

Analysis Report for L1-010-101-FR-GS-CO1-SB

L1-010-101C

WTB EXCAVATION

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-101-FR-GS-CO1-SB  
Sample Description : L1-010-101C WTB EXCAVATION  
Sample Type : Silt  
Unit :  
Sample Point :  
  
Sample Size : 2.916E+03 grams  
Facility : Diaryland\_NPP  
  
Sample Taken On : 9/14/2017 2:50:00PM  
Acquisition Started : 9/14/2017 3:58:48PM  
  
Procedure : Silt  
Operator : Administrator  
Detector Name : DET01-ENV  
Geometry : 1.5L Marinelli  
Live Time : 3600.0 seconds  
Real Time : 3624.9 seconds  
  
Dead Time : 0.69 %  
  
Peak Locate Threshold : 3.00  
Peak Locate Range (in channels) : 100 - 4096  
Peak Area Range (in channels) : 100 - 4096  
Identification Energy Tolerance : 1.000 keV  
  
Energy Calibration Used Done On : 6/3/2014  
Efficiency Calibration Used Done On : 6/3/2014  
Efficiency Calibration Description : 1.5 Marinelli  
  
Sample Number : 3398

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/14/2017 4:59:18PM

Peak Analysis From Channel : 100  
Peak Analysis To Channel : 4096

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	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
M	1	74.44	142 -	190	149.73	2.81E+02	28.49	8.57E+02	1.46
m	2	76.86	142 -	190	154.56	4.23E+02	31.07	7.67E+02	1.47
m	3	86.83	142 -	190	174.52	1.79E+02	24.95	8.34E+02	1.50
m	4	92.73	142 -	190	186.32	2.38E+02	27.43	8.24E+02	1.51
F	5	185.72	365 -	381	372.37	2.71E+02	30.31	1.25E+03	1.64
F	6	208.54	411 -	425	418.02	1.01E+02	27.61	9.89E+02	1.93
M	7	238.28	472 -	489	477.52	1.45E+03	43.33	5.04E+02	1.46
m	8	241.32	472 -	489	483.60	2.86E+02	24.77	5.56E+02	1.47
M	9	294.83	585 -	608	590.66	4.98E+02	29.25	4.28E+02	1.60
m	10	299.58	585 -	608	600.16	1.04E+02	18.19	3.80E+02	1.61
F	11	337.98	670 -	685	676.99	2.96E+02	25.03	6.01E+02	1.57
F	12	351.51	698 -	710	704.06	7.71E+02	33.08	4.34E+02	1.52
F	13	510.28	1015 -	1032	1021.72	3.42E+02	24.38	3.10E+02	2.78
F	14	582.67	1159 -	1177	1166.55	5.29E+02	26.71	2.77E+02	1.89
F	15	608.79	1212 -	1227	1218.79	6.88E+02	29.71	2.48E+02	1.75
F	16	661.10	1317 -	1334	1323.46	2.01E+03	46.99	2.39E+02	1.95
F	17	726.74	1448 -	1462	1454.79	1.47E+02	17.28	1.73E+02	2.54
F	18	767.53	1527 -	1541	1536.41	5.65E+01	12.95	1.80E+02	1.48
F	19	794.07	1581 -	1596	1589.50	6.57E+01	13.48	1.84E+02	1.86
F	20	859.99	1715 -	1729	1721.40	5.62E+01	13.47	1.58E+02	2.11
F	21	910.58	1814 -	1834	1822.62	3.98E+02	22.87	2.01E+02	2.01
F	22	968.32	1933 -	1947	1938.14	1.86E+02	18.34	2.21E+02	1.68
F	23	1119.56	2233 -	2252	2240.75	1.51E+02	17.34	2.04E+02	2.65
F	24	1172.38	2339 -	2352	2346.43	2.49E+02	20.04	1.56E+02	2.48
F	25	1331.57	2653 -	2673	2664.94	1.65E+02	15.67	1.20E+02	2.34
F	26	1377.13	2750 -	2763	2756.10	4.87E+01	9.94	4.30E+01	3.45
F	27	1459.91	2908 -	2932	2921.74	3.91E+03	63.20	6.25E+01	2.82
F	28	1763.48	3520 -	3539	3529.15	1.56E+02	13.21	1.90E+01	3.17

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/14/2017 4:59:18PM

Env. Background File : C:\Canberra\Apex\Root\Diaryland\_NPP\Data\0000003388.CNF

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	74.44	2.81E+02	28.49	7.82E+01	9.57E+00	2.03E+02	3.01E+01

