> = Calculated MDA is zero due to zero counts in the region, or
the region is outside the spectrum, or MDA has not been calculated

@ = Half-life too short to be able to perform the decay correction

****
***** G A M M A S P E C T R U M A N A L Y S I S *****
****

Detector DET03

Report Generated On	:	2/6/2018 11:03:35 AM
Sample Identification	:	2018-0375
Sample Title	:	NE Caisson Well Bottom of Well
Sample Information	:	
	:	
Sample Type	:	
Sample Geometry	:	
Peak Locate Threshold	:	2.50
Peak Locate Range (in channels)	:	100 - 4096
Peak Area Range (in channels)	:	100 - 4096
Identification Energy Tolerance	:	1.000 keV
Sample Size	:	1.820E+003 g
Sample Taken On	:	2/1/2018 4:00:00 PM
Acquisition Started	:	2/6/2018 10:28:15 AM
Live Time	:	1800.0 seconds
Real Time	:	1800.9 seconds
Dead Time	:	0.05 %

Energy Calibration Used Done On	:	3/4/2011
Efficiency Calibration Used Done On	:	5/13/2011
Efficiency ID	:	D3 1L HD

Performed by Ron Burrell Date 2-6-18
Alderman, Anderson, Abrams, Burrell, Eckhardt, Stephens, Stover

Reviewed by [signature] Date 2-6-18
(Print/Signature: Alderman, Anderson)

Peak Locate Analysis Report 2/6/2018 11:03:35 AM Page 2

****
***** PEAK LOCATE REPORT *****
****

Detector Name: DET03
Sample Title: NE Caisson Well Bottom of Well
Peak Locate Performed on: 2/6/2018 11:03:35 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096
Peak Search Sensitivity: 2.50

Peak No.	Centroid Channel	Centroid Uncertainty	Energy (keV)	Peak Significance
1	243.43	0.4701	121.56	2.97
2	477.51	0.3235	238.58	5.22
3	590.31	0.3959	295.18	3.40
4	676.35	0.4777	338.16	2.86
5	703.88	0.2974	352.00	5.21
6	1020.15	0.4525	510.21	3.22
7	1165.92	0.3326	583.07	3.91
8	1217.77	0.2944	609.10	5.36
9	1322.55	0.1169	661.47	29.10
10	1557.29	0.4148	778.92	2.75
11	2344.81	0.3406	1172.73	3.43
12	2663.89	0.3665	1331.89	2.88
13	2921.29	0.2001	1460.42	8.10

? = Adjacent peak noted

Errors quoted at 2.000 sigma

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: DET03
Sample Title: NE Caisson Well Bottom of Well
Peak Analysis Performed on: 2/6/2018 11:03:35 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 4096

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
F	1	239-	246	243.57	121.56	1.28	1.73E+002	43.19	5.07E+002
F	2	473-	481	477.34	238.58	1.19	2.75E+002	47.45	4.97E+002
F	3	586-	594	590.43	295.18	1.34	1.44E+002	33.02	2.59E+002
F	4	671-	680	676.30	338.16	1.10	6.44E+001	27.81	2.55E+002
F	5	699-	708	703.96	352.00	1.49	2.60E+002	37.18	2.27E+002
F	6	1015-	1025	1020.16	510.21	0.81	4.06E+001	21.76	1.64E+002
F	7	1155-	1170	1165.79	583.07	1.37	9.10E+001	24.38	1.62E+002
F	8	1212-	1223	1217.82	609.10	1.47	1.46E+002	27.26	9.16E+001
F	9	1317-	1327	1322.52	661.47	1.60	4.85E+003	136.06	6.73E+001
F	10	1554-	1560	1557.36	778.92	0.91	1.64E+001	11.43	2.24E+001
F	11	2340-	2351	2345.17	1172.73	1.81	5.87E+001	17.74	2.68E+001
F	12	2658-	2670	2663.77	1331.89	2.16	5.13E+001	16.21	1.99E+001
F	13	2914-	2928	2921.13	1460.42	2.24	4.04E+002	39.64	1.98E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: NE Caisson Well Bottom of Well
Nuclide Library Used: C:\GENIE2K\CAMFILES\HBPP.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/g)	Activity Uncertainty
Anhln	0.903	511.01*	100.00	2.49658E-002	1.34749E-002
K-40	0.976	1460.81*	10.67	5.45714E+000	6.10572E-001
Co-60	0.953	1173.22*	100.00	7.11259E-002	2.17933E-002
		1332.49*	100.00	6.89289E-002	2.20650E-002
Cs-137	0.995	661.65*	85.12	4.32678E+000	2.69717E-001
Tl-208	0.695	277.35	6.80		
		583.14*	84.20	7.40748E-002	2.03161E-002
		860.37	12.46		
Pb-212	0.894	238.63*	44.60	2.12505E-001	3.86104E-002
		300.09	3.41		
Bi-214	0.478	609.31*	46.30	2.24512E-001	4.37693E-002
		1120.29	15.10		
		1764.49	15.80		
Pb-214	0.792	241.98	7.49		
		295.21*	19.20	2.99286E-001	7.05709E-002
		351.92*	37.20	3.20080E-001	4.86139E-002

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

Interference Corrected Activity Report 2/6/2018 11:03:35 AM Page 5

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/g)	Wt mean Activity Uncertainty
Anhln	0.903	2.496579E-002	1.347494E-002
K-40	0.976	5.457136E+000	6.105719E-001
Co-60	0.953	7.004100E-002	1.550536E-002
Cs-137	0.995	4.326777E+000	2.697174E-001
Tl-208	0.695	7.407476E-002	2.031614E-002
Pb-212	0.894	2.125050E-001	3.861037E-002
Bi-214	0.478	2.245121E-001	4.376933E-002
Pb-214	0.792	3.133883E-001	4.003437E-002

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 2.000 sigma

Interference Corrected Activity Report 2/6/2018 11:03:35 AM Page 6

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 2/6/2018 11:03:35 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
F	1	121.56	9.5917E-002	25.02		Eu152
F	4	338.16	3.5774E-002	43.19	Tol.	Ac-228
F	10	778.92	9.1275E-003	69.58		Eu152

KEB 2-6-18

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Nuclide MDA Report 2/6/2018 11:03:35 AM Page 7

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: DET03
Sample Geometry:
Sample Title: NE Caisson Well Bottom of Well
Nuclide Library Used: C:\GENIE2K\CAMFILES\HBPP.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/g aaA)	Nuclide MDA (pCi/g)	Activity (pCi/g)	Dec. Level (pCi/g)
+	K-40	1460.81*	10.67	1.45E-001	1.45E-001	5.46E+000	5.40E-002
+	Co-60	1173.22*	100.00	3.59E-002	3.59E-002	7.11E-002	1.63E-002
		1332.49*	100.00	3.60E-002		6.89E-002	1.62E-002
	Nb-94	702.63	100.00	3.43E-002	3.35E-002	7.39E-003	1.61E-002
		871.10	100.00	3.35E-002		-9.38E-003	1.55E-002
	Ag-108m	433.93	89.90	5.14E-002	3.73E-002	-1.52E-002	2.49E-002
		614.37	90.40	4.21E-002		-2.04E-002	2.00E-002
		722.95	90.50	3.73E-002		1.15E-003	1.74E-002
	Cs-134	569.31	15.43	2.61E-001	3.95E-002	-5.46E-002	1.24E-001
		604.70	97.60	3.95E-002		-1.56E-002	1.88E-002
		795.84	85.40	4.17E-002		4.18E-003	1.95E-002
+	Cs-137	661.65*	85.12	3.95E-002	3.95E-002	4.33E+000	1.86E-002
	Eu-152	121.78	28.40	1.32E-001	1.32E-001	1.85E-001	6.44E-002
		244.69	7.49	5.55E-001		-7.76E-002	2.71E-001
		344.27	26.50	1.73E-001		2.22E-001	8.43E-002
		778.89	12.74	2.85E-001		8.37E-002	1.34E-001
		964.01	14.40	3.72E-001		1.21E-001	1.76E-001
		1085.78	10.00	4.44E-001		3.16E-001	2.07E-001
		1112.02	13.30	3.75E-001		1.86E-001	1.76E-001
		1407.95	20.70	1.97E-001		6.77E-003	8.91E-002
	Eu-154	123.07	40.50	9.09E-002	9.09E-002	-3.60E-002	4.45E-002
		723.30	19.70	1.78E-001		8.39E-002	8.36E-002
		873.19	11.50	2.78E-001		-1.15E-001	1.28E-001
		996.32	10.30	3.23E-001		-2.69E-001	1.48E-001
		1004.76	17.90	2.10E-001		8.34E-002	9.72E-002
		1274.45	35.50	1.09E-001		9.55E-003	4.95E-002
	Eu-155	105.31	20.70	1.76E-001	1.76E-001	-3.21E-002	8.61E-002
	Ac-228	338.32	11.40	3.76E-001	1.75E-001	2.59E-001	1.83E-001
		911.07	27.70	1.75E-001		2.04E-001	8.27E-002
		969.11	16.60	3.38E-001		2.94E-001	1.60E-001
	Th-234	63.29	3.80	2.22E+000	8.22E-001	1.17E+000	1.08E+000
		92.59	5.41	8.22E-001		6.21E-001	4.02E-001
	U-235	143.76	10.50	3.04E-001	6.51E-002	-3.80E-002	1.49E-001
		185.72	54.00	6.51E-002		7.30E-002	3.18E-002
	Np-237	311.98	38.60	9.72E-002	9.72E-002	-2.39E-002	4.71E-002
	Am-241	59.54	35.90	2.78E-001	2.78E-001	-1.99E-002	1.35E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** GAMMA SPECTRUM ANALYSIS *****
****

Detector DET01

Report Generated On	:	2/6/2018 10:32:03 AM
Sample Identification	:	2018-0376
Sample Title	:	NE Caisson Well
Sample Information	:	Composite Sample
	:	Above Pump
Sample Type	:	Water
Sample Geometry	:	
Peak Locate Threshold	:	3.00
Peak Locate Range (in channels)	:	100 - 4096
Peak Area Range (in channels)	:	100 - 4096
Identification Energy Tolerance	:	1.000 keV
Sample Size	:	1.077E+003 ml
Sample Taken On	:	2/1/2018 3:22:00 PM
Acquisition Started	:	2/1/2018 4:50:45 PM
Live Time	:	9000.0 seconds
Real Time	:	9002.9 seconds
Dead Time	:	0.03 %

Energy Calibration Used Done On	:	11/15/2010
Efficiency Calibration Used Done On	:	5/3/2011
Efficiency ID	:	D1 1L MD

Performed by Ron Burrell Date 2-6-18
Alderman, Anderson, Abrams, Burrell, Eckhardt, Stephens, Stover

Reviewed by [signature] Date 2-6-18
(Print/Signature: ~~Alderman~~, Anderson)

Peak Locate Analysis Report 2/6/2018 10:32:04 AM Page 2

****
***** P E A K L O C A T E R E P O R T *****
****

Detector Name: DET01
Sample Title: NE Caisson Well
Peak Locate Performed on: 2/6/2018 10:32:03 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096
Peak Search Sensitivity: 3.00

Peak No.	Centroid Channel	Centroid Uncertainty	Energy (keV)	Peak Significance
1	185.77	0.4224	92.89	3.54
2	1322.21	0.1020	661.72	33.44
3	2345.08	0.2910	1173.21	3.52
4	2663.62	0.2685	1332.36	4.40
5	2919.97	0.3170	1460.49	3.51

? = Adjacent peak noted

Errors quoted at 2.000 sigma

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: DET01
Sample Title: NE Caisson Well
Peak Analysis Performed on: 2/6/2018 10:32:03 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 4096

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
F	1	180-	190	185.83	92.89	1.05	8.67E+001	31.30	3.78E+002
F	2	1314-	1329	1322.30	661.72	1.65	3.39E+003	104.17	6.80E+001
F	3	2340-	2351	2345.21	1173.21	1.92	3.88E+001	13.13	1.80E+001
F	4	2657-	2670	2663.64	1332.36	1.86	4.68E+001	13.55	8.75E+000
F	5	2915-	2924	2920.06	1460.49	1.80	1.43E+001	10.95	8.75E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: NE Caisson Well
Nuclide Library Used: C:\GENIE2K\CAMFILES\HBPP.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/ml)	Activity Uncertainty
K-40	0.984	1460.81*	10.67	7.23086E-008	5.56991E-008
Co-60	0.999	1173.22*	100.00	1.74014E-008	5.94803E-009
		1332.49*	100.00	2.34170E-008	6.89421E-009
Cs-137	0.999	661.65*	85.12	1.06876E-006	6.77260E-008
Th-234	0.339	63.29	3.80		
		92.59*	5.41	1.06797E-007	3.93104E-008

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

Interference Corrected Activity Report 2/6/2018 10:32:04 AM Page 5

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/ml)	Wt mean Activity Uncertainty
K-40	0.984	7.230861E-008	5.569908E-008
Co-60	0.999	1.996838E-008	4.503566E-009
Cs-137	0.999	1.068757E-006	6.772601E-008
Th-234	0.339	1.067974E-007	3.931036E-008

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 2/6/2018 10:32:03 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide

All peaks were identified.

