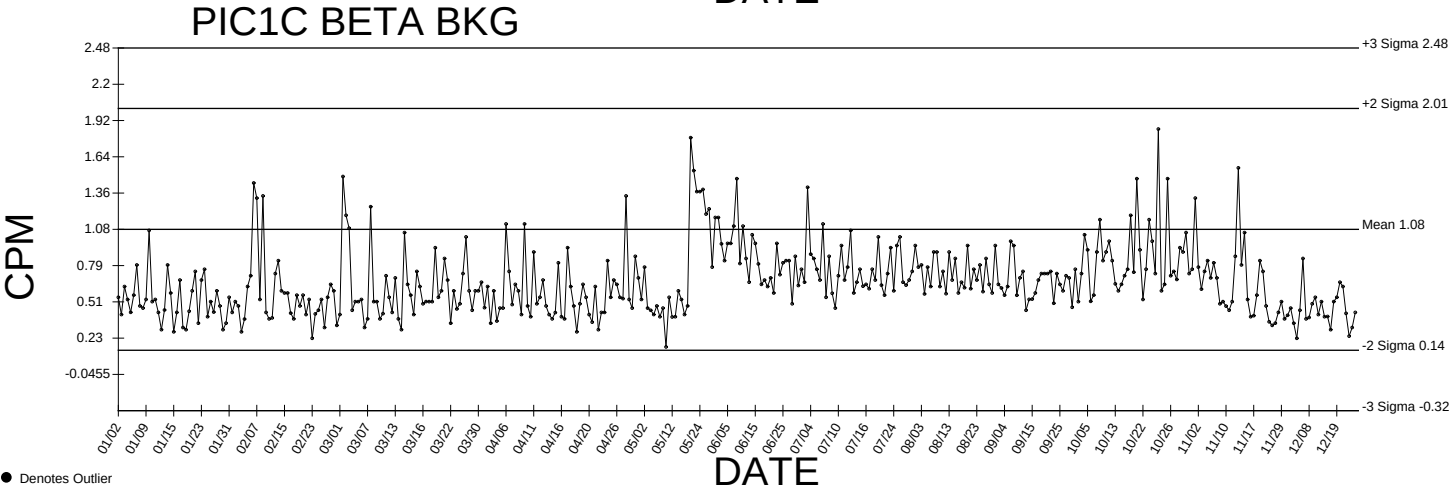
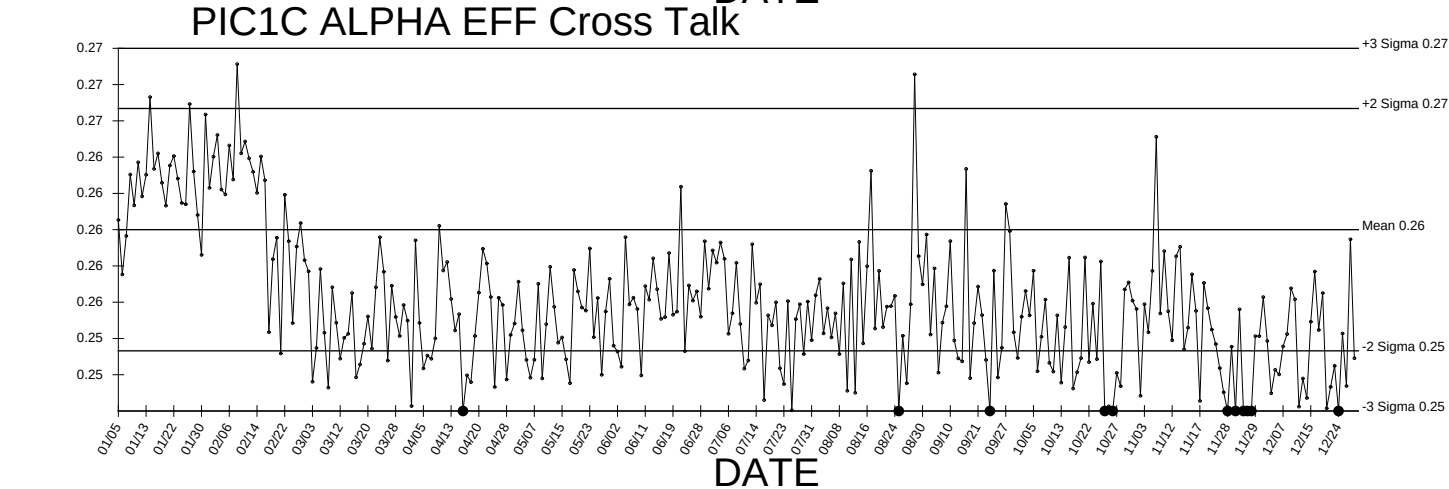
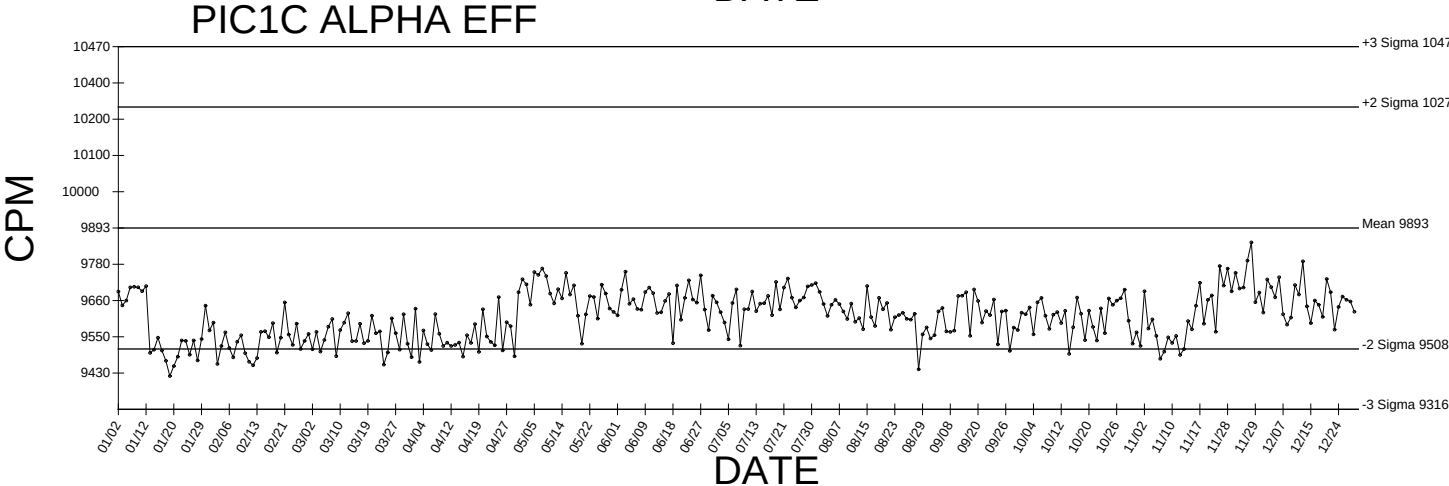
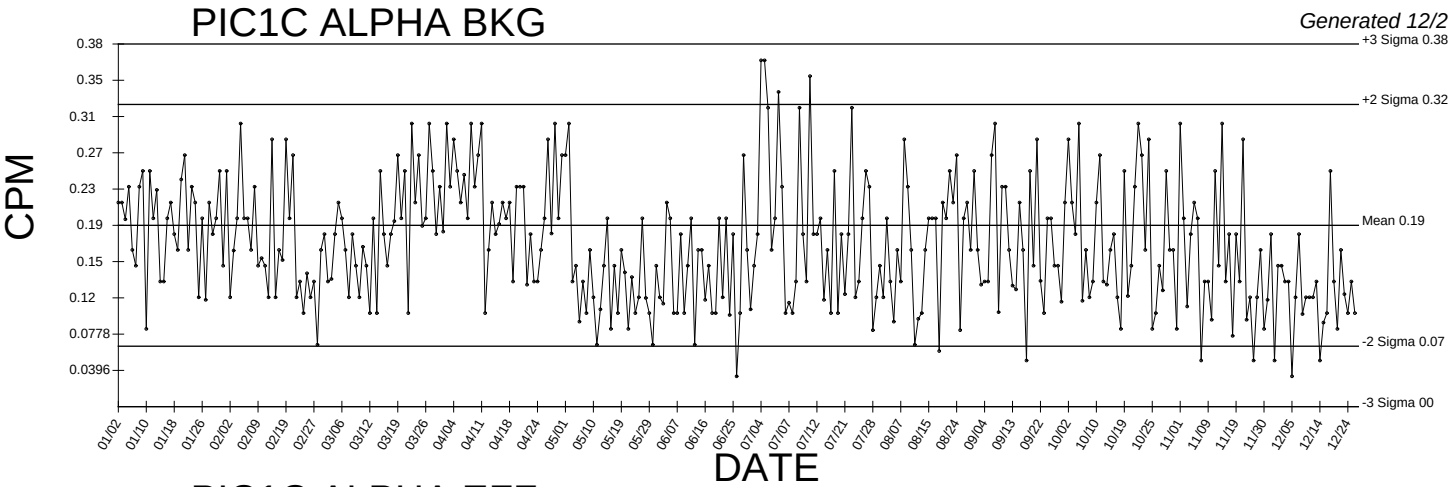
PIC1B BETA EFF

Generated 12/27/2018
+3 Sigma 21990



PIC1B BETA EFF Cross Talk

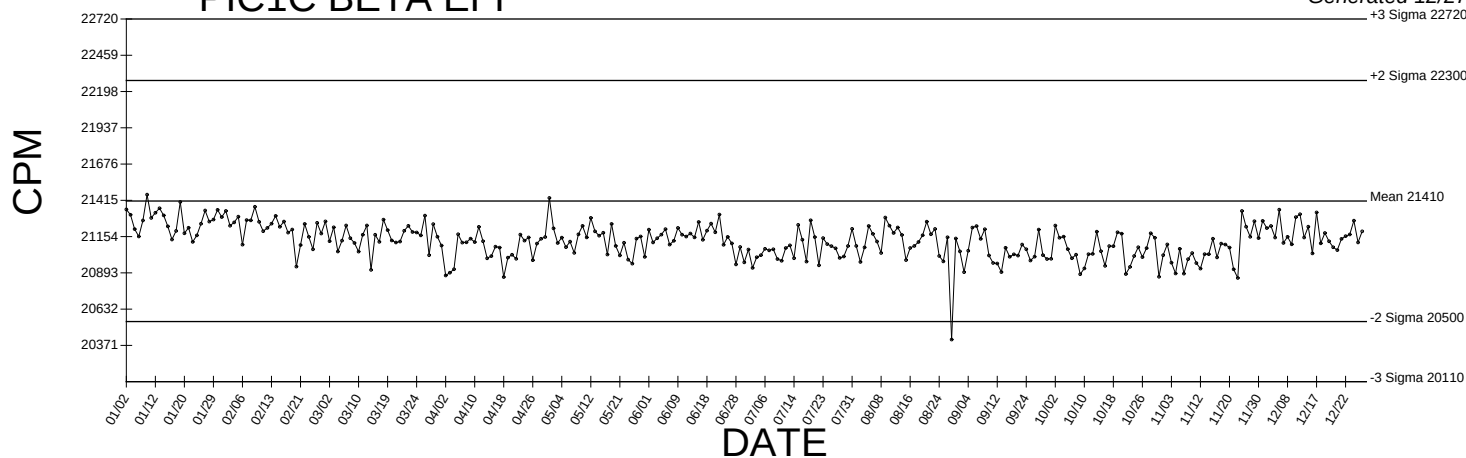




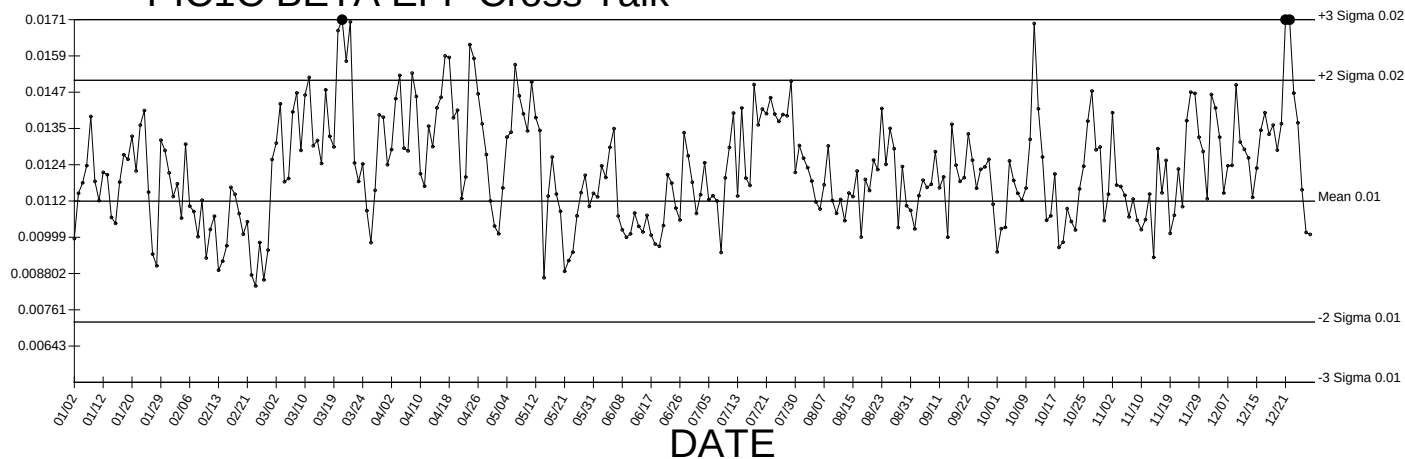
● Denotes Outlier

PIC1C BETA EFF

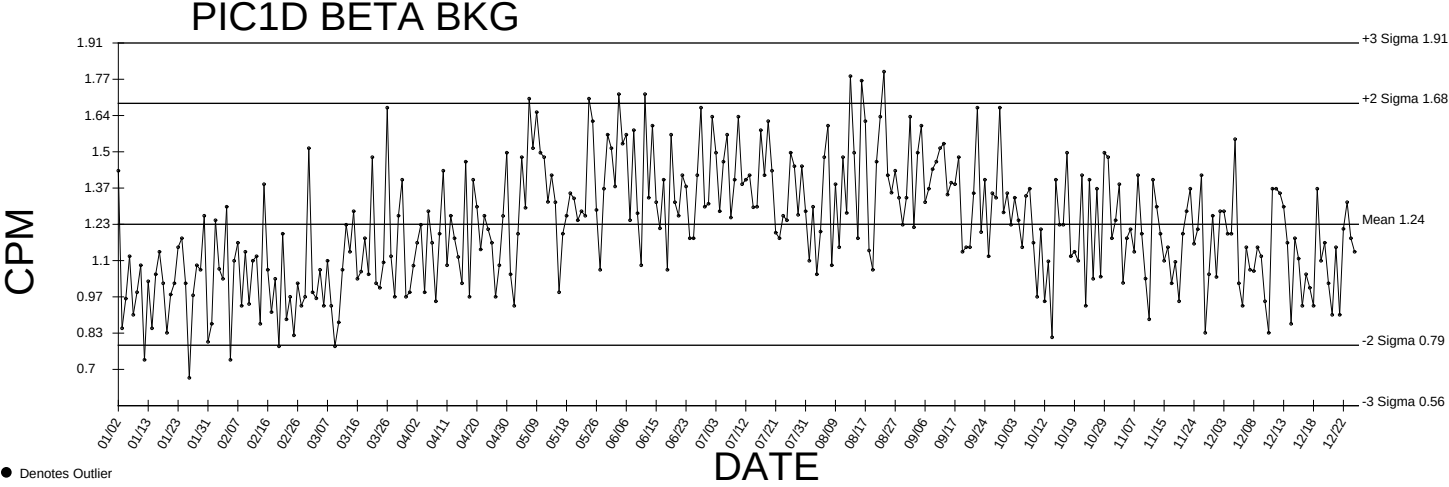
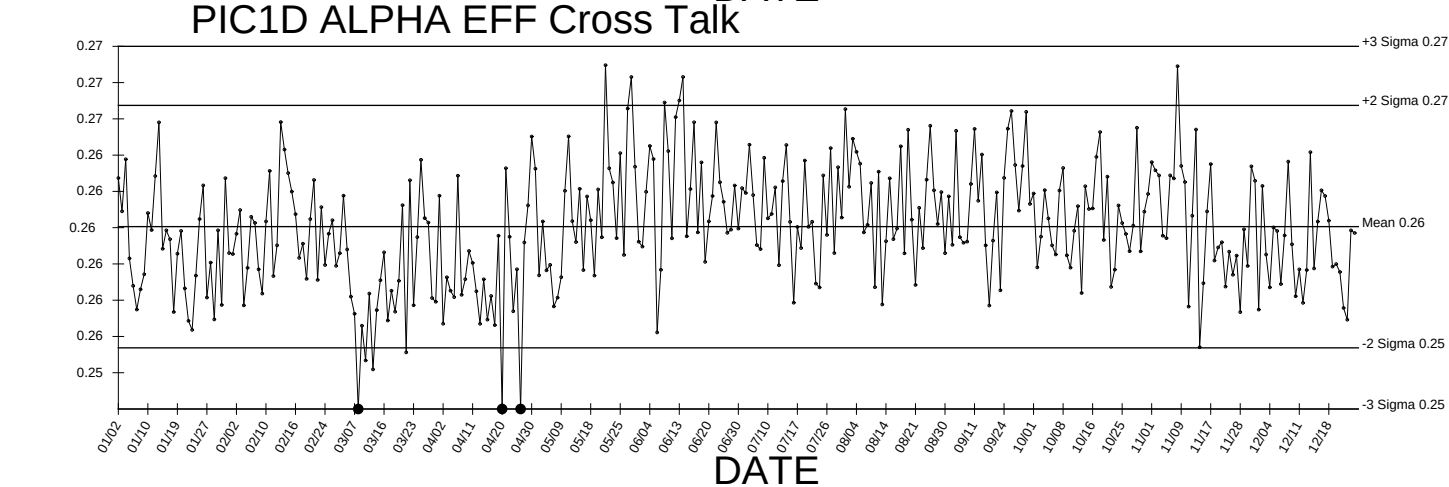
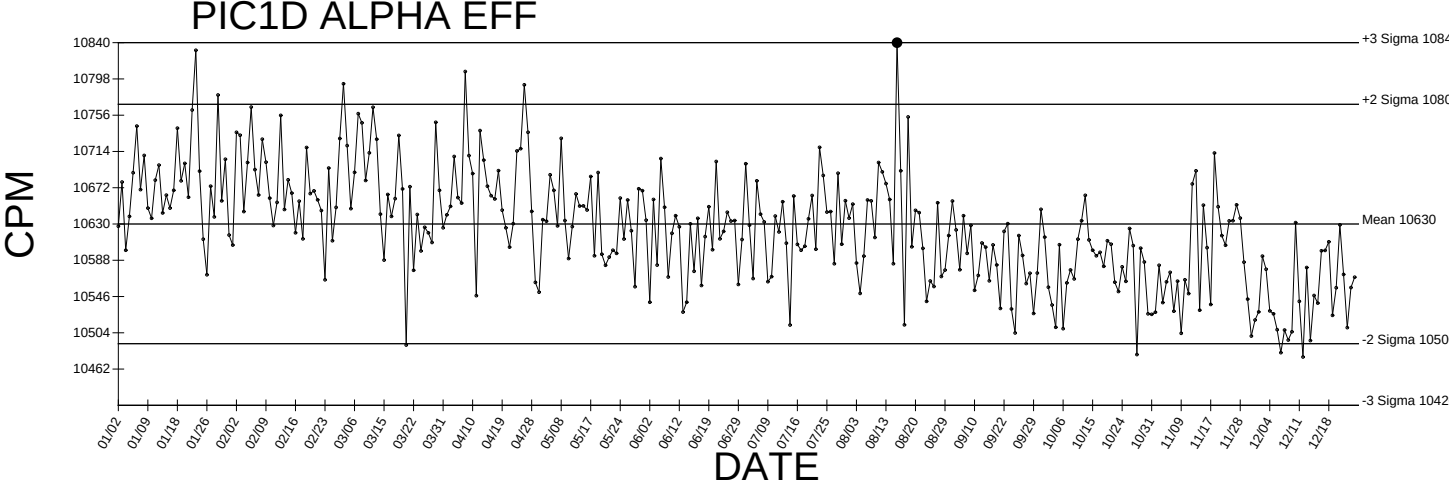
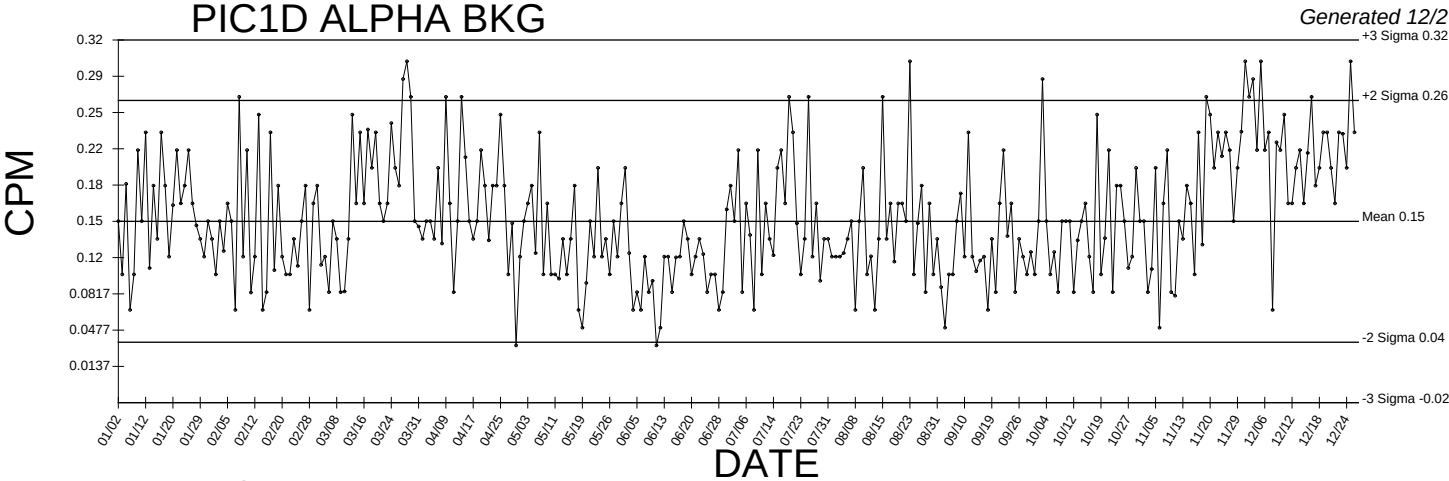
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PIC1C BETA EFF Cross Talk



