



November 13, 2018

Ms. Yasmin Guevara  
New York State Department of Environmental Conservation - Region 8  
Division of Solid and Hazardous Materials  
6274 East Avon-Lima Road  
Avon, New York 14414

RE: Hakes C&D, Campbell N.Y.  
Hakes C&D Landfill Permit No. 8-4630-00010/00001-0  
2018 2nd Quarter Leachate Radionuclide Monitoring Results

Dear Ms. Guevara:

Enclosed please find a copy of the radionuclide sampling and analysis report for leachate sampling conducted during the second quarter 2018. This report is being submitted as required by the facility Environmental Monitoring Plan. Should you have any questions or require clarification of the enclosed data, please do not hesitate to contact me at 603-545-7125 or at russell.anderson@casella.com.

Sincerely,

CASELLA WASTE SERVICES

A handwritten signature in black ink, appearing to read "CHOPKINS", is written over a faint, light-colored signature line.

Charles Hopkins  
Environmental Analyst

cc: Robert Kras, Casella (electronic)  
Russell Anderson, Casella (electronic)  
Jonathan Brandes, On-Site Technical Services (electronic)  
Richard Clarkson, NYSDEC (electronic)  
Timothy Rice, NYSDEC (electronic)  
Greg MacLean, NYSDEC (electronic)

Enclosures



## ON-SITE TECHNICAL SERVICES, INC

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72 Railroad Avenue  
Wellsville, New York 14895

Phone: (585) 593-1824  
Fax: (585) 593-7471

November 13, 2018

Mr. Charles Hopkins  
Casella Waste Systems, Inc.  
4376 Manning Ridge Road  
Campbell, New York 14870

Re: Hakes C & D Landfill Campbell, New York – 2<sup>nd</sup> Quarter-2018-Radionuclide Test Results

Dear Charles:

The purpose of this letter is to present results of the leachate radiological sampling conducted at the Hakes C & D Landfill during the second quarter 2018. Leachate sampling and analysis for radionuclides is required as detailed in section 2.6.3 of the April 2015 Environmental Monitoring Plan (EMP). The initial radiological sampling and analysis of each landfill cell and combined leachate was completed in May 2012. Therefore, the sampling required in the second quarter 2018 includes only landfill cells which have received gas well waste. Currently, the cells containing gas well waste includes cells 5 through 8. Leachate from cell 7 drains through cell 4 and cell 8A leachate flows through cell 3. Therefore, second quarter 2018 leachate samples were collected from cells 3, 4, 5, 6 and 8B. Samples were collected by On-Site on June 26, 2018 and analyzed by ALS Environmental (ALS) located in Fort Collins, Colorado. ALS Fort Collins is a New York State accredited laboratory. Attached Table 1 displays the current and historic leachate radionuclide results from leachate sampling conducted between the second quarter 2016 and second quarter 2018. Also enclosed are the second quarter 2018 field sampling forms and laboratory analytical report.

If you have any questions regarding the information in this submittal, please call me at 585-593-1824.

Sincerely,

A handwritten signature in black ink, appearing to read "Jonathan E. Brandes". The signature is written in a cursive, flowing style.

Jonathan E. Brandes, P.G.  
Senior Geologist

Enclosures



Table 1

**Leachate Radionuclide Analytical Results  
Second Quarter 2016 through Second Quarter 2018  
Hakes C and D Landfill  
Campbell, New York**

Parameter	Cell 5 Leachate 5/4/2016	Cell 5 Leachate 11/18/2016	Cell 5 Leachate 6/6/2017	Cell 5 Leachate 11/17/2017	Cell 5 Leachate 6/26/2018	Cell 6 Leachate 5/4/2016	Cell 6 Leachate 11/18/2016	Cell 6 Leachate 6/6/2017	Cell 6 Leachate 11/17/2017	Cell 6 Leachate 6/26/2018
<b>Field Parameters</b>										
Field pH (std. units)	6.87	7.02	6.79	6.88	6.88	6.96	7.13	6.84	6.97	6.99
ORP (mV)	54.2	-21.1	-205.9	-102.1	-85.2	-166.5	-222.1	-291.7	-239.1	-305.9
Specific Conductivity (us/cm)	6818	6101	6221	6278	8030	10908	9087	12178	10151	11169
Temperature (deg. C)	17.5	20.89	21.9	16.2	28.4	21.1	24.05	24.6	19.2	29.7
Turbidity (NTU)	88.7	23.4	64.3	41.6	78.8	41.8	60.2	67.4	107	26.3
<b>Radionuclide Act + Unc (MDC) pCi/L</b>										
Actinium-228, Dissolved (EPA 901.1)	11.706 ± 14.674 (15.24)	0.496 ± 36.150 (38.58)	11.148 ± 16.458 (16.64)	17 ± 14 (22)	-1 ± 11 (19)	8.192 ± 14.364 (15.24)	0 ± 8.469 (48.02)	0 ± 15.628 (36.2)	4.8 ± 9.1 (19.5)	16 ± 16 (26)
Actinium-228, Total (EPA 901.1)	0 ± 14.673 (46.24)	0 ± 12.276 (58.75)	0 ± 7.662 (20.81)	37 ± 17 (25)	14 ± 21 (35)	17.4 ± 28.767 (36.33)	0.39 ± 14.166 (17.1)	3.444 ± 16.759 (18.84)	15 ± 19 (30)	25 ± 14 (22)
Bismuth-212, Dissolved (EPA 901.1)	17.473 ± 55.120 (61.64)	35.101 ± 108.130 (116.3)	23.217 ± 62.770 (60.75)	68 ± 48 (75)	22 ± 25 (41)	0 ± 33.494 (71.72)	-4.793 ± 137.760 (152)	0 ± 39.340 (126.7)	-7 ± 49 (82)	-4 ± 58 (100)
Bismuth-212, Total (EPA 901.1)	0 ± 40.028 (142.4)	31.06 ± 106.960 (122.1)	0 ± 30.517 (67.34)	31 ± 59 (99)	41 ± 66 (109)	0 ± 32.683 (142.4)	20.552 ± 57.388 (62.96)	28.15 ± 56.478 (60.37)	38 ± 94 (157)	13 ± 49 (84)
Bismuth-214, Dissolved (EPA 901.1)	75.469 ± 14.748 (9.911)	595.81 ± 71.039 (25.89)	15.948 ± 9.449 (8.905)	-3 ± 12 (20)	2.5 ± 9.1 (15)	107.45 ± 17.701 (9.759)	17.385 ± 25.432 (27.25)	411.44 ± 51.257 (18.35)	-7.6 ± 9.5 (15.8)	23.6 ± 9.1 (12.9)
Bismuth-214, Total (EPA 901.1)	0 ± 10.770 (28.05)	347.44 ± 53.241 (23.93)	40.987 ± 11.091 (8.763)	14.1 ± 8.9 (13.9)	8 ± 19 (31)	74.751 ± 23.569 (22.52)	5.86 ± 10.909 (11.96)	8.261 ± 9.579 (12.72)	9.3 ± 9.7 (15.8)	-5 ± 12 (21)
Cesium-134, Dissolved (EPA 901.1)	-0.043 ± 4.463 (5.079)	4.488 ± 7.851 (12.69)	2.276 ± 4.549 (4.221)	-2.9 ± 3.1 (5.5)	-0.9 ± 2.1 (3.5)	0.325 ± 0.481 (5.767)	4.806 ± 4.715 (11.28)	0 ± 3.379 (9.98)	-1.7 ± 2 (3.5)	-0.8 ± 4 (6.9)
Cesium-134, Total (EPA 901.1)	-0.284 ± 7.800 (9.166)	0 ± 5.376 (12.68)	1.467 ± 3.817 (4.083)	-1.8 ± 4.2 (7.3)	-0.9 ± 5 (8.6)	2.219 ± 8.990 (10.27)	0.827 ± 4.805 (5.276)	0 ± 0.965 (5.21)	-3.9 ± 4.9 (8.6)	-2.2 ± 5.6 (9.6)
Cesium-137, Dissolved (EPA 901.1)	0 ± 0.862 (7.693)	0 ± 4.131 (11.41)	0.274 ± 4.280 (4.579)	0.6 ± 2.9 (4.9)	-1.1 ± 1.8 (3.1)	0 ± 1.927 (5.685)	-5.004 ± 11.852 (12.68)	0 ± 1.039 (10.47)	-2 ± 1.8 (3.2)	-0.8 ± 4.3 (7.5)
Cesium-137, Total (EPA 901.1)	-3.126 ± 10.186 (11.63)	0.457 ± 10.815 (12.48)	-0.102 ± 4.476 (4.993)	0.3 ± 4.3 (7.3)	-2.7 ± 5.2 (9.1)	3.194 ± 8.180 (9.422)	1.168 ± 4.088 (4.511)	1.041 ± 3.824 (4.245)	1.6 ± 4.8 (8.1)	2.6 ± 3.2 (5.2)
Lead-210, Dissolved (SOP 704)										
Lead-210, Total (SOP 704)										
Lead-212, Dissolved (EPA 901.1)	10.932 ± 18.133 (11.31)	195.89 ± 56.662 (23.86)	1.188 ± 5.691 (8.065)	-0.1 ± 6.9 (11.6)	0.2 ± 5.3 (8.8)	18.584 ± 16.533 (11.54)	4.077 ± 15.882 (19.13)	10.857 ± 9.656 (14.8)	-0.4 ± 5.5 (9.1)	2.8 ± 6.1 (10.2)
Lead-212, Total (EPA 901.1)	2.944 ± 15.715 (19.37)	73.833 ± 33.325 (27.92)	7.976 ± 14.760 (10.29)	0 ± 10 (17)	1.3 ± 9.9 (16.5)	0 ± 9.036 (22.42)	0 ± 4.170 (10.73)	3.325 ± 7.019 (8.608)	12.9 ± 6.2 (9.4)	4.3 ± 7.9 (13.1)
Lead-214, Dissolved (EPA 901.1)	75.215 ± 14.380 (9.459)	713.27 ± 85.748 (25.99)	8.424 ± 8.783 (9.561)	8.8 ± 6.1 (9.6)	2.1 ± 8.3 (13.7)	112.21 ± 18.663 (10.9)	34.098 ± 19.097 (21.01)	442.99 ± 53.175 (19.81)	-9.1 ± 8.4 (13.9)	11.3 ± 8.1 (12.9)
Lead-214, Total (EPA 901.1)	11.896 ± 17.951 (22.21)	345.25 ± 51.096 (24.26)	31.945 ± 11.578 (10.13)	-4 ± 12 (21)	5 ± 13 (22)	99.876 ± 26.198 (21.36)	11.224 ± 10.300 (10.35)	1.957 ± 8.850 (10.7)	12.9 ± 8.6 (13.5)	10.2 ± 6.5 (10.2)
Potassium-40, Dissolved (EPA 901.1)	150.28 ± 55.673 (53.17)	82.309 ± 106.210 (108)	110.43 ± 53.662 (50.04)	67 ± 75 (123)	146 ± 48 (71)	194.11 ± 50.952 (43.07)	204.34 ± 100.750 (109.1)	266.49 ± 95.889 (93.96)	55 ± 48 (78)	160 ± 120 (190)
Potassium-40, Total (EPA 901.1)	0 ± 69.751 (181.8)	46.882 ± 159.440 (181.5)	132.78 ± 49.874 (46.86)	80 ± 100 (170)	170 ± 140 (220)	209.21 ± 96.525 (114)	133.77 ± 52.140 (53.62)	216.58 ± 52.598 (40.14)	120 ± 140 (220)	153 ± 93 (147)
Radium-226, Dissolved (EPA 901.1)	97.244 ± 109.150 (128.9)	0 ± 192.880 (291.8)	12.579 ± 103.520 (119.4)	-1 ± 71 (118)	10 ± 73 (121)	112.13 ± 124.210 (142.8)	56.923 ± 204.080 (257)	0 ± 110.140 (207.1)	17 ± 67 (110)	20 ± 110 (190)
Radium-226, Dissolved (EPA 903.1)	2.96 ± 0.968 (0.507)	2.19 ± 1.30 (1.24)	0.898 ± 0.933 (1.39)	1.07 ± 0.36 (0.16)	0 ± 0.17 (0.25)	0.888 ± 0.642 (0.895)	0.762 ± 0.533 (0.643)	2.34 ± 1.21 (1.01)	2.77 ± 0.78 (0.19)	2.4 ± 1.2 (1.1)
Radium-226, Total (EPA 901.1)	0 ± 139.040 (263)	133.98 ± 195.550 (236.6)	18.509 ± 98.768 (124.1)	-10 ± 100 (170)	30 ± 110 (190)	0 ± 70.798 (237.6)	36.26 ± 99.458 (124.1)	8.462 ± 102.230 (128.4)	-30 ± 120 (210)	-40 ± 100 (180)
Radium-226, Total (EPA 903.1)	1.27 ± 1.18 (1.55)	1.2 ± 0.724 (0.793)	1.35 ± 1.30 (1.87)	1.07 ± 0.36 (0.19)	0.39 ± 0.33 (0.46)	1.83 ± 1.02 (0.977)	0.675 ± 0.536 (0.696)	2.75 ± 1.80 (1.84)	1.81 ± 0.53 (0.12)	2.11 ± 0.75 (0.3)
Radium-228, Dissolved (EPA 901.1)	11.706 ± 14.674 (15.24)	0.496 ± 36.150 (38.58)	11.148 ± 16.458 (16.64)	17 ± 14 (22)	-1 ± 11 (19)	8.192 ± 14.364 (15.24)	0 ± 8.469 (48.02)	0 ± 15.628 (36.2)	4.8 ± 9.1 (19.5)	16 ± 16 (26)
Radium-228, Dissolved (EPA 904.0)	0.00366 ± 0.308 (0.718)	2.33 ± 0.710 (0.898)	2.42 ± 0.699 (0.785)	1.85 ± 0.57 (0.61)	0.69 ± 0.46 (0.89)	0.957 ± 0.482 (0.86)	1.44 ± 0.569 (0.897)	2.07 ± 0.649 (0.807)	3.1 ± 0.84 (0.62)	2.28 ± 0.72 (0.82)
Radium-228, Total (EPA 901.1)	0 ± 14.673 (46.24)	0 ± 12.276 (58.75)	0 ± 7.662 (20.81)	37 ± 17 (25)	14 ± 21 (35)	17.4 ± 28.767 (36.33)	0.39 ± 14.166 (17.1)	3.444 ± 16.759 (18.84)	15 ± 19 (30)	25 ± 14 (22)
Radium-228, Total (EPA 904.0)	2.7 ± 0.770 (0.904)	1.94 ± 0.648 (0.893)	1.32 ± 0.846 (1.64)	1.07 ± 0.46 (0.75)	0.97 ± 0.49 (0.86)	3.27 ± 0.866 (0.879)	0.631 ± 0.409 (0.767)	2.4 ± 1.04 (1.77)	1.18 ± 0.46 (0.7)	2.64 ± 0.83 (0.9)
Thallium-208, Dissolved (EPA 901.1)	2.77 ± 3.703 (5.861)	3.648 ± 8.159 (9.008)	1.525 ± 4.526 (4.652)	-0.1 ± 4.8 (8.1)	-0.5 ± 3.5 (5.8)	3.686 ± 6.273 (5.861)	0 ± 4.822 (12.9)	0 ± 6.558 (11.15)	-1 ± 3.3 (5.5)	-0.5 ± 9.3 (15.6)
Thallium-208, Total (EPA 901.1)	0 ± 1.887 (12.82)	0 ± 6.257 (13)	0 ± 2.190 (6.381)	6.6 ± 4.2 (6.6)	8.1 ± 5.1 (8)	0 ± 2.882 (12.28)	4.871 ± 4.898 (4.409)	0.412 ± 4.491 (5.228)	-3.3 ± 7.4 (12.7)	1.6 ± 3.5 (5.8)
Thorium-227, Dissolved (EPA 901.1)				-2 ± 20 (33)	2 ± 15 (25)				1 ± 15 (25)	-9 ± 20 (35)
Thorium-227, Total (EPA 901.1)				10 ± 30 (49)	-8 ± 32 (55)				-29 ± 21 (36)	-9 ± 18 (31)
Thorium-232, Dissolved (EPA 901.1)	6190 ± 7584.700 (9106)	6861.1 ± 15847.000 (19150)	4675.1 ± 4366.500 (7076)	17 ± 14 (22)	-1 ± 11 (19)	921.92 ± 7622.700 (9453)	12222 ± 15484.000 (18540)	2714 ± 4543.300 (5446)	4.8 ± 9.1 (19.5)	16 ± 16 (26)
Thorium-232, Total (EPA 901.1)	2741 ± 4616.100 (5607)	-162.19 ± 6157.400 (7585)	-2397 ± 8099.700 (9950)	37 ± 17 (25)	14 ± 21 (35)	2805.9 ± 4794.100 (5821)	2355.3 ± 6995.900 (8633)	3529.6 ± 6603.800 (8070)	15 ± 19 (30)	25 ± 14 (22)
Thorium-234, Dissolved (EPA 901.1)	47.94 ± 441.450 (560.8)	345.91 ± 860.080 (1070)	96.497 ± 139.230 (414.4)	38 ± 40 (76)	-10 ± 71 (118)	0 ± 187.510 (551.7)	198.05 ± 909.930 (1156)	11.694 ± 258.590 (314.3)	49 ± 63 (105)	86 ± 55 (87)
Thorium-234, Total (EPA 901.1)	4.114 ± 269.030 (341.5)	15.067 ± 335.640 (418.4)	0 ± 212.310 (505.7)	69 ± 81 (138)	-30 ± 100 (170)	0 ± 190.660 (363.4)	88.555 ± 378.210 (486)	0 ± 238.760 (515.5)	-10 ± 100 (170)	80 ± 120 (200)
Total Uranium, Dissolved (ASTM D5174-97)		0.000518 ± 0.034 (0.385)	0.000797 ± 0.036 (0.385)				0.000732 ± 0.032 (0.385)	0.00105 ± 0.047 (0.385)		
Total Uranium, Total (ASTM D5174-97)		0.00052 ± 0.032 (0.385)	0.000733 ± 0.034 (0.385)				0.00062 ± 0.026 (0.385)	0.00112 ± 0.039 (0.385)		
Total Uranium, Dissolved (EPA 908.0)	0.536 ± 0.340 (0.529)					0.742 ± 0.450 (0.716)				
Total Uranium, Total (EPA 908.0)	0.239 ± 0.307 (0.555)					0.262 ± 0.325 (0.585)				
Total Uranium, Dissolved (HASL-300)				0.75 ± 0.2 (0.1)	0.51 ± 0.19 (0.13)				0.32 ± 0.13 (0.09)	0.63 ± 0.19 (0.1)
Total Uranium, Total (HASL-300)				0.82 ± 0.26 (0.15)	0.52 ± 0.18 (0.13)				0.25 ± 0.19 (0.23)	0.67 ± 0.2 (0.12)