Nuclide MDA Report 2/6/2018 10:32:04 AM Page 6

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: DET01
Sample Geometry:
Sample Title: NE Caisson Well
Nuclide Library Used: C:\GENIE2K\CAMFILES\HBPP.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (uCi/ml)	Nuclide MDA (uCi/ml)	Activity (uCi/ml)	Dec. Level (uCi/ml)
+	K-40	1460.81*	10.67	8.78E-008	8.78E-008	7.23E-008	3.70E-008
+	Co-60	1173.22*	100.00	1.11E-008	9.43E-009	1.74E-008	4.95E-009
		1332.49*	100.00	9.43E-009		2.34E-008	4.04E-009
	Nb-94	702.63	100.00	1.20E-008	1.20E-008	1.01E-008	5.63E-009
		871.10	100.00	1.31E-008		2.50E-009	6.10E-009
	Ag-108m	433.93	89.90	2.04E-008	1.19E-008	1.05E-008	9.94E-009
		614.37	90.40	1.51E-008		-1.14E-009	7.18E-009
		722.95	90.50	1.19E-008		2.29E-009	5.49E-009
	Cs-134	569.31	15.43	8.19E-008	1.36E-008	-8.49E-008	3.89E-008
		604.70	97.60	1.36E-008		-1.39E-008	6.45E-009
		795.84	85.40	1.42E-008		8.78E-009	6.59E-009
+	Cs-137	661.65*	85.12	1.57E-008	1.57E-008	1.07E-006	7.40E-009
	Eu-152	121.78	28.40	3.15E-008	3.15E-008	3.30E-008	1.54E-008
		244.69	7.49	1.52E-007		-7.43E-008	7.40E-008
		344.27	26.50	5.45E-008		2.37E-008	2.65E-008
		778.89	12.74	1.04E-007		9.44E-008	4.86E-008
		964.01	14.40	1.07E-007		5.20E-008	4.99E-008
		1085.78	10.00	1.56E-007		9.37E-008	7.23E-008
		1112.02	13.30	1.15E-007		2.09E-008	5.29E-008
		1407.95	20.70	7.86E-008		3.48E-008	3.59E-008
	Eu-154	123.07	40.50	2.22E-008	2.22E-008	3.21E-008	1.09E-008
		723.30	19.70	5.40E-008		2.29E-008	2.50E-008
		873.19	11.50	1.13E-007		-6.04E-008	5.22E-008
		996.32	10.30	1.37E-007		4.57E-008	6.32E-008
		1004.76	17.90	7.78E-008		2.21E-008	3.59E-008
		1274.45	35.50	3.59E-008		3.73E-009	1.61E-008
	Eu-155	105.31	20.70	3.45E-008	3.45E-008	-1.98E-008	1.68E-008
	Ac-228	338.32	11.40	1.20E-007	4.94E-008	-1.54E-007	5.83E-008
		911.07	27.70	4.94E-008		0.00E+000	2.29E-008
		969.11	16.60	9.37E-008		3.94E-008	4.38E-008
+	Th-234	63.29	3.80	2.07E-007	1.25E-007	1.96E-007	1.01E-007
		92.59*	5.41	1.25E-007		1.07E-007	6.07E-008
	U-235	143.76	10.50	7.86E-008	2.04E-008	-7.44E-009	3.83E-008
		185.72	54.00	2.04E-008		2.09E-008	9.98E-009
	Np-237	311.98	38.60	3.02E-008	3.02E-008	-7.36E-009	1.46E-008
	Am-241	59.54	35.90	2.16E-008	2.16E-008	-1.29E-008	1.05E-008

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

Appendix 4 – GEL Lab Results

GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
F 843.766.1178

gel.com

January 31, 2018

Ms. Dee Anderson
Pacific Gas and Electric, Humboldt Bay Power Plant
1000 King Salmon Avenue
Eureka, California 95503

Re: Final Status Survey
Work Order: 441883

Dear Ms. Anderson:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on January 18, 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. 4504.

Sincerely,

Lindsay Fabra

Lindsay Fabra for
Erin Trent
Project Manager

Purchase Order: 3501121709, line 2
Enclosures

Table of Contents

Case Narrative

Case Narrative
for
Pacific Gas and Electric Company
SDG: 441883

January 31, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary

Sample Receipt The sample arrived at GEL Laboratories LLC, Charleston, South Carolina on January 18, 2018 for analysis. The sample was 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 sample:

Laboratory ID	Client ID
441883001	2018-0045: Caisson NE Well 1-B

Case Narrative

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) 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.

Data Package

The enclosed data package contains the following sections: General Narrative, Chain of Custody and Supporting Documentation, and data from the following fractions: Radiochemistry.

Lindsay Fabra
Lindsay Fabra for
Erin Trent
Project Manager

Chain of Custody and Supporting Documentation

P. O. # 3501062072
Line Item #007
Vendor #

44883 Lab: GEL Chain of Custody and Analytical Request

Page 1 of 1
Laboratory Number:
Excavation Permit #

Client Name: PGE Phone 707-444-0746
Project/Site Name: HBPP Fax #: 707-444-2671
Address: 1000 King Salmon, Eureka, CA 95503 Contact: Dee Anderson
Collected by: HBPP Send Results to: HBPPLABFSS@pge.com

Sample Analysis Requested (5) (Fill in the number of containers for each test)

Sample ID	Date Collected (mm-dd-yy)	Time Collected (hh:mm))	QC Code (2)	Field Filtered (3)	Sample Matrix (4)	Should this sample be considered: Radio-active	TSCA Regulated	Total Number of Containers	Gamma	HTDs				Preservative Type (6) / Comments Note: Extra Sample is Required for Sample Specific QC
2018-0045: Caisson NE Well 1-B	1/4/2018	15:05	N	N	SO	Y	N	1	X	X				1-L Marinelli (not dried)

TAT Requested: Normal X Rush: Specify: Fax Results: Yes / No Circle Deliverable: C of A / QC Summary / Level 1 / Level 2 / Level 3 / Level 4

Remarks: Are there any known hazards applicable to these samples? If so, please list the hazards. Samples can be discarded appropriately. In case of emergency, please call 707-444-0809. Analyze 1-L Marineeli (dried) for gamma in current container. Analyze HTDs (Hard to Detects). Requested MDAs attached.

Chain of Custody Signatures

Relinquished By (Signed)	Date	Time	Received By (Signed)	Date	Time
1. [signature]	1-15-18	1555	1. [signature]	1/18/18	1055
2.			2.		
3.			3.		

Sample Shipping and Delivery Details

GEL PM:
Method of Shipment: Date Shipped:
Airbill #:
Airbill #:

1.) Chain of Custody Number = Client Determined
2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample. G = Grab, C = Composite
3.) Field Filterd: For liquid matrices, indicate with a -Y_ for yes the sample was field filtered or -N- for sample was not field filtered.
4.) Matrix Codes: DW+Drinking Water, GW=Groundwater, SW=Surface Water, WW= Waste Water, W=Water, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal
5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1)
6.) Preservative Type: HA=Hydrochloric Acid, NI=Nitric Acid, SH=Sodium Hyrdroxide, SA=Sulfuric Acid, AA=Ascorbic Acid, HX=Hexane, ST=Sodium Thiosulfate
If no preservative is added = leave field blank.

For Lab Receiving Use Only
Custody Seal Intact?
YES NO
Cooler Temp:
C

Appendix 4 – GEL Lab Results

Final Status Survey Planning (FSSP) Worksheet
NOL01-09

MDCs for gamma analysis of soil samples:

Nuclide	10% to %50 of the DCGL (pCi/g)		
Co-60	3.58E-01	to	1.79E+00
Nb-94	6.70E-01	to	3.35E+00
Cs-137	7.45E-01	to	3.73E+00
Eu-152	9.43E-01	to	4.72E+00
Eu-154	8.87E-01	to	4.43E+00
Np-237	1.04E-01	to	5.19E-01

The desired MDCs in the laboratory analyses of FSS soil samples will be the 10% DCGL values. If it is impractical to achieve those, the 50% DCGL values must be achieved in the laboratory analyses of the soil samples.

MDC's for HTD nuclide:

Nuclide	10%		50% of the DCGL (pCi/g)
C-14	6.30E-01	to	3.15E+00
Ni-59	1.90E+02	to	9.50E+02
Ni-63	7.20E+01	to	3.60E+02
Sr-90	1.50E-01	to	7.50E-01
Tc-99	1.20E+00	to	6.00E+00
Pu-238	2.90E+00	to	1.45E+01
Pu-239/240	2.60E+00	to	1.30E+01
Pu-241	8.60E+01	to	4.30E+02
Am-241	2.36E+00	to	1.18E+01
Cm-243/244	2.90E+00	to	1.45E+01
Cm-245/246	1.70E+00	to	8.50E+00

The desired MDCs in the off-site laboratory analyses of FSS soil samples will be the 10% DCGL values. If it is impractical to achieve those, the 50% DCGL values must be achieved in the laboratory analyses of the soil samples. The MDC values for difficult to detect nuclides will be conveyed to the outside laboratory via the sample Chain-Of-Custody form which will accompany the soil samples.

GEL Laboratories LLC ET

SAMPLE RECEIPT & REVIEW FORM

Client: PCGE	SDG/AR/COC/Work Order: 441883
Received By: MSH	Date Received: 1/18/18
Carrier and Tracking Number	Circle Applicable: (FedEx Express) FedEx Ground UPS Field Services Courier Other 8092 0937 8236

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?		X	Hazard Class Shipped: UN#:
COC/Samples marked or classified as radioactive?	X		Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 200 (CPM) mR/Hr Classified as: Rad 1 Rad 2 Rad 3
Is package, COC, and/or Samples marked HAZ?		X	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?	X			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	X			
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*		X		Preservation Method: Wet Ice Ice Packs Dry ice (None) Other: *all temperatures are recorded in Celsius TEMP: 21°C
4	Daily check performed and passed on IR temperature gun?	X			Temperature Device Serial #: IR4-16 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	X			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?		X		Sample ID's and Containers Affected: If Preservation added, Lot#:
7	Do any samples require Volatile Analysis?			X	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?	X			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	X			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	X			Sample ID's affected:
11	Number of containers received match number indicated on COC?	X			Sample ID's affected:
12	Are sample containers identifiable as GEL provided?			X	
13	COC form is properly signed in relinquished/received sections?	X			

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials AM Date 1/19/18 Page 1 of 1

GL-CHL-SR-001 Rev 5

Laboratory Certifications

List of current GEL Certifications as of 31 January 2018

State	Certification
Alaska	UST-0110
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
Delaware	SC00012
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 Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-17-12
Utah NELAP	SC000122017-25
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404

Radiological Analysis

Case Narrative

Radiochemistry
Technical Case Narrative
Pacific Gas and Electric Company (PCGE)
SDG #: 441883

Product: **Alphaspec Am241, Cm, Solid 1.64 pCi/g RDL**
Analytical Method: DOE EML HASL-300, Am-05-RC Modified
Analytical Procedure: GL-RAD-A-011 REV# 26
Analytical Batch: 1733449

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956943	Method Blank (MB)
1203956944	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956945	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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 1203956943 (MB) and 441883001 (2018-0045: Caisson NE Well 1-B) were recounted due to a suspected false positive. The recounts are reported.