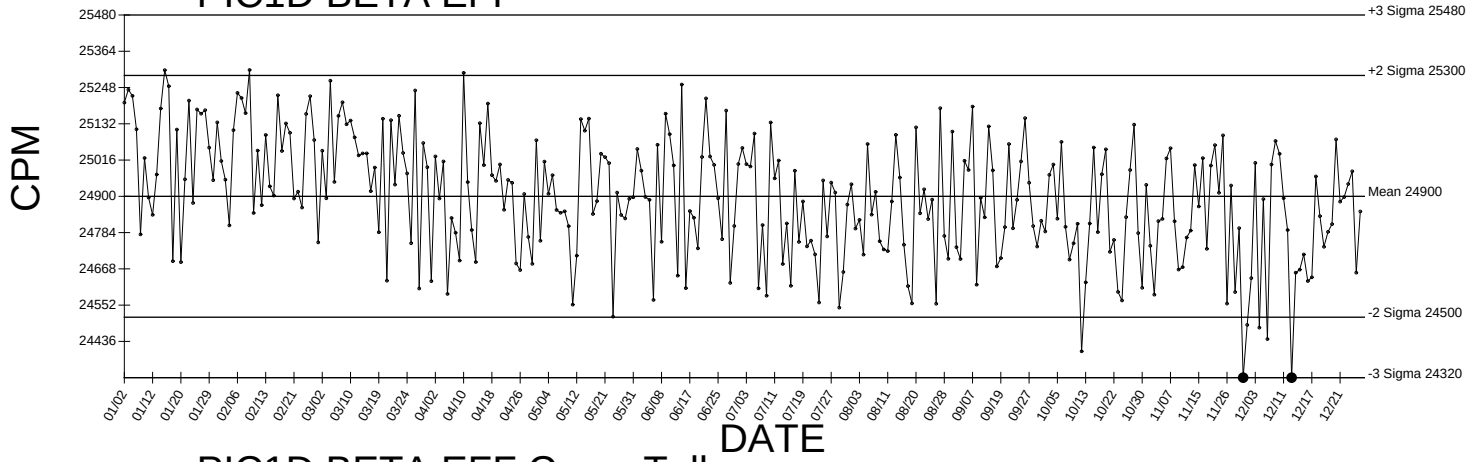
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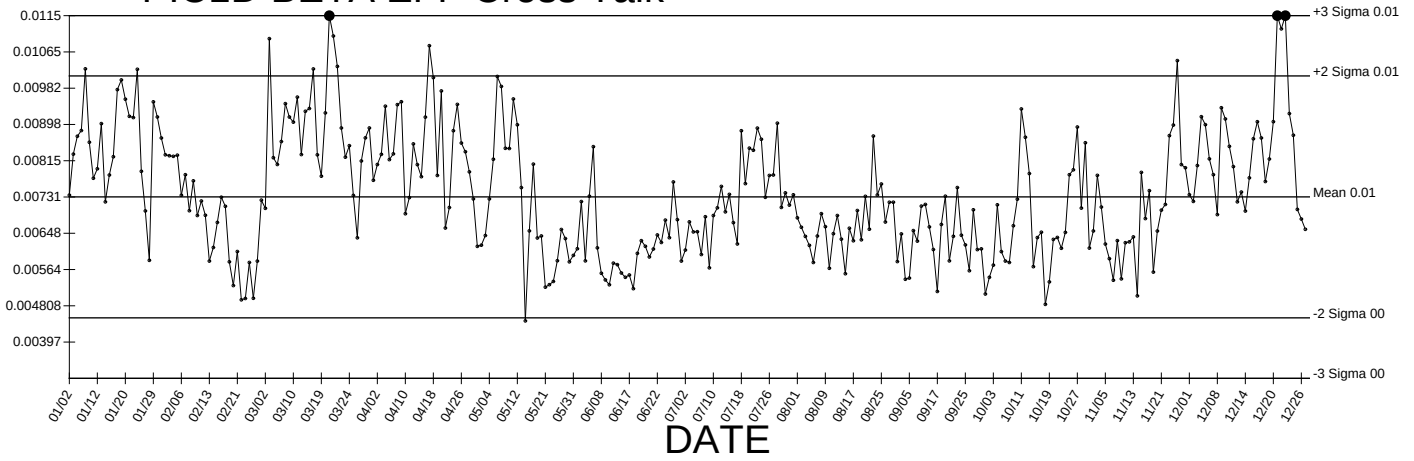
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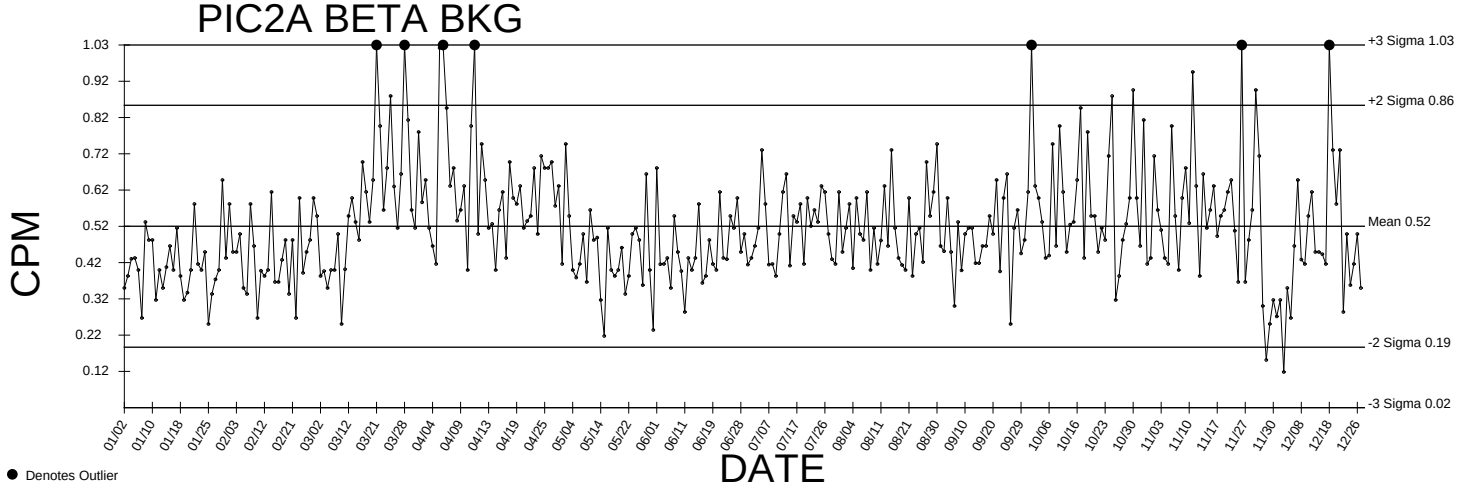
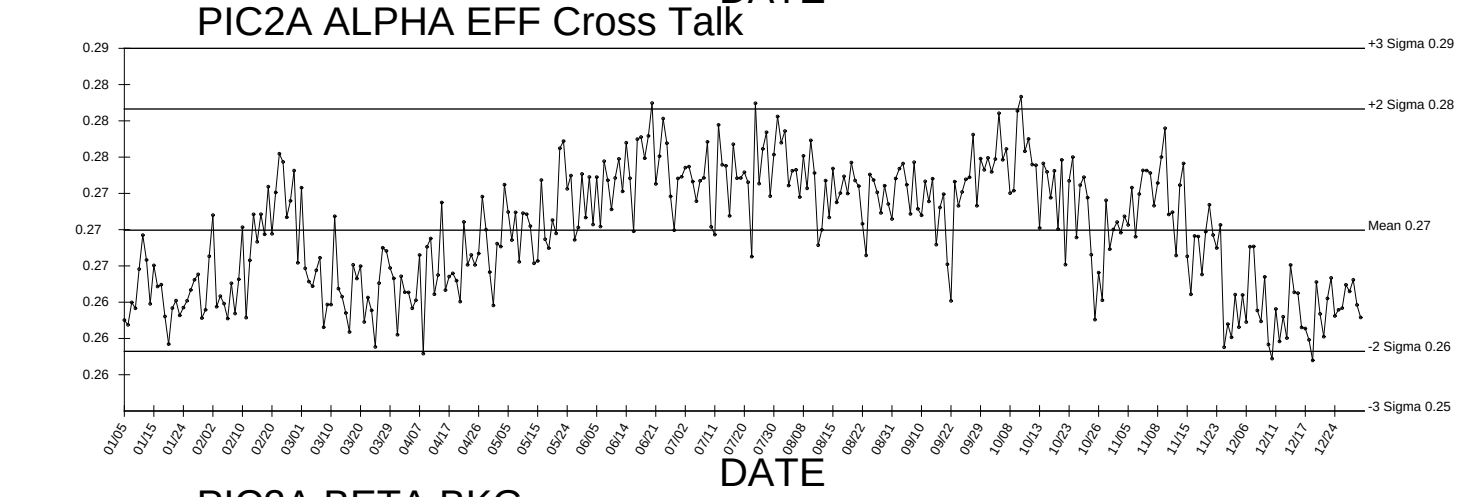
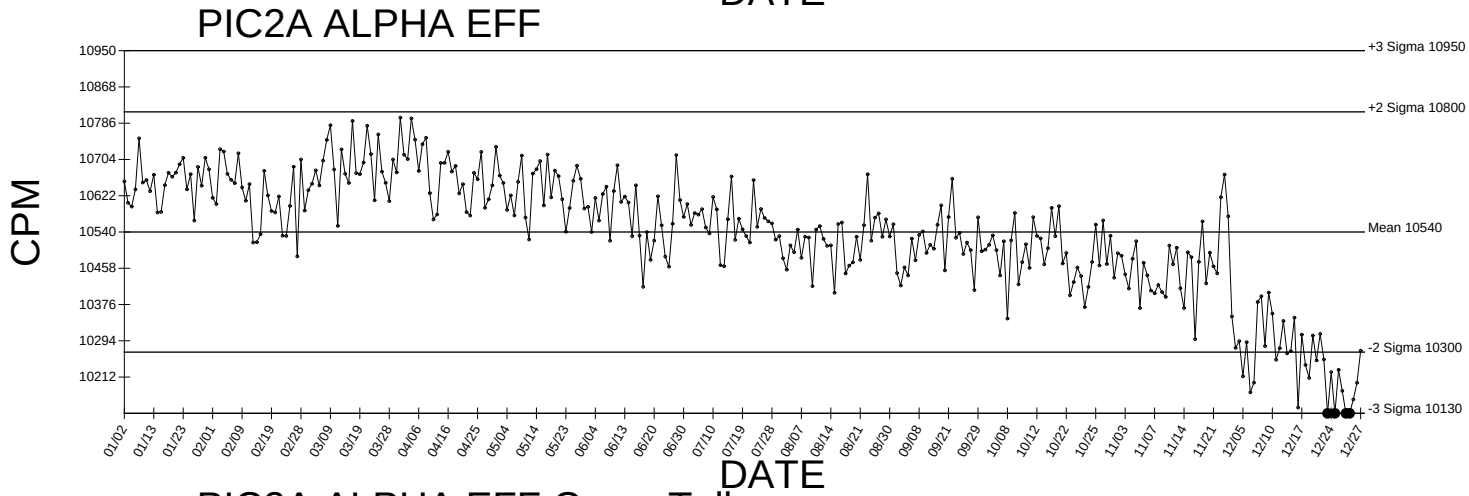
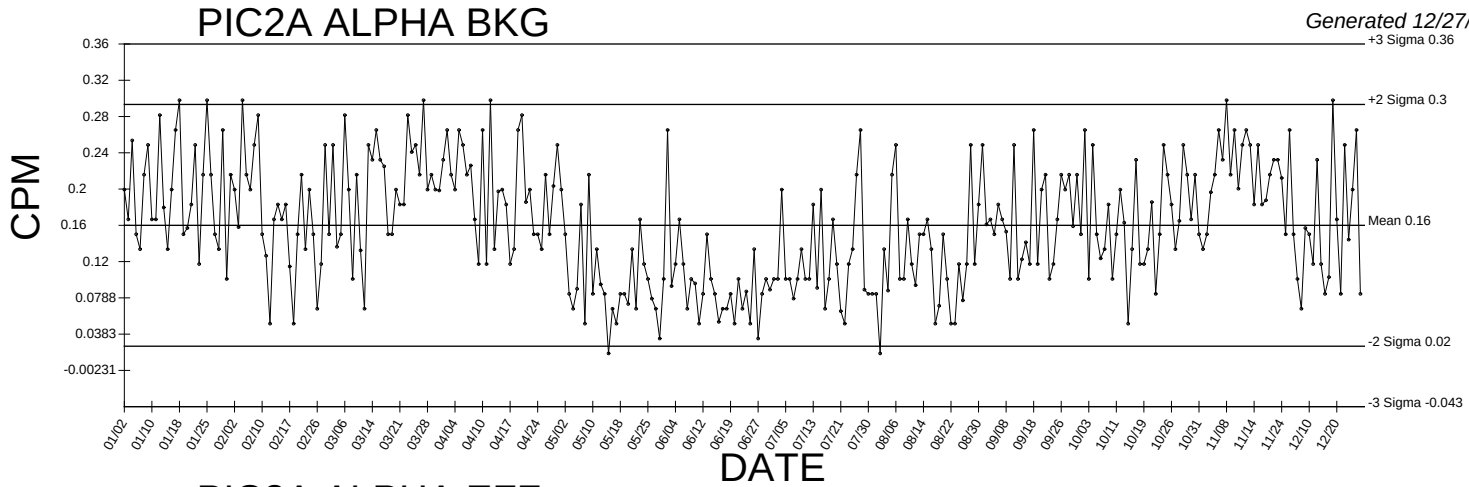
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PIC1D BETA EFF Cross Talk

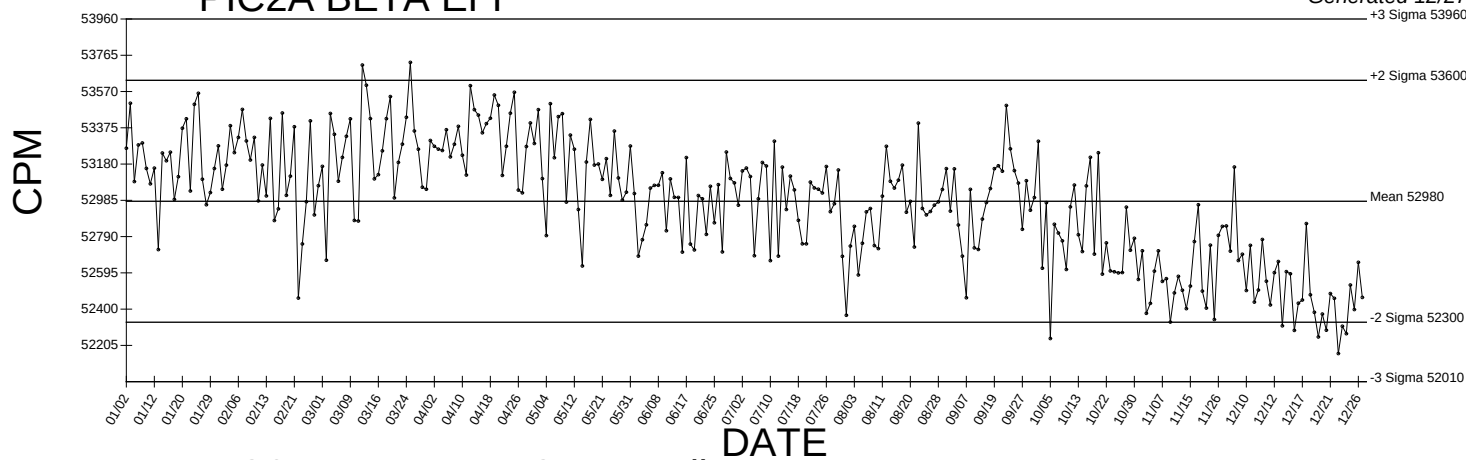


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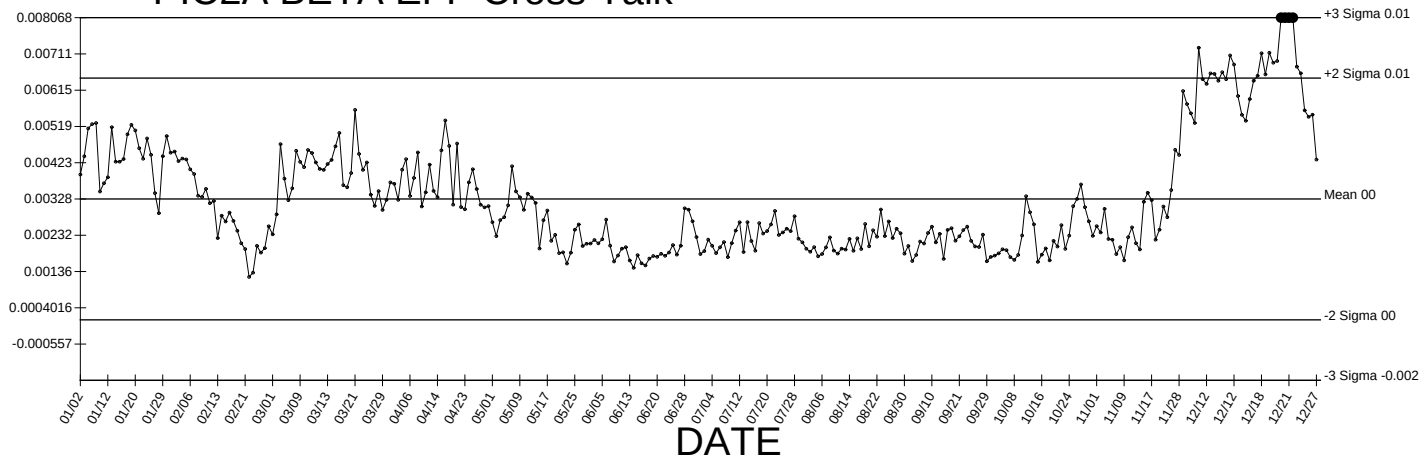