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	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
m	2	76.86	4.23E+02	31.07			4.23E+02	3.11E+01
m	3	86.83	1.79E+02	24.95			1.79E+02	2.49E+01
m	4	92.73	2.38E+02	27.43	5.07E+01	8.63E+00	1.87E+02	2.88E+01
F	5	185.72	2.71E+02	30.31	3.67E+01	8.25E+00	2.34E+02	3.14E+01
F	6	208.54	1.01E+02	27.61			1.01E+02	2.76E+01
M	7	238.28	1.45E+03	43.33	3.14E+01	6.41E+00	1.42E+03	4.38E+01
m	8	241.32	2.86E+02	24.77			2.86E+02	2.48E+01
M	9	294.83	4.98E+02	29.25	1.00E+01	5.91E+00	4.88E+02	2.98E+01
m	10	299.58	1.04E+02	18.19			1.04E+02	1.82E+01
F	11	337.98	2.96E+02	25.03	9.67E+00	5.86E+00	2.86E+02	2.57E+01
F	12	351.51	7.71E+02	33.08	2.24E+01	5.47E+00	7.48E+02	3.35E+01
F	13	510.28	3.42E+02	24.38	1.52E+02	8.10E+00	1.90E+02	2.57E+01
F	14	582.67	5.29E+02	26.71	2.14E+01	4.78E+00	5.07E+02	2.71E+01
F	15	608.79	6.88E+02	29.71	2.18E+01	4.83E+00	6.66E+02	3.01E+01
F	16	661.10	2.01E+03	46.99	1.38E+01	4.37E+00	1.99E+03	4.72E+01
F	17	726.74	1.47E+02	17.28			1.47E+02	1.73E+01
F	18	767.53	5.65E+01	12.95			5.65E+01	1.29E+01
F	19	794.07	6.57E+01	13.48			6.57E+01	1.35E+01
F	20	859.99	5.62E+01	13.47			5.62E+01	1.35E+01
F	21	910.58	3.98E+02	22.87	1.35E+01	3.68E+00	3.84E+02	2.32E+01
F	22	968.32	1.86E+02	18.34			1.86E+02	1.83E+01
F	23	1119.56	1.51E+02	17.34	1.09E+01	3.21E+00	1.40E+02	1.76E+01
F	24	1172.38	2.49E+02	20.04			2.49E+02	2.00E+01
F	25	1331.57	1.65E+02	15.67			1.65E+02	1.57E+01
F	26	1377.13	4.87E+01	9.94			4.87E+01	9.94E+00
F	27	1459.91	3.91E+03	63.20	5.78E+01	4.59E+00	3.85E+03	6.34E+01
F	28	1763.48	1.56E+02	13.21	1.38E+01	2.34E+00	1.42E+02	1.34E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

## NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Diaryland\_NPP\Library\ENVLIB.NLB

### IDENTIFIED NUCLIDES

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>
K-40	0.88	1460.81	*	10.67	6.28E+00
CO-60	0.88	1173.22	*	100.00	3.73E-02

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<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>
CO-60	0.88	1332.49	*	100.00	2.71E-02	2.66E-03
CS-137	0.95	661.65	*	85.12	2.30E-01	8.29E-03
BI-212	0.57	727.17	*	11.80	1.31E-01	1.57E-02
		785.42		2.00		
		1620.56		2.75		
PB-212	0.94	77.11	*	17.50	2.71E-01	2.19E-02
		87.20	*	6.30	2.44E-01	3.49E-02
		89.80		1.75		
		238.63	*	44.60	1.83E-01	7.42E-03
		300.09	*	3.41	1.92E-01	3.40E-02
BI-214	0.45	609.31	*	46.30	1.34E-01	7.12E-03
		768.36	*	5.04	1.22E-01	2.82E-02
		806.17		1.23		
		934.06		3.21		
		1120.29	*	15.10	1.34E-01	1.72E-02
		1155.19		1.69		
		1238.11		5.94		
		1280.96		1.47		
		1377.67	*	4.11	1.99E-01	4.09E-02
		1401.50		1.39		
		1407.98		2.48		
		1509.19		2.19		
		1661.28		1.15		
		1729.60		3.05		
		1764.49		15.80		
		1847.44		2.12		
PB-214	0.93	74.81	*	6.33	3.90E-01	5.93E-02
		77.11	*	10.70	4.43E-01	3.58E-02
		87.20	*	3.70	4.15E-01	5.95E-02
		89.80		1.03		
		241.98	*	7.49	2.21E-01	2.00E-02
		295.21	*	19.20	1.60E-01	1.05E-02
		351.92	*	37.20	1.37E-01	6.99E-03
		785.91		1.10		
RA-226	0.96	186.21	*	3.28	3.86E-01	5.30E-02

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

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**INTERFERENCE CORRECTED REPORT**