Miscellaneous Information

Manual Integration
Manual integration of alpha spectroscopy spectra 1203956945 (LCS) was performed to fully separate counts in Regions of Interest which would have been biased.

Product: **Alphaspec Pu, Solid 2.51 pCi/g RDL**
Analytical Method: DOE EML HASL-300, Pu-11-RC Modified
Analytical Procedure: GL-RAD-A-011 REV# 26
Analytical Batch: 1733450

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956946	Method Blank (MB)
1203956947	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956948	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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: **Dry Weight**
Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B

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: **Gammaspec, Gamma, Direct Count**
Analytical Method: DOE HASL 300, 4.5.2.3/Ga-01-R
Analytical Procedure: GL-RAD-A-013 REV# 27
Analytical Batch: 1732744

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203955060	Method Blank (MB)

1203955061 441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203955062 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 QC 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
1203955061 (2018-0045: Caisson NE Well 1-BDUP)	Bismuth-214	RPD 101* (0.0%-100.0%) RER 3 (0-3)
	Lead-210	RPD 24.5* (0.00%-20.00%) RER 2.23 (0-3)

Qualifier Information

Qualifier	Reason	Analyte	Sample	Client Sample
UI	Results are considered a false positive due to interference.	Sodium-22	441883001	2018-0045: Caisson NE Well 1-B
			1203955061	2018-0045: Caisson NE Well 1-B(441883001
UI	Results are considered a false positive due to low abundance.	Barium-133	441883001	2018-0045: Caisson NE Well 1-B
		Bismuth-214	1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Cesium-134	441883001	2018-0045: Caisson NE Well 1-B
		Cobalt-57	441883001	2018-0045: Caisson NE Well 1-B
			1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Europium-154	441883001	2018-0045: Caisson NE Well 1-B

			1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Iridium-192	441883001	2018-0045: Caisson NE Well 1-B
			1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Lead-212	441883001	2018-0045: Caisson NE Well 1-B
			1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Lead-214	1203955061	2018-0045: Caisson NE Well 1-B(441883001
		Zinc-65	441883001	2018-0045: Caisson NE Well 1-B
			1203955061	2018-0045: Caisson NE Well 1-B(441883001
UI	Results are considered a false positive due to no valid peak.	Barium-133	1203955061	2018-0045: Caisson NE Well 1-B(441883001

Product: **Gamma Ni59, Solid 183 pCi/g RDL**
Analytical Method: DOE RESL Ni-1
Analytical Procedure: GL-RAD-A-022 REV# 18
Analytical Batch: 1733102

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956059	Method Blank (MB)
1203956060	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956061	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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: **GFPC, Sr90, soil 0.145 pCi/g RDL**
Analytical Method: EPA 905.0 Modified/DOE RP501 Rev. 1 Modified
Analytical Procedure: GL-RAD-A-004 REV# 19
Analytical Batch: 1732910

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203955551	Method Blank (MB)
1203955552	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203955553	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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 441883001 (2018-0045: Caisson NE Well 1-B) was recounted due to a suspected blank false positive. The recount is reported. Samples 1203955552 (2018-0045: Caisson NE Well 1-BDUP) and 441883001 (2018-0045: Caisson NE Well 1-B) were verified by recounting at least five days from the separation date. The recounts are reported.

Product: **Liquid Scint Pu241, Solid 82.9 pCi/g RDL**
Analytical Method: DOE EML HASL-300, Pu-11-RC Modified
Analytical Procedure: GL-RAD-A-035 REV# 19
Analytical Batch: 1733451

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956949	Method Blank (MB)
1203956950	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956951	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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: **Liquid Scint Tc99, Solid 1.16 pCi/g RDL**
Analytical Method: DOE EML HASL-300, Tc-02-RC Modified
Analytical Procedure: GL-RAD-A-059 REV# 5
Analytical Batch: 1733051

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203955910	Method Blank (MB)
1203955911	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203955912	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: **Liquid Scint C14, Solid, 0.577 pCi/g RDL**
Analytical Method: EPA EERF C-01 Modified
Analytical Procedure: GL-RAD-A-003 REV# 15
Analytical Batch: 1733084

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956000	Method Blank (MB)
1203956001	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956002	441883001(2018-0045: Caisson NE Well 1-B) Matrix Spike (MS)
1203956003	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, 1203956002 (2018-0045: Caisson NE Well 1-BMS), aliquot was reduced to conserve sample volume.

Product: **Liquid Scint Ni63, Solid 69.4 pCi/g RDL**
Analytical Method: DOE RESL Ni-1, Modified
Analytical Procedure: GL-RAD-A-022 REV# 18
Analytical Batch: 1733099

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1732731

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

GEL Sample ID#	Client Sample Identification
441883001	2018-0045: Caisson NE Well 1-B
1203956050	Method Blank (MB)
1203956051	441883001(2018-0045: Caisson NE Well 1-B) Sample Duplicate (DUP)
1203956052	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" 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.

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

PCGE006 Pacific Gas and Electric Company

Client SDG: 441883 GEL Work Order: 441883

The Qualifiers in this report are defined as follows:

M Result is < LLD and > MDC
U Result is < LLD and < MDC
UI Uncertain identification for gamma spectroscopy

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: Heather McCarty **Name: Heather McCarty**

Date: 31 JAN 2018 **Title: Analyst II**

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

GEL Sample ID: 441883001
Client Sample ID: 2018-0045: Caisson NE Well 1-B
Client Matrix: Soil
Amount of Sample Received:

Client: Pacific Gas and Electric Company
Collect Date: January 04, 2018
Receive Date: January 18, 2018
Report Date: January 31, 2018

Isotope	Run Date	Qualifier	Activity	2 Sigma Uncertainty	MDC	LLD	2 Sigma TPU	Units
C-14	01/24/18		3.18E+00	3.04E-01	4.30E-01	5.77E-01	3.82E-01	pCi/g
Ni-63	01/27/18	U	1.05E+01	1.40E+01	2.28E+01	6.94E+01	1.42E+01	pCi/g
Sr-90	01/31/18		6.35E-01	1.06E-01	1.04E-01	1.45E-01	1.56E-01	pCi/g
Tc-99	01/30/18	U	5.20E-01	5.43E-01	8.94E-01	1.16E+00	5.46E-01	pCi/g
Pu-241	01/26/18	U	1.58E+01	2.43E+01	3.99E+01	8.29E+01	2.46E+01	pCi/g
Alpha Spec								
Pu-238	01/25/18	U	7.03E-02	1.38E-01	1.91E-01	2.80E+00	1.38E-01	pCi/g
Pu-239/240	01/25/18	U	1.90E-01	1.93E-01	1.91E-01	2.51E+00	1.95E-01	pCi/g
Am-241	01/25/18	U	1.02E-01	3.40E-01	6.28E-01	2.41E+00	3.40E-01	pCi/g
Cm-243/244	01/25/18	U	-5.03E-02	3.45E-01	8.25E-01	2.80E+00	3.46E-01	pCi/g
Cm-245/246	01/25/18	U	3.23E-01	4.41E-01	4.72E-01	1.64E+00	4.46E-01	pCi/g
Gamma Spec								
Be-7	01/19/18	U	2.19E-01	3.63E-01	4.23E-01		3.64E-01	pCi/g
Na-22	01/19/18	UI	3.27E-02	4.98E-02	3.27E-02		1.55E-01	pCi/g
K-40	01/19/18		3.23E+00	2.17E-01	1.46E-01		3.90E-01	pCi/g
Cr-51	01/19/18	U	-4.37E-02	2.88E-01	5.02E-01		2.88E-01	pCi/g
Mn-54	01/19/18	U	-1.13E-03	3.10E-02	5.03E-02		3.10E-02	pCi/g
Fe-59	01/19/18	U	-1.44E-02	5.97E-02	1.02E-01		6.00E-02	pCi/g
Co-56	01/19/18	U	7.57E-03	3.68E-02	5.68E-02		3.70E-02	pCi/g
Co-57	01/19/18	UI	1.64E-01	9.69E-02	1.64E-01		2.15E+01	pCi/g
Co-58	01/19/18		6.82E-02	5.41E-02	5.48E-02		7.37E-02	pCi/g
Co-60	01/19/18		5.46E+00	6.32E-02	2.46E-02	3.44E-01	5.36E-01	pCi/g
Ni-59	01/25/18	U	-6.21E+00	3.18E+01	5.06E+01	1.83E+02	3.20E+01	pCi/g
Zn-65	01/19/18	UI	1.17E-01	7.09E-02	1.17E-01		4.76E-01	pCi/g
Y-88	01/19/18	U	-3.39E-03	4.62E-03	7.62E-03		4.87E-03	pCi/g
Zr-95	01/19/18		7.49E-01	1.09E-01	1.03E-01		1.27E-01	pCi/g
Nb-94	01/19/18	U	-9.87E-03	2.67E-02	4.40E-02	6.44E-01	2.71E-02	pCi/g
Nb-95	01/19/18		2.70E-01	4.96E-02	5.57E-02		5.48E-02	pCi/g
Ru-106	01/19/18	U	-1.60E-01	2.53E-01	4.20E-01		2.64E-01	pCi/g
Ag-110m	01/19/18	U	-6.97E-03	4.14E-02	7.17E-02		4.15E-02	pCi/g
Sn-113	01/19/18	U	1.30E-02	3.19E-02	5.51E-02		3.25E-02	pCi/g
Sb-124	01/19/18	U	-6.33E-03	1.41E-02	1.94E-02		1.44E-02	pCi/g
Sb-125	01/19/18	U	-1.96E-02	6.76E-02	1.16E-01		6.82E-02	pCi/g
Cs-134	01/19/18	UI	5.60E-02	4.40E-02	5.60E-02		5.90E-02	pCi/g
Cs-136	01/19/18	U	6.07E-02	7.19E-02	1.24E-01		7.72E-02	pCi/g

Notes:
1. LLDs are a-priori values.
2. MDCs are calculated a-posteriori values.
3. Gamma spectroscopy analysis results are calculated from a measurement using only one gamma energy line.
4. Air sample volumes are received in units of ft3. GEL converts the units and reports them as m3.