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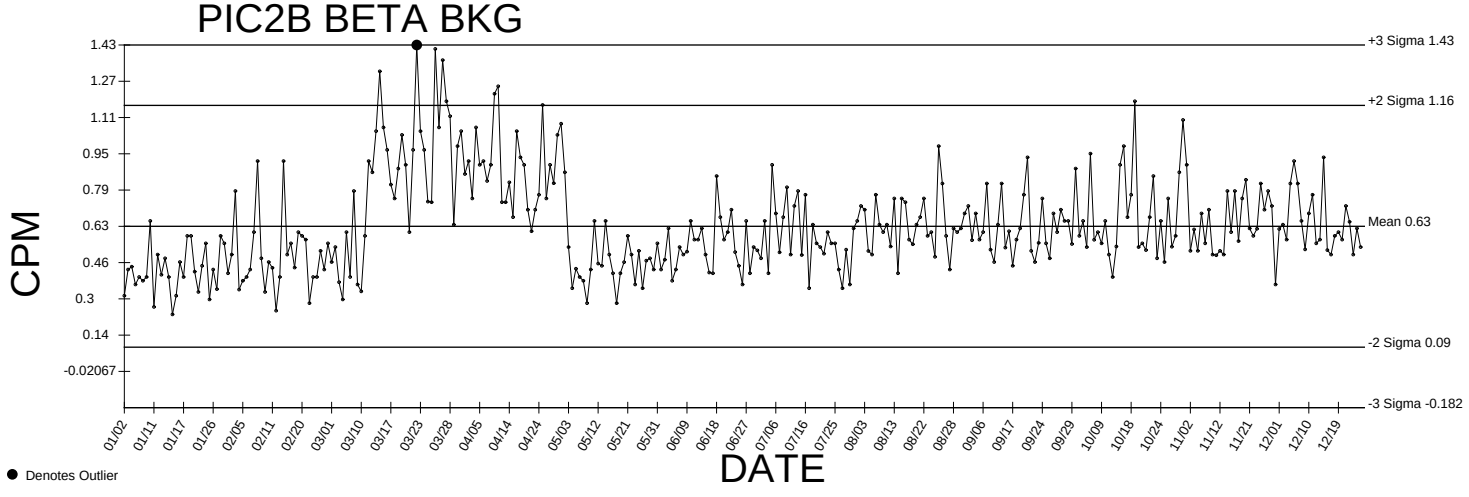
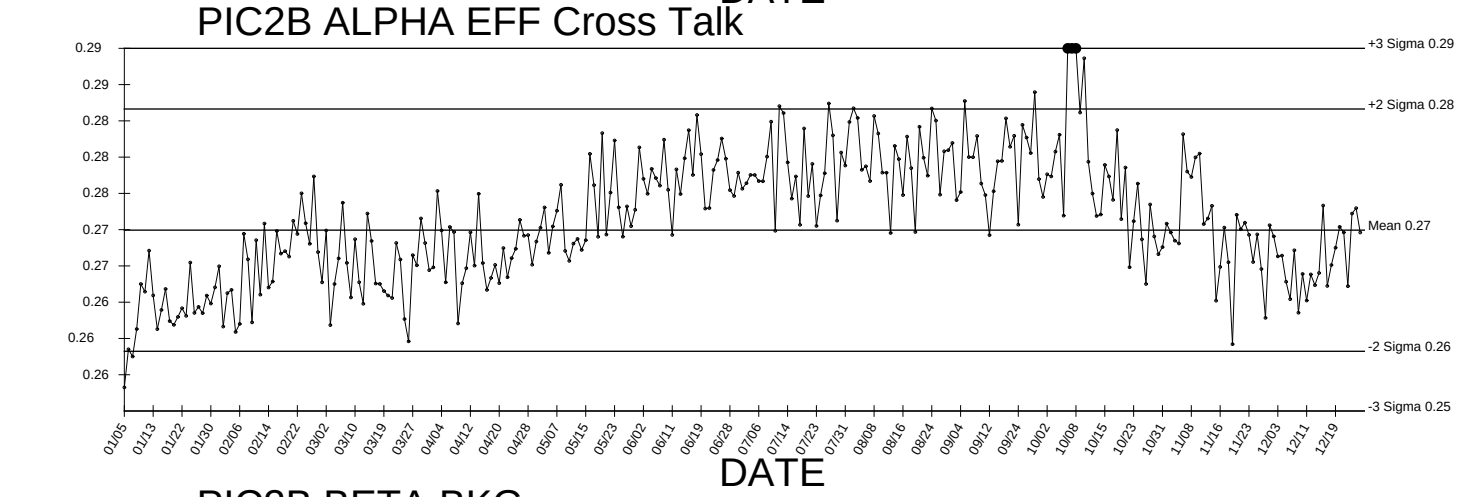
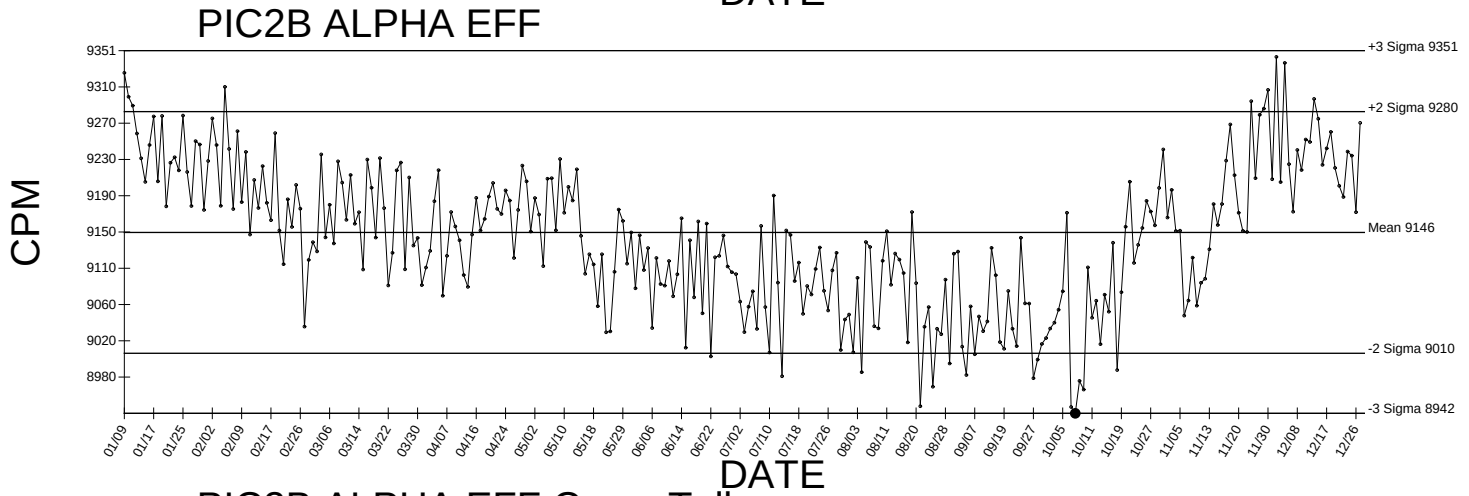
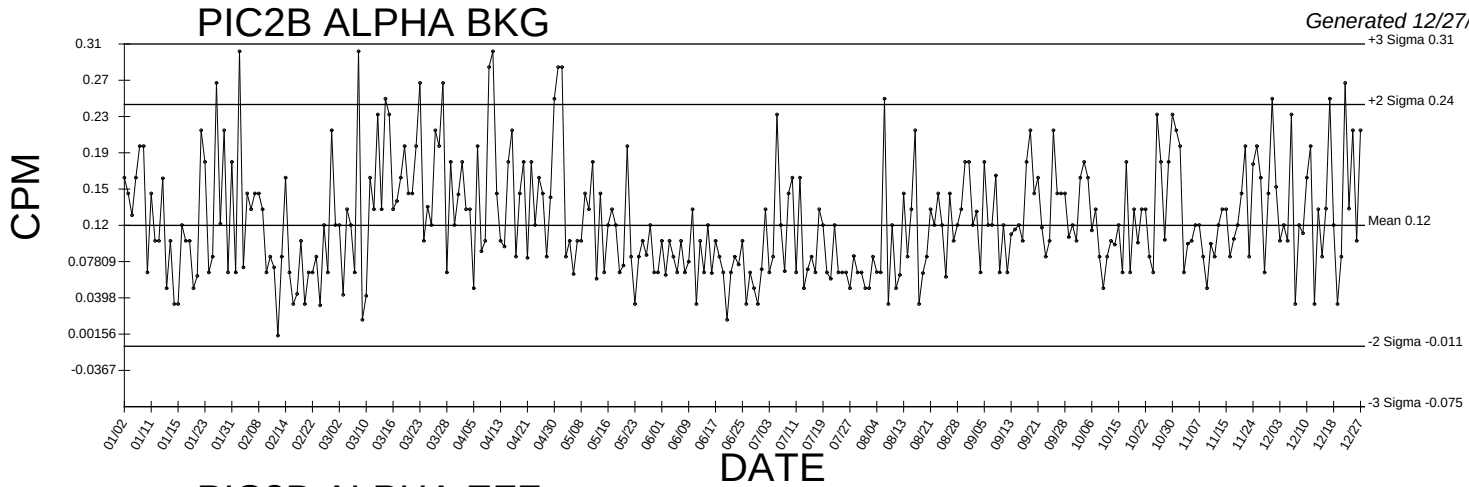
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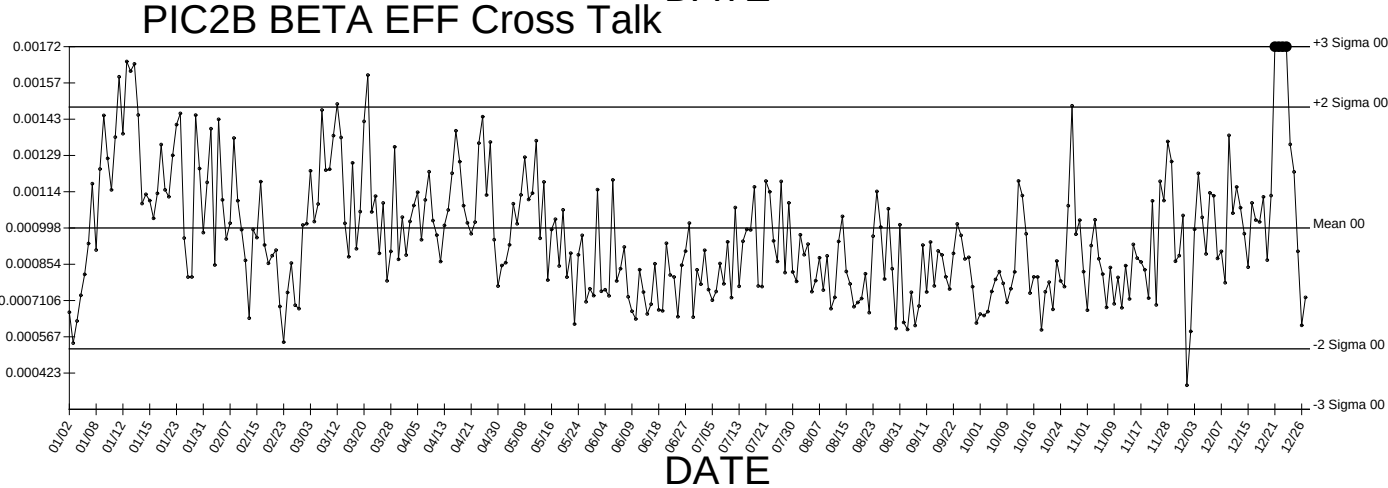
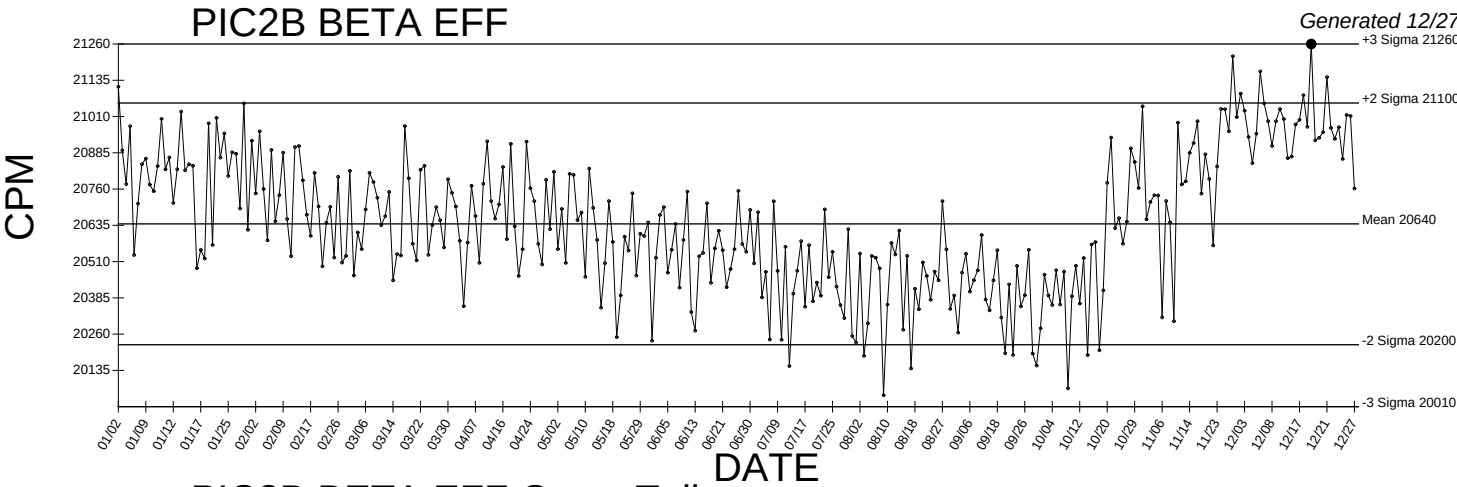
PIC2A BETA EFF Cross Talk