Table 1

**Leachate Radionuclide Analytical Results**  
**Second Quarter 2016 through Second Quarter 2018**  
**Hakes C and D Landfill**  
**Campbell, New York**

Parameter	Cell 8 Leachate 5/4/2016	Cell 8 Leachate 11/18/2016	Cell 8 Leachate 6/6/2017	Cell 8 Leachate 11/17/2017	Cell 8 Leachate 2/27/2018	Cell 8 Leachate 6/26/2018
<b>Field Parameters</b>						
Field pH (std. units)	6.45	6.55	6.74	6.62	6.47	6.62
ORP (mV)	-153.5	73.6	-257.4	-13.5	10	-208.4
Specific Conductivity (us/cm)	2785	1220	5306	2286	1577	3300
Temperature (deg. C)	17.6	6.08	22	14	16	28.2
Turbidity (NTU)	175	35.4	38.4	140	111	1000 >
<b>Radionuclide Act + Unc (MDC) pCi/L</b>						
Actinium-228, Dissolved (EPA 901.1)	0.448 ± 34.301 (43.22)	47.093 ± 73.980 (76.54)	12.267 ± 9.673 (19.95)	4 ± 25 (43)	10 ± 28 (48)	27 ± 15 (23)
Actinium-228, Total (EPA 901.1)	0 ± 15.389 (54.22)	4.586 ± 15.790 (18.22)	6.953 ± 102.350 (110.6)	-3 ± 11 (19)	-9 ± 26 (46)	23 ± 19 (36)
Bismuth-212, Dissolved (EPA 901.1)	23.229 ± 129.950 (152.9)	0 ± 142.110 (286)	0 ± 26.514 (75.19)	5 ± 49 (84)	21 ± 81 (138)	32 ± 49 (81)
Bismuth-212, Total (EPA 901.1)	0 ± 73.084 (171.8)	31.518 ± 54.776 (59.23)	0 ± 81.230 (391.1)	-16 ± 49 (82)	25 ± 80 (135)	28 ± 57 (96)
Bismuth-214, Dissolved (EPA 901.1)	0 ± 9.677 (28.89)	3779.3 ± 407.970 (48.82)	113.23 ± 18.794 (12.43)	-3 ± 14 (24)	5 ± 17 (28)	16.3 ± 8.7 (13.2)
Bismuth-214, Total (EPA 901.1)	0 ± 12.206 (26.3)	10.19 ± 11.736 (12.56)	6067.2 ± 653.720 (70.33)	-10.8 ± 9.6 (15.9)	10 ± 21 (35)	15 ± 14 (23)
Cesium-134, Dissolved (EPA 901.1)	0.569 ± 9.337 (10.78)	0 ± 7.265 (22.76)	1.167 ± 5.520 (5.334)	-0.5 ± 5.8 (9.8)	-4.4 ± 6 (10.6)	-5.4 ± 4.1 (7.2)
Cesium-134, Total (EPA 901.1)	-3.016 ± 10.794 (12.16)	0 ± 1.553 (5.413)	2.72 ± 24.998 (27.3)	-2.6 ± 2.1 (3.6)	-3.4 ± 5.5 (9.7)	-1.3 ± 4 (6.9)
Cesium-137, Dissolved (EPA 901.1)	-1.427 ± 10.640 (12.26)	0 ± 5.201 (23.21)	-3.479 ± 5.542 (5.783)	1.1 ± 3.6 (6)	1.1 ± 5.5 (9.4)	-0.9 ± 3.8 (6.5)
Cesium-137, Total (EPA 901.1)	7.067 ± 6.059 (6.365)	0.863 ± 4.064 (4.511)	0 ± 15.721 (32.75)	-1.7 ± 1.8 (3.2)	0.5 ± 5.6 (9.7)	-2 ± 4 (7)
Lead-210, Dissolved (SOP 704)					0.36 ± 0.6 (0.98)	
Lead-210, Total (SOP 704)					0.19 ± 0.59 (0.98)	
Lead-212, Dissolved (EPA 901.1)	10.6 ± 14.194 (17.14)	1005.6 ± 123.520 (41.77)	37.763 ± 15.140 (9.644)	0 ± 10 (17)	5.1 ± 9.9 (16.4)	4.6 ± 9.5 (15.8)
Lead-212, Total (EPA 901.1)	2.013 ± 16.195 (19.96)	0 ± 4.168 (9.541)	1621.7 ± 196.040 (66.02)	3 ± 5.7 (9.4)	0.1 ± 9.9 (16.7)	17.8 ± 9.5 (14.9)
Lead-214, Dissolved (EPA 901.1)	0 ± 11.947 (22.78)	3990.1 ± 429.570 (59.09)	113.2 ± 16.304 (11.11)	3.6 ± 7.1 (11.7)	5 ± 13 (21)	0 ± 12 (20)
Lead-214, Total (EPA 901.1)	0 ± 9.755 (21)	11.641 ± 9.172 (10.6)	6183.9 ± 666.770 (83.91)	-1 ± 8.4 (13.9)	11.2 ± 9.7 (15.5)	19 ± 11 (17)
Potassium-40, Dissolved (EPA 901.1)	0 ± 73.330 (192.2)	0 ± 121.870 (261.7)	153.87 ± 56.967 (51.02)	-43 ± 98 (166)	16 ± 97 (167)	0 ± 80 (135)
Potassium-40, Total (EPA 901.1)	0 ± 90.521 (192.2)	17.429 ± 44.542 (53.76)	204.12 ± 307.190 (305.2)	-96 ± 46 (78)	-110 ± 120 (230)	250 ± 100 (150)
Radium-226, Dissolved (EPA 901.1)	0 ± 110.980 (240.1)	254.23 ± 451.840 (540.6)	44.007 ± 103.980 (128.6)	10 ± 110 (180)	30 ± 110 (180)	20 ± 120 (200)
Radium-226, Dissolved (EPA 903.1)	1.13 ± 0.622 (0.554)	0.233 ± 0.355 (0.21)	1.51 ± 1.00 (0.455)	0.88 ± 0.31 (0.16)	0.59 ± 0.27 (0.23)	0.16 ± 0.3 (0.52)
Radium-226, Total (EPA 901.1)	0 ± 102.250 (256.4)	0 ± 38.887 (122.7)	32.493 ± 635.900 (770)	5 ± 66 (110)	30 ± 110 (190)	33 ± 89 (148)
Radium-226, Total (EPA 903.1)	0.211 ± 0.774 (1.27)	0.0769 ± 0.351 (0.208)	2.43 ± 2.24 (1.32)	1.38 ± 0.45 (0.18)	0.89 ± 0.34 (0.2)	2.4 ± 0.83 (0.35)
Radium-228, Dissolved (EPA 901.1)	0.448 ± 34.301 (43.22)	47.093 ± 73.980 (76.54)	12.267 ± 9.673 (19.95)	4 ± 25 (43)	10 ± 28 (48)	27 ± 15 (23)
Radium-228, Dissolved (EPA 904.0)	0.669 ± 0.465 (0.897)	0.585 ± 0.461 (0.918)	1.65 ± 0.611 (0.89)	1.38 ± 0.51 (0.72)	0.96 ± 0.4 (0.63)	1.68 ± 0.62 (0.87)
Radium-228, Total (EPA 901.1)	0 ± 15.389 (54.22)	4.586 ± 15.790 (18.22)	6.953 ± 102.350 (110.6)	-3 ± 11 (19)	-9 ± 26 (46)	23 ± 19 (36)
Radium-228, Total (EPA 904.0)	0.732 ± 0.475 (0.905)	0.27 ± 0.378 (0.801)	1.77 ± 1.34 (2.7)	1.46 ± 0.54 (0.79)	0.7 ± 0.38 (0.68)	1.71 ± 0.62 (0.85)
Thallium-208, Dissolved (EPA 901.1)	0 ± 4.219 (10.49)	0 ± 4.529 (26.23)	4.204 ± 4.813 (5.453)	4.6 ± 3.9 (6.3)	2.7 ± 8.1 (13.6)	5.9 ± 4 (6.3)
Thallium-208, Total (EPA 901.1)	0 ± 5.660 (12.82)	0 ± 2.277 (5.75)	0 ± 11.613 (37.38)	-0.7 ± 3.3 (5.6)	1.5 ± 8.8 (14.9)	0.9 ± 6.5 (10.9)
Thorium-227, Dissolved (EPA 901.1)				4 ± 29 (48)	9 ± 41 (68)	-3 ± 20 (33)
Thorium-227, Total (EPA 901.1)				-10 ± 15 (26)	14 ± 26 (43)	-4 ± 28 (48)
Thorium-232, Dissolved (EPA 901.1)	1621.9 ± 4696.100 (5768)	-2891.6 ± 12811.000 (15380)	-4078.5 ± 8549.500 (10290)	4 ± 25 (43)	10 ± 28 (48)	27 ± 15 (23)
Thorium-232, Total (EPA 901.1)	-2043.6 ± 5291.000 (6465)	0 ± 4624.000 (10330)	194.63 ± 17777.000 (21420)	-3 ± 11 (19)	-9 ± 26 (46)	23 ± 19 (36)
Thorium-234, Dissolved (EPA 901.1)	10.514 ± 271.710 (344.3)	0 ± 451.110 (882.2)	0 ± 153.520 (569.2)	148 ± 92 (146)	-40 ± 100 (180)	100 ± 180 (290)
Thorium-234, Total (EPA 901.1)	0 ± 110.800 (360.7)	161.38 ± 394.500 (501.3)	0 ± 607.490 (1214)	62 ± 64 (104)	10 ± 130 (220)	2 ± 88 (147)
Total Uranium, Dissolved (ASTM D5174-97)		0.000649 ± 0.024 (0.385)	0.000911 ± 0.047 (0.385)			
Total Uranium, Total (ASTM D5174-97)		0.000612 ± 0.026 (0.385)	0.000866 ± 0.046 (0.385)			
Total Uranium, Dissolved (EPA 908.0)	1.48 ± 0.518 (0.588)					
Total Uranium, Total (EPA 908.0)	0.856 ± 0.445 (0.662)					
Total Uranium, Dissolved (HASL-300)				0.59 ± 0.21 (0.16)	0.5 ± 0.2 (0.15)	4.22 ± 0.66 (0.11)
Total Uranium, Total (HASL-300)				0.65 ± 0.18 (0.12)	0.52 ± 0.16 (0.06)	7.8 ± 1 (0.2)