Qualifiers:
U Target isotope was analyzed for but not detected above the MDC and LLD.
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details.
M Reported result is less than the LLD and greater than the MDC.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

GEL Sample ID: 441883001
Client Sample ID: 2018-0045: Caisson NE Well 1-B
Client Matrix: Soil
Amount of Sample Received:

Client: Pacific Gas and Electric Company
Collect Date: January 04, 2018
Receive Date: January 18, 2018
Report Date: January 31, 2018

Isotope	Run Date	Qualifier	Activity	2 Sigma Uncertainty	MDC	LLD	2 Sigma TPU	Units
Cs-137	01/19/18		1.17E+01	7.06E-02	5.03E-02	7.16E-01	9.83E-01	pCi/g
Ba-133	01/19/18	UI	5.81E-02	5.26E-02	5.81E-02		2.77E-01	pCi/g
Ba-140	01/19/18	U	7.06E-02	2.38E-01	3.59E-01		2.40E-01	pCi/g
Ce-139	01/19/18	U	3.19E-03	2.73E-02	4.52E-02		2.74E-02	pCi/g
Ce-141	01/19/18	U	4.17E-02	5.92E-02	9.13E-02		6.22E-02	pCi/g
Ce-144	01/19/18	U	7.32E-02	1.77E-01	2.97E-01		1.80E-01	pCi/g
Nd-147	01/19/18	U	-2.45E-02	5.00E-01	7.54E-01		5.00E-01	pCi/g
Pm-144	01/19/18	U	-1.46E-04	3.06E-02	4.50E-02		3.06E-02	pCi/g
Pm-146	01/19/18	U	1.46E-02	3.21E-02	5.49E-02		3.28E-02	pCi/g
Eu-152	01/19/18		1.39E+02	3.18E-01	1.30E-01	9.06E-01	1.28E+01	pCi/g
Eu-154	01/19/18	UI	1.87E-01	1.41E-01	1.87E-01	8.52E-01	2.09E+00	pCi/g
Eu-155	01/19/18	U	1.49E-01	1.89E-01	2.02E-01		1.90E-01	pCi/g
Ir-192	01/19/18	UI	4.79E-02	3.45E-02	4.79E-02		4.62E-02	pCi/g
Hg-203	01/19/18	U	3.29E-03	3.52E-02	5.16E-02		3.53E-02	pCi/g
Tl-208	01/19/18		8.44E-02	2.78E-02	4.75E-02		2.87E-02	pCi/g
Pb-210	01/19/18		3.81E+02	1.73E+01	1.16E+01		5.55E+01	pCi/g
Pb-212	01/19/18	UI	8.16E-02	6.05E-02	8.16E-02		1.01E-01	pCi/g
Pb-214	01/19/18		2.38E-01	8.19E-02	9.13E-02		8.43E-02	pCi/g
Bi-212	01/19/18	U	1.49E-02	4.70E-01	6.88E-01		4.71E-01	pCi/g
Bi-214	01/19/18		2.37E-01	7.44E-02	8.88E-02		7.70E-02	pCi/g
Ra-228	01/19/18	U	1.59E-01	1.59E-01	1.88E-01		1.75E-01	pCi/g
Ac-228	01/19/18	U	1.59E-01	1.59E-01	1.88E-01		1.75E-01	pCi/g
Th-234	01/19/18	U	1.49E-01	1.42E+00	2.47E+00		1.42E+00	pCi/g
U-235	01/19/18	U	-3.09E-02	1.74E-01	2.90E-01		1.74E-01	pCi/g
U-238	01/19/18	U	1.49E-01	1.42E+00	2.47E+00		1.42E+00	pCi/g
Np-237	01/19/18	U	-3.06E-02	5.60E-02	8.82E-02	9.97E-02	5.77E-02	pCi/g
Np-239	01/19/18	U	1.36E-01	3.39E-01	5.30E-01		3.45E-01	pCi/g
Am-241	01/19/18	U	1.45E-01	1.83E-01	3.19E-01	2.27E+00	1.95E-01	pCi/g

Notes:
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Qualifiers:
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UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details.
M Reported result is less than the LLD and greater than the MDC.

Quality Control Summary

QC Summary

Client : Pacific Gas and Electric, Humboldt Bay Power Plant
1000 King Salmon Avenue

Eureka, California

Contact: Ms. Dee Anderson

Workorder: 441883

Report Date: January 31, 2018

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Alpha Spec										
Batch 1733449										
QC1203956944 441883001 DUP										
Americium-241	U	1.02E-01	U	1.68E-01	pCi/g	0		N/A	MXS2	01/25/1808:35
	Uncert:	+/-3.40E-01		+/-2.66E-01						
	TPU:	+/-3.40E-01		+/-2.67E-01						
Curium-243/244	U	-5.03E-02	U	-2.03E-02	pCi/g	0		N/A		
	Uncert:	+/-3.45E-01		+/-8.98E-02						
	TPU:	+/-3.46E-01		+/-9.00E-02						
Curium-245/246	U	3.23E-01	U	6.28E-02	pCi/g	0		N/A		
	Uncert:	+/-4.41E-01		+/-1.73E-01						
	TPU:	+/-4.46E-01		+/-1.73E-01						
QC1203956945 LCS										
Americium-241	9.51E+00			9.22E+00	pCi/g		96.9	(75%-125%)	MXS2	01/25/1808:35
	Uncert:			+/-1.25E+00						
	TPU:			+/-1.82E+00						
Curium-243/244	1.19E+01			9.38E+00	pCi/g		78.5	(75%-125%)		
	Uncert:			+/-1.25E+00						
	TPU:			+/-1.84E+00						
Curium-245/246			M	1.99E-01	pCi/g					
	Uncert:			+/-2.19E-01						
	TPU:			+/-2.21E-01						
QC1203956943 MB										
Americium-241			U	-3.98E-02	pCi/g				MXS2	01/25/1814:38
	Uncert:			+/-1.36E-01						
	TPU:			+/-1.36E-01						
Curium-243/244			U	-3.92E-02	pCi/g					
	Uncert:			+/-1.34E-01						
	TPU:			+/-1.34E-01						
Curium-245/246			U	-1.82E-02	pCi/g					
	Uncert:			+/-1.52E-01						
	TPU:			+/-1.53E-01						
Batch 1733450										
QC1203956947 441883001 DUP										
Plutonium-238	U	7.02E-02	U	5.24E-02	pCi/g	0		N/A	MXS2	01/25/1808:35
	Uncert:	+/-1.38E-01		+/-1.97E-01						
	TPU:	+/-1.38E-01		+/-1.97E-01						
Plutonium-239/240	U	1.90E-01	U	-4.69E-02	pCi/g	0		N/A		
	Uncert:	+/-1.93E-01		+/-2.12E-01						
	TPU:	+/-1.95E-01		+/-2.12E-01						
QC1203956948 LCS										
Plutonium-238			U	1.57E-01	pCi/g				MXS2	01/25/1808:35
	Uncert:			+/-1.85E-01						
	TPU:			+/-1.87E-01						

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Alpha Spec										
Batch 1733450										
Plutonium-239/240	9.55E+00			1.17E+01	pCi/g		122	(75%-125%)		
	Uncert:			+/-1.37E+00						
	TPU:			+/-2.16E+00						
QC1203956946 MB										
Plutonium-238			U	1.24E-02	pCi/g				MXS2	01/25/1808:35
	Uncert:			+/-1.41E-01						
	TPU:			+/-1.41E-01						
Plutonium-239/240			U	1.24E-02	pCi/g					
	Uncert:			+/-1.41E-01						
	TPU:			+/-1.41E-01						
Batch 1733451										
QC1203956950 441883001 DUP										
Plutonium-241	U	1.58E+01	U	-1.68E+01	pCi/g	0		N/A	MXS2	01/26/1808:00
	Uncert:	+/-2.43E+01		+/-3.97E+01						
	TPU:	+/-2.46E+01		+/-3.97E+01						
QC1203956951 LCS										
Plutonium-241	3.45E+02			3.69E+02	pCi/g		107	(75%-125%)	MXS2	01/26/1808:32
	Uncert:			+/-3.21E+01						
	TPU:			+/-8.37E+01						
QC1203956949 MB										
Plutonium-241			U	-5.78E+00	pCi/g				MXS2	01/26/1807:29
	Uncert:			+/-1.96E+01						
	TPU:			+/-1.96E+01						
Rad Gamma Spec										
Batch 1732744										
QC1203955061 441883001 DUP										
Actinium-228	U	1.59E-01	U	4.53E-03	pCi/g	0		N/A	MXR1	01/19/1815:27
	Uncert:	+/-1.59E-01		+/-1.07E-01						
	TPU:	+/-1.75E-01		+/-1.07E-01						
Americium-241	U	1.45E-01	U	9.82E-02	pCi/g	0		N/A		
	Uncert:	+/-1.83E-01		+/-2.43E-01						
	TPU:	+/-1.95E-01		+/-2.47E-01						
Antimony-124	U	-6.33E-03	U	-4.95E-03	pCi/g	0		N/A		
	Uncert:	+/-1.41E-02		+/-1.01E-02						
	TPU:	+/-1.44E-02		+/-1.04E-02						
Antimony-125	U	-1.96E-02	U	-9.10E-03	pCi/g	0		N/A		
	Uncert:	+/-6.76E-02		+/-5.89E-02						
	TPU:	+/-6.82E-02		+/-5.91E-02						
Barium-133	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-5.26E-02		+/-4.59E-02						
	TPU:	+/-2.77E-01		+/-6.36E-02						
Barium-140	U	7.06E-02	U	4.25E-03	pCi/g	0		N/A		
	Uncert:	+/-2.38E-01		+/-2.04E-01						
	TPU:	+/-2.40E-01		+/-2.04E-01						
Beryllium-7	U	2.19E-01	U	1.04E-01	pCi/g	0		N/A		

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
	Uncert:	+/-3.63E-01		+/-2.15E-01						
	TPU:	+/-3.64E-01		+/-2.20E-01						
Bismuth-212	U	1.49E-02	U	6.66E-02	pCi/g	0		N/A		
	Uncert:	+/-4.70E-01		+/-3.86E-01						
	TPU:	+/-4.71E-01		+/-3.87E-01						
Bismuth-214		2.37E-01	UI	0.00E+00	pCi/g	101*		(0% - 100%)		
	Uncert:	+/-7.44E-02		+/-6.31E-02						
	TPU:	+/-7.70E-02		+/-1.35E-01						
Cerium-139	U	3.19E-03	U	1.99E-02	pCi/g	0		N/A		
	Uncert:	+/-2.73E-02		+/-2.66E-02						
	TPU:	+/-2.74E-02		+/-2.84E-02						
Cerium-141	U	4.17E-02	U	3.34E-02	pCi/g	0		N/A		
	Uncert:	+/-5.92E-02		+/-5.87E-02						
	TPU:	+/-6.22E-02		+/-6.06E-02						
Cerium-144	U	7.32E-02	U	-1.54E-01	pCi/g	0		N/A		
	Uncert:	+/-1.77E-01		+/-1.76E-01						
	TPU:	+/-1.80E-01		+/-1.89E-01						
Cesium-134	UI	0.00E+00	U	4.61E-02	pCi/g	0		N/A		
	Uncert:	+/-4.40E-02		+/-4.09E-02						
	TPU:	+/-5.90E-02		+/-4.61E-02						
Cesium-136	U	6.07E-02	U	1.58E-02	pCi/g	0		N/A		
	Uncert:	+/-7.19E-02		+/-6.23E-02						
	TPU:	+/-7.72E-02		+/-6.28E-02						
Cesium-137		1.17E+01		1.13E+01	pCi/g	3.39		(0%-20%)		
	Uncert:	+/-7.06E-02		+/-6.03E-02						
	TPU:	+/-9.83E-01		+/-9.29E-01						
Chromium-51	U	-4.37E-02	U	-1.08E-02	pCi/g	0		N/A		
	Uncert:	+/-2.88E-01		+/-2.91E-01						
	TPU:	+/-2.88E-01		+/-2.91E-01						
Cobalt-56	U	7.57E-03	U	8.60E-03	pCi/g	0		N/A		
	Uncert:	+/-3.68E-02		+/-3.20E-02						
	TPU:	+/-3.70E-02		+/-3.23E-02						
Cobalt-57	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-9.69E-02		+/-9.39E-02						
	TPU:	+/-2.15E+01		+/-2.10E+01						
Cobalt-58		6.82E-02		6.56E-02	pCi/g	3.92		(0% - 100%)		
	Uncert:	+/-5.41E-02		+/-4.57E-02						
	TPU:	+/-7.37E-02		+/-6.81E-02						
Cobalt-60		5.46E+00		5.38E+00	pCi/g	1.35		(0%-20%)		
	Uncert:	+/-6.32E-02		+/-5.04E-02						
	TPU:	+/-5.36E-01		+/-5.65E-01						
Europium-152		1.39E+02		1.34E+02	pCi/g	3.51		(0%-20%)		
	Uncert:	+/-3.18E-01		+/-2.52E-01						
	TPU:	+/-1.28E+01		+/-1.23E+01						
Europium-154	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-1.41E-01		+/-1.26E-01						