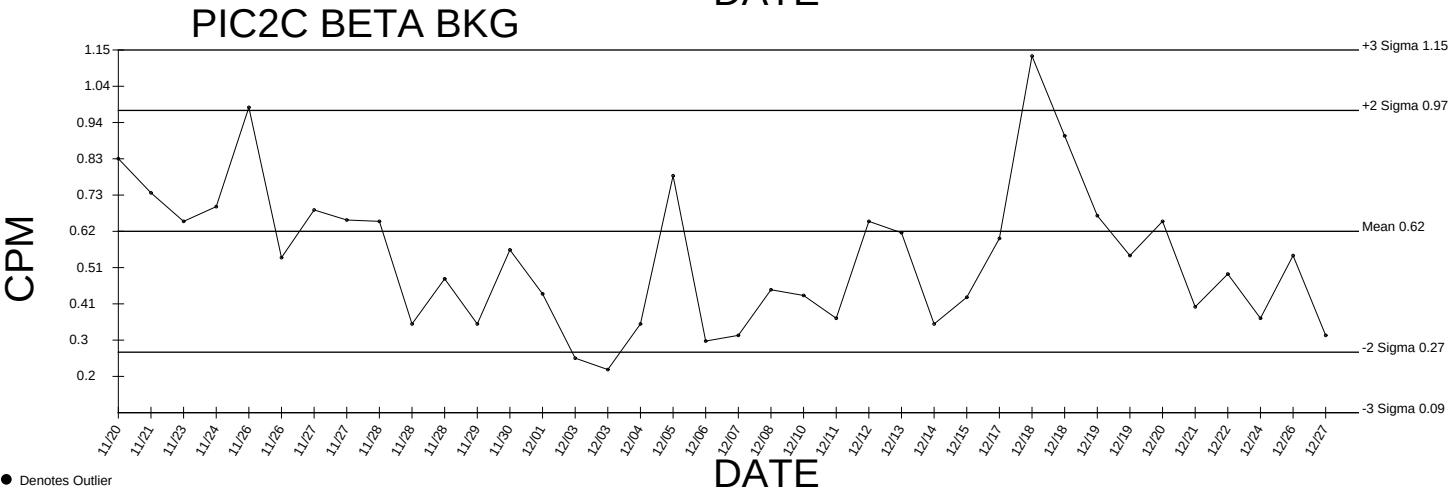
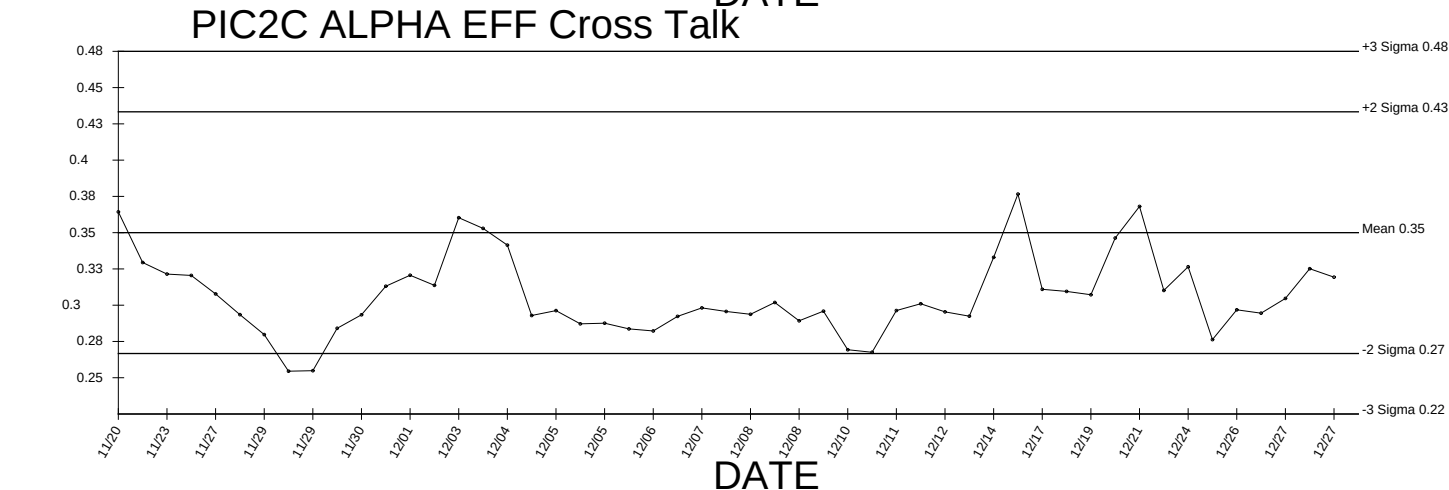
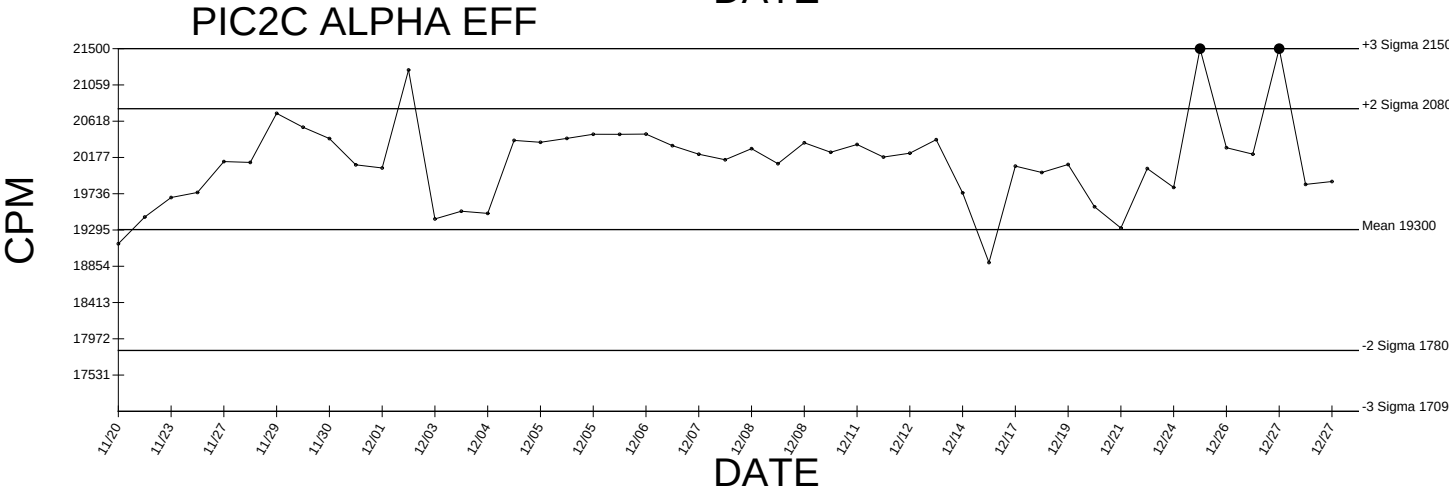
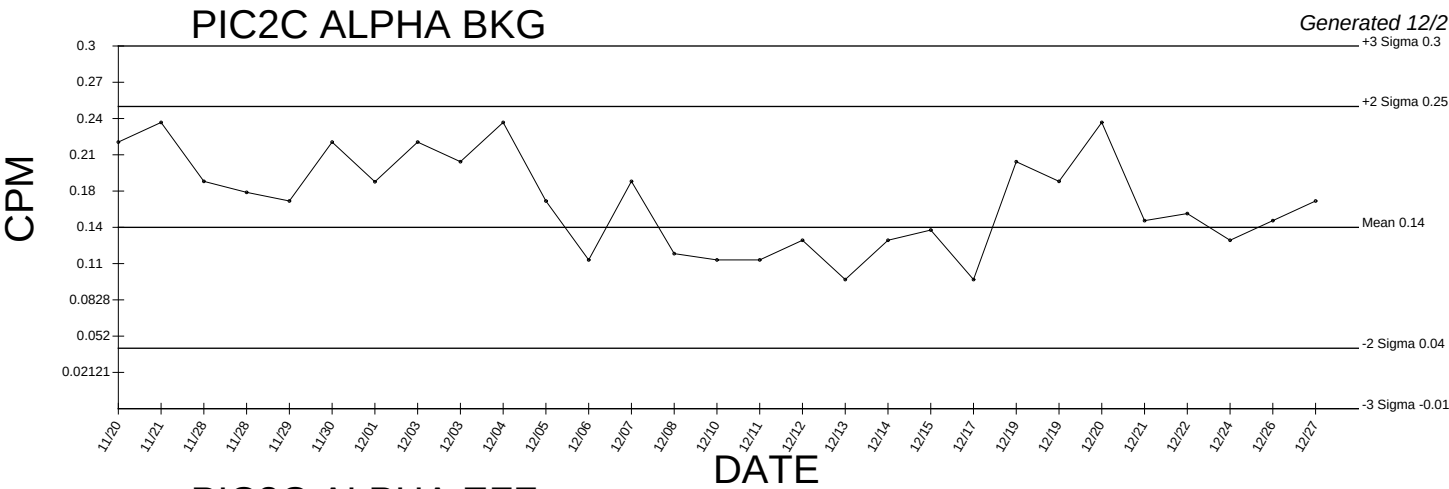


● Denotes Outlier



● Denotes Outlier

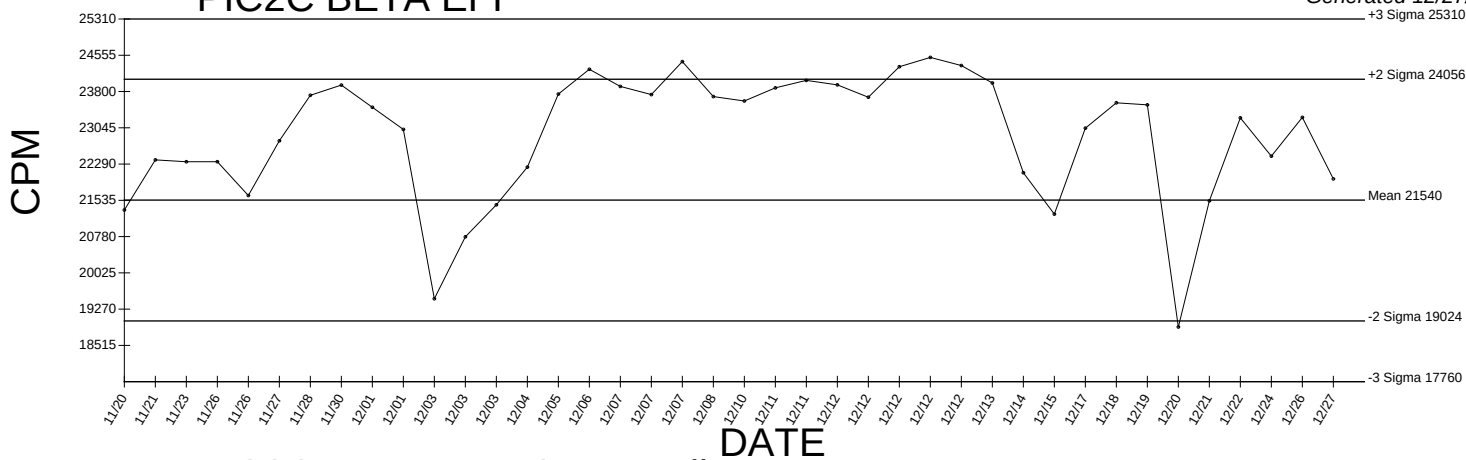




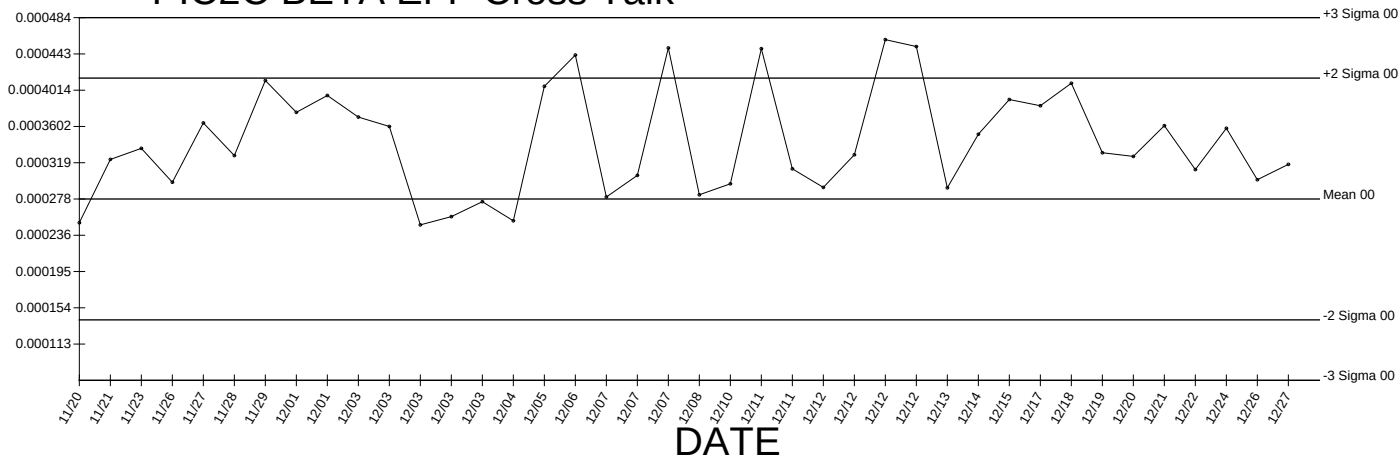
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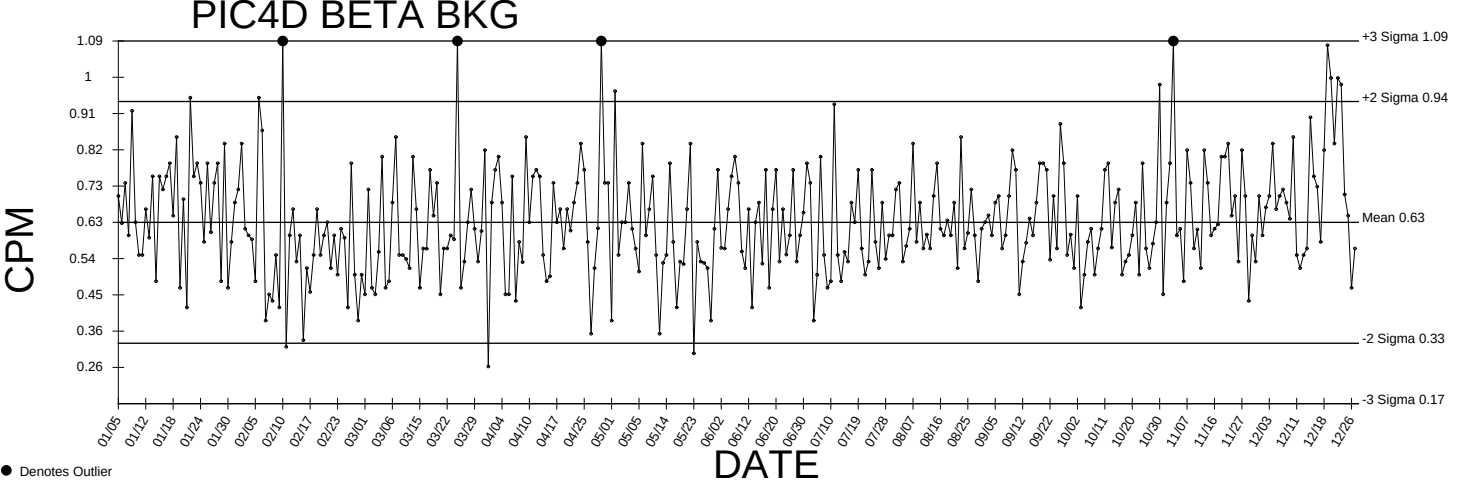
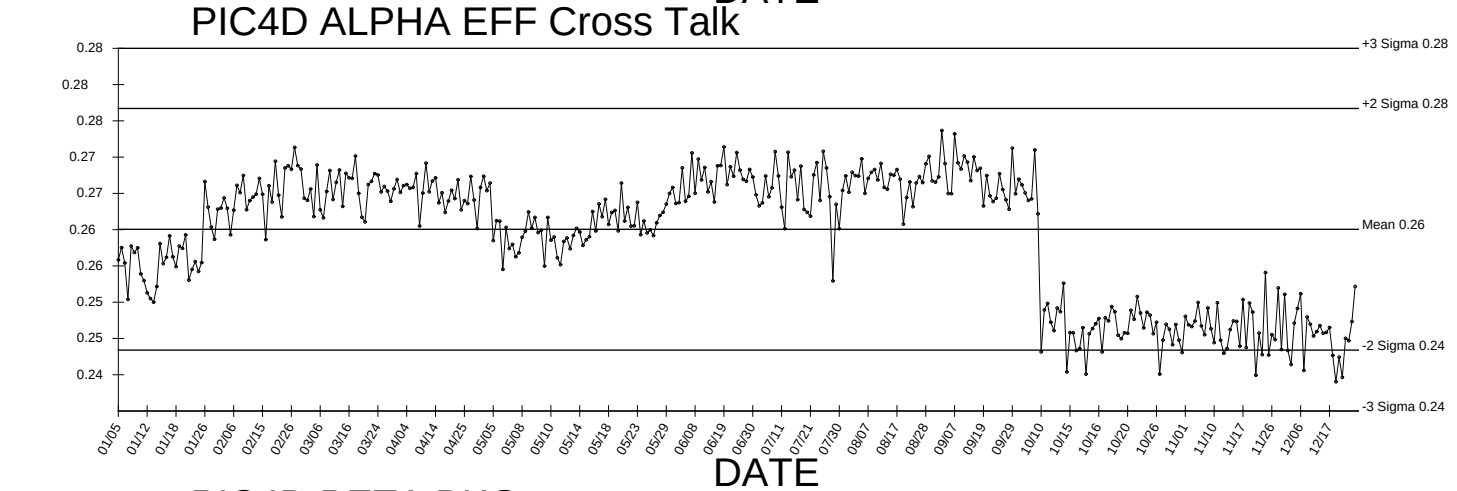
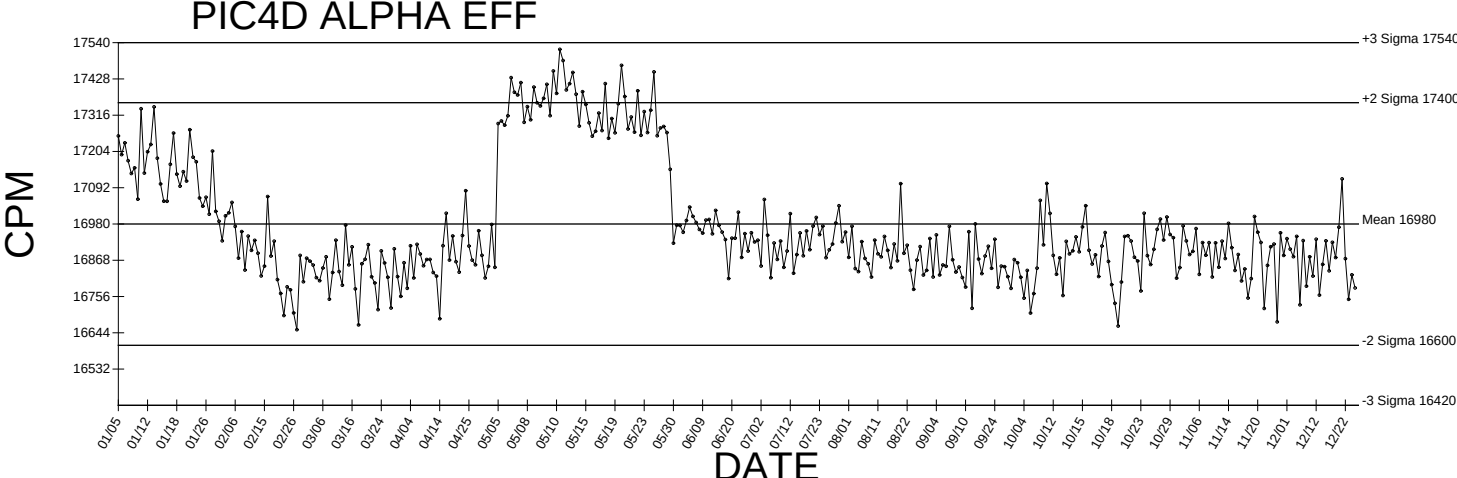
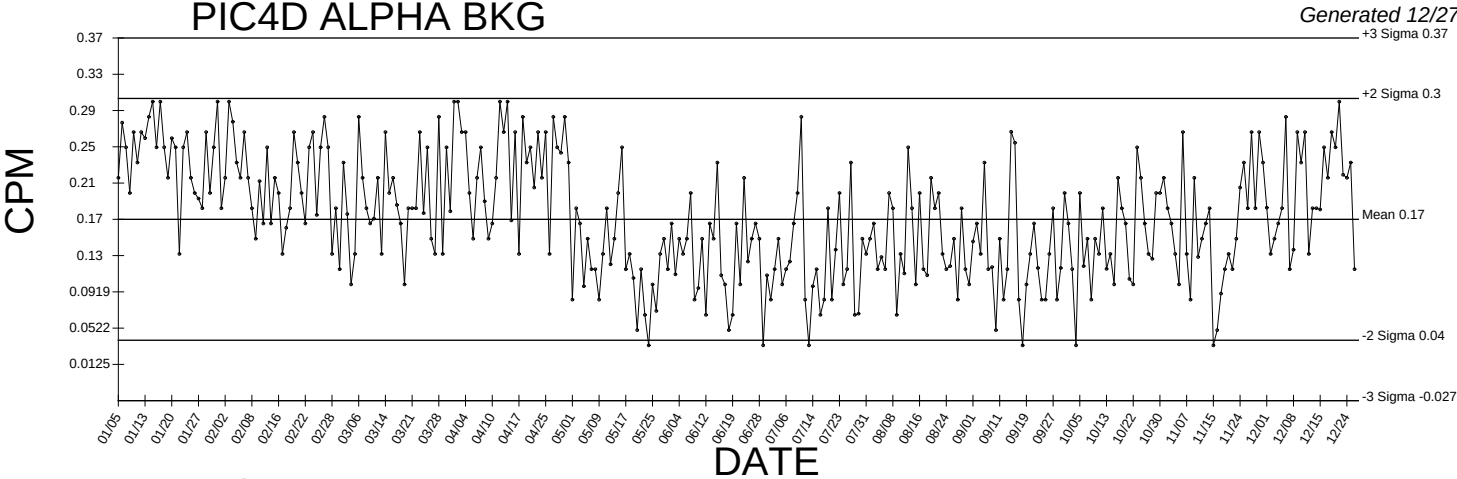
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PIC2C BETA EFF Cross Talk