# Groundwater Suppression and Leachate Sampling Field Form On-Site Technical Services, Inc.

Project: Hakes C&D Landfill, Campbell, New York

Date: 6-26-18

Sampling Location: cell-3

Sample ID: Cell3RAD-0618  
~~Cell30~~

Arrival Time: 1230

**Weather Conditions:**

Temp. 73° F  Sunny ( ) Partly Cloudy ( ) Cloudy ( ) Light Rain ( ) Hvy. Rain ( ) Snow

Wind Conditions: 0-5 mph

**Location Type**

( ) Groundwater Suppression  Leachate ( ) Secondary Leachate ( ) Surface Water/Sediment ( ) Res. Water  
( ) Other \_\_\_\_\_

**Flow and Depth Information (as appropriate)**

Depth: NA Estimated Flow: \_\_\_\_\_

Comments: \_\_\_\_\_

**Field Parameters (as appropriate)**

Meter: YSI (sn: 170/08273), Hach 2100P (sn: 13309)

Field Parameters tested in: ( ) Submerged Probe  Cup  
Note: Turbidity measured from a vial grab sample

Time	pH	Conductivity (us/cm)	Turbidity (ntu)	D.O. (mg/L)	Temp. (°C)	ORP (mV)
<u>1235</u>	<u>6.87</u>	<u>7430</u>	<u>48.4</u>	<u>NA</u>	<u>26.9</u>	<u>33.7</u>

**Sample Information**

Sample Type:  Grab ( ) Composite Sample Location:  Riser Discharge Pipe ( ) Pond ( ) Ditch

Location Description/Condition: Cell 3 Riser

Sample Collection Equipment/Method: Ded 5gal Sample Time: 1235

Sample Description (clarity/color): clear w/light Amber tint Sample Odor (Y) or (N) Explain: leachate odor

Other Observations/Comments: \_\_\_\_\_

Analysis Requested: RAD Number of Containers: 10

Sampling Completion: Time 1245 Date 6-26-18 Samplers K Dye - J

# Groundwater Suppression and Leachate Sampling Field Form

## On-Site Technical Services, Inc.

Project: Hakes C&D Landfill, Campbell, New York

Date: 6-26-18

Sampling Location: Cell-4 Sample ID: Cell4RAD-0618 Arrival Time: 1248

### Weather Conditions:

Temp. 73 ° F  Sunny ( ) Partly Cloudy ( ) Cloudy ( ) Light Rain ( ) Hvy. Rain ( ) Snow

Wind Conditions: 0-5 mph

### Location Type

( ) Groundwater Suppression  Leachate ( ) Secondary Leachate ( ) Surface Water/Sediment ( ) Res. Water  
( ) Other \_\_\_\_\_

### Flow and Depth Information (as appropriate)

Depth: NA Estimated Flow: \_\_\_\_\_

Comments: \_\_\_\_\_

### Field Parameters (as appropriate)

Meter: YSI (sn: 170108273), Hach 2100P (sn: 13309)

Field Parameters tested in: ( ) Submerged Probe  Cup  
Note: Turbidity measured from a vial grab sample

Time	pH	Conductivity (us/cm)	Turbidity (ntu)	D.O. (mg/L)	Temp. (°C)	ORP (mV)
<u>1250</u>	<u>7.08</u>	<u>7893</u>	<u>87.0</u>	<u>NA</u>	<u>26.4</u>	<u>-136.4</u>

### Sample Information

Sample Type:  Grab ( ) Composite Sample Location:  Discharge Pipe ( ) Pond ( ) Ditch

Location Description/Condition: Cell-4 Riser

Sample Collection Equipment/Method: Del. 5 gal Bucket Sample Time: 1250

Sample Description (clarity/color): Slightly cloudy with light Amber tint Sample Odor  (Y) or (N) Explain: Slight leachate odor

Other Observations/Comments: \_\_\_\_\_

Analysis Requested: RAD Number of Containers: 10

Sampling Completion: Time 1300 Date 6-26-18 Samplers K Dye - J. Brandes

# Groundwater Suppression and Leachate Sampling Field Form

## On-Site Technical Services, Inc.

Project: Hakes C&D Landfill, Campbell, New York

Date: 6-26-18

Sampling Location: Cell-5 Sample ID: Cell5RAD-0618 Arrival Time: 1301

### Weather Conditions:

Temp. 74 ° F  Sunny ( ) Partly Cloudy ( ) Cloudy ( ) Light Rain ( ) Hvy. Rain ( ) Snow

Wind Conditions: 0-5 mph

### Location Type

( ) Groundwater Suppression  Leachate ( ) Secondary Leachate ( ) Surface Water/Sediment ( ) Res. Water  
( ) Other \_\_\_\_\_

### Flow and Depth Information (as appropriate)

Depth: NA Estimated Flow: \_\_\_\_\_

Comments: \_\_\_\_\_

### Field Parameters (as appropriate)

Meter: YSI (sn: 170108273), Hach 2100P (sn: 13309)

Field Parameters tested in: ( ) Submerged Probe ( ) Cup

Note: Turbidity measured from a vial grab sample

Time	pH	Conductivity (us/cm)	Turbidity (ntu)	D.O. (mg/L)	Temp. (°C)	ORP (mV)
<u>1305</u>	<u>6.88</u>	<u>8830</u>	<u>78.8</u>	<u>NA</u>	<u>28.4</u>	<u>-85.2</u>

### Sample Information

Sample Type:  Grab ( ) Composite Sample Location:  <sup>Riser</sup> Discharge Pipe ( ) Pond ( ) Ditch

Location Description/Condition: Cell-5 Riser

Sample Collection Equipment/Method: Dev 5 gal Bucket Sample Time: 1305

Sample Description (clarity/color): Slightly Cloudy with light amber tint Sample Odor  (Y) or (N) Explain: light leachate odor

Other Observations/Comments: \_\_\_\_\_

Analysis Requested: RAD Number of Containers: 10

Sampling Completion: Time 1312 Date 6-26-18 Samplers K. Dye - J. Brandes



# Groundwater Suppression and Leachate Sampling Field Form

## On-Site Technical Services, Inc.

Project: Hakes C&D Landfill, Campbell, New York

Date: 6-26-18

Sampling Location: Cell-6

Sample ID: Cell6RAD-0618

Arrival Time: 1315

### Weather Conditions:

Temp. 74 ° F  Sunny ( ) Partly Cloudy ( ) Cloudy ( ) Light Rain ( ) Hvy. Rain ( ) Snow

Wind Conditions: 1-5 mph

### Location Type

( ) Groundwater Suppression  Leachate ( ) Secondary Leachate ( ) Surface Water/Sediment ( ) Res. Water  
( ) Other \_\_\_\_\_

### Flow and Depth Information (as appropriate)

Depth: NA Estimated Flow: \_\_\_\_\_

Comments: \_\_\_\_\_

### Field Parameters (as appropriate)

Meter: YSI (sn: 17D108273), Hach 2100P (sn: 13309)

Field Parameters tested in: ( ) Submerged Probe  Cup  
Note: Turbidity measured from a vial grab sample

Time	pH	Conductivity (us/cm)	Turbidity (ntu)	D.O. (mg/L)	Temp. (°C)	ORP (mV)
<u>1320</u>	<u>6.99</u>	<u>1116.9</u>	<u>26.3</u>	<u>NA</u>	<u>29.7</u>	<u>-305.9</u>

### Sample Information

Sample Type:  Grab ( ) Composite Sample Location:  Riser Discharge Pipe ( ) Pond ( ) Ditch

Location Description/Condition: Riser in Cell 6

Sample Collection Equipment/Method: Dee 5 gal Bucket Sample Time: 1320

Sample Description (clarity/color): Clear with light Amber color Sample Odor  (Y) or (N) Explain: Slight leachate odor

Other Observations/Comments: \_\_\_\_\_

Analysis Requested: RAD Number of Containers: 10

Sampling Completion: Time 1327 Date 6-26-18 Samplers K DYE - J. Brandes

# Groundwater Suppression and Leachate Sampling Field Form On-Site Technical Services, Inc.

Project: Hakes C&D Landfill, Campbell, New York

Date: 6-26-18

Sampling Location: Cell 8 Sample ID: Cell 8 RAD-0618 Arrival Time: 1339

### Weather Conditions:

Temp. 77° F  Sunny ( ) Partly Cloudy ( ) Cloudy ( ) Light Rain ( ) Hvy. Rain ( ) Snow

Wind Conditions: 0-5 mph

### Location Type

( ) Groundwater Suppression  Leachate ( ) Secondary Leachate ( ) Surface Water/Sediment ( ) Res. Water  
( ) Other \_\_\_\_\_

### Flow and Depth Information (as appropriate)

Depth: NA Estimated Flow: \_\_\_\_\_

Comments: \_\_\_\_\_

### Field Parameters (as appropriate)

Meter: YSI (sn: 17D108273), Hach 2100P (sn: 13309)

Field Parameters tested in: ( ) Submerged Probe  Cup  
Note: Turbidity measured from a vial grab sample

Time	pH	Conductivity (us/cm)	Turbidity (ntu) <sup>RD</sup>	D.O. (mg/L)	Temp. (°C)	ORP (mV)
<u>1345</u>	<u>6.62</u>	<u>3300</u>	<u>40.7</u> <u>51000</u>	<u>NA</u>	<u>28.2</u>	<u>-208.4</u>

### Sample Information

Sample Type:  Grab ( ) Composite Sample Location:  <sup>Riser</sup> Discharge Pipe ( ) Pond ( ) Ditch

Location Description/Condition: Cell 8 Riser

Sample Collection Equipment/Method: 5 gal Bucket Sample Time: 1345

Sample Description (clarity/color): DK Gray Silty Sample Odor  (Y) or (N) Explain: Slight leachate odor

Other Observations/Comments: \_\_\_\_\_

Analysis Requested: RAD Number of Containers: 10

Sampling Completion: Time 1357 Date 6-26-18 Samplers K Dye - Jr Brandes



August 14, 2018

Service Request No:R1805974

Russell Anderson  
Casella Waste Systems - Hakes Billing  
4 Chenell Drive Suite 200  
Concord, NH 03301

**Laboratory Results for: Hakes C&D Landfill - Leachate RAD.**

Dear Russell,

Enclosed are the results of the sample(s) submitted to our laboratory June 27, 2018  
For your reference, these analyses have been assigned our service request number **R1805974**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and ALS Environmental is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. The measurement uncertainty of the results included in this report is within that expected when using the prescribed method(s) for analysis of these samples, and represented by Laboratory Control Sample control limits. Any events, such as QC failures, which may add to the uncertainty are explained in the report narrative.

Please contact me if you have any questions. My extension is 7472. You may also contact me via email at [Janice.Jaeger@alsglobal.com](mailto:Janice.Jaeger@alsglobal.com).

Respectfully submitted,

**ALS Group USA, Corp. dba ALS Environmental**

Janice Jaeger  
Project Manager

CC: Jon Brandes

ADDRESS 1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623  
PHONE +1 585 288 5380 | FAX +1 585 288 8475  
ALS Group USA, Corp.  
dba ALS Environmental



# Narrative Documents

**ALS Environmental—Rochester Laboratory**  
1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623  
Phone (585) 288-5380 Fax (585) 288-8475  
[www.alsglobal.com](http://www.alsglobal.com)



**Client:** Casella Waste Systems (Hampden ME)  
**Project:** Hakes C&D Landfill - Leachate RAD.  
**Sample Matrix:** Water

**Service Request:** R1805974  
**Date Received:** 06/27/2018

#### **CASE NARRATIVE**

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables, including results of QC samples analyzed from this delivery group. Analytical procedures performed by the lab are validated in accordance with NELAC standards. Any parameters that are not included in the lab's NELAC accreditation are identified on a "Non-Certified Analytes" report in the Miscellaneous Forms Section of this report. Individual analytical results requiring further explanation are flagged with qualifiers and/or discussed below. The flags are explained in the Report Qualifiers and Definitions page in the Miscellaneous Forms section of this report.

#### **Sample Receipt:**

Ten water samples were received for analysis at ALS Environmental on 06/27/2018. Any discrepancies noted upon initial sample inspection are noted on the cooler receipt and preservation form included in this data package. The samples were received in good condition and consistent with the accompanying chain of custody form. Samples are refrigerated at 6°C upon receipt at the lab except for aqueous samples designated for metals analyses, which are stored at room temperature.