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
	TPU:	+/-2.09E+00		+/-2.11E+00						
Europium-155	U	1.49E-01	U	-4.03E-02	pCi/g	0		N/A		
	Uncert:	+/-1.89E-01		+/-1.22E-01						
	TPU:	+/-1.90E-01		+/-1.24E-01						
Iridium-192	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-3.45E-02		+/-3.81E-02						
	TPU:	+/-4.62E-02		+/-5.94E-02						
Iron-59	U	-1.44E-02	U	-2.93E-02	pCi/g	0		N/A		
	Uncert:	+/-5.97E-02		+/-4.77E-02						
	TPU:	+/-6.00E-02		+/-4.96E-02						
Lead-210		3.81E+02		2.98E+02	pCi/g	24.5*		(0%-20%)		
	Uncert:	+/-1.73E+01		+/-2.42E+01						
	TPU:	+/-5.55E+01		+/-4.79E+01						
Lead-212	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-6.05E-02		+/-5.40E-02						
	TPU:	+/-1.01E-01		+/-9.22E-02						
Lead-214		2.38E-01	UI	0.00E+00	pCi/g	96.4		(0% - 100%)		
	Uncert:	+/-8.19E-02		+/-7.53E-02						
	TPU:	+/-8.43E-02		+/-1.48E-01						
Manganese-54	U	-1.13E-03	U	-1.69E-02	pCi/g	0		N/A		
	Uncert:	+/-3.10E-02		+/-2.51E-02						
	TPU:	+/-3.10E-02		+/-2.62E-02						
Mercury-203	U	3.29E-03	U	1.07E-02	pCi/g	0		N/A		
	Uncert:	+/-3.52E-02		+/-2.99E-02						
	TPU:	+/-3.53E-02		+/-3.03E-02						
Neodymium-147	U	-2.45E-02	U	2.18E-01	pCi/g	0		N/A		
	Uncert:	+/-5.00E-01		+/-5.38E-01						
	TPU:	+/-5.00E-01		+/-5.48E-01						
Neptunium-237	U	-3.06E-02	U	-8.14E-03	pCi/g	0		N/A		
	Uncert:	+/-5.60E-02		+/-5.09E-02						
	TPU:	+/-5.77E-02		+/-5.10E-02						
Neptunium-239	U	1.36E-01	U	7.78E-02	pCi/g	0		N/A		
	Uncert:	+/-3.39E-01		+/-3.46E-01						
	TPU:	+/-3.45E-01		+/-3.48E-01						
Niobium-94	U	-9.87E-03	U	-1.37E-02	pCi/g	0		N/A		
	Uncert:	+/-2.67E-02		+/-2.20E-02						
	TPU:	+/-2.71E-02		+/-2.29E-02						
Niobium-95		2.70E-01		2.75E-01	pCi/g	1.91		(0%-20%)		
	Uncert:	+/-4.96E-02		+/-4.18E-02						
	TPU:	+/-5.48E-02		+/-4.82E-02						
Potassium-40		3.23E+00		3.37E+00	pCi/g	4.45		(0%-20%)		
	Uncert:	+/-2.17E-01		+/-1.88E-01						
	TPU:	+/-3.90E-01		+/-4.04E-01						
Promethium-144	U	-1.46E-04	U	-6.11E-03	pCi/g	0		N/A		
	Uncert:	+/-3.06E-02		+/-2.52E-02						
	TPU:	+/-3.06E-02		+/-2.54E-02						

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
Promethium-146	U	1.46E-02	U	-8.86E-03	pCi/g	0		N/A		
	Uncert:	+/-3.21E-02		+/-2.78E-02						
	TPU:	+/-3.28E-02		+/-2.81E-02						
Radium-228	U	1.59E-01	U	4.53E-03	pCi/g	0		N/A		
	Uncert:	+/-1.59E-01		+/-1.07E-01						
	TPU:	+/-1.75E-01		+/-1.07E-01						
Ruthenium-106	U	-1.60E-01	U	1.62E-02	pCi/g	0		N/A		
	Uncert:	+/-2.53E-01		+/-2.11E-01						
	TPU:	+/-2.64E-01		+/-2.11E-01						
Silver-110m	U	-6.97E-03	U	2.23E-02	pCi/g	0		N/A		
	Uncert:	+/-4.14E-02		+/-3.61E-02						
	TPU:	+/-4.15E-02		+/-3.76E-02						
Sodium-22	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-4.98E-02		+/-4.43E-02						
	TPU:	+/-1.55E-01		+/-1.60E-01						
Thallium-208		8.44E-02		1.19E-01	pCi/g	34.1		(0% - 100%)		
	Uncert:	+/-2.78E-02		+/-3.07E-02						
	TPU:	+/-2.87E-02		+/-3.22E-02						
Thorium-234	U	1.49E-01	U	-6.67E-01	pCi/g	0		N/A		
	Uncert:	+/-1.42E+00		+/-1.79E+00						
	TPU:	+/-1.42E+00		+/-1.82E+00						
Tin-113	U	1.30E-02	U	-1.40E-02	pCi/g	0		N/A		
	Uncert:	+/-3.19E-02		+/-2.83E-02						
	TPU:	+/-3.25E-02		+/-2.90E-02						
Uranium-235	U	-3.09E-02	U	-4.65E-02	pCi/g	0		N/A		
	Uncert:	+/-1.74E-01		+/-1.72E-01						
	TPU:	+/-1.74E-01		+/-1.73E-01						
Uranium-238	U	1.49E-01	U	-6.67E-01	pCi/g	0		N/A		
	Uncert:	+/-1.42E+00		+/-1.79E+00						
	TPU:	+/-1.42E+00		+/-1.82E+00						
Yttrium-88	U	-3.39E-03	U	-4.53E-03	pCi/g	0		N/A		
	Uncert:	+/-4.62E-03		+/-3.86E-03						
	TPU:	+/-4.87E-03		+/-4.38E-03						
Zinc-65	UI	0.00E+00	UI	0.00E+00	pCi/g	0		N/A		
	Uncert:	+/-7.09E-02		+/-8.37E-02						
	TPU:	+/-4.76E-01		+/-4.39E+00						
Zirconium-95		7.49E-01		6.93E-01	pCi/g	7.73		(0%-20%)		
	Uncert:	+/-1.09E-01		+/-9.28E-02						
	TPU:	+/-1.27E-01		+/-1.11E-01						
QC1203955062 LCS										
Actinium-228				6.67E-01	pCi/g				MXR1	01/19/1811:10
	Uncert:			+/-3.25E-01						
	TPU:			+/-3.32E-01						
Americium-241	3.92E+01			3.95E+01	pCi/g		101	(75%-125%)		
	Uncert:			+/-1.51E+00						
	TPU:			+/-4.42E+00						

QC Summary

Workorder: 441883

Parmname	NOM	Sample Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec									
Batch 1732744									
Antimony-124			U -1.23E-02	pCi/g					
	Uncert:		+/-3.46E-02						
	TPU:		+/-3.51E-02						
Antimony-125			U -5.20E-02	pCi/g					
	Uncert:		+/-1.59E-01						
	TPU:		+/-1.61E-01						
Barium-133			U 3.14E-02	pCi/g					
	Uncert:		+/-7.46E-02						
	TPU:		+/-7.60E-02						
Barium-140			U 8.63E-02	pCi/g					
	Uncert:		+/-1.87E-01						
	TPU:		+/-1.91E-01						
Beryllium-7			U -1.02E-01	pCi/g					
	Uncert:		+/-4.81E-01						
	TPU:		+/-4.84E-01						
Bismuth-212			U 4.94E-01	pCi/g					
	Uncert:		+/-7.19E-01						
	TPU:		+/-7.54E-01						
Bismuth-214			4.71E-01	pCi/g					
	Uncert:		+/-1.72E-01						
	TPU:		+/-2.76E-01						
Cerium-139			U 5.88E-03	pCi/g					
	Uncert:		+/-5.03E-02						
	TPU:		+/-5.03E-02						
Cerium-141			U 2.20E-02	pCi/g					
	Uncert:		+/-8.33E-02						
	TPU:		+/-8.39E-02						
Cerium-144			U -6.62E-02	pCi/g					
	Uncert:		+/-3.70E-01						
	TPU:		+/-3.71E-01						
Cesium-134			U 4.81E-02	pCi/g					
	Uncert:		+/-5.81E-02						
	TPU:		+/-6.22E-02						
Cesium-136			U -4.30E-04	pCi/g					
	Uncert:		+/-8.03E-02						
	TPU:		+/-8.03E-02						
Cesium-137	1.32E+01		1.42E+01	pCi/g		107	(75%-125%)		
	Uncert:		+/-3.26E-01						
	TPU:		+/-1.20E+00						
Chromium-51			U -3.77E-02	pCi/g					
	Uncert:		+/-4.12E-01						
	TPU:		+/-4.12E-01						
Cobalt-56			U -2.43E-02	pCi/g					
	Uncert:		+/-5.74E-02						
	TPU:		+/-5.84E-02						
Cobalt-57			U -3.77E-03	pCi/g					

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
	Uncert:			+/-4.92E-02						
	TPU:			+/-4.92E-02						
Cobalt-58			U	-1.81E-02	pCi/g					
	Uncert:			+/-5.48E-02						
	TPU:			+/-5.54E-02						
Cobalt-60	8.79E+00			9.66E+00	pCi/g		110	(75%-125%)		
	Uncert:			+/-3.11E-01						
	TPU:			+/-1.06E+00						
Europium-152			U	-8.73E-02	pCi/g					
	Uncert:			+/-1.58E-01						
	TPU:			+/-1.63E-01						
Europium-154			U	-1.56E-02	pCi/g					
	Uncert:			+/-9.56E-02						
	TPU:			+/-9.59E-02						
Europium-155			U	8.60E-02	pCi/g					
	Uncert:			+/-2.16E-01						
	TPU:			+/-2.19E-01						
Iridium-192			U	-2.01E-02	pCi/g					
	Uncert:			+/-5.06E-02						
	TPU:			+/-5.14E-02						
Iron-59			U	-7.66E-02	pCi/g					
	Uncert:			+/-1.08E-01						
	TPU:			+/-1.14E-01						
Lead-210				3.92E+02	pCi/g					
	Uncert:			+/-6.43E+01						
	TPU:			+/-7.95E+01						
Lead-212				5.48E-01	pCi/g					
	Uncert:			+/-1.68E-01						
	TPU:			+/-1.74E-01						
Lead-214				7.14E-01	pCi/g					
	Uncert:			+/-2.84E-01						
	TPU:			+/-2.90E-01						
Manganese-54			U	4.83E-02	pCi/g					
	Uncert:			+/-5.49E-02						
	TPU:			+/-5.92E-02						
Mercury-203			U	6.27E-03	pCi/g					
	Uncert:			+/-5.00E-02						
	TPU:			+/-5.01E-02						
Neodymium-147			U	1.07E-01	pCi/g					
	Uncert:			+/-3.35E-01						
	TPU:			+/-3.39E-01						
Neptunium-237			U	6.16E-03	pCi/g					
	Uncert:			+/-1.08E-01						
	TPU:			+/-1.08E-01						
Neptunium-239			U	-5.33E-01	pCi/g					
	Uncert:			+/-5.45E-01						
	TPU:									

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
				+/-5.99E-01						
Niobium-94			U	1.36E-02	pCi/g					
	Uncert:			+/-4.23E-02						
	TPU:			+/-4.28E-02						
Niobium-95			U	7.49E-03	pCi/g					
	Uncert:			+/-5.20E-02						
	TPU:			+/-5.21E-02						
Potassium-40				8.57E-01	pCi/g					
	Uncert:			+/-4.52E-01						
	TPU:			+/-4.61E-01						
Promethium-144			U	-4.55E-02	pCi/g					
	Uncert:			+/-4.28E-02						
	TPU:			+/-4.76E-02						
Promethium-146			U	6.87E-02	pCi/g					
	Uncert:			+/-7.96E-02						
	TPU:			+/-8.57E-02						
Radium-228				6.67E-01	pCi/g					
	Uncert:			+/-3.25E-01						
	TPU:			+/-3.32E-01						
Ruthenium-106			U	4.47E-01	pCi/g					
	Uncert:			+/-4.69E-01						
	TPU:			+/-5.12E-01						
Silver-110m			U	2.02E-02	pCi/g					
	Uncert:			+/-8.35E-02						
	TPU:			+/-8.40E-02						
Sodium-22			U	-7.93E-03	pCi/g					
	Uncert:			+/-3.31E-02						
	TPU:			+/-3.33E-02						
Thallium-208				1.09E-01	pCi/g					
	Uncert:			+/-1.35E-01						
	TPU:			+/-1.36E-01						
Thorium-234			U	1.78E+00	pCi/g					
	Uncert:			+/-4.35E+00						
	TPU:			+/-4.44E+00						
Tin-113			U	-1.61E-02	pCi/g					
	Uncert:			+/-6.80E-02						
	TPU:			+/-6.84E-02						
Uranium-235			U	3.16E-04	pCi/g					
	Uncert:			+/-3.69E-01						
	TPU:			+/-3.69E-01						
Uranium-238			U	1.78E+00	pCi/g					
	Uncert:			+/-4.35E+00						
	TPU:			+/-4.44E+00						
Yttrium-88			U	2.54E-03	pCi/g					
	Uncert:			+/-2.19E-02						
	TPU:			+/-2.20E-02						