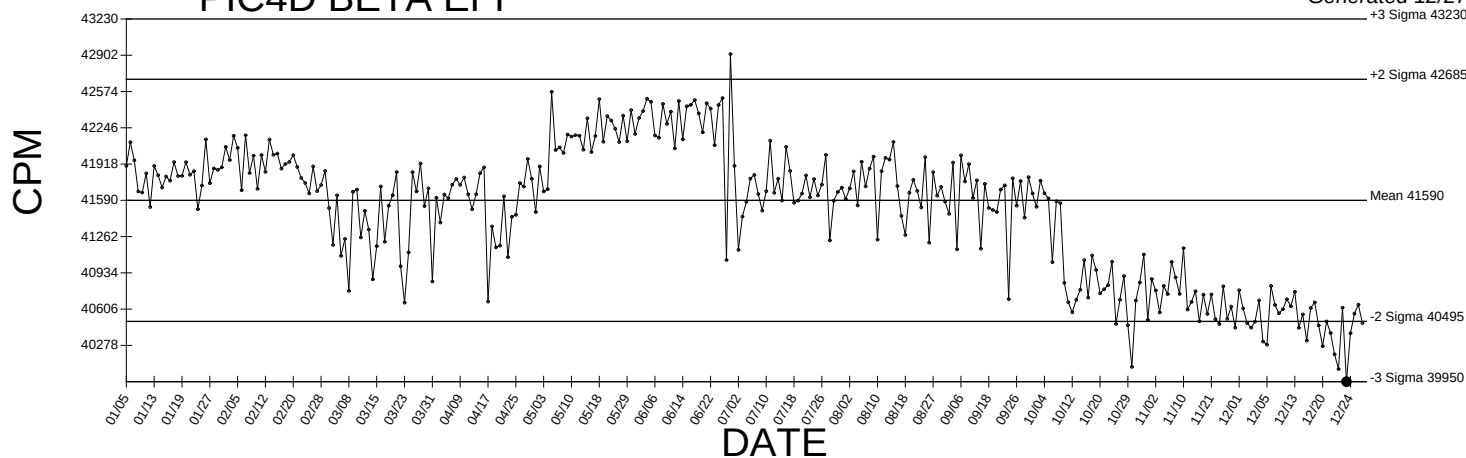


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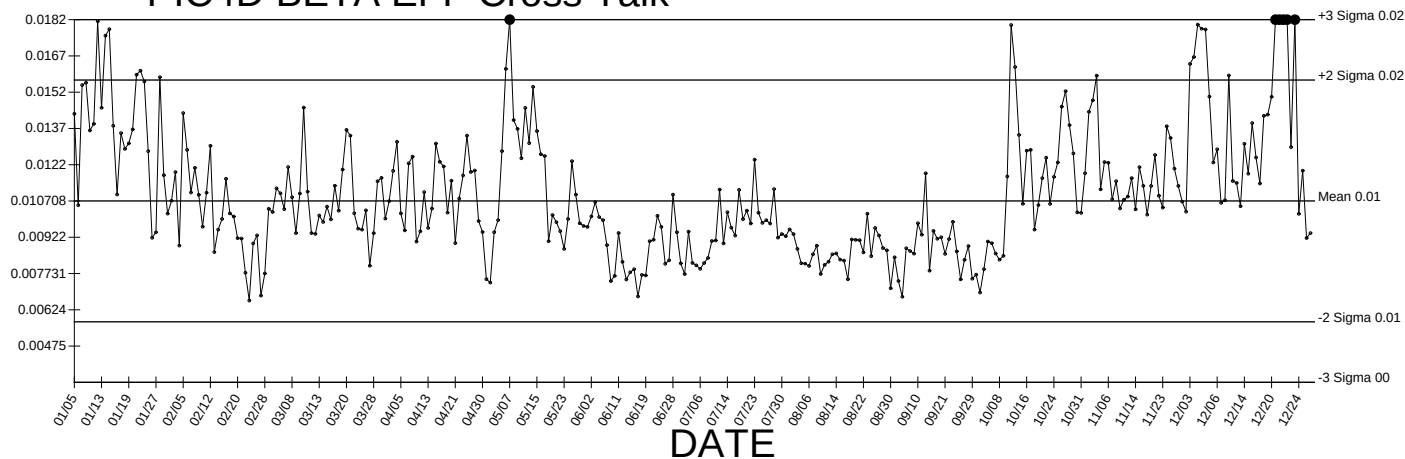


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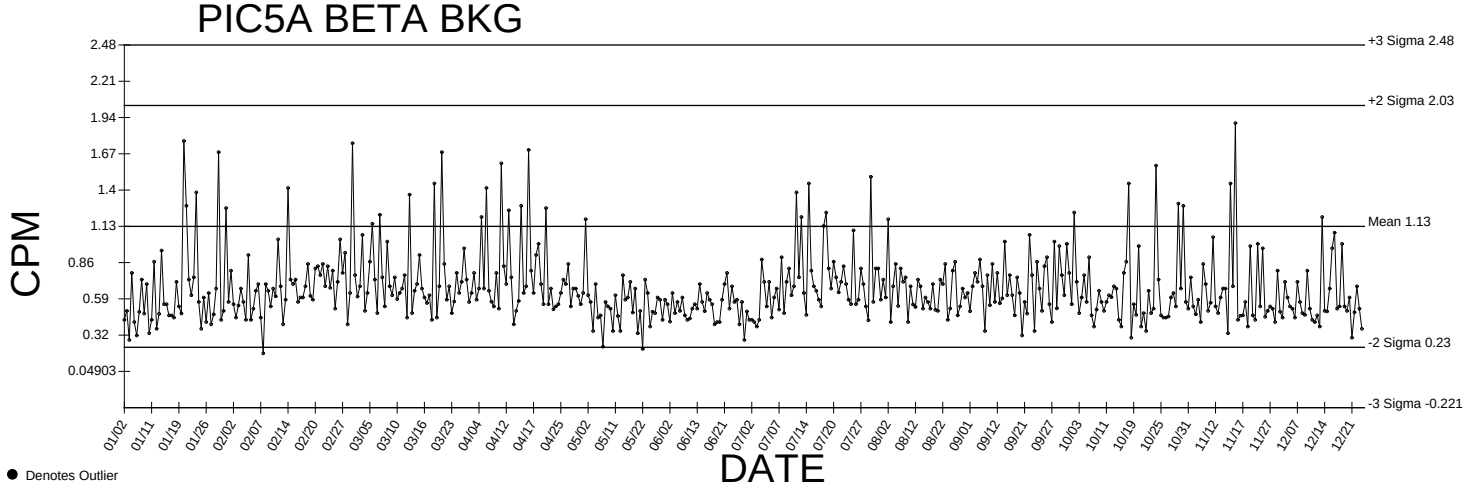
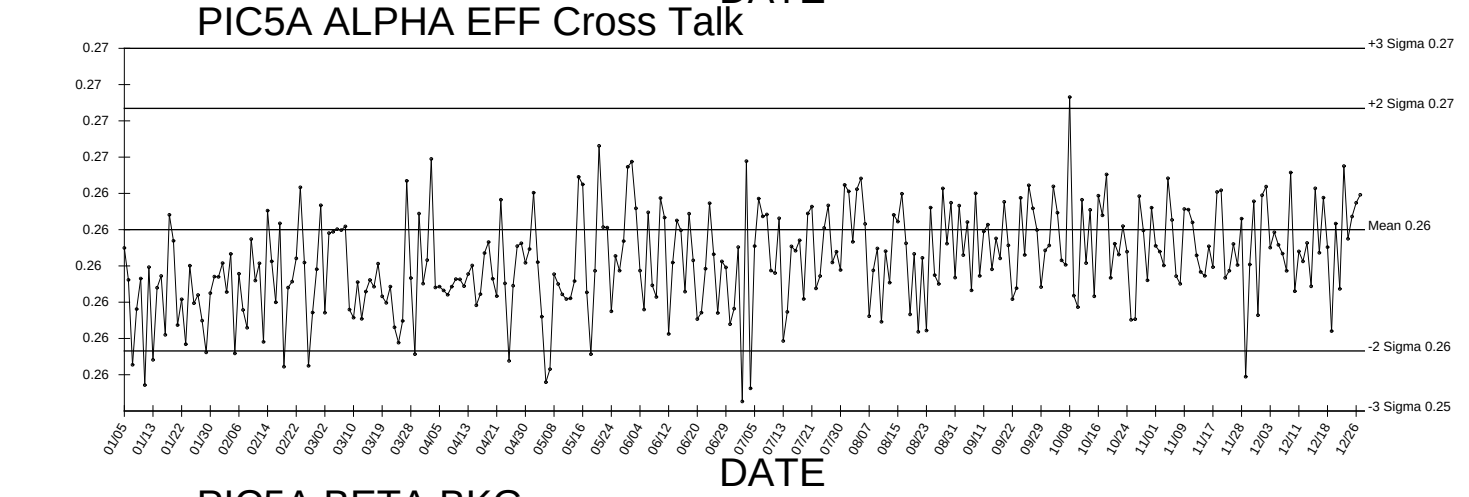
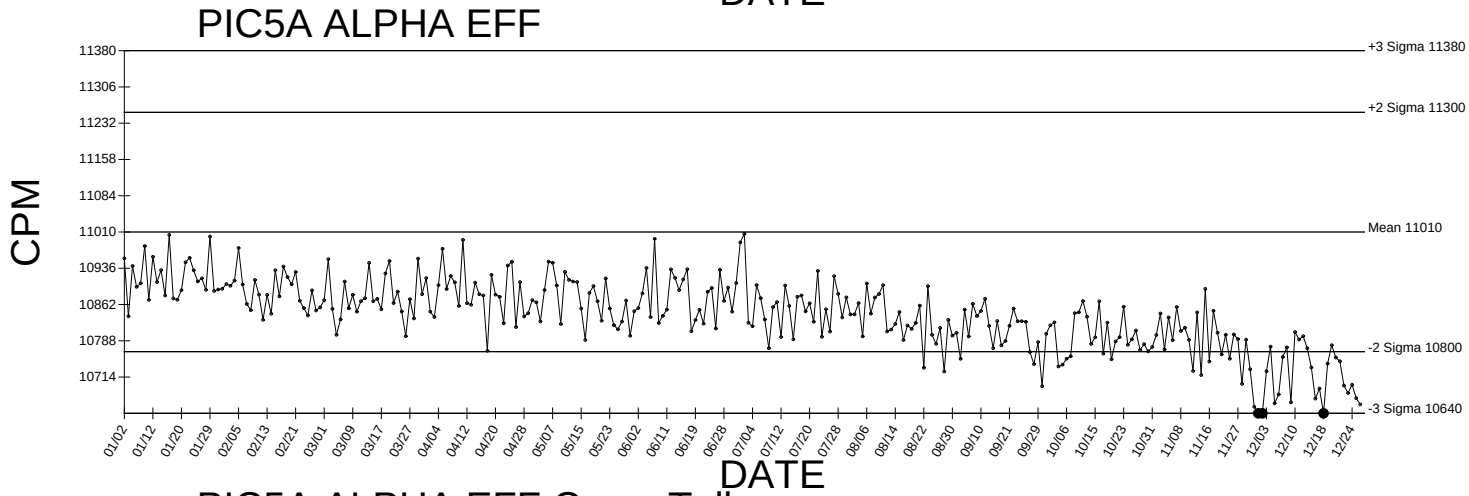
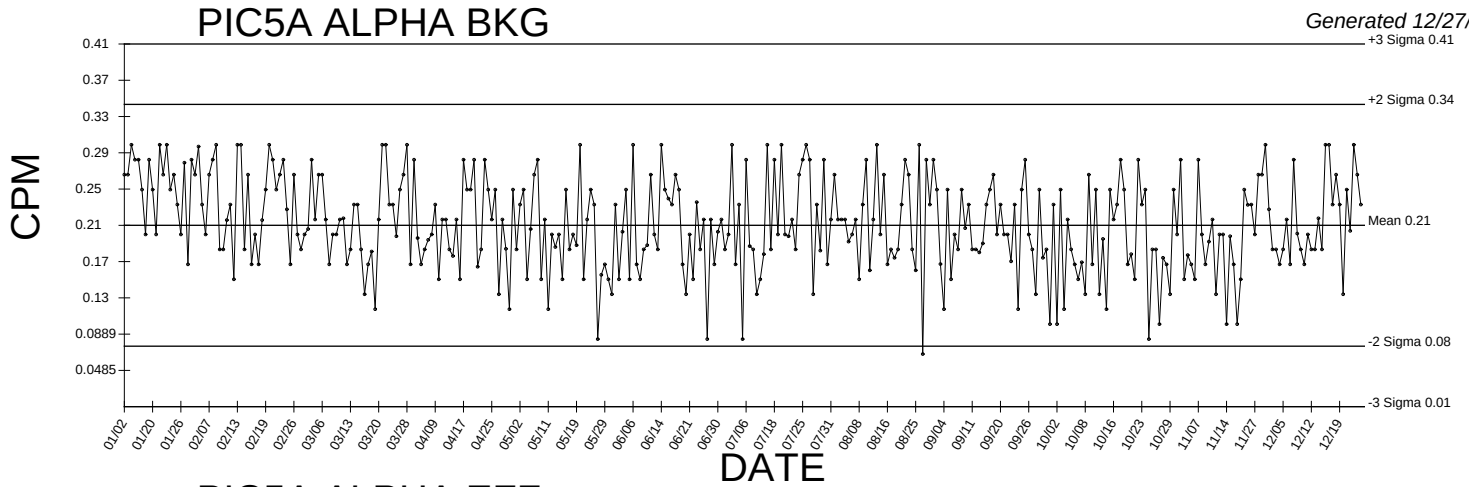
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+3 Sigma 43230