#### **Subcontracted Analytical Parameters:**

One or more samples were subcontracted to another laboratory for testing. The certified analytical report from the subcontractor has been included in its entirety at the end of this report and includes the name and address of the subcontracted laboratory.

A handwritten signature in black ink, appearing to read 'Samantha', is written over a horizontal line.

Approved by \_\_\_\_\_

Date 08/14/2018



## Sample Receipt Information

**ALS Environmental—Rochester Laboratory**  
1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623  
Phone (585) 288-5380 Fax (585) 288-8475  
[www.alsglobal.com](http://www.alsglobal.com)

**Client:** Casella Waste Systems (Hampden ME)  
**Project:** Hakes C&D Landfill - Leachate RAD.

**Service Request:**R1805974

**SAMPLE CROSS-REFERENCE**

<u>SAMPLE #</u>	<u>CLIENT SAMPLE ID</u>	<u>DATE</u>	<u>TIME</u>
R1805974-001	Cell3RAD - 0618	6/26/2018	1235
R1805974-002	Cell4RAD - 0618	6/26/2018	1250
R1805974-003	Cell5RAD - 0618	6/26/2018	1305
R1805974-004	Cell6RAD - 0618	6/26/2018	1320
R1805974-005	Cell8RAD - 0618	6/26/2018	1345
R1805974-006	Cell3RAD - 0618 Dissolved	6/26/2018	1235
R1805974-007	Cell4RAD - 0618 Dissolved	6/26/2018	1250
R1805974-008	Cell5RAD - 0618 Dissolved	6/26/2018	1305
R1805974-009	Cell6RAD - 0618 Dissolved	6/26/2018	1320
R1805974-010	Cell8RAD - 0618 Dissolved	6/26/2018	1345



ALS-Environmental  
 1565 Jefferson Rd, Bldg 300, Suite 360  
 Rochester, NY 14623  
 585.288.5380

Client: **Casella/On-Site**  
 4376 Manning Ridge Road  
 Campbell, NY 14870

**CHAIN of CUSTODY**

Page 1 of 1

Project Manager: **Lance Stevens/Jon Brandes**

Project: **Hakes C&D Landfill - Leachate RAD.**

Method of Shipment

Telephone No. 585-593-1824  
 Email: jonb@on-sitehs.com

FED EX

Special Detection  
 Limit/Reporting

PDF to Lance and On-Site, and EDD to On-Site.

Sample I.D.

Lab Sample No.	No. of Containers	Matrix				Prsv.		Sampling Date	Sampling Time	Total: Gamma Spec (901.1), Ra-226 (903.1), Ra-228 (904.0) (HNO3)	Total: Uranium (HAST-300) (HNO3)	Dissolved: Gamma Spec (901.1), Ra-226 (903.1), Ra-228 (904.0)	Dissolved: Uranium (HAST-300)																
		Soil	Water	Air	Other	Yes	No																						
Cell 3 RAD-0618	10	X				X	X	6-26-18	1235	X	X	X	X																
Cell 4 RAD-0618	10	X				X	X	6-26-18	1250	X	X	X	X																
Cell 5 RAD-0618	10	X				X	X	6-26-18	1305	X	X	X	X																
Cell 6 RAD-0618	10	X				X	X	6-26-18	1320	X	X	X	X																
Cell 8 RAD-0618	10	X				X	X	6-26-18	1345	X	X	X	X																
Note: Dissolved analysis requires lab filtering																													

REMARKS

Sample Received Intact: Yes No

Temperature received: Ice No ice

Relinquished by: *Kevin Dye / Kevin Dye*

Date: 6-26-18 Time: 1500

Received by: *Gregory O. Esmerian*  
 Received by: ALS 6-27-18 09:10

Lab Work No.

Relinquished by

Date Time

Received by


Relinquished by

Date Time

Received by laboratory

Date Time

**R1805974 5**  
 Casella Waste Systems - Hakes Billing  
 Hakes C&D Landfill - Leachate RAD.







# Cooler Receipt and Preservation Check Form

R1805974

5

Casella Waste Systems - Hakes Billing  
Hakes C&D Landfill - Leachate RAD.



Project/Client Casella/On Site

Folder Number \_\_\_\_\_

GROWAU

Cooler received on 6-27-18

by: JE

COURIER: ALS UPS FEDEX VELOCITY CLIENT

1	Were Custody seals on outside of cooler?	<u>Y</u>	N
2	Custody papers properly completed (ink, signed)?	<u>Y</u>	N
3	Did all bottles arrive in good condition (unbroken)?	Y	N
4	Circle: <u>Wet Ice</u> Dry Ice Gel packs present?	Y	<u>N</u>

5a	Perchlorate samples have required headspace?	Y	N	<u>NA</u>
5b	Did VOA vials, Alk, or Sulfide have sig* bubbles?	Y	N	<u>NA</u>
6	Where did the bottles originate?	<u>ALS/ROC</u>	CLIENT	
7	Soil VOA received as:	Bulk	Encore	5035set <u>NA</u>

8. Temperature Readings

Date: 6-27-18 Time: 09:16

ID: IR#7 IR#9

From: Temp Blank Sample Bottle

Observed Temp (°C)	<u>26.5</u>	<u>26.0</u>	<u>26.0</u>	<u>26.2</u>	<u>25.7</u>		
Correction Factor (°C)	<u>+0.8</u>	<u>+0.8</u>	<u>+0.8</u>	<u>+0.8</u>	<u>+0.8</u>	<u>NE 6-27-18</u>	
Corrected Temp (°C)	<u>27.3</u>	<u>26.8</u>	<u>26.8</u>	<u>27.0</u>	<u>26.8</u>	<u>26.5</u>	
Temp from: Type of bottle	<u>cent tube</u>	<u>cent tube</u>	<u>cent tube</u>	<u>cent tube</u>	<u>cent tube</u>		
Within 0-6°C?	<u>Y N</u>	<u>Y N</u>	<u>Y N</u>	<u>Y N</u>	<u>Y N</u>	Y N	Y N
If <0°C, were samples frozen?	Y N	Y N	Y N	Y N	Y N	Y N	Y N

If out of Temperature, note packing/ice condition: \_\_\_\_\_ Ice melted Poorly Packed (described below) Same Day Rule

& Client Approval to Run Samples: \_\_\_\_\_ Standing Approval Client aware at drop-off Client notified by: \_\_\_\_\_

All samples held in storage location: SMD by JE on 6-27-18 at 09:24  
 5035 samples placed in storage location: \_\_\_\_\_ by \_\_\_\_\_ on \_\_\_\_\_ at \_\_\_\_\_

Cooler Breakdown/Preservation Check\*\*: Date: 6/27/18 Time: 1335 by: JE

- 9. Were all bottle labels complete (i.e. analysis, preservation, etc.)? YES NO
- 10. Did all bottle labels and tags agree with custody papers? YES NO
- 11. Were correct containers used for the tests indicated? YES NO
- 12. Were 5035 vials acceptable (no extra labels, not leaking)? YES NO
- 13. Air Samples: Cassettes / Tubes Intact with MS? Canisters Pressurized Tedlar® Bags Inflated N/A

pH	Lot of test paper	Reagent	Preserved?		Lot Received	Exp	Sample ID Adjusted	Vol. Added	Lot Added	Final pH
			Yes	No						
≥12		NaOH								
≤2	<u>8</u>	HNO <sub>3</sub>			<u>B2801C</u>	<u>4/19</u>				
≤2		H <sub>2</sub> SO <sub>4</sub>								
<4		NaHSO <sub>4</sub>								
5-9		For 608pest			No=Notify for 3day					
Residual Chlorine (-)		For CN, Phenol, 625, 608pest, 522			If +, contact PM to add Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (625, 608, CN), ascorbic (phenol).					
		Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>								
		ZnAcetate	-	-						
		HCl	**	**						

\*\*VOAs and 1664 Not to be tested before analysis. Otherwise, all bottles of all samples with chemical preservatives are checked (not just representatives).

Bottle lot numbers: 041618-2ARI

Explain all Discrepancies/ Other Comments:

CLRES	BULK
DO	FLDT
HPROD	HGFB
HTR	LL3541
PH	<u>SUB</u>
SO3	MARRS
ALS	REV

Labels secondary reviewed by: JE  
 PC Secondary Review: JE 6/28/18

\*significant air bubbles: VOA > 5-6 mm : WC > 1 in. diameter



## Miscellaneous Forms

**ALS Environmental—Rochester Laboratory**  
1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623  
Phone (585) 288-5380 Fax (585) 288-8475  
[www.alsglobal.com](http://www.alsglobal.com)

## REPORT QUALIFIERS AND DEFINITIONS

- |   |  |
|---|--|
| <p><b>U</b> Analyte was analyzed for but not detected. The sample quantitation limit has been corrected for dilution and for percent moisture, unless otherwise noted in the case narrative.</p> <p><b>J</b> Estimated value due to either being a Tentatively Identified Compound (TIC) or that the concentration is between the MRL and the MDL. Concentrations are not verified within the linear range of the calibration. For DoD: concentration &gt;40% difference between two GC columns (pesticides/Aroclors).</p> <p><b>B</b> Analyte was also detected in the associated method blank at a concentration that may have contributed to the sample result.</p> <p><b>E</b> Inorganics- Concentration is estimated due to the serial dilution was outside control limits.</p> <p><b>E</b> Organics- Concentration has exceeded the calibration range for that specific analysis.</p> <p><b>D</b> Concentration is a result of a dilution, typically a secondary analysis of the sample due to exceeding the calibration range or that a surrogate has been diluted out of the sample and cannot be assessed.</p> <p><b>*</b> Indicates that a quality control parameter has exceeded laboratory limits. Under the "Notes" column of the Form I, this qualifier denotes analysis was performed out of Holding Time.</p> <p><b>H</b> Analysis was performed out of hold time for tests that have an "immediate" hold time criteria.</p> <p><b>#</b> Spike was diluted out.</p> | <p><b>+</b> Correlation coefficient for MSA is &lt;0.995.</p> <p><b>N</b> Inorganics- Matrix spike recovery was outside laboratory limits.</p> <p><b>N</b> Organics- Presumptive evidence of a compound (reported as a TIC) based on the MS library search.</p> <p><b>S</b> Concentration has been determined using Method of Standard Additions (MSA).</p> <p><b>W</b> Post-Digestion Spike recovery is outside control limits and the sample absorbance is &lt;50% of the spike absorbance.</p> <p><b>P</b> Concentration &gt;40% difference between the two GC columns.</p> <p><b>C</b> Confirmed by GC/MS</p> <p><b>Q</b> DoD reports: indicates a pesticide/Aroclor is not confirmed (<math>\times 100\%</math> Difference between two GC columns).</p> <p><b>X</b> See Case Narrative for discussion.</p> <p><b>MRL</b> Method Reporting Limit. Also known as:</p> <p><b>LOQ</b> Limit of Quantitation (LOQ)<br/>The lowest concentration at which the method analyte may be reliably quantified under the method conditions.</p> <p><b>MDL</b> Method Detection Limit. A statistical value derived from a study designed to provide the lowest concentration that will be detected 99% of the time. Values between the MDL and MRL are estimated (see J qualifier).</p> <p><b>LOD</b> Limit of Detection. A value at or above the MDL which has been verified to be detectable.</p> <p><b>ND</b> Non-Detect. Analyte was not detected at the concentration listed. Same as U qualifier.</p> |
|---|--|



### Rochester Lab ID # for State Certifications<sup>1</sup>

Connecticut ID # PH0556	Maine ID #NY0032	New Hampshire ID #
Delaware Approved	New Jersey ID # NY004	294100 A/B
DoD ELAP #65817	New York ID # 10145	Pennsylvania ID# 68-786
Florida ID # E87674	North Carolina #676	Rhode Island ID # 158
		Virginia #460167

<sup>1</sup> Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state or agency requirements. The test results meet requirements of the current NELAP/TNI standards or state or agency requirements, where applicable, except as noted in the case narrative. Since not all analyte/method/matrix combinations are offered for state/NELAC accreditation, this report may contain results which are not accredited. For a specific list of accredited analytes, contact the laboratory or go to <https://www.alsglobal.com/locations/americas/north-america/usa/new-york/rochester-environmental>

# ALS Laboratory Group

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## Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.



# INORGANIC PREPARATION METHODS

The preparation methods associated with this report are found in these tables unless discussed in the case narrative.

## Water/Liquid Matrix

Analytical Method	Preparation Method
200.7	200.2
200.8	200.2
6010C	3005A/3010A
6020A	ILM05.3
9014 Cyanide Reactivity	SW846 Ch7, 7.3.4.2
9034 Sulfide Reactivity	SW846 Ch7, 7.3.4.2
9034 Sulfide Acid Soluble	9030B
9056A Bomb (Halogens)	5050A
9066 Manual Distillation	9065
SM 4500-CN-E Residual Cyanide	SM 4500-CN-G
SM 4500-CN-E WAD Cyanide	SM 4500-CN-I

## Solid/Soil/Non-Aqueous Matrix

Analytical Method	Preparation Method
6010C	3050B
6020A	3050B
6010C TCLP (1311) extract	3005A/3010A
6010 SPLP (1312) extract	3005A/3010A
7196A	3060A
7199	3060A
9056A Halogens/Halides	5050
300.0 Anions/ 350.1/ 353.2/ SM 2320B/ SM 5210B/ 9056A Anions	DI extraction

For analytical methods not listed, the preparation method is the same as the analytical method reference.



## Subcontracted Analytical Parameters

**ALS Environmental—Rochester Laboratory**  
1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623  
Phone (585) 288-5380 Fax (585) 288-8475  
[www.alsglobal.com](http://www.alsglobal.com)



Wednesday, August 08, 2018

Janice Jaeger  
ALS Environmental  
1565 Jefferson Rd., Bldg 300  
Rochester, NY 14623

Re: ALS Workorder: 1806810  
Project Name:  
Project Number: R1805974

Dear Ms. Jaeger:

Ten water samples were received from ALS Environmental, on 6/30/2018. The samples were scheduled for the following analyses:

Gamma Spectroscopy

Radium-226

Radium-228

Total Uranium

The results for these analyses are contained in the enclosed reports.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Thank you for your confidence in ALS Environmental. Should you have any questions, please call.