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
Zinc-65			U	6.75E-03	pCi/g					
	Uncert:			+/-1.27E-01						
	TPU:			+/-1.27E-01						
Zirconium-95			U	2.55E-02	pCi/g					
	Uncert:			+/-8.71E-02						
	TPU:			+/-8.79E-02						
QC1203955060 MB										
Actinium-228			U	-1.41E-03	pCi/g				MXR1	01/19/1811:10
	Uncert:			+/-1.32E-02						
	TPU:			+/-1.33E-02						
Americium-241			U	2.22E-03	pCi/g					
	Uncert:			+/-1.79E-02						
	TPU:			+/-1.79E-02						
Antimony-124			U	-1.37E-03	pCi/g					
	Uncert:			+/-4.94E-03						
	TPU:			+/-4.98E-03						
Antimony-125			U	-1.33E-03	pCi/g					
	Uncert:			+/-5.71E-03						
	TPU:			+/-5.74E-03						
Barium-133			U	-1.73E-03	pCi/g					
	Uncert:			+/-2.81E-03						
	TPU:			+/-2.92E-03						
Barium-140			U	2.72E-03	pCi/g					
	Uncert:			+/-8.48E-03						
	TPU:			+/-8.57E-03						
Beryllium-7			U	-1.64E-02	pCi/g					
	Uncert:			+/-1.88E-02						
	TPU:			+/-2.02E-02						
Bismuth-212			U	1.72E-02	pCi/g					
	Uncert:			+/-2.88E-02						
	TPU:			+/-2.99E-02						
Bismuth-214			U	-2.17E-03	pCi/g					
	Uncert:			+/-6.36E-03						
	TPU:			+/-6.44E-03						
Cerium-139			U	3.52E-04	pCi/g					
	Uncert:			+/-2.03E-03						
	TPU:			+/-2.04E-03						
Cerium-141			U	-2.97E-03	pCi/g					
	Uncert:			+/-3.97E-03						
	TPU:			+/-4.20E-03						
Cerium-144			U	3.10E-03	pCi/g					
	Uncert:			+/-1.41E-02						
	TPU:			+/-1.42E-02						
Cesium-134			U	-1.09E-03	pCi/g					
	Uncert:			+/-2.44E-03						
	TPU:			+/-2.49E-03						

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
Cesium-136			U	-3.35E-04	pCi/g					
	Uncert:			+/-2.92E-03						
	TPU:			+/-2.93E-03						
Cesium-137			U	4.66E-04	pCi/g					
	Uncert:			+/-2.44E-03						
	TPU:			+/-2.45E-03						
Chromium-51			U	1.71E-02	pCi/g					
	Uncert:			+/-1.84E-02						
	TPU:			+/-2.00E-02						
Cobalt-56			U	1.16E-04	pCi/g					
	Uncert:			+/-2.38E-03						
	TPU:			+/-2.38E-03						
Cobalt-57			U	-8.38E-04	pCi/g					
	Uncert:			+/-2.18E-03						
	TPU:			+/-2.21E-03						
Cobalt-58			U	-1.30E-03	pCi/g					
	Uncert:			+/-3.77E-03						
	TPU:			+/-3.82E-03						
Cobalt-60			U	2.47E-04	pCi/g					
	Uncert:			+/-2.24E-03						
	TPU:			+/-2.25E-03						
Europium-152			U	2.14E-03	pCi/g					
	Uncert:			+/-7.31E-03						
	TPU:			+/-7.38E-03						
Europium-154			U	-3.43E-03	pCi/g					
	Uncert:			+/-8.58E-03						
	TPU:			+/-8.73E-03						
Europium-155			U	4.07E-03	pCi/g					
	Uncert:			+/-8.56E-03						
	TPU:			+/-8.76E-03						
Iridium-192			U	3.46E-04	pCi/g					
	Uncert:			+/-1.98E-03						
	TPU:			+/-1.99E-03						
Iron-59			U	-6.17E-04	pCi/g					
	Uncert:			+/-2.90E-03						
	TPU:			+/-2.92E-03						
Lead-210			U	-4.86E-01	pCi/g					
	Uncert:			+/-7.71E-01						
	TPU:			+/-8.05E-01						
Lead-212			U	5.62E-03	pCi/g					
	Uncert:			+/-7.18E-03						
	TPU:			+/-7.63E-03						
Lead-214			U	1.31E-03	pCi/g					
	Uncert:			+/-4.95E-03						
	TPU:			+/-4.99E-03						
Manganese-54			U	8.76E-04	pCi/g					

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
	Uncert:			+/-2.03E-03						
	TPU:			+/-2.06E-03						
Mercury-203			U	8.16E-04	pCi/g					
	Uncert:			+/-2.31E-03						
	TPU:			+/-2.34E-03						
Neodymium-147			U	2.45E-03	pCi/g					
	Uncert:			+/-1.47E-02						
	TPU:			+/-1.48E-02						
Neptunium-237			U	-5.12E-04	pCi/g					
	Uncert:			+/-4.43E-03						
	TPU:			+/-4.43E-03						
Neptunium-239			U	7.48E-03	pCi/g					
	Uncert:			+/-2.15E-02						
	TPU:			+/-2.18E-02						
Niobium-94			U	-1.97E-03	pCi/g					
	Uncert:			+/-2.23E-03						
	TPU:			+/-2.41E-03						
Niobium-95			U	-1.58E-03	pCi/g					
	Uncert:			+/-2.68E-03						
	TPU:			+/-2.77E-03						
Potassium-40			U	8.66E-03	pCi/g					
	Uncert:			+/-3.50E-02						
	TPU:			+/-3.52E-02						
Promethium-144			U	1.43E-04	pCi/g					
	Uncert:			+/-2.63E-03						
	TPU:			+/-2.63E-03						
Promethium-146			U	-9.98E-05	pCi/g					
	Uncert:			+/-3.07E-03						
	TPU:			+/-3.07E-03						
Radium-228			U	-1.41E-03	pCi/g					
	Uncert:			+/-1.32E-02						
	TPU:			+/-1.33E-02						
Ruthenium-106			U	1.88E-03	pCi/g					
	Uncert:			+/-2.08E-02						
	TPU:			+/-2.08E-02						
Silver-110m			U	3.42E-03	pCi/g					
	Uncert:			+/-3.14E-03						
	TPU:			+/-3.51E-03						
Sodium-22			U	-1.27E-03	pCi/g					
	Uncert:			+/-2.99E-03						
	TPU:			+/-3.05E-03						
Thallium-208			U	-3.57E-03	pCi/g					
	Uncert:			+/-2.96E-03						
	TPU:			+/-3.38E-03						
Thorium-234			U	-6.11E-02	pCi/g					
	Uncert:			+/-1.86E-01						
	TPU:									

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gamma Spec										
Batch 1732744										
				+/-1.88E-01						
Tin-113			U	2.39E-03	pCi/g					
	Uncert:			+/-2.77E-03						
	TPU:			+/-2.98E-03						
Uranium-235			U	-2.44E-02	pCi/g					
	Uncert:			+/-1.96E-02						
	TPU:			+/-2.26E-02						
Uranium-238			U	-6.11E-02	pCi/g					
	Uncert:			+/-1.86E-01						
	TPU:			+/-1.88E-01						
Yttrium-88			U	9.16E-04	pCi/g					
	Uncert:			+/-2.45E-03						
	TPU:			+/-2.49E-03						
Zinc-65			U	4.57E-03	pCi/g					
	Uncert:			+/-4.49E-03						
	TPU:			+/-4.95E-03						
Zirconium-95			U	-1.31E-03	pCi/g					
	Uncert:			+/-4.15E-03						
	TPU:			+/-4.19E-03						
Batch 1733102										
QC1203956060 441883001 DUP										
Nickel-59	U	-6.21E+00	U	-3.91E+00	pCi/g	0		N/A	TXJ1	01/25/1814:54
	Uncert:	+/-3.18E+01		+/-1.69E+01						
	TPU:	+/-3.20E+01		+/-1.70E+01						
QC1203956061 LCS										
Nickel-59	1.95E+03			1.72E+03	pCi/g		88.3	(75%-125%)	TXJ1	01/25/1815:35
	Uncert:			+/-2.13E+02						
	TPU:			+/-2.71E+02						
QC1203956059 MB										
Nickel-59			U	-3.56E+01	pCi/g				TXJ1	01/25/1814:53
	Uncert:			+/-3.54E+01						
	TPU:			+/-3.90E+01						
Rad Gas Flow										
Batch 1732910										
QC1203955552 441883001 DUP										
Strontium-90		6.34E-01		7.14E-01	pCi/g	11.9		(0%-20%)	LXB3	01/31/1809:17
	Uncert:	+/-1.06E-01		+/-1.07E-01						
	TPU:	+/-1.56E-01		+/-1.66E-01						
QC1203955553 LCS										
Strontium-90	5.83E+00			4.46E+00	pCi/g		76.5	(75%-125%)	LXB3	01/27/1812:13
	Uncert:			+/-2.50E-01						
	TPU:			+/-8.63E-01						
QC1203955551 MB										
Strontium-90			U	-1.29E-03	pCi/g				LXB3	01/31/1806:42
	Uncert:			+/-2.39E-02						
	TPU:									

QC Summary

Workorder: 441883

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Gas Flow										
Batch 1732910										
				+/-2.39E-02						
Rad Liquid Scintillation										
Batch 1733051										
QC1203955911 441883001 DUP										
Technetium-99		U 5.20E-01	U	8.43E-02	pCi/g	0		N/A	CXS7	01/30/1807:16
	Uncert:	+/-5.43E-01		+/-5.30E-01						
	TPU:	+/-5.46E-01		+/-5.30E-01						
QC1203955912 LCS										
Technetium-99	3.34E+01			3.24E+01	pCi/g		96.8	(75%-125%)	CXS7	01/30/1808:27
	Uncert:			+/-1.92E+00						
	TPU:			+/-4.17E+00						
QC1203955910 MB										
Technetium-99			U	5.58E-01	pCi/g				CXS7	01/30/1806:03
	Uncert:			+/-4.90E-01						
	TPU:			+/-4.94E-01						
Batch 1733084										
QC1203956001 441883001 DUP										
Carbon-14		3.18E+00		3.13E+00	pCi/g	1.32		(0%-20%)	BXM4	01/24/1819:02
	Uncert:	+/-3.04E-01		+/-3.11E-01						
	TPU:	+/-3.82E-01		+/-3.86E-01						
QC1203956003 LCS										
Carbon-14	2.43E+01			2.25E+01	pCi/g		92.5	(75%-125%)	BXM4	01/24/1822:08
	Uncert:			+/-5.10E-01						
	TPU:			+/-1.72E+00						
QC1203956000 MB										
Carbon-14			U	-9.50E-03	pCi/g				BXM4	01/24/1817:29
	Uncert:			+/-2.59E-01						
	TPU:			+/-2.59E-01						
QC1203956002 441883001 MS										
Carbon-14	5.75E+01	3.18E+00		5.78E+01	pCi/g		95	(75%-125%)	BXM4	01/24/1820:35
	Uncert:	+/-3.04E-01		+/-1.24E+00						
	TPU:	+/-3.82E-01		+/-4.40E+00						
Batch 1733099										
QC1203956051 441883001 DUP										
Nickel-63		U 1.05E+01	U	2.05E+01	pCi/g	0		N/A	TXJ1	01/27/1800:45
	Uncert:	+/-1.40E+01		+/-1.50E+01						
	TPU:	+/-1.42E+01		+/-1.55E+01						
QC1203956052 LCS										
Nickel-63	6.42E+02			6.96E+02	pCi/g		108	(75%-125%)	TXJ1	01/27/1801:01
	Uncert:			+/-3.40E+01						
	TPU:			+/-1.34E+02						
QC1203956050 MB										
Nickel-63			U	3.78E-02	pCi/g				TXJ1	01/27/1800:29
	Uncert:			+/-1.42E+01						
	TPU:			+/-1.42E+01						

QC Summary

Workorder: 441883

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

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

M Result is < LLD and > MDC

U Result is < LLD and < MDC

UI Uncertain identification for gamma spectroscopy

X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details

X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details.