PIC4D BETA EFF Cross Talk



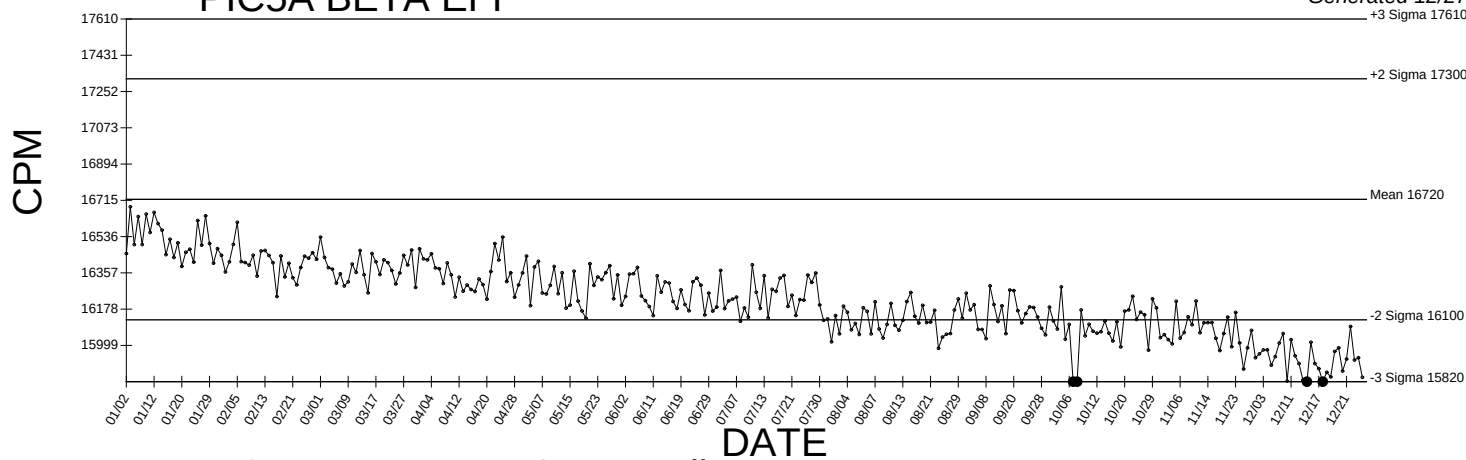
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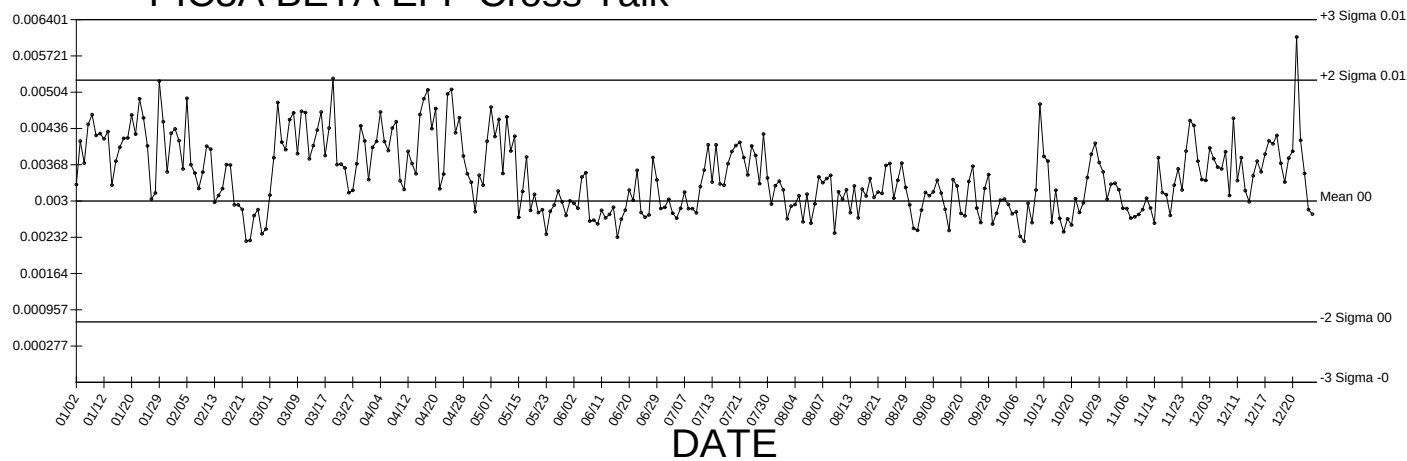
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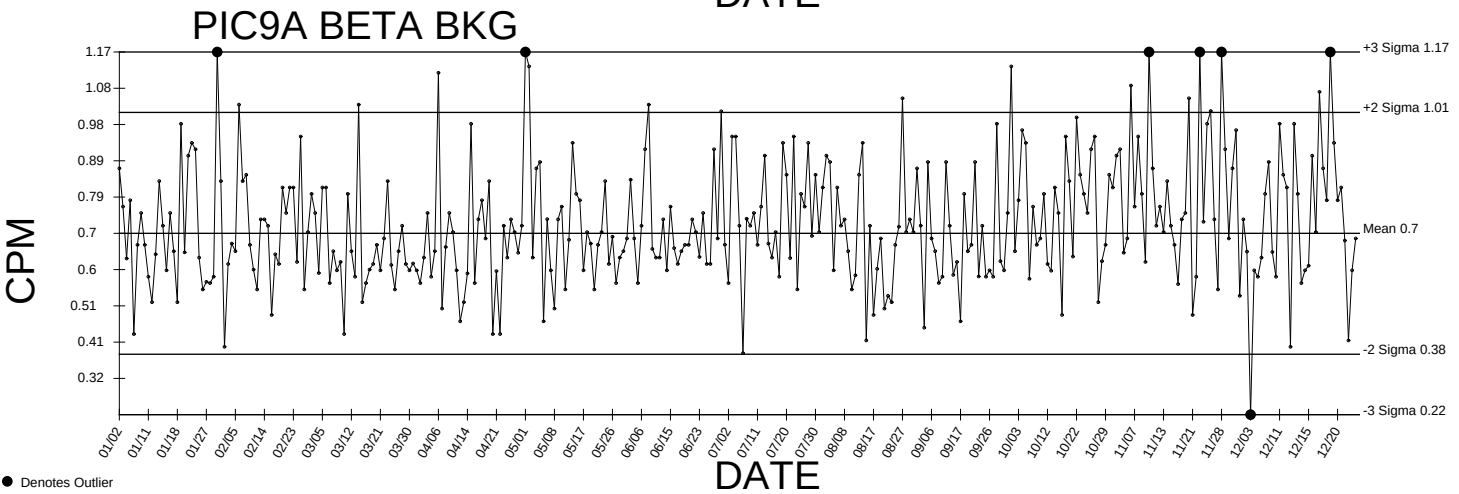
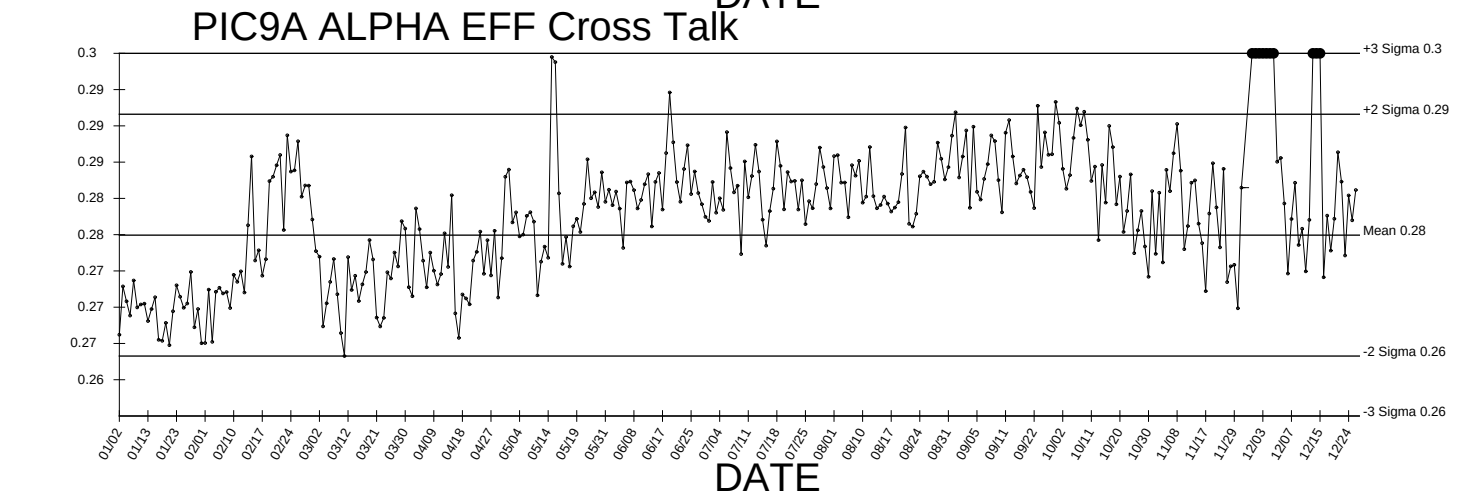
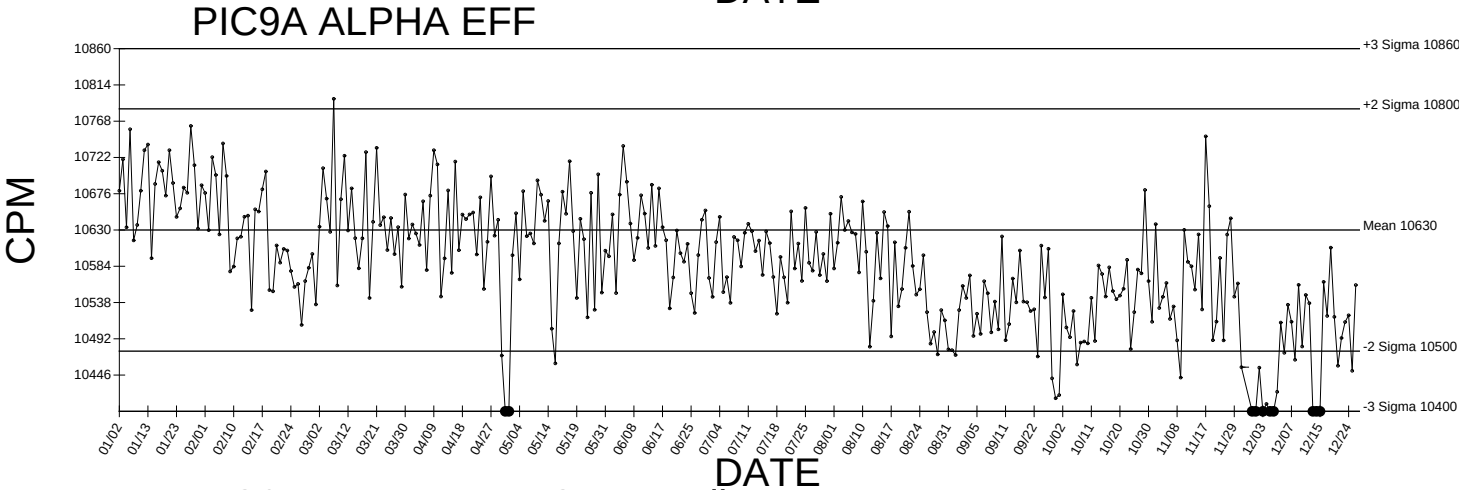
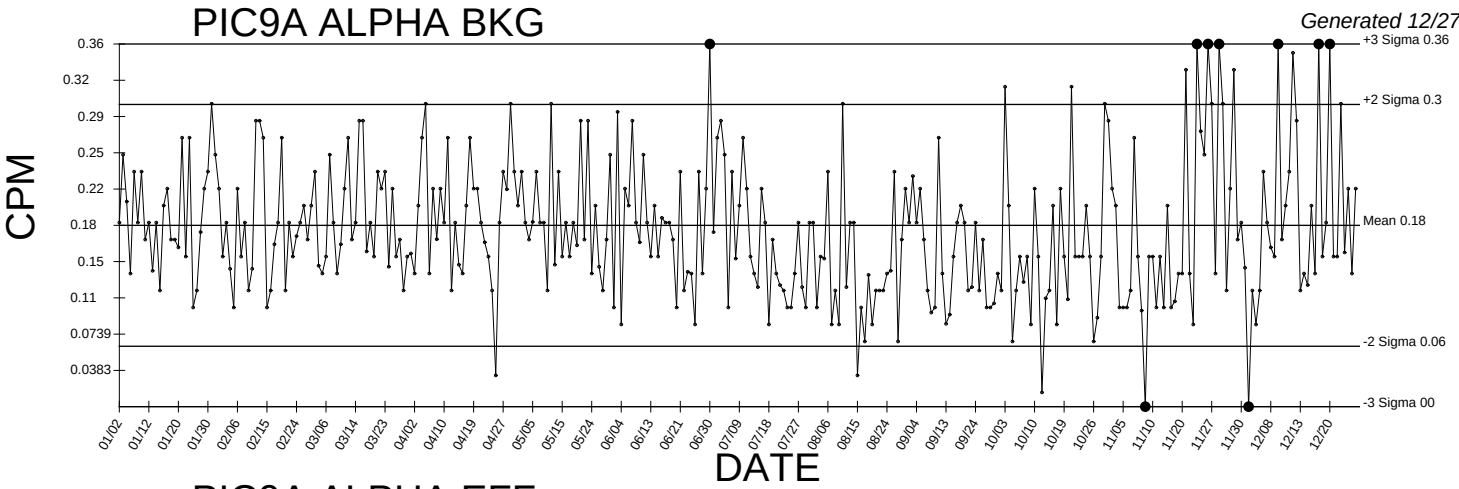
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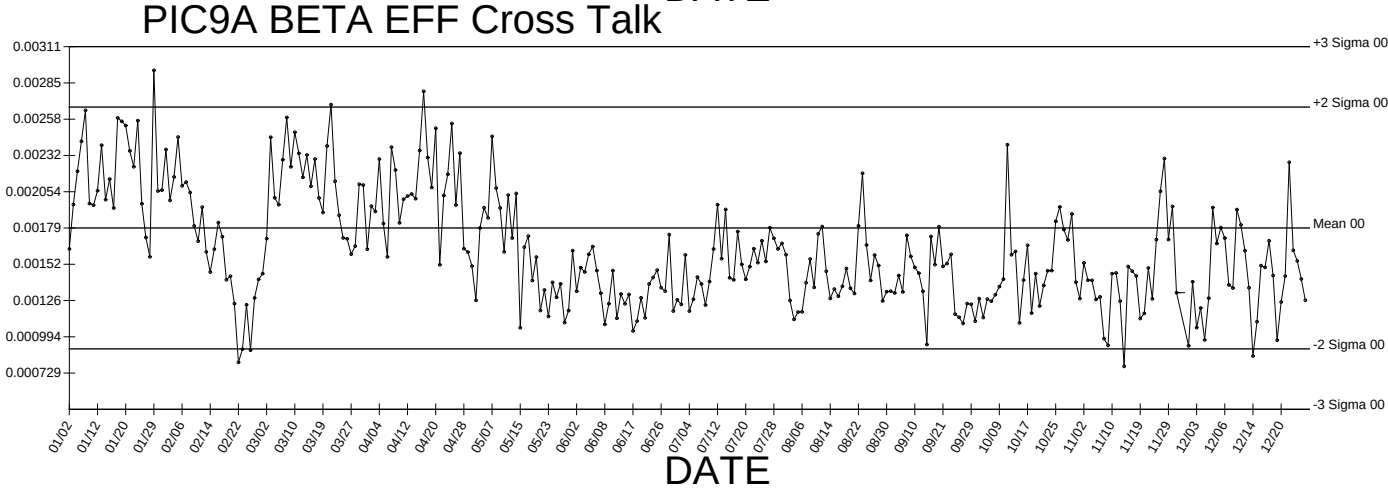
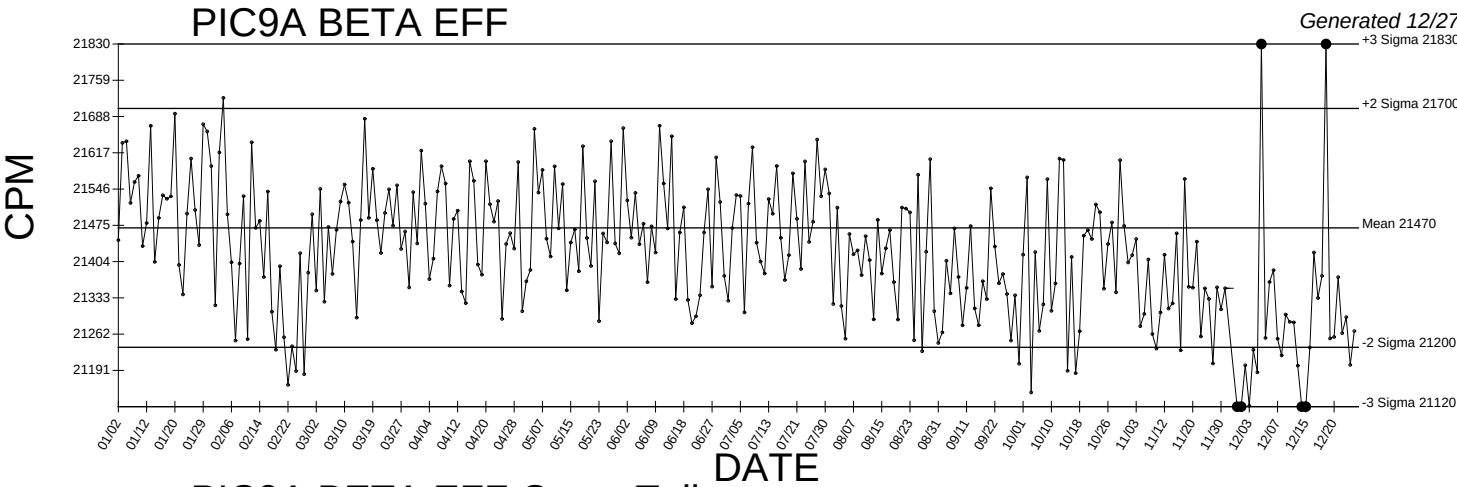
PIC5A BETA EFF Cross Talk

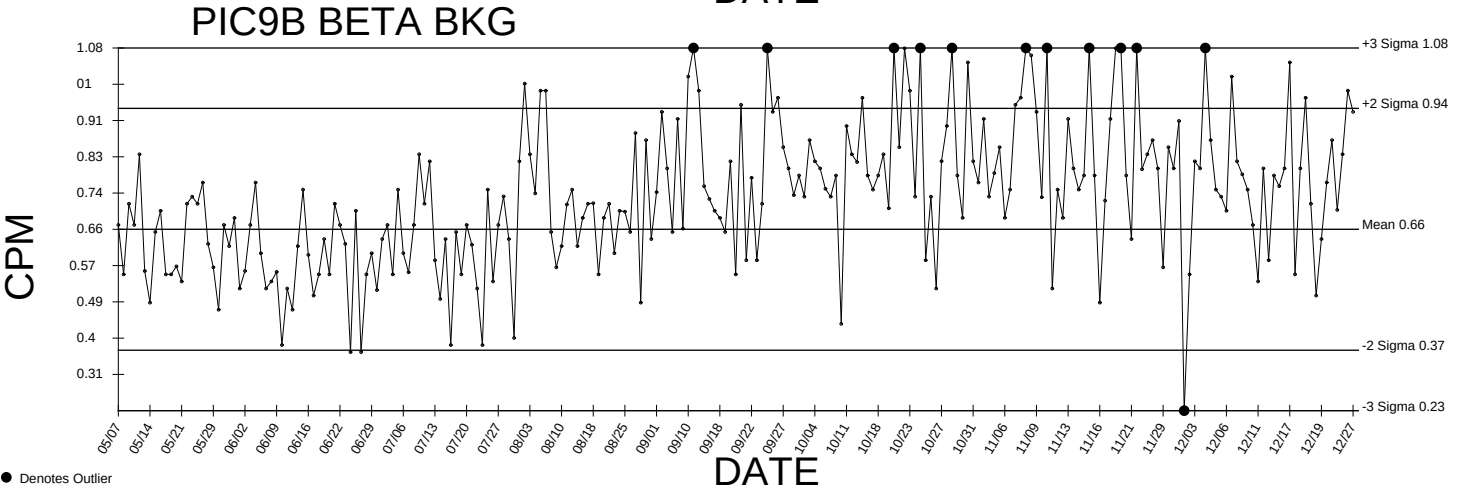
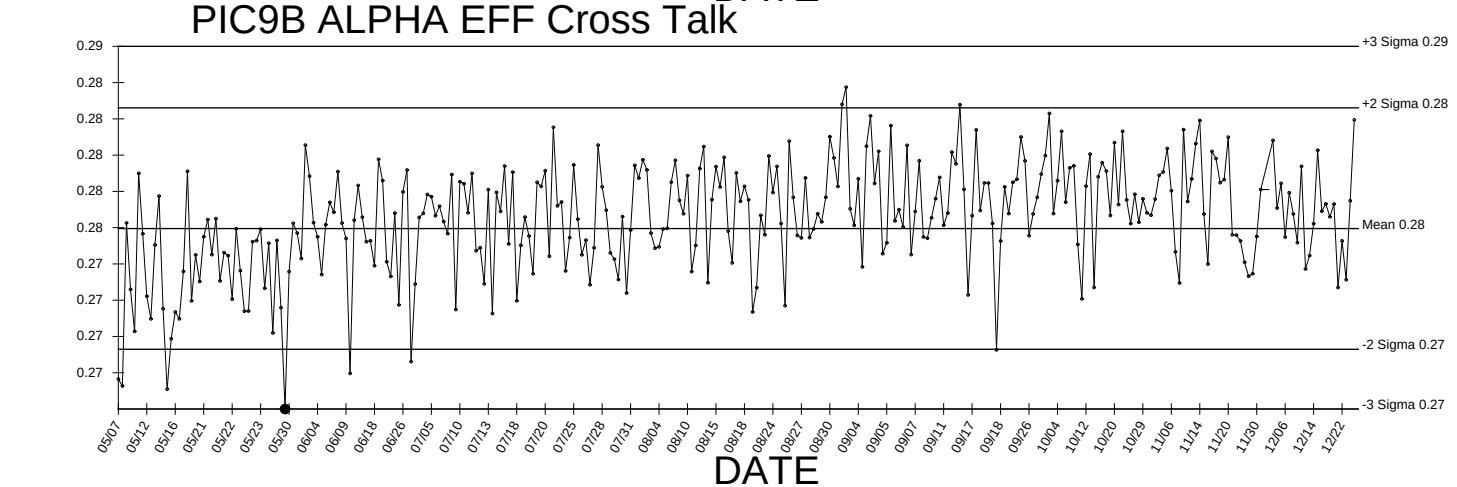
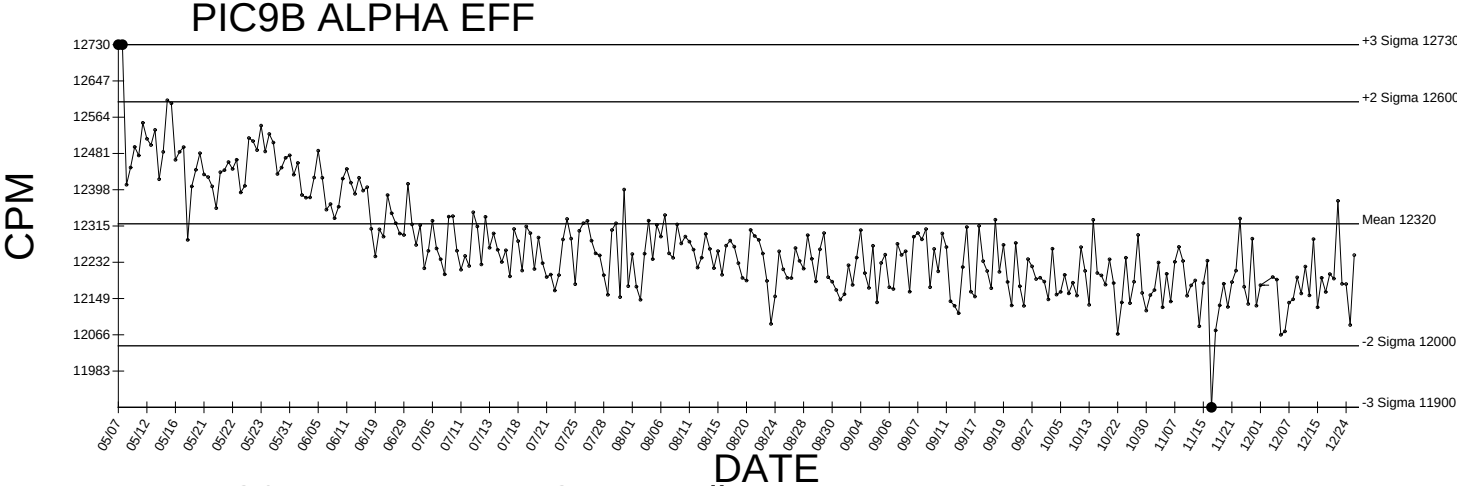
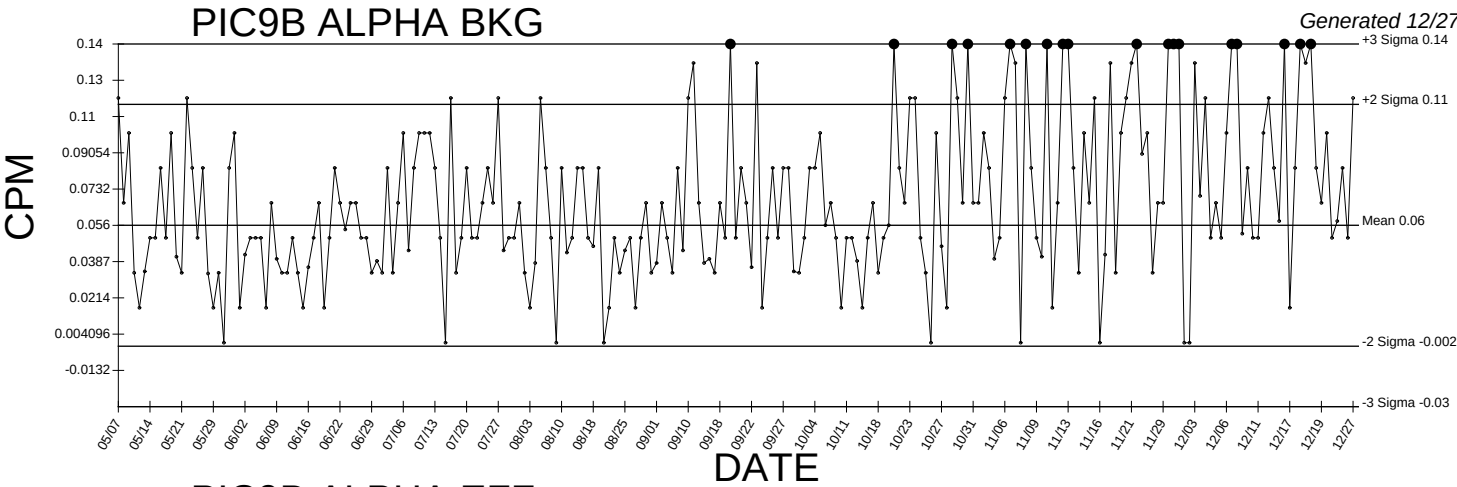