Sincerely,

ALS Environmental  
Jeff R. Kujawa  
Project Manager

ALS Environmental – Fort Collins is accredited by the following accreditation bodies for various testing scopes in accordance with requirements of each accreditation body. All testing is performed under the laboratory management system, which is maintained to meet these requirement and regulations. Please contact the laboratory or accreditation body for the current scope testing parameters.

ALS Environmental – Fort Collins	
Accreditation Body	License or Certification Number
AIHA	214884
Alaska (AK)	UST-086
Arizona (AZ)	AZ0742
California (CA)	06251CA
Colorado (CO)	CO01099
Florida (FL)	E87914
Idaho (ID)	CO01099
Kansas (KS)	E-10381
Kentucky (KY)	90137
PJ-LA (DoD ELAP/ISO 170250)	95377
Maryland (MD)	285
Missouri (MO)	175
Nebraska(NE)	NE-OS-24-13
Nevada (NV)	CO000782008A
New York (NY)	12036
North Dakota (ND)	R-057
Oklahoma (OK)	1301
Pennsylvania (PA)	68-03116
Tennessee (TN)	2976
Texas (TX)	T104704241
Utah (UT)	CO01099
Washington (WA)	C1280





## 1806810

Samples 1806810-6 through -10 were filtered and preserved prior to analysis.

### **Gamma Spectroscopy:**

The samples were analyzed for the presence of gamma emitting radionuclides according to EPA method 901.1.

Radium-226 quantification based on the 186.21 keV photon suffers from interference with the 185.72 keV photon emitted by  $^{235}\text{U}$ . Due to the high abundance of this photon in  $^{235}\text{U}$  emissions, even small amounts of  $^{235}\text{U}$  may bias the  $^{226}\text{Ra}$  results high. Thus, any measured activity for  $^{226}\text{Ra}$  has been flagged with an "SI" qualifier, denoting spectral interference.

In cases where there are no peaks found in the peak search routine, the software performs a net quantification. This indicates that nuclides are not detected or supported at any level above the reported MDC. Consequently, these nuclides are flagged with an "NQ" qualifier on the final reports. Please refer to the Technical Bulletin Addendum at the end of this report.

Activity concentrations above the calculated MDC are reported in some instances where minimum nuclide identification criteria are not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the 'diagnostic' peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Nuclides not meeting these requirements have been flagged with a "TI" qualifier.

All remaining acceptance criteria were met.

### **Radium-228:**

The samples were analyzed for the presence of  $^{228}\text{Ra}$  by low background gas flow proportional counting of  $^{228}\text{Ac}$ , which is the ingrown progeny of  $^{228}\text{Ra}$ , according to EPA method 904.0.

All acceptance criteria were met.

### **Radium-226:**

The samples were prepared and analyzed according to EPA method 903.1.

Sample 1806810-9 has a chemical recovery of 34%, below the 40% lower control limit. Results are reported per project manager direction.

All remaining acceptance criteria were met.



**Total Uranium:**

The samples were analyzed for the presence of isotopic and total uranium according to HASL 300 method U-02.

U-234 and URANIUM, TOTAL activity is reported in the associated method blank AS180730-1MB above the minimum detectable concentration value. The measured blank activity is below the requested MDC. Results are acceptable according to the current revision of SOP 715, and are submitted without further qualification.

All remaining acceptance criteria were met.

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

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**OrderNum:** 1806810

**Client Name:** ALS Environmental

**Client Project Name:**

**Client Project Number:** R1805974

**Client PO Number:** R1805974

---

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
Cell3RAD - 0618	1806810-1		WATER	26-Jun-18	12:35
Cell4RAD - 0618	1806810-2		WATER	26-Jun-18	12:50
Cell5RAD - 0618	1806810-3		WATER	26-Jun-18	13:05
Cell6RAD - 0618	1806810-4		WATER	26-Jun-18	13:20
Cell8RAD - 0618	1806810-5		WATER	26-Jun-18	12:45
Cell3RAD - 0618 Dissolved	1806810-6		WATER	26-Jun-18	12:35
Cell4RAD - 0618 Dissolved	1806810-7		WATER	26-Jun-18	12:50
Cell5RAD - 0618 Dissolved	1806810-8		WATER	26-Jun-18	13:05
Cell6RAD - 0618 Dissolved	1806810-9		WATER	26-Jun-18	13:20
Cell8RAD - 0618 Dissolved	1806810-10		WATER	26-Jun-18	13:45

# ALS Environmental Chain of Custody

1565 Jefferson Rd, Building 300 • Rochester, NY 14623 • 585-288-5380 • FAX 585-288-8475

ALS Contact: Janice Jaeger

Project Number: R1805974  
 Project Manager: Janice Jaeger  
 QAP: LAB QAP

1806810

URANIUM  
HASL 300

Lab Code	Sample ID	# of Cont.	Matrix	Sample		Lab ID	Gamma Spec 901.1	Radium 226 903.1	Radium 228 904.0	
				Date	Time					
R1805974-001	Cell3RAD - 0618	5	Water	6/26/18	1235	Fort Collins ALS	X	X	X	X
R1805974-002	Cell4RAD - 0618		Water	6/26/18	1250	Fort Collins ALS	X	X	X	X
R1805974-003	Cell5RAD - 0618		Water	6/26/18	1305	Fort Collins ALS	X	X	X	X
R1805974-004	Cell6RAD - 0618		Water	6/26/18	1320	Fort Collins ALS	X	X	X	X
R1805974-005	Cell8RAD - 0618		Water	6/26/18	1345	Fort Collins ALS	X	X	X	X
R1805974-006	Cell3RAD - 0618 Dissolved		Water	6/26/18	1235	Fort Collins ALS	X	X	X	X
R1805974-007	Cell4RAD - 0618 Dissolved		Water	6/26/18	1250	Fort Collins ALS	X	X	X	X
R1805974-008	Cell5RAD - 0618 Dissolved		Water	6/26/18	1305	Fort Collins ALS	X	X	X	X
R1805974-009	Cell6RAD - 0618 Dissolved		Water	6/26/18	1320	Fort Collins ALS	X	X	X	X
R1805974-010	Cell8RAD - 0618 Dissolved		Water	6/26/18	1345	Fort Collins ALS	X	X	X	X

Test Comments  
 Gamma Spec - 901.1

R1805974-006,7,8,9,10

Require Lab Filter

<p><b>Special Instructions/Comments</b></p> <p style="font-size: 18pt; font-weight: bold;">Report NDS at MRL Standard EDD</p> <p style="font-size: 18pt; font-weight: bold;">NPDES Report only total Uranium (NO isotopes)</p> <p>H - Test is On Hold      P - Test is Authorized for Prep Only</p>	<p><b>Turnaround Requirements</b></p> <p><input type="checkbox"/> RUSH (Surcharges Apply)</p> <p><b>PLEASE CIRCLE WORK DAYS</b></p> <p style="text-align: center;">1 2 3 4 5</p> <p><input checked="" type="checkbox"/> STANDARD</p> <p>Requested FAX Date: _____</p> <p>Requested Report Date: <u>07/09/18</u></p>	<p><b>Report Requirements</b></p> <p><input type="checkbox"/> I. Results Only</p> <p><input checked="" type="checkbox"/> II. Results + QC Summaries</p> <p><input type="checkbox"/> III. Results + QC and Calibration Summaries</p> <p><input type="checkbox"/> IV. Data Validation Report with Raw Data</p> <p>PQL/MDL/J    <u>N</u></p> <p>EDD            <u>Y</u></p>	<p><b>Invoice Information</b></p> <hr/> <p>PO# 58R1805974</p> <hr/> <p>Bill to</p>
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Requisitioned By: Aug 2/8 6/28/18 1125      Received By: C Drumbler 6-30-18 0930      Airbill Number: \_\_\_\_\_

18 of 40

# ALS Environmental Chain of Custody

1565 Jefferson Rd, Building 300 • Rochester, NY 14623 • 585-288-5380 • FAX 585-288-8475

ALS Contact: Janice Jaeger

1806810

**Project Number:** R1805974  
**Project Manager:** Janice Jaeger  
**QAP:** LAB QAP

**Test Comments**

Radium 226 - 903.1	,10	Require Lab Filter
Radium 228 - 904.0	R1805974-006,7,8,9,10	Require Lab Filter

**Folder Comments:**

Gamma Isotope list Rad 226&228, Actinium 228, Bismuth 212&214, Cesium 134&137, Lead 212&214, Potassium 40, Thallium 208 & Thorium 232&234

<p><b>Special Instructions/Comments</b></p>   <p><b>NPDES</b></p>  <p>H - Test is On Hold      P - Test is Authorized for Prep Only</p>	<p style="text-align: center;"><b>Turnaround Requirements</b></p> <p><input type="checkbox"/> RUSH (Surcharges Apply)</p> <p style="text-align: center;"><b>PLEASE CIRCLE WORK DAYS</b></p> <p style="text-align: center;">1   2   3   4   5</p> <p><input type="checkbox"/> STANDARD</p> <p>Requested FAX Date: _____</p> <p>Requested Report Date: <u>07/09/18</u></p>	<p style="text-align: center;"><b>Report Requirements</b></p> <p><input type="checkbox"/> I. Results Only</p> <p><input type="checkbox"/> II. Results + QC Summaries</p> <p><input type="checkbox"/> III. Results + QC and Calibration Summaries</p> <p><input type="checkbox"/> IV. Data Validation Report with Raw Data</p> <p>PQL/MDL/J    <u>N</u></p> <p>EDD            <u>Y</u></p>	<p style="text-align: center;"><b>Invoice Information</b></p> <hr/> <p>PO# 58R1805974</p> <hr/> <p>Bill to</p>
--	--	---	--

7 of 28  
 Relinquished By: \_\_\_\_\_ Received By: C. Jumbly 6-30-18 0932 Airbill Number: \_\_\_\_\_



ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: ALS - Rochester

Workorder No: 1806810

Project Manager: \_\_\_\_\_

Initials: COT Date: 6-30-18

1. Are airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	<input type="radio"/> NO				
2. Are custody seals on <b>shipping</b> containers intact?	NONE	<input checked="" type="radio"/> YES	<input type="radio"/> NO				
3. Are custody seals on <b>sample</b> containers intact?	<input checked="" type="radio"/> NONE	<input type="radio"/> YES	<input type="radio"/> NO				
4. Is there a COC (chain-of-custody) present?		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
5. Is the COC in agreement with samples received? (IDs, dates, times, # of samples, # of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
6. Are short-hold samples present?		<input type="radio"/> YES	<input checked="" type="radio"/> NO				
7. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
8. Were all sample containers received intact? (not broken or leaking)		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
9. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
10. Are all samples in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	<input type="radio"/> NO				
11. Are all aqueous samples preserved correctly, if required? (excluding volatiles)	N/A	<input type="radio"/> YES	<input checked="" type="radio"/> NO				
12. Are all aqueous non-preserved samples pH 4-9?	N/A	<input type="radio"/> YES	<input type="radio"/> NO				
13. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) free of bubbles > 6 mm (1/4 inch) diameter? (i.e. size of green pea)	<input checked="" type="radio"/> N/A	<input type="radio"/> YES	<input type="radio"/> NO				
14. Were the samples shipped on ice?		<input checked="" type="radio"/> YES	<input checked="" type="radio"/> NO				
15. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*:	#1 <input type="radio"/>	#3 <input checked="" type="radio"/>	#4 <input type="radio"/>	RAD ONLY	<input type="radio"/> YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u> <u>2</u> <u>3</u>							
Temperature (°C): <u>Am5</u> <u>23.1</u> <u>22.8</u>							
No. of custody seals on cooler: <u>1</u> <u>1</u> <u>1</u>							
External µR/hr reading: <u>11</u> <u>15</u> <u>14</u>							
Background µR/hr reading: <u>11</u>							
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / <input type="radio"/> NO / <input type="radio"/> NA (If no, see Form 008.)							