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 acceptence 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.

Appendix 5 – Detector Calibration Documentation

DETECTOR DATA SHEET

Detector Model	44-162	Detector Serial #	320027	Setup #	8
2350-1 Serial #	149794	Instrument Set #	16	Date	9/21/2017

NIST Certified Sources

SCN	Use	Type/Activity in DPM	
502	Plateau/Dead Time/Source Check	Cs137	1495803
501	Dead Time	Cs137	1449344
536	Efficiency	Cs137	279933
538	Efficiency	Cs137	264703
537	Efficiency	Cs137	134233
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

High Voltage Determination

HV	Background	Source	HV	Background	Source
500	530	514	725	5786	27751
525	759	1921	750	6170	28414
550	1069	9409	775	6435	29603
575	1405	12426	800	6739	30095
600	1952	15523	825	6983	30653
625	2623	18685	850	7301	32177
650	3472	21391	875	8016	33954
675	4196	24259	900	9906	37841
700	5210	26286	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

As Left High Voltage: 775 [X] Plateau attached

DETECTOR DATA SHEET

Detector Model	44-162	Detector Serial #	320027	Detector Setup #	8

Dead Time Determination

Method	Background	Source #1 Counts	Sources #1 & #2	Source # 2 Counts	Dead Time μ Seconds
A	N/A	N/A	N/A	N/A	0.0
Method	Background	Low Source Counts	High Source Counts		Dead Time μ Seconds
B	N/A	N/A	N/A		N/A

Background Count

Count Time (seconds)	Gross Counts	Net Counts per Minute
600	74280	7428

Source Counts

Count Time (seconds)	Gross Counts	Net Counts per Minute	Efficiency
300	N/A	N/A	N/A

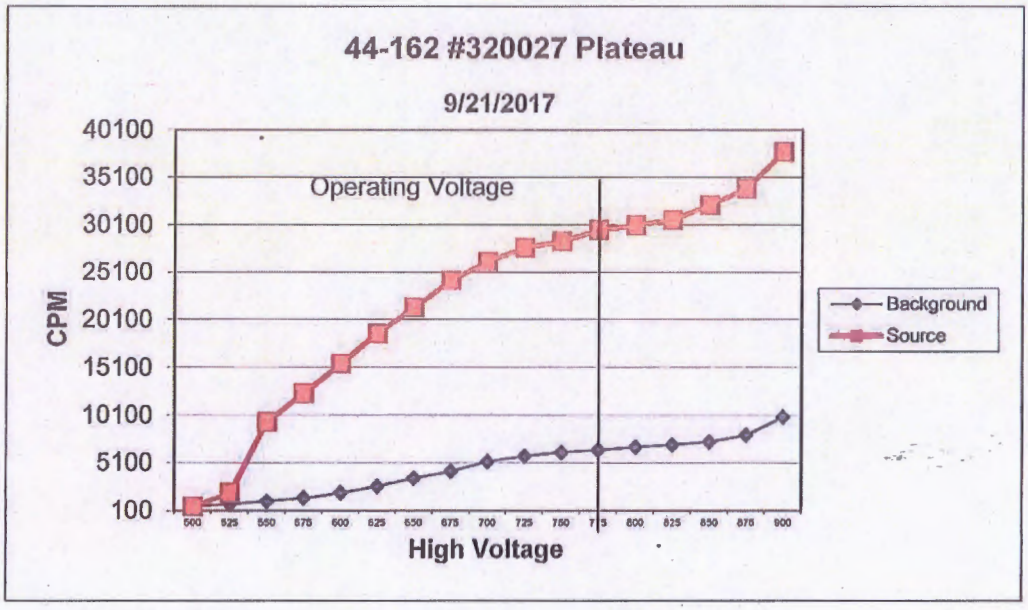
Detector Source Response

Detector	SCN	Gross Response	Background CPM	Corrected CPM	Acceptable Range (CPM)
Pos 1	502	154690	6545	24393	19515 - 29272
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Remarks

100 ft cable.

Performed By: K. Dragosljvich	Cal Date: 9/21/2017	Next Cal Due: 9/20/2018
Reviewed By:	Review Date	Database Updated


44-162 #320027 Plateau
9/21/2017
Operating Voltage
CPM
40100
35100
30100
25100
20100
15100
10100
5100
100
500
525
550
575
600
625
650
675
700
725
750
775
800
825
850
875
900
High Voltage
Background
Source

Appendix 5 – Detector Calibration Documentation

GAMMA PIPE SCINTILLATOR EFFICIENCY DATA SHEET

Ludlum 2350-1 Serial Number	149794
Detector Model	44-162
Calibration Date	9/21/2017

Detector Serial #	320027
Calibration Due Date	9/20/2018

Calibration Geometry: [X] 8" Pipe [ ] 12" Pipe [ ] 24" Pipe

Radiation Sources		
Source Number	Contained (4π) Activity(DPM)	Active Area (cm^2)
1 536	1 279933	1 970
2 538	2 264703	2 970
3 N/A	3 N/A	3 N/A
	Σ 544636	Σ 1940

Instrument Counts		
Background (10 Minute Count)	Average Source (5 Minute Count)	Net Counts (CPM)
N/A	N/A	#VALUE!

TA[(544636)/ 1940)]*100= 28074 (DPM/100cm^2)

E_i=(#VALUE!)/(28074) = #VALUE!

Comments: _____

Performed By: K. Dragosljvich Date: 9/21/2017

Verified By: _____ Date: _____

Appendix 5 – Detector Calibration Documentation

GAMMA PIPE SCINTILLATOR EFFICIENCY DATA SHEET

Ludlum 2350-1 Serial Number	149794
Detector Model	44-162
Calibration Date	9/21/2017

Detector Serial #	320027
Calibration Due Date	9/20/2018

Calibration Geometry: ☐ 8" Pipe ☒ 11" metal cans ☐ 24" Pipe

Radiation Sources		
Source Number	Contained (4π) Activity(DPM)	Active Area (cm^2)
1 536	1 279933	1 970
2 537	2 134233	2 434
3 538	3 264703	3 970
	Σ 678870	Σ 2374

Instrument Counts		
Background (10 Minute Count)	Source (5 Minute Count)	Net Counts (CPM)
74280	91309	10834

TA[(678870)/ 2374)]*100= 28596 (DPM/100cm^2)

E_i=(10834)/(28596) = 37.89%

Comments: _____

Performed By: K. Dragosljvich Date: 9/21/2017

Verified By: _____ Date: _____

Appendix 5 – Detector Calibration Documentation
GAMMA PIPE SCINTILLATOR EFFICIENCY DATA SHEET

Ludlum 2350-1 Serial Number	149794
Detector Model	44-162
Calibration Date	9/21/2017

Detector Serial #	320027
Calibration Due Date	9/20/2018

Calibration Geometry: ☐ 8" Pipe ☐ 12" Pipe ☒ 15" Pipe

Radiation Sources		
Source Number	Contained (4π) Activity(DPM)	Active Area (cm^2)
1 536	1 279933	1 970
2 538	2 264703	2 970
3 N/A	3 N/A	3 N/A
	Σ 544636	Σ 1940
Instrument Counts		
Background (10 Minute Count)	Source (5 Minute Count)	Net Counts (CPM)
N/A	N/A	N/A

TA[(N/A)/ N/A)]*100= N/A (DPM/100cm^2)

E_i=(N/A)/(N/A) = N/A

Comments: _____

Performed By: N/A Date: N/A

Verified By: N/A Date: N/A

DETECTOR PARAMETER SHEET

Data Logger Serial Number	149794	Cable Length	100'

Parameter*	Previous As Left	As Found	As Left
Detector Setup Number **(D)**	8	8	8
Detector Model **(M)**	44-162	44-162	44-162
Detector S/N **(N)**	320027	320027	320027
Readout Units **(SU)**	Counts (7)	Counts (7)	Counts (7)
Readout Range Multiplier **(SM)**	Auto (0)	Auto (0)	Auto (0)
Readout Time Base **(SB)**	Minute (1)	Minute (1)	Minute (1)
High Voltage **(H)**	750	750	775
Window **(W)**	Off	Off	Off
Scaler Count Time **(F)****	60	60	60
Threshold **(T)**	200	200	200
Detector Calibration Constant **(SC)**	1.0	1.0	1.0
Detector Dead Time **(SL)**	0 µsec	0 µsec	0 µsec
Ratemeter Alarm Setting **(J)****	1.00E+09	1.00E+09	1.00E+09
Ratemeter Low Alarm Setting **(SVC)****	0.0	0.0	0.0
Scaler Alarm Setting **(K)****	1.00E+06	1.00E+06	1.00E+06
Integrated Dose Alarm Setting **(P)****	1.00E+09	1.00E+09	1.00E+09
($SID_{(0-1)}$) 0=Off 1=On**	Off	Off	Off
Overload Current **(O)**	Off	Off	Off
Data Entered By	K. Dragosljvich	K. Dragosljvich	K. Dragosljvich
Date Completed			9/21/2017

*Commands to change parameters in parentheses.

**Count Time/Alarm settings may be adjusted at the discretion of RP Supervision.

Remarks

SET #16

Action	Command	Barcode
Model	44-162	
Enter model number M44-162		
Serial Number	320027	
Enter serial number N320027		
Readout in Counts	7	
Enter readout in counts SU7		
Readout multiplier (0)	0	
Enter multiplier SM0		
Readout Time Base in minutes	1	
Enter Time Base in minutes SB1		
Set High Voltage	775	
Enter High Voltage H775		
Set Threshold	200	
Enter Threshold T200		
Set Dead Time	0.00E+00	
Enter Deadtime SL0		
Set Ratemeter Alarm to 1.0E+9	1.00E+09	
Enter Ratemeter Alarm J1000000000		
Set Scaler Alarm to 1.0E+6	1.00E+06	
Enter Scaler Alarm K1000000		
Set Integrated Dose Alarm to 1.0E+9	1.00E+09	
Enter Integrated Dose Alarm P1000000000		
Window to Off	OFF	
Enter Window Off WOFF		
Overload to Off	OFF	
Enter Overload Off OOFF		
Save Parameters	8	
Enter Save Parameters SP8		
"Y" to save parameters	Y	
Enter "Y" to confirm parameters		