● Denotes Outlier



● Denotes Outlier

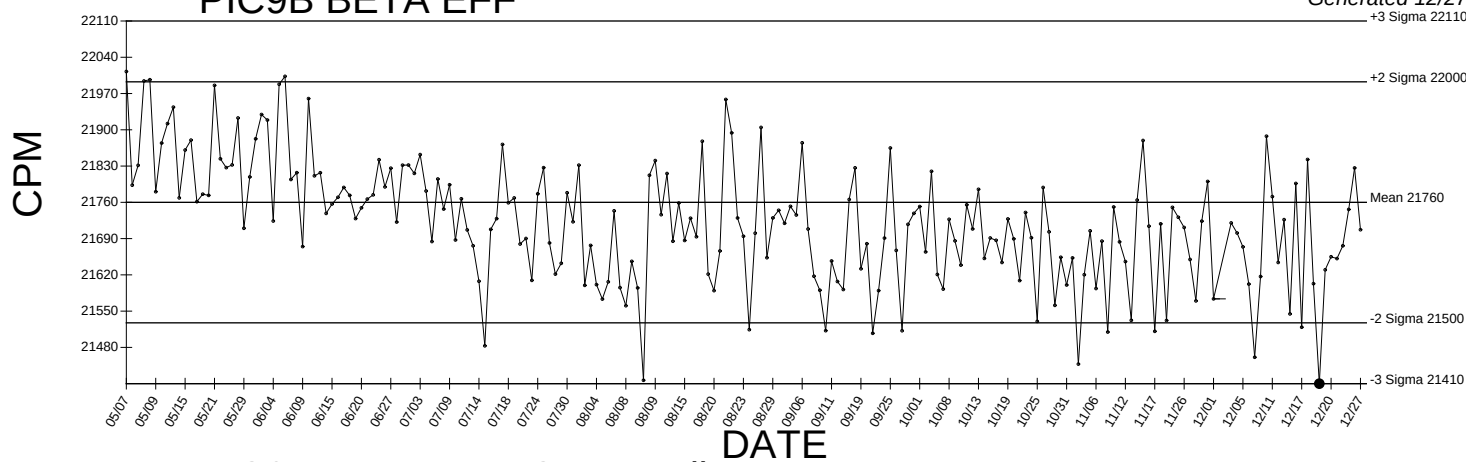




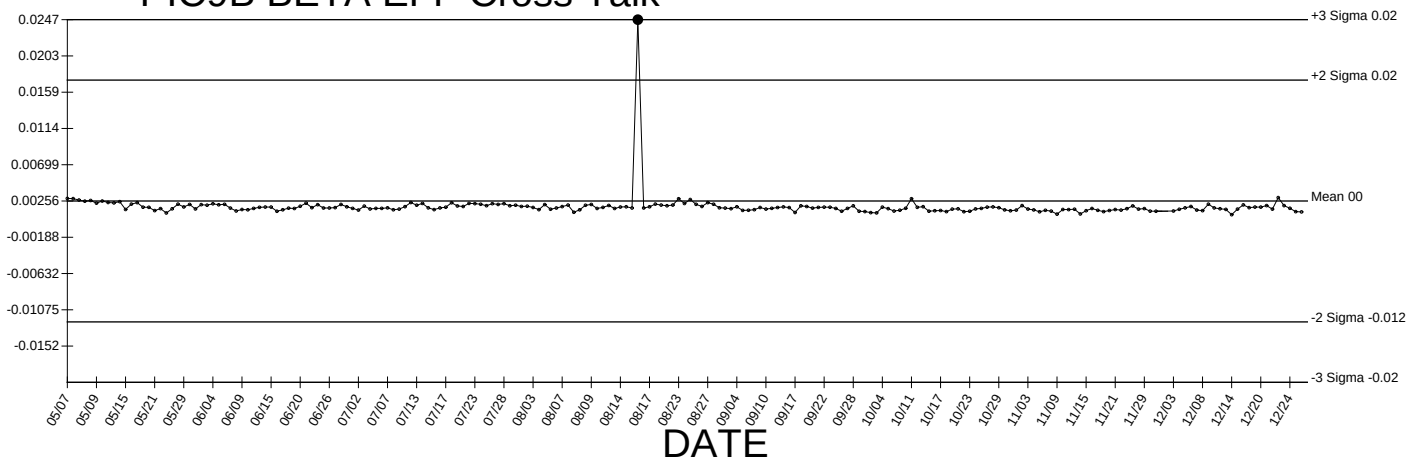
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PIC9B BETA EFF

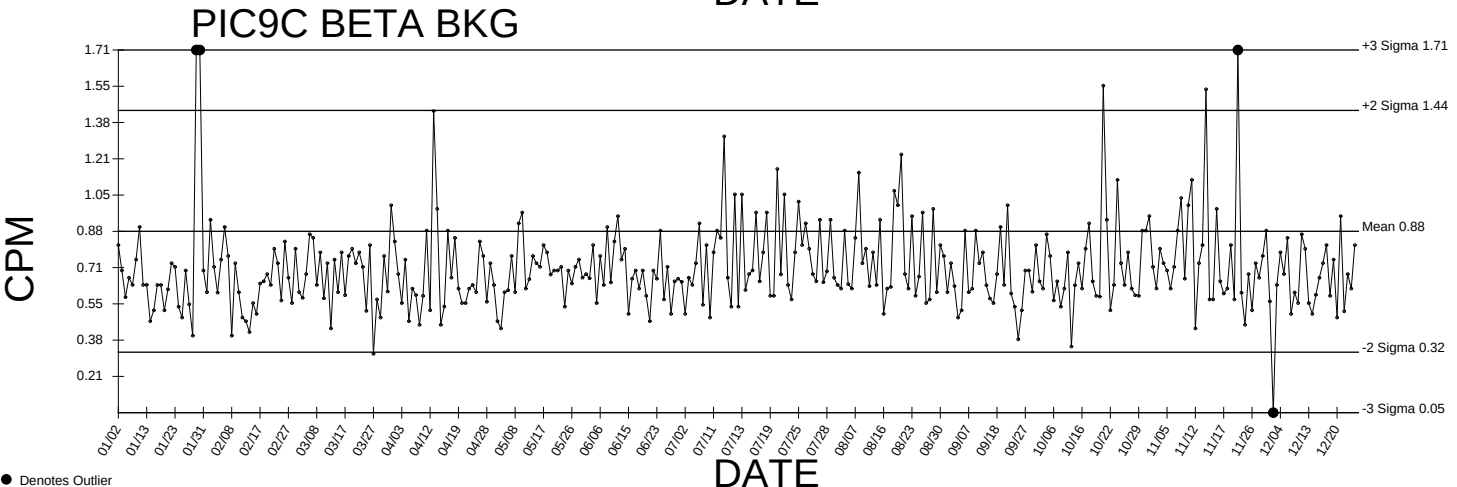
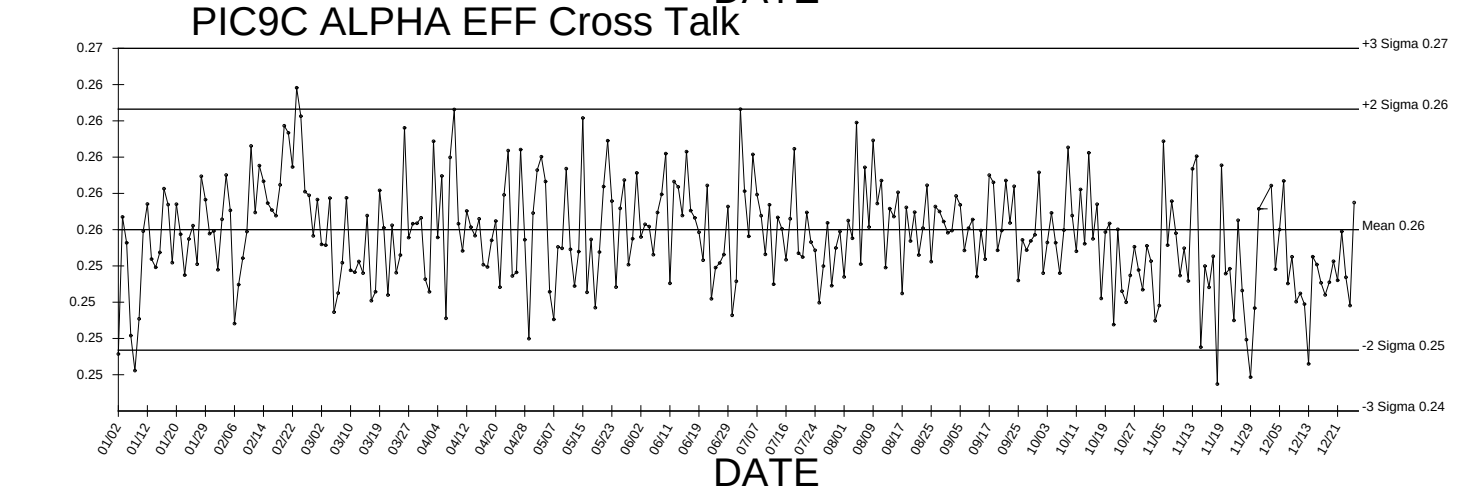
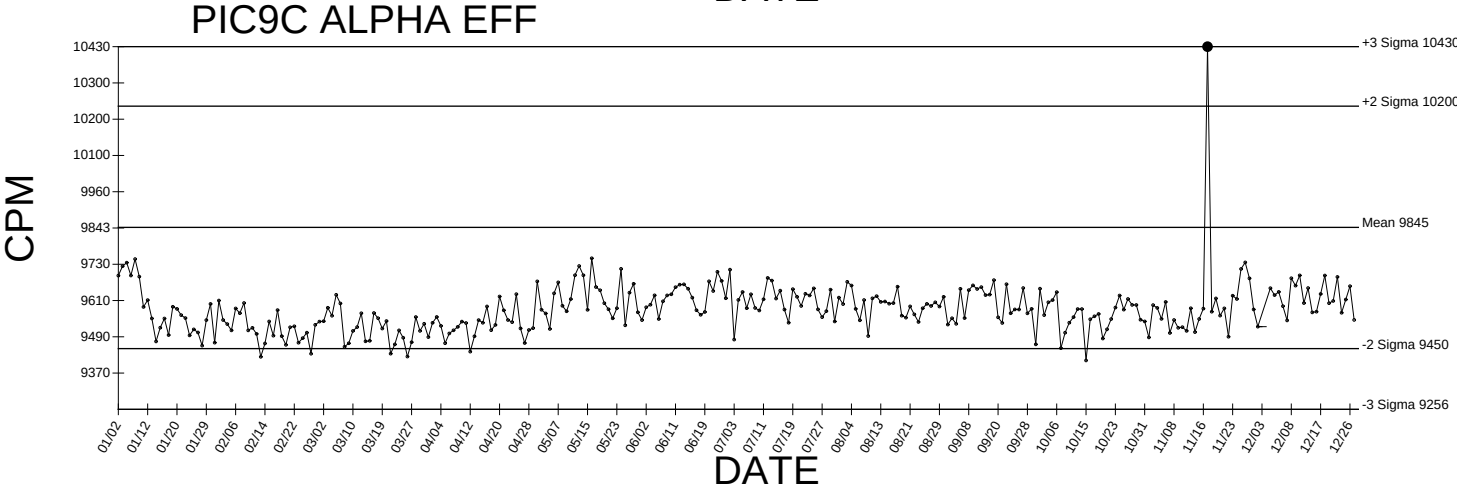
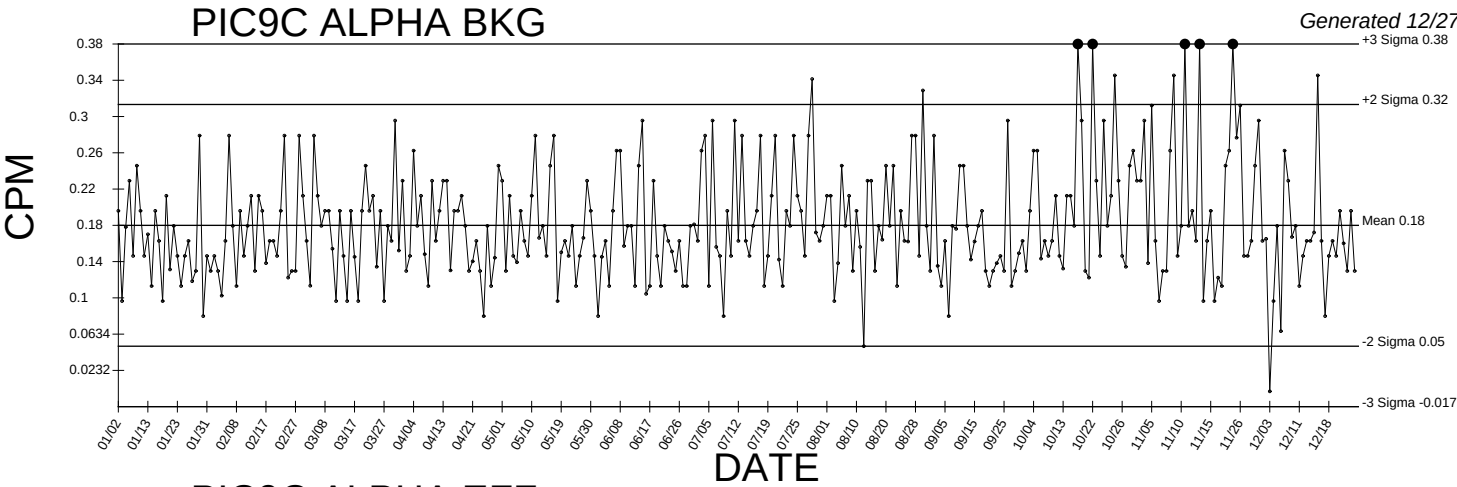
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PIC9B BETA EFF Cross Talk



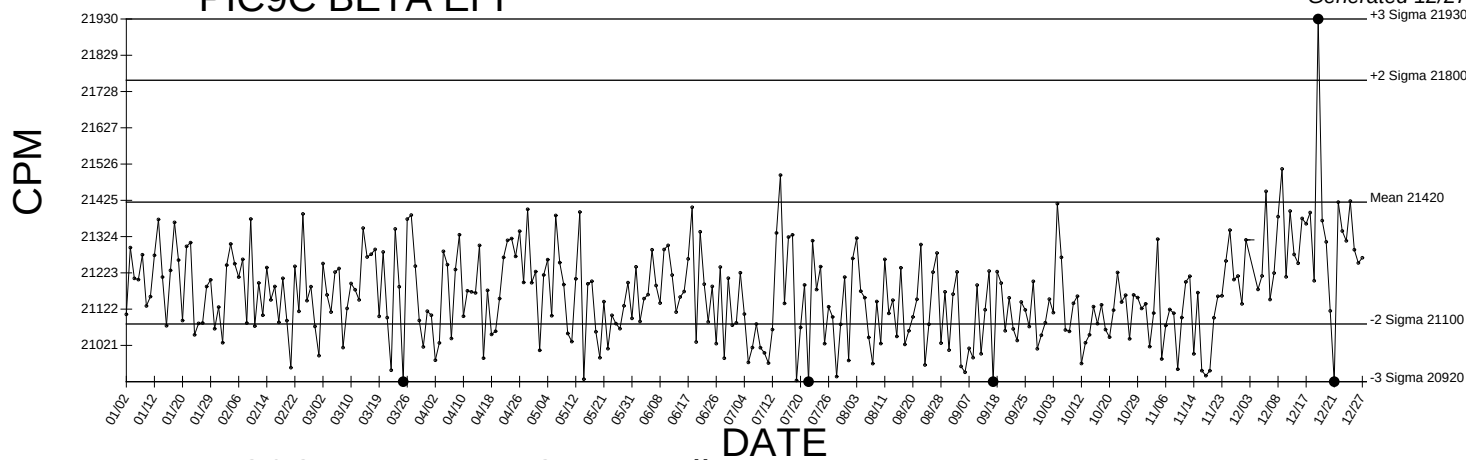
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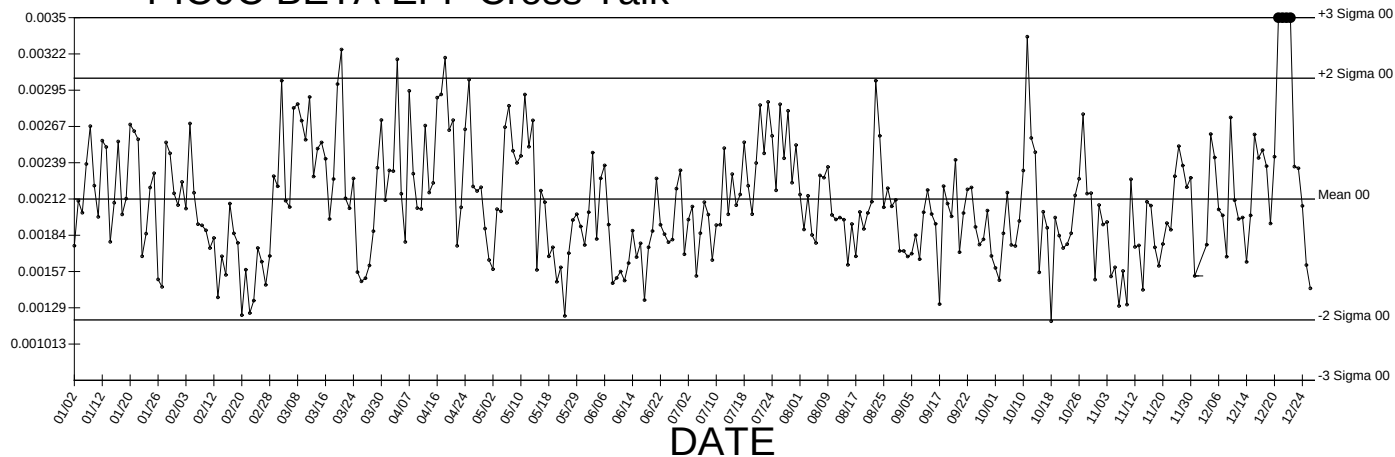
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PIC9C BETA EFF

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 ± 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:			
Radiionuclide	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 4πγ ionization chamber. A calibrated using a barium-133 solution whose activity was determined by 4π(ε+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, $u_c(y)/y$, (%)				0.26
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 [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)	111,56121
Amount of Std (mL)	1
Standard Prep Date	10/10/2018

Std #	Count Date	Quench Number	Gross cpm	Bkg cpm
1	10/10/2018	79112	1700.00	17.90
2	10/10/2018	79112	1700.00	17.90
3	10/10/2018	79112	1700.00	17.90

Std #	Net cpm	Calculated Avg Eff	Standard dp (mL)	Measured cpm
1	1682.10	0.763551	4282.03	4282.03
2	1682.04	0.763551	4177.04	4177.04
3	1682.31	0.763551	4233.14	4233.14

Mean Value =	4231.43
Stdev =	62.50642344
Certificate Value*	4548.3
Two sigma =	125.011
10 % of Mean =	423.143
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

Handwritten signature: B. K. P.