Additional Information: Please provide details here for any NO responses to gray-shaded boxes above, or any other issues noted:

3.0 ml HNO3 WAS ADDED TO ALL BOTTLES IN SAMPLES 1-5.  
FINAL pH < 2, HNO3 lot no. 169331

If applicable, was the client contacted? YES / NO  NO Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 7-3-18

1806810

ORIGIN ID:ONHA (585) 672-7464  
SNO  
ALS ENVIRONMENTAL  
1565 JEFFERSON RD  
BLDG 300 SUITE 360  
ROCHESTER, NY 14620  
UNITED STATES US

SHIP DATE: 28JUN18  
ACTWTG: 41.30 LB  
CAD: 0342584/CAFE3210

BILL SENDER

228

TO SAMPLE RECEIVING  
ALS LABS - FT. COLLINS  
225 COMMERCE DRIVE

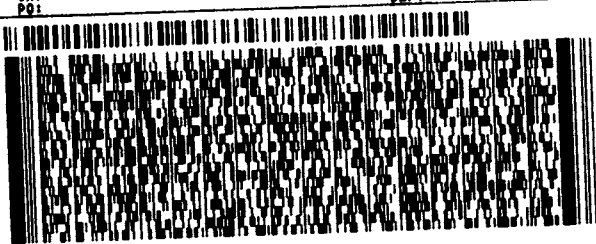
14  
L

FORT COLLINS CO 80524

(970) 490-1511

REF:

DEPT:



FedEx  
Express



551C2/938F/104C  
J181118042001 NY

3 of 3

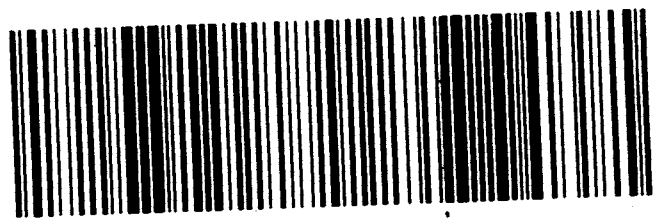
MPS# 4150 9190 9261  
0263  
Metr# 4150 9190 9240

0201

FRI - 29 JUN 10:30A  
PRIORITY OVERNIGHT

XH FTCA

80524  
CO-US DEN



1806810

ORIGIN ID:ONHA (585) 672-7464  
SMO  
ALS ENVIRONMENTAL  
1565 JEFFERSON RD  
BLDG 300 SUITE 360  
ROCHESTER, NY 14623  
UNITED STATES US

SHIP DATE: 28JUN18  
ACTWTG: 50.50 LB  
CAD: 0342584/CAFE3210

BILL SENDER

TO **SAMPLE RECEIVING**  
**ALS LABS - FT. COLLINS**  
**225 COMMERCE DRIVE**

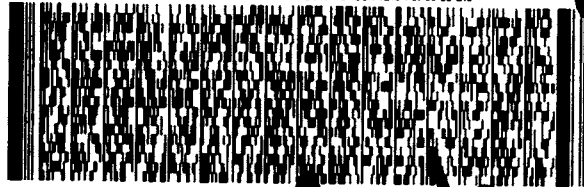
**FORT COLLINS CO 80524**

(970) 490-1611

REF:

INVT

DEPT:



**FedEx**  
Express



J181118042001 1W

1 of 3

TRK#  
0201 4150 9190 9240

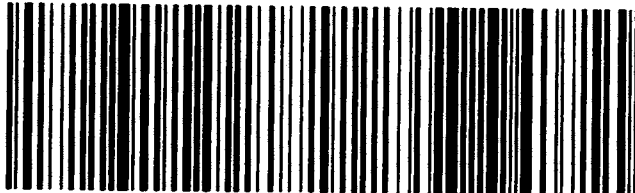
## MASTER ##

*ALS* FRI - 29 JUN 10:30A  
PRIORITY OVERNIGHT

**XH FTCA**

80524

CO-US DEN



1806810



1806810

ORIGIN ID:ONHA (585) 672-7464  
SNO  
ALS ENVIRONMENTAL  
1565 JEFFERSON RD  
BLDG 300 SUITE 360  
ROCHESTER, NY 14623  
UNITED STATES US

SHIP DATE: 28JUN18  
ACTWGT: 50.15 LB  
CAD: 0342594/CAFE3210

BILL SENDER

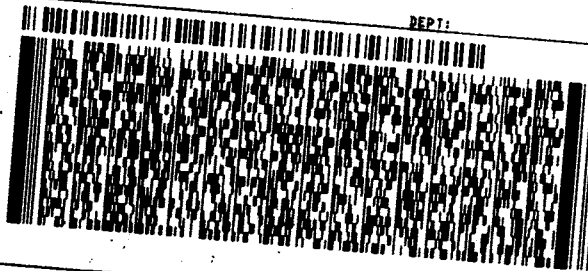
TO **SAMPLE RECEIVING**  
**ALS LABS - FT. COLLINS**  
**225 COMMERCE DRIV**

**FORT COLLINS CO 80524**

(970) 490-1611  
INV:  
PO:

REF:

DEPT:



FedEx  
Express



J1811180420018

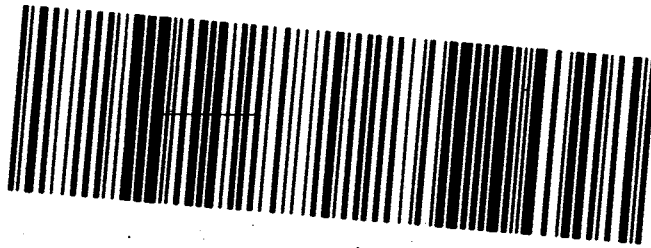
2 of 3  
MPS# 4150 9190 9250  
0263  
Metr# 4150 9190 9240

FRI - 29 JUN 10:30A  
PRIORITY OVERNIGHT

0201

**XH FTCA**

80524  
CO-US DEN



**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell3RAD - 0618  
**Legal Location:**  
**Collection Date:** 6/26/2018 12:35

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-1  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	3 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Bi-212	-10 (+/- 51)	U	88	pCi/l	NA	7/21/2018 10:25
Bi-214	8 (+/- 17)	U	28	pCi/l	NA	7/21/2018 10:25
Cs-134	-0.2 (+/- 6.1)	U	10.3	pCi/l	NA	7/21/2018 10:25
Cs-137	0.9 (+/- 3.6)	U	6.2	pCi/l	NA	7/21/2018 10:25
K-40	119 (+/- 87)	U	138	pCi/l	NA	7/21/2018 10:25
Pb-212	0.5 (+/- 9.1)	U	15.2	pCi/l	NA	7/21/2018 10:25
Pb-214	1 (+/- 13)	U	22	pCi/l	NA	7/21/2018 10:25
Ra-226	0 (+/- 120)	U,SI	200	pCi/l	NA	7/21/2018 10:25
Ra-228	3 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Th-227	4 (+/- 20)	U	34	pCi/l	NA	7/21/2018 10:25
Th-232	3 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Th-234	20 (+/- 170)	U	290	pCi/l	NA	7/21/2018 10:25
Tl-208	2.5 (+/- 7)	U	11.6	pCi/l	NA	7/21/2018 10:25
<b>Radium-226 by Radon Emanation - Method 903.1</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>1.39 (+/- 0.57)</b>		<b>0.36</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	87.3		40-110	%REC	DL = NA	8/7/2018 11:07
<b>Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>4.2 (+/- 1.1)</b>		<b>0.8</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	94.2		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	68.6		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.25 (+/- 0.12)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.042 (+/- 0.052)	LT	0.038	pCi/l	NA	7/26/2018 15:29
U-238	0.055 (+/- 0.062)	U	0.099	pCi/l	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.35 (+/- 0.15)</b>		<b>0.12</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell4RAD - 0618  
**Legal Location:**  
**Collection Date:** 6/26/2018 12:50

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-2  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	0 (+/- 24)	U	41	pCi/l	NA	7/21/2018 10:25
Bi-212	-19 (+/- 60)	U	105	pCi/l	NA	7/21/2018 10:25
Bi-214	7 (+/- 14)	U	24	pCi/l	NA	7/21/2018 10:25
Cs-134	0.1 (+/- 5.7)	U	9.7	pCi/l	NA	7/21/2018 10:25
Cs-137	-3.5 (+/- 4.4)	U	7.7	pCi/l	NA	7/21/2018 10:25
K-40	70 (+/- 98)	U	161	pCi/l	NA	7/21/2018 10:25
Pb-212	1.7 (+/- 9.7)	U	16.1	pCi/l	NA	7/21/2018 10:25
Pb-214	12.6 (+/- 8.1)	U	12.7	pCi/l	NA	7/21/2018 10:25
Ra-226	30 (+/- 120)	U,SI	200	pCi/l	NA	7/21/2018 10:25
Ra-228	0 (+/- 24)	U	41	pCi/l	NA	7/21/2018 10:25
Th-227	-24 (+/- 31)	U	54	pCi/l	NA	7/21/2018 10:25
Th-232	0 (+/- 24)	U	41	pCi/l	NA	7/21/2018 10:25
Th-234	-69 (+/- 98)	U	166	pCi/l	NA	7/21/2018 10:25
Tl-208	1.9 (+/- 5.8)	U	9.7	pCi/l	NA	7/21/2018 10:25
<b>Radium-226 by Radon Emanation - Method 903.1</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>2.57 (+/- 0.91)</b>		<b>0.45</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	<i>88</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	8/7/2018 11:07
<b>Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>2.32 (+/- 0.76)</b>		<b>0.9</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	<i>89.6</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	7/30/2018 08:48
<b>Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	<i>56.4</i>		<i>30-110</i>	<i>%REC</i>	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.46 (+/- 0.19)</b>		<b>0.11</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.045 (+/- 0.063)	U	0.094	pCi/l	NA	7/26/2018 15:29
<b>U-238</b>	<b>0.33 (+/- 0.15)</b>		<b>0.08</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.84 (+/- 0.25)</b>		<b>0.13</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell5RAD - 0618  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:05

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-3  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	14 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Bi-212	41 (+/- 66)	U	109	pCi/l	NA	7/21/2018 10:25
Bi-214	8 (+/- 19)	U	31	pCi/l	NA	7/21/2018 10:25
Cs-134	-0.9 (+/- 5)	U	8.6	pCi/l	NA	7/21/2018 10:25
Cs-137	-2.7 (+/- 5.2)	U	9.1	pCi/l	NA	7/21/2018 10:25
K-40	170 (+/- 140)	U	220	pCi/l	NA	7/21/2018 10:25
Pb-212	1.3 (+/- 9.9)	U	16.5	pCi/l	NA	7/21/2018 10:25
Pb-214	5 (+/- 13)	U	22	pCi/l	NA	7/21/2018 10:25
Ra-226	30 (+/- 110)	U,SI	190	pCi/l	NA	7/21/2018 10:25
Ra-228	14 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Th-227	-8 (+/- 32)	U	55	pCi/l	NA	7/21/2018 10:25
Th-232	14 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:25
Th-234	-30 (+/- 100)	U	170	pCi/l	NA	7/21/2018 10:25
<b>TI-208</b>	<b>8.1 (+/- 5.1)</b>	NQ	<b>8</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
<b>Radium-226 by Radon Emanation - Method 903.1</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
Ra-226	0.39 (+/- 0.33)	U	0.46	pCi/l	NA	8/7/2018 11:07
Carr: BARIUM	96.8		40-110	%REC	DL = NA	8/7/2018 11:07
<b>Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
Ra-228	0.97 (+/- 0.49)	LT	0.86	pCi/l	NA	7/30/2018 08:48
Carr: BARIUM	95.6		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
Tracer: U-232	68.7		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.31 (+/- 0.14)</b>		<b>0.12</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.028 (+/- 0.051)	U	0.038	pCi/l	NA	7/26/2018 15:29
U-238	0.18 (+/- 0.1)	LT	0.08	pCi/l	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.52 (+/- 0.18)</b>		<b>0.13</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell6RAD - 0618  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:20

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-4  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
<b>Ac-228</b>	<b>25 (+/- 14)</b>	NQ	<b>22</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
Bi-212	13 (+/- 49)	U	84	pCi/l	NA	7/21/2018 10:25
Bi-214	-5 (+/- 12)	U	21	pCi/l	NA	7/21/2018 10:25
Cs-134	-2.2 (+/- 5.6)	U	9.6	pCi/l	NA	7/21/2018 10:25
Cs-137	2.6 (+/- 3.2)	U	5.2	pCi/l	NA	7/21/2018 10:25
<b>K-40</b>	<b>153 (+/- 93)</b>		<b>147</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
Pb-212	4.3 (+/- 7.9)	U	13.1	pCi/l	NA	7/21/2018 10:25
<b>Pb-214</b>	<b>10.2 (+/- 6.5)</b>	NQ	<b>10.2</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
Ra-226	-40 (+/- 100)	U,SI	180	pCi/l	NA	7/21/2018 10:25
<b>Ra-228</b>	<b>25 (+/- 14)</b>	NQ	<b>22</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
Th-227	-9 (+/- 18)	U	31	pCi/l	NA	7/21/2018 10:25
<b>Th-232</b>	<b>25 (+/- 14)</b>	NQ	<b>22</b>	<b>pCi/l</b>	NA	7/21/2018 10:25
Th-234	80 (+/- 120)	U	200	pCi/l	NA	7/21/2018 10:25
TI-208	1.6 (+/- 3.5)	U	5.8	pCi/l	NA	7/21/2018 10:25
<b>Radium-226 by Radon Emanation - Method 903.1</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>2.11 (+/- 0.75)</b>		<b>0.3</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	95.1		40-110	%REC	DL = NA	8/7/2018 11:07
<b>Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>2.64 (+/- 0.83)</b>		<b>0.9</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	87.9		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	71.8		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.41 (+/- 0.16)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.058 (+/- 0.062)	U	0.09	pCi/l	NA	7/26/2018 15:29
<b>U-238</b>	<b>0.21 (+/- 0.11)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.67 (+/- 0.2)</b>		<b>0.12</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell8RAD - 0618  
**Legal Location:**  
**Collection Date:** 6/26/2018 12:45

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-5  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	23 (+/- 19)	U	36	pCi/l	NA	7/21/2018 10:26
Bi-212	28 (+/- 57)	U	96	pCi/l	NA	7/21/2018 10:26
Bi-214	15 (+/- 14)	U	23	pCi/l	NA	7/21/2018 10:26
Cs-134	-1.3 (+/- 4)	U	6.9	pCi/l	NA	7/21/2018 10:26
Cs-137	-2 (+/- 4)	U	7	pCi/l	NA	7/21/2018 10:26
<b>K-40</b>	<b>250 (+/- 100)</b>		<b>150</b>	<b>pCi/l</b>	NA	7/21/2018 10:26
<b>Pb-212</b>	<b>17.8 (+/- 9.5)</b>		<b>14.9</b>	<b>pCi/l</b>	NA	7/21/2018 10:26
<b>Pb-214</b>	<b>19 (+/- 11)</b>		<b>17</b>	<b>pCi/l</b>	NA	7/21/2018 10:26
Ra-226	33 (+/- 89)	U,SI	148	pCi/l	NA	7/21/2018 10:26
Ra-228	23 (+/- 19)	U	36	pCi/l	NA	7/21/2018 10:26
Th-227	-4 (+/- 28)	U	48	pCi/l	NA	7/21/2018 10:26
Th-232	23 (+/- 19)	U	36	pCi/l	NA	7/21/2018 10:26
Th-234	2 (+/- 88)	U	147	pCi/l	NA	7/21/2018 10:26
TI-208	0.9 (+/- 6.5)	U	10.9	pCi/l	NA	7/21/2018 10:26
<b>Radium-226 by Radon Emanation - Method 903.1</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>2.4 (+/- 0.83)</b>		<b>0.35</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	96.8		40-110	%REC	DL = NA	8/7/2018 11:07
<b>Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>1.71 (+/- 0.62)</b>		<b>0.85</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	95.7		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	69.2		30-110	%REC	DL = NA	8/1/2018 14:05
<b>U-234</b>	<b>4.65 (+/- 0.85)</b>		<b>0.15</b>	<b>pCi/l</b>	NA	8/1/2018 14:05
<b>U-235</b>	<b>0.25 (+/- 0.12)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	8/1/2018 14:05
<b>U-238</b>	<b>2.92 (+/- 0.57)</b>		<b>0.11</b>	<b>pCi/l</b>	NA	8/1/2018 14:05
<b>URANIUM, TOTAL</b>	<b>7.8 (+/- 1)</b>		<b>0.2</b>	<b>pCi/l</b>	NA	8/1/2018 14:05