Appendix 6 – Well Logs

DATE	C5M-DW1	daily		C5M-DW2	daily		C5M-DW3	daily		C5M-DW4	daily		DAILY TOTAL	TONY's #'s	
11/16/16													60000	60000	
11/17/16	32596			83235			28575			57339					
11/18/16	48513	15917		106106	22871		49837	21262		72680	15341		15341	75391	
11/30/16	57175	19119		117302	34067		61219	32664		80181	22842		22842	108692	
12/1/16	65341	8166		127961	10659		72185	10966		86991	6810		36601	36601	
12/2/16	72645	7304		138661	10700		82884	10699		93839	6848		35551	35551	
12/6/16	80162	7517		149152	10491		93632	10748		100762	6923		35697	35679	
12/7/16	86709	6547		159050	9898		103398	9766		107191	6429		32640	32640	
12/8/16	92426	5717		168002	8952		111515	8117		113095	5904		28690	28690	
12/13/16	98180	5754		177747	9745		121166	9651		119452	6357		31507	31507	
12/15/16	100685	2505		182312	4565		126034	4868		122362	2910		14848	14848	
12/16/16	104881	4196		193013	10701		137113	11079		129524	7162		33138	33138	
12/19/16	106667	1786	0.28	226287	33274	5.5	146778	9665	1.6	161056	31532	5.25	76257	76257	pumps on in "manual"
12/20/16	110243	3576		231921	5634		152138	5360		164714	3658		18228	18228	
12/21/16	111485	1242		237098	5177		157391	5253		168248	3534		15206	15206	
12/22/16	111485	0		239229	2131		159684	2293		169803	1555		5979	5979	Found pump 1 breaker tripped, reset breaker
1/3/17	115525	4040		243928	4699		164529	4845		173157	3354		16938	16938	
1/4/17	119813	4288	69gpm	248982	5054	81gpm	169703	5174	83gpm	176727	3570	57gpm	18086	18086	on 0749 off 1652 9:03 543/17= 62 min run time
1/5/17	123903	4090		256058	7076		175542	5839		182745	6018		23023	23023	
1/10/17	125784	1881		258260	2202		177764	2222		184227	1482		7787	7787	short pump day due to weather
1/11/17	129189	3405		263079	4819		182757	4993		187745	3518		16735	16735	
1/12/17	132217	3028		267987	4908		187906	5149		191053	3308		16393	16393	
1/13/17	135238	3021		273231	5244		193216	5310		194821	3768		17343	17343	
1/16/17	138340	3102		278274	5043		198261	5045		198508	3687		16877	16877	
1/17/17	141109	2769		283200	4926		203283	5022		201976	3468		16185	16185	
1/18/17	143701	2592		288038	4838		208032	4749		205127	3151		15330	15330	
1/19/17	146572	2871		292678	4640		212863	4831		208646	3519		15861	15861	
1/24/17	149742	3170		297346	4668		217721	4858		212147	3501		16197	16197	
1/25/17	152658	2916		302010	4664		222439	4718		215608	3461		15759	15759	
1/26/17	155807	3149		306636	4626		227081	4642		218930	3322		15739	15739	
1/27/17	158811	3004		311529	4893		231958	4877		222487	3557		16331	16331	
1/30/17	161738	2927		342644	31115		236681	4723		226099	3612		42377	42377	Pump 2 in "Hand"
1/31/17	164479	2741		374568	31924		241274	4593		229702	3603		42861	42861	Pump 2 in "Hand"
2/1/17	166925	2446		379072	4504		245861	4587		232961	3259		14796	14796	
2/2/17	169232	2307		383534	4462		249996	4135		236166	3205		14109	14109	
2/7/17	169861	629		384425	891		250776	780		236741	575		2875	2875	5hort day
2/8/17	172926	3065		389269	4844		255527	4751		240130	3389		16049	16049	
2/9/17	175896	2970		394604	5335		260753	5226		243924	3794		17325	17325	
2/10/17	178398	2502		399351	4747		265413	4660		247467	3543		15452	15452	
2/13/17	179497	1099		404938	5587		271176	5763		251526	4059		16508	16508	Pump #1 OO5, other pumps 3 min on, 15 min off
2/15/17	212004	32507		455272	50334		283249	12073		259928	8402		103316	103316	Pumped supppression chamber
2/22/17	212992	988		461748	6476		294803	11554		276865	16937		35955	35955	Pump #1 returned to service
2/23/17	213950	958		468162	6414		300967	6164		281985	5120		18656	18656	
2/27/17	214677	727		471963	3801		305386	4419		285070	3085		12032	12032	
2/28/17	216051	1374		478805	6842		312860	7474		290367	5297		18107	20987	
3/1/17	217321	1270		485423	6618		319970	7110		295395	5028		20026	20026	

DATE	CSM-DW1	daily	CSM-DW2	daily	CSM-DW3	daily	CSM-DW4	daily	DAILY TOTAL	TONY's #'s	
3/2/17	218389	1068	490688	5265	325761	5791	299402	4007	16131	16131	
3/6/17	219251	862	504597	13909	330355	4594	302587	3185	22550	22550	
3/7/17	220460	1209	544719	40122	337193	6838	307125	4538	52707	52707	
3/9/17	253210	32750	586342	41623	344270	7077	311653	4528	85978	85978	Pumped supppression chamber
3/16/17	253367	157	590272	3930	346261	1991	315612	3959	10037	10037	CSM Pumping holiday
4/5/17	253586	219	601782	11510	351209	4948	326547	10935	27612	27612	3' level change - 9000 gal/ft
4/13/17	257655	4069	609290	7508	355828	4619	333220	6673	22869	22869	Pumped supppression chamber into #1 well
4/27/17	258617	962	616029	6739	363590	7762	338406	5186	20649	20649	
5/2/17	259620	1003	622190	6161	370365	6775	343042	4636	18575	18575	
5/3/17		0								0	Pumped supppression chamber into #1 well, absorbed all water
5/4/17	260571	951	628599	6409	377521	7156	347903	4861	19377	19377	
5/5/17	261108	537	634602	6003	384492	6971	352716	4813	18324	18324	
5/8/17	261698	590	661731	27129	397521	13029	378988	26272	67020	67020	
5/17/17	261885	187	702085	40354	412963	15442	434168	55180	111163	111163	
5/18/17	262076	191	737171	35086	423043	10080	470191	36023	81380	81380	
	262076	0	757424	20253	429222	6179	492469	22278	48710	48710	
5/31/17	262076	0	758448	1024	430366	1144	493160	691	2589	2859	
6/7/17	262076	0	775118	16670	437361	6995	509108	4372	28037	28037	
7/11/17	262076	0	781089	5971	444093	6732	513480	15948	28638	28651	
	262076	0	794139	13050	451149	7056	526865	13385	33491	33491	
	262076	0	800448	6309	455367	4218	533188	6323	16836	16850	
8/11/17	262076	0	806341	5893	462191	6824	537564	4376	17093	17093	
8/14/17	262076	0	809352	3011	465823	3632	539921	2357	9000	9000	
8/15/17	262076	0	814347	4995	471742	5919	544195	4274	15188	15188	
8/23/17	262076	0	845188	30841	487871	16129	580222	36027	82997	82997	
8/24/17	262076	0	849651	4463	496326	8455	597534	17312	30230	30230	
8/25/17	262076	0			509173	12847	636683	39149	51996	51996	
8/28/17	262076	0			519766	10593	664694	28011	38604	38604	
missed days	262076	0								0	
9/7/17	262076	0	879664	30013	551100	31334	775696	111002	172349	172349	
9/11/17	262076	0	897615	17951	561296	10196	806002	30306	58453	58453	
9/12/17	262076	0	910939	13324	572274	10978	831412	25410	49712	49712	
9/13/17	262076	0	926095	15156	580244	7970	864392	32980	56106	56106	
9/14/17	262076	0	931413	5318	582096	1852	876694	12302	19472	19472	
9/21/17	262076	0	931413	0	582096	0	876694	0	0	0	
9/22/17	262076	0	938937	7524	587062	4966	906406	29712	42202	42202	
9/25/17	262076	0	943474	4537	589813	2751	932439	26033	33321	33321	
9/26/17	262076	0	944632	1158	590793	980	954460	22021	24159	24159	
9/27/17	262076	0	944704	72	591028	235	963696	9236	9543	9543	
9/28/17	262076	0	944733	29	591448	420	967040	3344	3793	3793	
10/3/17	262076	0	944737	4	591922	474	989716	22676	23154	23154	
10/5/17	262076	0	944931	194	594810	2888	1008830	19114	22196	22196	
10/6/17	262076	0	944999	68	600776	5966	1027158	18328	24362	24362	
10/9/17	262076	0	945591	592	602997	2221	1030203	3045	5858	5858	
10/10/17	262076	0	945591	0	605047	2050	1051294	21091	23141	23141	
10/11/17	262076	0	945591	0	605047	0	1070730	19436	19436	19436	

DATE	C5M-DW1	daily	C5M-DW2	daily	C5M-DW3	daily	C5M-DW4	daily	DAILY TOTAL	TONY's #'s
10/12/17	262076	0	945591	0	605047	0	1087698	16968	16968	16968
10/17/17	262076	0	945591	0	605047	0	1110765	23067	23067	23067
10/18/17	262076	0	945591	0	605047	0	1110965	200	200	200
10/19/17	262076	0	945619	28	605474	427	1119053	8088	8543	8543
10/20/17	262076	0	945646	27	609042	3568	1150619	31566	35161	35161
10/23/17	262076	0	945677	31	610959	1917	1165647	15028	16976	16976
10/24/17	262076	0	945682	5	612910	1951	1178939	13292	15248	15248
10/25/17	262076	0	945740	58	614929	2019	1191507	12568	14645	14645
10/26/17	262076	0	945757	17	616897	1968	1203542	12035	14020	14020
10/31/17	262076	0	945778	21	619089	2192	1218488	14946	17159	17159
11/1/17	262076	0	945822	44	620572	1483	1230635	12147	13674	13674
11/2/17	262076	0	945822	0	621476	904	1237780	7145	8049	8049
11/6/17	262076	0	945824	2	623395	1919	1253436	15656	17577	17577
11/7/17	262076	0	945828	4	625628	2233	1266978	13542	15779	15779
11/14/17	262076	0	945828	0	627479	1851	1267458	480	2331	2331
11/15/17	262076	0	945828	0	631739	4260	1291112	23654	27914	27914
11/16/17	262076	0	945828	0	634429	2690	1305110	13998	16688	16688
11/17/17	262076	0	945842	14	637730	3301	1319565	14455	17770	17770
11/20/17	262076	0	945842	0	644286	6556	1344547	24982	31538	31538
11/22/17	262076	0	945842	0	646880	2594	1353245	8698	11292	11292
11/28/17	262076	0	945876	34	650919	4039	1367677	14432	18505	18505
11/29/17	262076	0	945884	8	654673	3754	1380161	12484	16246	16246
11/30/17	262076	0	945905	21	658349	3676	1391924	11763	15460	15460
12/1/17	262076	0	945910	5	661766	3417	1403035	11111	14533	14533
12/4/17	262076	0	945910	0	665483	3717	1415499	12464	16181	16181
12/5/17	262076	0	945911	1	668869	3386	1426405	10906	14293	14293
12/6/17	262076	0	945911	0	672003	3134	1435687	9282	12416	12416
12/13/17	262076	0	945911	0	674587	2584	1445772	10085	12669	12669
12/14/17	262076	0	945918	7	678420	3833	1459378	13606	17446	17446
12/15/18	262076	0	945918	0	681396	2976	1471313	11935	14911	14911
12/18/18	262076	0	945918	0	682491	1095	1482328	11015	12110	12110
12/19/18	262076	0	945918	0	684928	2437	1496375	14047	16484	16484
12/20/18	262076	0	945918	0	685864	936	1503564	7189	8125	8125
12/21/18	262076	0	945918	0	686297	433	1512361	8797	9230	9230
1/2/18	262076	0	945918	0	687135	838	1513771	1410	2248	2248
1/3/18	262076	0	945918	0	690711	3576	1525039	11268	14844	14844
1/4/18	262076	0	945918	0	694911	4200	1543654	18615	22815	22815
1/9/18	262076	0	945918	0	697940	3029	1559261	15607	18636	18636
1/11/18	262076	0	945918	0	701216	3276	1574024	14763	18039	18039
1/16/18	262076	0	945918	0	703809	2593	1587265	13241	15834	15834
1/17/18	262076	0	945918	0	707642	3833	1594718	7453	11286	11286
1/28/18	262076	0	945918	0	712475	4833	1629335	34617	39450	39450
1/29/18	262076	0	945918	0	716674	4199	1636412	7077	11276	11276
1/30/18	262076	0	945918	0	724141	7467	1650058	13646	21113	21113
1/31/18	262076	0	945918	0	730917	6776	1676627	26569	33345	33345
2/1/18	262076	0	945918	0	734680	3763	1685799	9172	12935	12935

DATE	CSM-DW1	daily	CSM-DW2	daily	CSM-DW3	daily	CSM-DW4	daily	DAILY TOTAL	TONY's #'s	
2/6/18	262076	0	946065	147	738513	3833	1719973	34174	38154	38154	
2/7/18	262076	0	946065	0	743131	4618	1756915	36942	41560	41560	
2/8/18	262076	0	948921	2856	747960	4829	1786233	29318	37003	37003	
2/9/18	262076	0	957399	8478	750480	2520	1801767	15534	26532	26532	
									3550869	3699928	Total water pumped to date