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 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 (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/grp04/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)

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: 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		

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

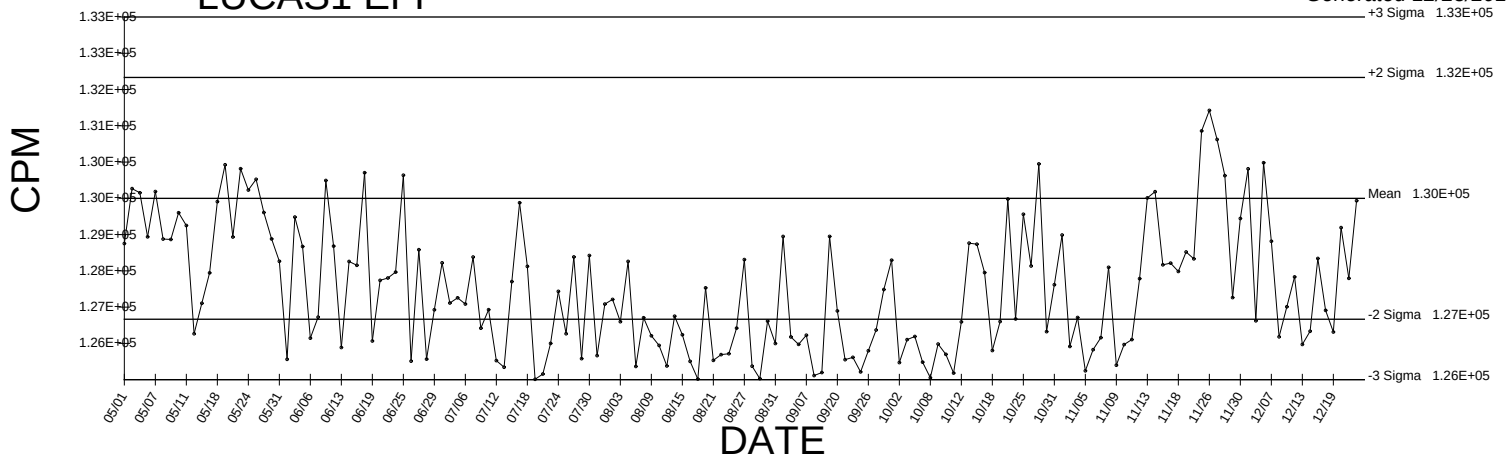
Date: 23-DEC-18

GEL Laboratories LLC

Efficiency Data

LUCAS1 EFF

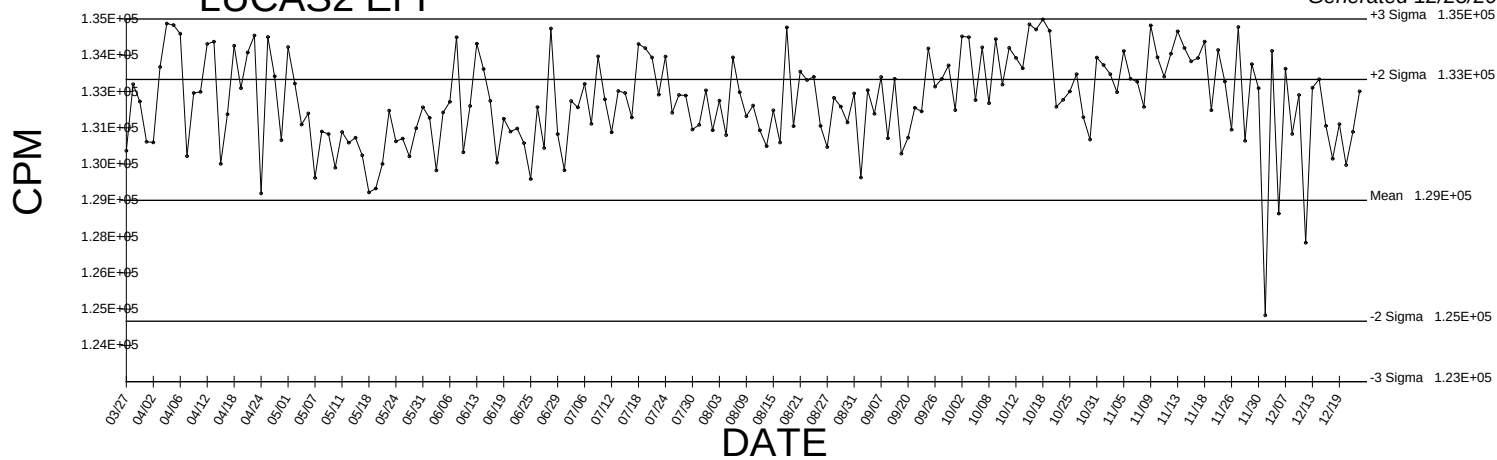
Generated 12/23/2018



● Denotes Outlier

LUCAS2 EFF

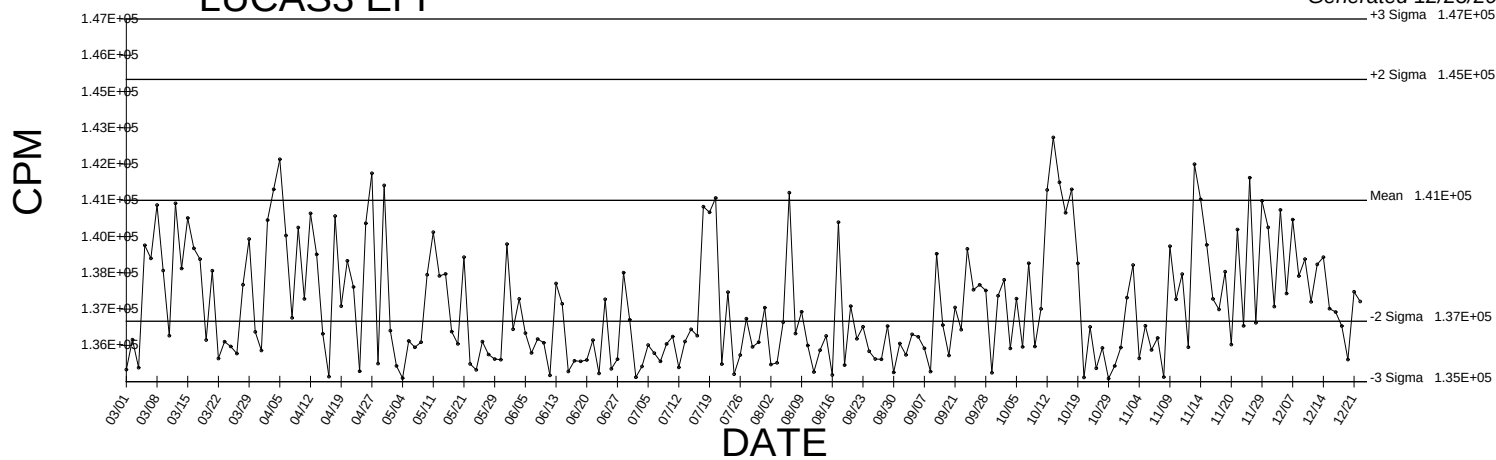
Generated 12/23/2018



● Denotes Outlier

LUCAS3 EFF

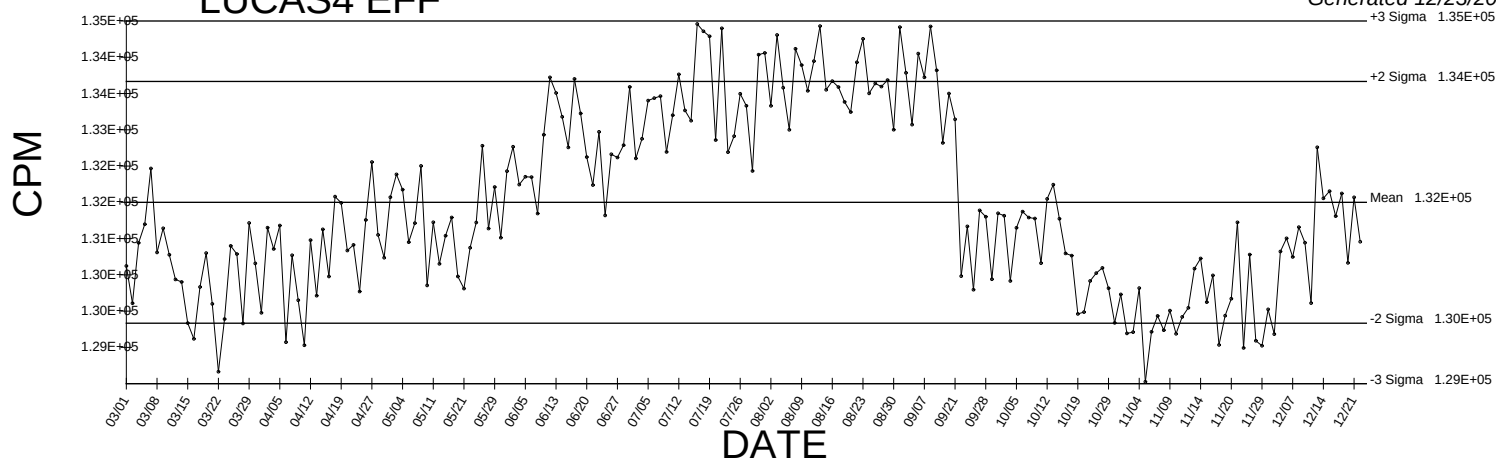
Generated 12/23/2018



● Denotes Outlier

LUCAS4 EFF

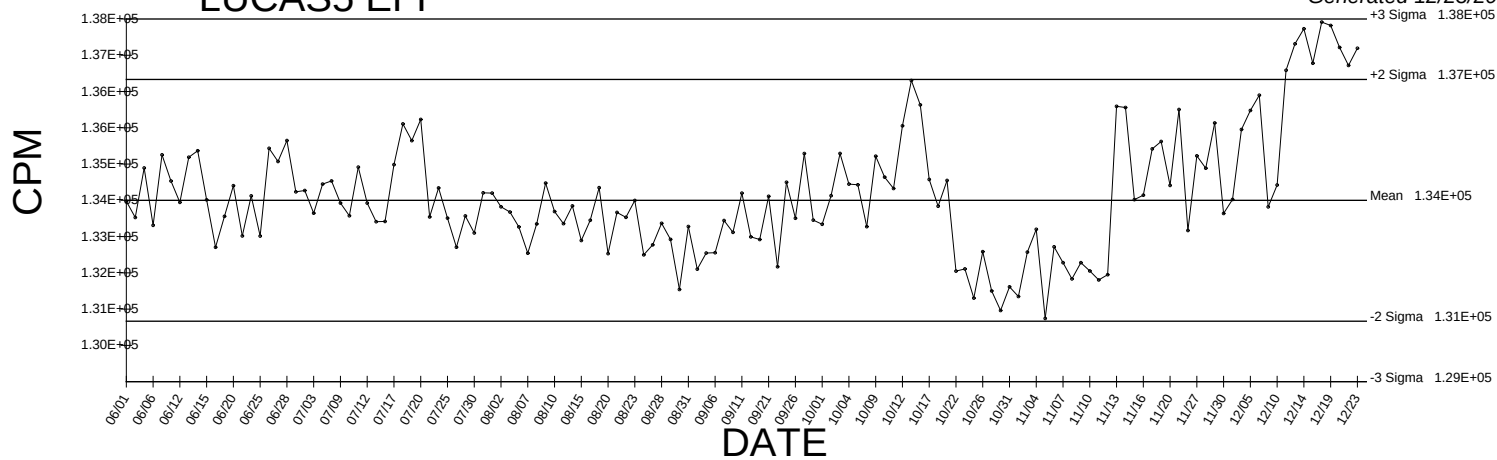
Generated 12/23/2018



● Denotes Outlier

LUCAS5 EFF

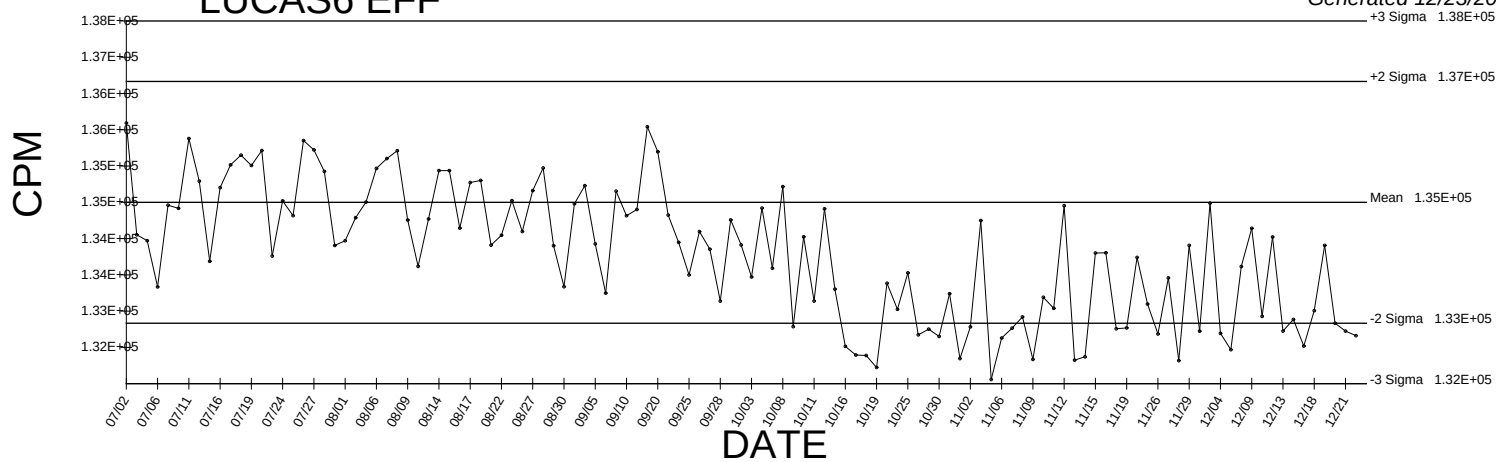
Generated 12/23/2018



● Denotes Outlier

LUCAS6 EFF

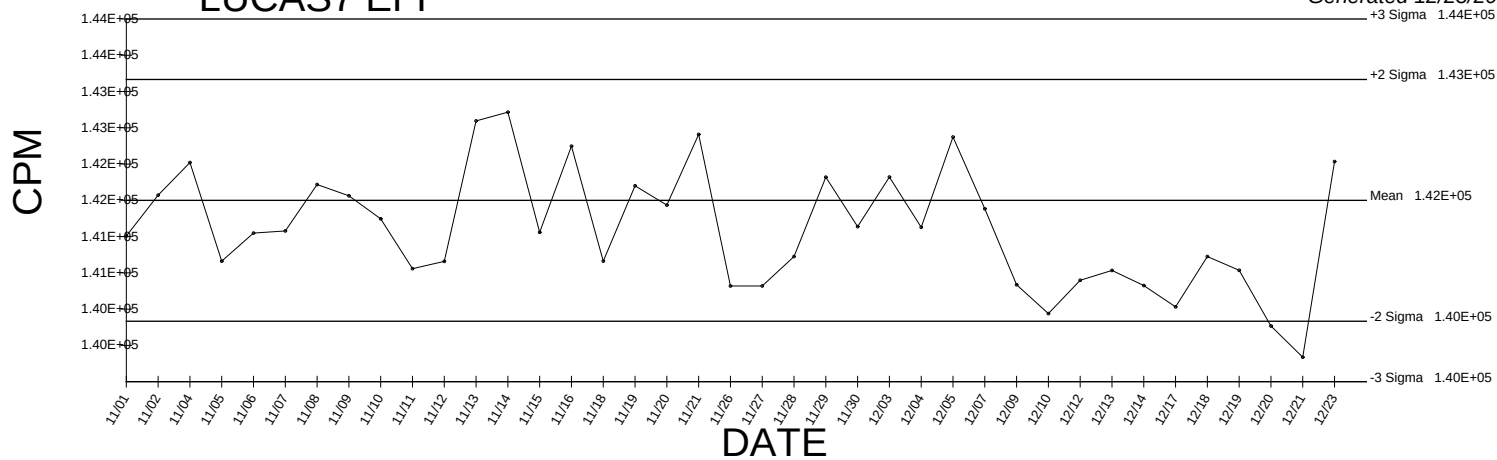
Generated 12/23/2018



● Denotes Outlier

LUCAS7 EFF

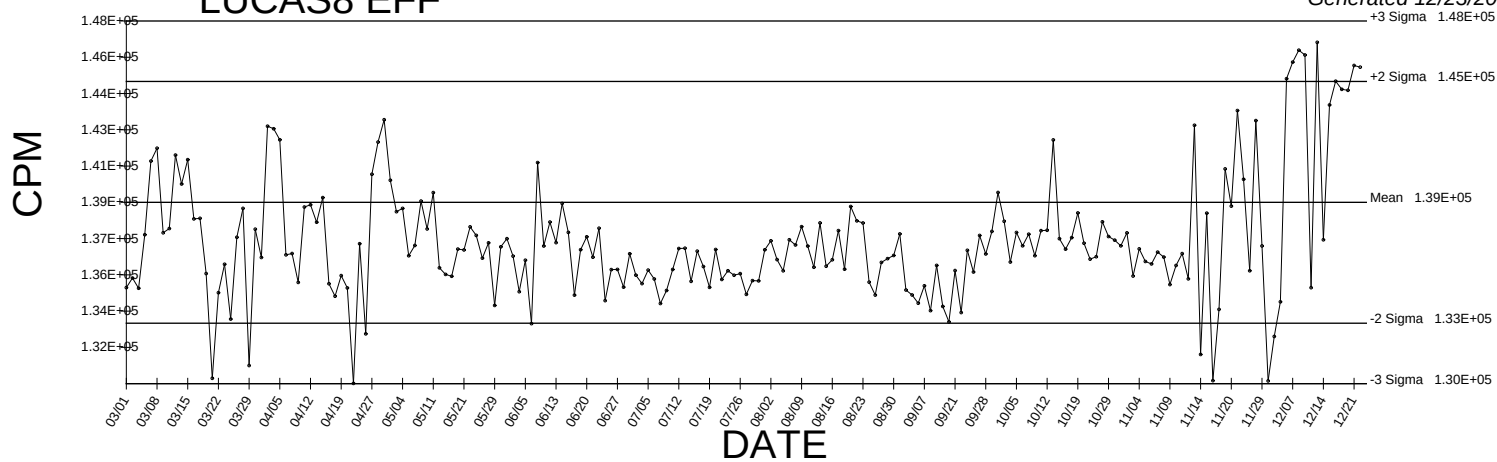
Generated 12/23/2018



● Denotes Outlier

LUCAS8 EFF

Generated 12/23/2018



● 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_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:	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	EXP
Verification Prep Date	2-1-19

Standard Information	
Isotope	Ra-226
Serial Number	
Isotope Activity	6000 ± 0.1 Y
Reference Date	
Ref Act (dpm/g)	
Analysis Sig (yL)	
Standard Prep Date	

Std #	Count Date	Quench Number	Gross cpm	Blkg cpm
1				
2				
3				

Std #	Net cpm	Calculated Avg. Eff.	Standard dpm/ml	Measured dpm
1	225.00	0.833318	269.97	269.27
2	232.50	0.833318	277.46	277.46
3	234.50	0.833318	279.75	279.75

Mean Value = 274.52
Stddev = 7.14064487
Certificate Value* = 288.4
Two sigma = ±4.259
50 % of Mean = 27.452
Rule A (Pass/Fail) Pass
% Recovery 55.79%
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 glass vials. The three 10 ml of Ecoscint L standard source when each vial was added to each of the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 10 ml of Ecoscint Ultra liquid scintillation cocktail. The standard verification vials and background source were dark adapted for at least two hours and counted on LSCYELLOW for Ra-226 source standard verification. The Ra-226 efficiency calibration when was used for verification calculations was determined on 2-4-2019 as in Ra-226 source 1715-D.

Standard results for each verification source was calculated as follows

Source dpm/ml = (A - B)/C/D
where
A = Net source cpm
B = BKG cpm
C = System efficiency (cpm/dpm) and
D = recovery used for standard verification

Ra-226-001

1715-D

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