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell3RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 12:35

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-6  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Dissolved Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	4 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:26
Bi-212	-70 (+/- 63)	U	111	pCi/l	NA	7/21/2018 10:26
Bi-214	4 (+/- 11)	U	18	pCi/l	NA	7/21/2018 10:26
Cs-134	-0.7 (+/- 3.1)	U	5.3	pCi/l	NA	7/21/2018 10:26
Cs-137	-1.9 (+/- 3.4)	U	6	pCi/l	NA	7/21/2018 10:26
K-40	109 (+/- 77)	U	122	pCi/l	NA	7/21/2018 10:26
Pb-212	-3.2 (+/- 6.6)	U	11.2	pCi/l	NA	7/21/2018 10:26
Pb-214	1.6 (+/- 9.7)	U	16.1	pCi/l	NA	7/21/2018 10:26
Ra-226	1 (+/- 70)	U,SI	117	pCi/l	NA	7/21/2018 10:26
Ra-228	4 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:26
Th-227	-4 (+/- 13)	U	23	pCi/l	NA	7/21/2018 10:26
Th-232	4 (+/- 21)	U	35	pCi/l	NA	7/21/2018 10:26
Th-234	17 (+/- 49)	U	81	pCi/l	NA	7/21/2018 10:26
Tl-208	1.4 (+/- 4.9)	U	8.1	pCi/l	NA	7/21/2018 10:26
<b>Dissolved Radium-226 by Radon Emanation - Method 903.</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>1.18 (+/- 0.56)</b>		<b>0.44</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	<i>94.5</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	8/7/2018 11:07
<b>Dissolved Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>1.9 (+/- 0.68)</b>		<b>0.92</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	<i>91</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	7/30/2018 08:48
<b>Dissolved Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	<i>68</i>		<i>30-110</i>	<i>%REC</i>	DL = NA	7/26/2018 15:29
U-234	0.129 (+/- 0.086)	LT	0.089	pCi/l	NA	7/26/2018 15:29
U-235	-0.006 (+/- 0.051)	U	0.116	pCi/l	NA	7/26/2018 15:29
U-238	0.149 (+/- 0.094)	LT	0.098	pCi/l	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.27 (+/- 0.14)</b>		<b>0.14</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell4RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 12:50

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-7  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Dissolved Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	18 (+/- 16)	U	25	pCi/l	NA	7/21/2018 10:26
Bi-212	-47 (+/- 54)	U	97	pCi/l	NA	7/21/2018 10:26
<b>Bi-214</b>	<b>13.6 (+/- 8)</b>	NQ	<b>12.2</b>	<b>pCi/l</b>	NA	7/21/2018 10:26
Cs-134	-1.6 (+/- 3.5)	U	6.1	pCi/l	NA	7/21/2018 10:26
Cs-137	3.3 (+/- 3.5)	U	5.6	pCi/l	NA	7/21/2018 10:26
K-40	71 (+/- 90)	U	148	pCi/l	NA	7/21/2018 10:26
Pb-212	0.2 (+/- 8)	U	13.4	pCi/l	NA	7/21/2018 10:26
Pb-214	8.2 (+/- 7)	U	11.2	pCi/l	NA	7/21/2018 10:26
Ra-226	6 (+/- 90)	U,SI	150	pCi/l	NA	7/21/2018 10:26
Ra-228	18 (+/- 16)	U	25	pCi/l	NA	7/21/2018 10:26
Th-227	-4 (+/- 22)	U	45	pCi/l	NA	7/21/2018 10:26
Th-232	18 (+/- 16)	U	25	pCi/l	NA	7/21/2018 10:26
Th-234	1 (+/- 53)	U	88	pCi/l	NA	7/21/2018 10:26
Tl-208	5.4 (+/- 3.7)	U	5.8	pCi/l	NA	7/21/2018 10:26
<b>Dissolved Radium-226 by Radon Emanation - Method 903.</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>2.54 (+/- 0.95)</b>		<b>0.36</b>	<b>pCi/l</b>	NA	8/7/2018 11:07
<i>Carr: BARIUM</i>	<i>77.7</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	8/7/2018 11:07
<b>Dissolved Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>2.14 (+/- 0.73)</b>		<b>0.92</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
<i>Carr: BARIUM</i>	<i>90.3</i>		<i>40-110</i>	<i>%REC</i>	DL = NA	7/30/2018 08:48
<b>Dissolved Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
<i>Tracer: U-232</i>	<i>66.6</i>		<i>30-110</i>	<i>%REC</i>	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.42 (+/- 0.16)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.028 (+/- 0.053)	U	0.039	pCi/l	NA	7/26/2018 15:29
<b>U-238</b>	<b>0.28 (+/- 0.13)</b>		<b>0.08</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.73 (+/- 0.21)</b>		<b>0.11</b>	<b>pCi/l</b>	NA	7/26/2018 15:29



**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell5RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:05

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-8  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Dissolved Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	-1 (+/- 11)	U	19	pCi/l	NA	7/21/2018 10:26
Bi-212	22 (+/- 25)	U	41	pCi/l	NA	7/21/2018 10:26
Bi-214	2.5 (+/- 9.1)	U	15	pCi/l	NA	7/21/2018 10:26
Cs-134	-0.9 (+/- 2.1)	U	3.5	pCi/l	NA	7/21/2018 10:26
Cs-137	-1.1 (+/- 1.8)	U	3.1	pCi/l	NA	7/21/2018 10:26
<b>K-40</b>	<b>146 (+/- 48)</b>		<b>71</b>	<b>pCi/l</b>	NA	7/21/2018 10:26
Pb-212	0.2 (+/- 5.3)	U	8.8	pCi/l	NA	7/21/2018 10:26
Pb-214	2.1 (+/- 8.3)	U	13.7	pCi/l	NA	7/21/2018 10:26
Ra-226	10 (+/- 73)	U,SI	121	pCi/l	NA	7/21/2018 10:26
Ra-228	-1 (+/- 11)	U	19	pCi/l	NA	7/21/2018 10:26
Th-227	2 (+/- 15)	U	25	pCi/l	NA	7/21/2018 10:26
Th-232	-1 (+/- 11)	U	19	pCi/l	NA	7/21/2018 10:26
Th-234	-10 (+/- 71)	U	118	pCi/l	NA	7/21/2018 10:26
Tl-208	-0.5 (+/- 3.5)	U	5.8	pCi/l	NA	7/21/2018 10:26
<b>Dissolved Radium-226 by Radon Emanation - Method 903.</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
Ra-226	0 (+/- 0.17)	U	0.25	pCi/l	NA	8/7/2018 11:34
Carr: BARIUM	94.2		40-110	%REC	DL = NA	8/7/2018 11:34
<b>Dissolved Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
Ra-228	0.69 (+/- 0.46)	U	0.89	pCi/l	NA	7/30/2018 08:48
Carr: BARIUM	90.9		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Dissolved Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
Tracer: U-232	58.8		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.29 (+/- 0.14)</b>		<b>0.12</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.032 (+/- 0.06)	U	0.044	pCi/l	NA	7/26/2018 15:29
U-238	0.19 (+/- 0.11)	LT	0.08	pCi/l	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.51 (+/- 0.19)</b>		<b>0.13</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell6RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:20

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-9  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Dissolved Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
Ac-228	16 (+/- 16)	U	26	pCi/l	NA	7/22/2018 12:06
Bi-212	-4 (+/- 58)	U	100	pCi/l	NA	7/22/2018 12:06
<b>Bi-214</b>	<b>23.6 (+/- 9.1)</b>	NQ	<b>12.9</b>	<b>pCi/l</b>	NA	7/22/2018 12:06
Cs-134	-0.8 (+/- 4)	U	6.9	pCi/l	NA	7/22/2018 12:06
Cs-137	-0.8 (+/- 4.3)	U	7.5	pCi/l	NA	7/22/2018 12:06
K-40	160 (+/- 120)	U	190	pCi/l	NA	7/22/2018 12:06
Pb-212	2.8 (+/- 6.1)	U	10.2	pCi/l	NA	7/22/2018 12:06
Pb-214	11.3 (+/- 8.1)	U	12.9	pCi/l	NA	7/22/2018 12:06
Ra-226	20 (+/- 110)	U,SI	190	pCi/l	NA	7/22/2018 12:06
Ra-228	16 (+/- 16)	U	26	pCi/l	NA	7/22/2018 12:06
Th-227	-9 (+/- 20)	U	35	pCi/l	NA	7/22/2018 12:06
Th-232	16 (+/- 16)	U	26	pCi/l	NA	7/22/2018 12:06
Th-234	86 (+/- 55)	U	87	pCi/l	NA	7/22/2018 12:06
Tl-208	-0.5 (+/- 9.3)	U	15.6	pCi/l	NA	7/22/2018 12:06
<b>Dissolved Radium-226 by Radon Emanation - Method 903.</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
<b>Ra-226</b>	<b>2.4 (+/- 1.2)</b>	Y2,M3	<b>1.1</b>	<b>pCi/l</b>	NA	8/7/2018 11:34
Carr: BARIUM	34	Y2	40-110	%REC	DL = NA	8/7/2018 11:34
<b>Dissolved Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>2.28 (+/- 0.72)</b>	Y1	<b>0.82</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
Carr: BARIUM	100	Y1	40-110	%REC	DL = NA	7/30/2018 08:48
<b>Dissolved Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
Tracer: U-232	67.5		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>0.29 (+/- 0.13)</b>		<b>0.09</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.009 (+/- 0.05)	U	0.074	pCi/l	NA	7/26/2018 15:29
<b>U-238</b>	<b>0.33 (+/- 0.14)</b>		<b>0.03</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>0.63 (+/- 0.19)</b>		<b>0.1</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell8RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:45

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-10  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
<b>Dissolved Gamma Spectroscopy Results</b>						
			<b>SOP 713</b>		Prep Date: <b>7/17/2018</b>	PrepBy: <b>SDW</b>
<b>Ac-228</b>	<b>27 (+/- 15)</b>	NQ	<b>23</b>	<b>pCi/l</b>	NA	7/22/2018 12:07
Bi-212	32 (+/- 49)	U	81	pCi/l	NA	7/22/2018 12:07
<b>Bi-214</b>	<b>16.3 (+/- 8.7)</b>	NQ	<b>13.2</b>	<b>pCi/l</b>	NA	7/22/2018 12:07
Cs-134	-5.4 (+/- 4.1)	U	7.2	pCi/l	NA	7/22/2018 12:07
Cs-137	-0.9 (+/- 3.8)	U	6.5	pCi/l	NA	7/22/2018 12:07
K-40	0 (+/- 80)	U	135	pCi/l	NA	7/22/2018 12:07
Pb-212	4.6 (+/- 9.5)	U	15.8	pCi/l	NA	7/22/2018 12:07
Pb-214	0 (+/- 12)	U	20	pCi/l	NA	7/22/2018 12:07
Ra-226	20 (+/- 120)	U,SI	200	pCi/l	NA	7/22/2018 12:07
<b>Ra-228</b>	<b>27 (+/- 15)</b>	NQ	<b>23</b>	<b>pCi/l</b>	NA	7/22/2018 12:07
Th-227	-3 (+/- 20)	U	33	pCi/l	NA	7/22/2018 12:07
<b>Th-232</b>	<b>27 (+/- 15)</b>	NQ	<b>23</b>	<b>pCi/l</b>	NA	7/22/2018 12:07
Th-234	100 (+/- 180)	U	290	pCi/l	NA	7/22/2018 12:07
Tl-208	5.9 (+/- 4)	U	6.3	pCi/l	NA	7/22/2018 12:07
<b>Dissolved Radium-226 by Radon Emanation - Method 903.</b>						
			<b>SOP 783</b>		Prep Date: <b>7/30/2018</b>	PrepBy: <b>CXW</b>
Ra-226	0.16 (+/- 0.3)	U	0.52	pCi/l	NA	8/7/2018 11:34
Carr: BARIUM	95.1		40-110	%REC	DL = NA	8/7/2018 11:34
<b>Dissolved Radium-228 Analysis by GFPC</b>						
			<b>SOP 724</b>		Prep Date: <b>7/23/2018</b>	PrepBy: <b>NCC</b>
<b>Ra-228</b>	<b>1.68 (+/- 0.62)</b>		<b>0.87</b>	<b>pCi/l</b>	NA	7/30/2018 08:48
Carr: BARIUM	99.6		40-110	%REC	DL = NA	7/30/2018 08:48
<b>Dissolved Total Uranium by Alpha Spectroscopy</b>						
			<b>SOP 714</b>		Prep Date: <b>7/18/2018</b>	PrepBy: <b>NRB</b>
Tracer: U-232	63.2		30-110	%REC	DL = NA	7/26/2018 15:29
<b>U-234</b>	<b>2.29 (+/- 0.51)</b>		<b>0.07</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
U-235	0.17 (+/- 0.1)	LT	0.04	pCi/l	NA	7/26/2018 15:29
<b>U-238</b>	<b>1.76 (+/- 0.41)</b>		<b>0.1</b>	<b>pCi/l</b>	NA	7/26/2018 15:29
<b>URANIUM, TOTAL</b>	<b>4.22 (+/- 0.66)</b>		<b>0.11</b>	<b>pCi/l</b>	NA	7/26/2018 15:29

**Client:** ALS Environmental  
**Project:** R1805974  
**Sample ID:** Cell8RAD - 0618 Dissolved  
**Legal Location:**  
**Collection Date:** 6/26/2018 13:45

**Date:** 08-Aug-18  
**Work Order:** 1806810  
**Lab ID:** 1806810-10  
**Matrix:** WATER  
**Percent Moisture:**

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
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**Explanation of Qualifiers**

**Radiochemistry:**

- "Report Limit" is the MDC
- U or ND - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.
- G - Sample density differs by more than 15% of LCS density.
- D - DER is greater than Control Limit
- M - Requested MDC not met.
- LT - Result is less than requested MDC but greater than achieved MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Inorganics:**

- B - Result is less than the requested reporting limit but greater than the instrument method detection limit (MDL).
- U or ND - Indicates that the compound was analyzed for but not detected.
- E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
- M - Duplicate injection precision was not met.
- N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
- Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.
- \* - Duplicate analysis (relative percent difference) not within control limits.
- S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

**Organics:**

- U or ND - Indicates that the compound was analyzed for but not detected.
- B - Analyte is detected in the associated method blank as well as in the sample. It indicates probable blank contamination and warns the data user.
- E - Analyte concentration exceeds the upper level of the calibration range.
- J - Estimated value. The result is less than the reporting limit but greater than the instrument method detection limit (MDL).
- A - A tentatively identified compound is a suspected aldol-condensation product.
- X - The analyte was diluted below an accurate quantitation level.
- \* - The spike recovery is equal to or outside the control criteria used.
- + - The relative percent difference (RPD) equals or exceeds the control criteria.
- G - A pattern resembling gasoline was detected in this sample.
- D - A pattern resembling diesel was detected in this sample.
- M - A pattern resembling motor oil was detected in this sample.
- C - A pattern resembling crude oil was detected in this sample.
- 4 - A pattern resembling JP-4 was detected in this sample.
- 5 - A pattern resembling JP-5 was detected in this sample.
- H - Indicates that the fuel pattern was in the heavier end of the retention time window for the analyte of interest.
- L - Indicates that the fuel pattern was in the lighter end of the retention time window for the analyte of interest.
- Z - This flag indicates that a significant fraction of the reported result did not resemble the patterns of any of the following petroleum hydrocarbon products:
  - gasoline
  - JP-8
  - diesel
  - mineral spirits
  - motor oil
  - Stoddard solvent
  - bunker C

ALS -- Fort Collins

Date: 8/8/2018 11:17:

Client: ALS Environmental

**QC BATCH REPORT**

Work Order: 1806810

Project: R1805974

Batch ID: RE180730-1-1

Instrument ID Alpha Scin

Method: Radium-226 by Radon Emanation

**LCS** Sample ID: RE180730-1 Units: pCi/l Analysis Date: 8/7/2018 11:34

Client ID: Run ID: RE180730-1A Prep Date: 7/30/2018 DF: NA

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-226	50 (+/- 12)	0	47.88		104	67-120					P
Carr: BARIUM	15640		17200		90.9	40-110					

**MB** Sample ID: RE180730-1 Units: pCi/l Analysis Date: 8/7/2018 11:34

Client ID: Run ID: RE180730-1A Prep Date: 7/30/2018 DF: NA

Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-226	0.05 (+/- 0.18)	0.34									U
Carr: BARIUM	15360		17200		89.3	40-110					

The following samples were analyzed in this batch:

1806810-1	1806810-2	1806570-2
1806810-3	1806810-4	1806810-5
1806810-6	1806810-7	1806810-8
1806810-9	1806810-10	

Client: ALS Environmental  
 Work Order: 1806810  
 Project: R1805974

# QC BATCH REPORT

Batch ID: **AS180717-2-2** Instrument ID **AlphaSpec2** Method: **Total Uranium by Alpha Spectro**

LCS		Sample ID: <b>AS180717-2</b>		Units: <b>pCi/l</b>		Analysis Date: <b>7/27/2018 08:49</b>					
Client ID:		Run ID: <b>AS180717-2U</b>			Prep Date: <b>7/18/2018</b>		DF: <b>NA</b>				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	4.06 (+/- 0.72)	0.03	4.22		96.3	82-122					P
U-235	0.207 (+/- 0.079)	0.04	0.2017		103						
U-238	4.64 (+/- 0.82)	0.03	4.382		106	78-126					P
URANIUM, TOTAL	8.9 (+/- 1.1)	0	8.804		101	82-122					P
Tracer: U-232	3.68	0.06	4.645		79.1	30-110					

LCSD		Sample ID: <b>AS180717-2</b>		Units: <b>pCi/l</b>		Analysis Date: <b>7/27/2018 08:49</b>					
Client ID:		Run ID: <b>AS180717-2U</b>			Prep Date: <b>7/18/2018</b>		DF: <b>NA</b>				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	4.04 (+/- 0.72)	0.04	4.22		95.6	82-122		4.06	0.03	2.1	P
U-235	0.24 (+/- 0.089)	0.053	0.2017		119			0.207	0.3	2.1	
U-238	4.49 (+/- 0.8)	0.04	4.382		103	78-126		4.64	0.1	2.1	P
URANIUM, TOTAL	8.8 (+/- 1.1)	0.1	8.804		99.6	82-122		8.9	0.2	2.1	P
Tracer: U-232	3.45	0.06	4.645		74.2	30-110		3.68			

MB		Sample ID: <b>AS180717-2</b>		Units: <b>pCi/l</b>		Analysis Date: <b>7/28/2018 11:15</b>					
Client ID:		Run ID: <b>AS180717-2U</b>			Prep Date: <b>7/18/2018</b>		DF: <b>NA</b>				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	0.013 (+/- 0.022)	0.043									U
U-235	0.016 (+/- 0.023)	0.034									U
U-238	0.012 (+/- 0.019)	0.035									U
URANIUM, TOTAL	0.041 (+/- 0.037)	0.052									U
Tracer: U-232	3.35	0.05	4.645		72.1	30-110					

The following samples were analyzed in this batch:

1806810-1	1806810-2	1806810-3
1806810-4	1806810-6	1806810-7
1806810-8	1806810-9	1806810-10

Client: ALS Environmental  
 Work Order: 1806810  
 Project: R1805974

# QC BATCH REPORT

Batch ID: **AS180730-1-1** Instrument ID **AlphaSpec2** Method: **Total Uranium by Alpha Spectro**

DUP		Sample ID: <b>1806810-5</b>		Units: <b>pCi/l</b>			Analysis Date: <b>8/1/2018 14:05</b>				
Client ID: <b>Cell8RAD - 0618</b>		Run ID: <b>AS180730-1UR</b>			Prep Date: <b>7/30/2018</b>			DF: <b>NA</b>			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	4.55 (+/- 0.84)	0.09						4.65	0.08	2.1	
U-235	0.22 (+/- 0.12)	0.1						0.25	0.2	2.1	
U-238	3.27 (+/- 0.64)	0.14						2.92	0.4	2.1	
URANIUM, TOTAL	8 (+/- 1.1)	0.2						7.8	0.3	2.1	
Tracer: U-232	13.8	0.2	23.22		59.2	30-110		16.1			

LCS		Sample ID: <b>AS180730-1</b>		Units: <b>pCi/l</b>			Analysis Date: <b>8/1/2018 14:05</b>				
Client ID:		Run ID: <b>AS180730-1UR</b>			Prep Date: <b>7/30/2018</b>			DF: <b>NA</b>			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	4.24 (+/- 0.68)	0.03	4.22		101	82-122					P
U-235	0.353 (+/- 0.083)	0.031	0.2017		175						
U-238	4.53 (+/- 0.73)	0.03	4.382		103	78-126					P
URANIUM, TOTAL	9.1 (+/- 1)	0	8.804		104	82-122					P
Tracer: U-232	3.03	0.03	4.644		65.3	30-110					

MB		Sample ID: <b>AS180730-1</b>		Units: <b>pCi/l</b>			Analysis Date: <b>8/1/2018 14:05</b>				
Client ID:		Run ID: <b>AS180730-1UR</b>			Prep Date: <b>7/30/2018</b>			DF: <b>NA</b>			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
U-234	0.057 (+/- 0.024)	0.019									B3
U-235	0.013 (+/- 0.012)	0.015									U
U-238	0.016 (+/- 0.016)	0.023									U
URANIUM, TOTAL	0.086 (+/- 0.031)	0.03									B3
Tracer: U-232	3.6	0.03	4.644		77.4	30-110					

The following samples were analyzed in this batch:

1806810-5

Client: ALS Environmental  
 Work Order: 1806810  
 Project: R1805974

## QC BATCH REPORT

Batch ID: RA180723-1-2 Instrument ID LB4100-C Method: Radium-228 Analysis by GFPC

LCS		Sample ID: RA180723-1		Units: pCi/l			Analysis Date: 7/30/2018 08:24				
Client ID:		Run ID: RA180723-1A			Prep Date: 7/23/2018			DF: NA			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-228	5.7 (+/- 1.6)	0.9	5.981		96	70-130					P
Carr: BARIUM	34990		36020		97.1	40-110					

LCSD		Sample ID: RA180723-1		Units: pCi/l			Analysis Date: 7/30/2018 08:24				
Client ID:		Run ID: RA180723-1A			Prep Date: 7/23/2018			DF: NA			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-228	5.4 (+/- 1.5)	0.9	5.981		89.6	70-130		5.7	0.2	2.1	P
Carr: BARIUM	35410		36020		98.3	40-110		34990			

MB		Sample ID: RA180723-1		Units: pCi/l			Analysis Date: 7/30/2018 08:48				
Client ID:		Run ID: RA180723-1A			Prep Date: 7/23/2018			DF: NA			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ra-228	-0.14 (+/- 0.23)	0.55									Y1,U
Carr: BARIUM	36100		36030		100	40-110					Y1

The following samples were analyzed in this batch:

1806810-1	1806810-2	1806810-3
1806810-4	1806810-5	1806810-6
1806810-7	1806810-8	1806810-9
1806810-10		



Client: ALS Environmental  
 Work Order: 1806810  
 Project: R1805974

# QC BATCH REPORT

Batch ID: **GS180717-11-2** Instrument ID: **GAMMA** Method: **Gamma Spectroscopy Results**

LCS		Sample ID: <b>GS180717-11</b>			Units: <b>pCi/l</b>		Analysis Date: <b>7/21/2018 09:28</b>				
Client ID:		Run ID: <b>GS180717-11A</b>			Prep Date: <b>7/17/2018</b>		DF: <b>NA</b>				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Am-241	99000 (+/- 12000)	2000	101300		97.6	85-115					P
Co-60	42300 (+/- 5000)	100	42430		99.7	85-115					P
Cs-137	38800 (+/- 4600)	200	38710		100	85-115					P,M3

MB		Sample ID: <b>GS180717-11B</b>			Units: <b>pCi/l</b>		Analysis Date: <b>7/22/2018 12:07</b>				
Client ID:		Run ID: <b>GS180717-11A</b>			Prep Date: <b>7/17/2018</b>		DF: <b>NA</b>				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	DER Ref	DER	DER Limit	Qual
Ac-228	11 (+/- 23)	39									U
Am-241	-26 (+/- 29)	51									U
Bi-212	8 (+/- 61)	104									U
Bi-214	2 (+/- 13)	22									U
Co-60	4.9 (+/- 4.6)	7.4									U
Cs-134	-1.6 (+/- 4.1)	7									U
Cs-137	-2.5 (+/- 4.3)	7.6									U
K-40	-32 (+/- 88)	152									U
Pb-212	-0.4 (+/- 9)	15.1									U
Pb-214	-1 (+/- 12)	20									U
Ra-226	0 (+/- 110)	190									U,S
Ra-228	11 (+/- 23)	39									U
Th-227	-5 (+/- 30)	50									U
Th-232	11 (+/- 23)	39									U
Th-234	20 (+/- 100)	170									U
Tl-208	1.7 (+/- 5.8)	9.9									U

The following samples were analyzed in this batch:

1806810-1	1806810-2	1806810-3
1806810-4	1806810-5	1806810-6
1806810-7	1806810-8	1806810-9
1806810-10		

## TECHNICAL BULLETIN ADDENDUM

The library used for analysis defines the gamma emission(s) to be used for analysis of each nuclide. If multiple gamma emissions are used for quantification, then a 'NET' quantification emission (or peak) must be defined in the library. This designation provides for the calculation of nuclide activity concentrations and detection limits in the case of non-presence of the nuclide. When the nuclide is not present, or the software is unable to resolve a peak at the library defined 'NET' energy, the software evaluates the 'NET' region of interest ('NET' peak energy +/- 2 keV) by performing a summation of the net counts above the background level. This 'NET' quantification can result in net negative, zero, or positive activity results, and is highly dependent on the spectral distribution in the region of interest of the 'NET' peak. In cases where only the 'NET' peak is found, and the software performs a net quantification, the nuclide result will be flagged with an 'NQ' qualifier on the final reports. This indicates that the nuclide is not detected or supported at any level above the reported MDC. Results are submitted without further qualification.

All nuclides specified in the library of analysis for gamma spectroscopy are evaluated for positive OR tentative identification on the following criteria:

- The individual abundances for the gamma emissions specified for each nuclide are summed to obtain a total nuclide abundance.
- From the total nuclide abundance, a positive identification criterion is set as 75% of this total nuclide abundance.
- For all nuclide peaks that are not net quantified, those peak abundances are summed. The total non-net quantified peak sum is compared to the calculated 75% abundance criterion. If this sum is greater than the 75% criterion, the nuclide is considered to be positively identified at the reported concentration. If the sum is less than the 75% criterion, the nuclide is tentatively identified at the reported concentration. These results will be flagged with a 'TI' qualifier on the final reports to indicate that the 75% abundance criterion was not met.