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L1-010-101C

WTB EXCAVATION

<b><i>Nuclide Name</i></b>	<b><i>Nuclide Id Confidence</i></b>	<b><i>Wt mean Activity (pCi/grams)</i></b>	<b><i>Wt mean Activity Uncertainty</i></b>	<b><i>Comments</i></b>
K-40	0.880	6.28E+00	2.02E-01	
CO-60	0.884	3.14E-02	2.03E-03	
CS-137	0.952	2.30E-01	8.29E-03	
BI-212	0.573	1.31E-01	1.57E-02	
PB-212	0.947	1.82E-01	6.76E-03	
BI-214	0.456	1.35E-01	6.33E-03	
PB-214	0.939	1.52E-01	5.49E-03	
RA-226	0.963	3.86E-01	5.30E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/14/2017 4:59:18PM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Peak Size (CPS)</b>	<b>Peak CPS (%) Uncertainty</b>	<b>Peak Type</b>	<b>Tolerance Nuclide</b>
m	4	92.73	5.19170E-02	15.39	Tol.	TH-234 TH-234
F	6	208.54	2.81025E-02	27.29	Tol.	AC-228
F	11	337.98	7.94920E-02	8.98	Tol.	AC-228
F	13	510.28	5.27622E-02	13.53		
F	14	582.67	1.40937E-01	5.35	Tol.	TL-208
F	19	794.07	1.82503E-02	20.52	Sum	
F	20	859.99	1.56148E-02	23.96	Tol.	TL-208
F	21	910.58	1.06748E-01	6.03		
F	22	968.32	5.17775E-02	9.84	Sum	
F	28	1763.48	3.95330E-02	9.43		

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M = First peak in a multiplet region  
 m = Other peak in a multiplet region  
 F = Fitted singlet  
 Errors quoted at 1.000sigma

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## NUCLIDE MDA REPORT

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Nuclide Library Used : C:\Canberra\Apex\Root\Diaryland\_NPP\Library\ENVLIB.NLB

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	K-40	1460.81	*	10.67	6.28E+00	1.03E-01	1.03E-01
+	MN-54	834.83		99.97	7.96E-03	1.23E-02	1.23E-02
+	CO-60	1173.22	*	100.00	3.73E-02	1.06E-02	1.06E-02
		1332.49	*	100.00	2.71E-02		1.17E-02
+	ZN-65	1115.52		50.75	4.92E-02	3.40E-02	3.40E-02

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	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	KR-85	513.99		0.43	7.01E+00	2.98E+00	2.98E+00
+	CD-109	88.03		3.72	1.36E+00	5.88E-01	5.88E-01
+	CS-134	604.70		97.60	7.76E-02	1.42E-02	1.62E-02
		795.84		85.40	-5.00E-03		1.42E-02
+	CS-137	661.65	*	85.12	2.30E-01	1.12E-02	1.12E-02
+	EU-154	123.07		40.40	-1.38E-02	3.35E-02	3.35E-02
		722.30		20.00	7.93E-02		6.21E-02
		873.20		12.09	9.31E-03		1.01E-01
		996.30		10.34	3.76E-02		1.28E-01
		1004.76		17.90	6.15E-02		7.50E-02
		1274.51		34.40	2.85E-02		4.53E-02
+	EU-155	86.54		32.80	-7.13E-02	6.85E-02	6.85E-02
		105.31		21.80	-7.85E-03		7.03E-02
+	TL-208	72.80		2.02	-7.55E+06	1.41E+06	1.35E+08
		74.97		3.41	-6.60E+05		7.41E+07
		84.90		1.51	-5.40E+08		1.17E+08
		277.36		6.31	1.51E+07		1.53E+07
		583.19		84.50	5.08E+06		1.41E+06
		763.13		1.81	7.05E+07		5.61E+07
		860.56		12.42	6.33E+05		8.64E+06
		1093.90		0.40	-2.01E+07		3.08E+08
+	BI-214	609.31	*	46.30	1.34E-01	1.92E-02	1.92E-02
		768.36	*	5.04	1.22E-01		1.70E-01
		806.17		1.23	-2.06E-01		8.92E-01
		934.06		3.21	6.50E-02		4.11E-01
		1120.29	*	15.10	1.34E-01		8.83E-02
		1155.19		1.69	1.55E+00		1.00E+00
		1238.11		5.94	3.11E-01		3.11E-01
		1280.96		1.47	-9.23E-02		1.03E+00
		1377.67	*	4.11	1.99E-01		1.59E-01
		1401.50		1.39	1.20E+00		8.51E-01
		1407.98		2.48	2.36E-01		4.78E-01
		1509.19		2.19	7.06E-02		4.47E-01
		1661.28		1.15	8.11E-01		7.08E-01
		1729.60		3.05	9.58E-02		2.68E-01
		1764.49		15.80	1.87E-01		8.44E-02
		1847.44		2.12	2.44E-01		4.24E-01
+	PB-214	74.81	*	6.33	3.90E-01	2.13E-02	2.80E-01
		77.11	*	10.70	4.43E-01		1.38E-01
		87.20	*	3.70	4.15E-01		3.18E-01
		89.80		1.03	-4.54E-01		2.04E+00
		241.98	*	7.49	2.21E-01		8.70E-02
		295.21	*	19.20	1.60E-01		3.32E-02
		351.92	*	37.20	1.37E-01		2.13E-02
		785.91		1.10	4.31E-01		1.16E+00
+	RA-223	81.07		15.00	-7.15E-02	8.45E-02	1.67E-01
		83.78		24.80	-2.81E-01		8.89E-02
		94.90		11.30	-1.06E-01		1.65E-01
		122.31		1.19	2.43E-01		1.15E+00
		144.20		3.26	-9.26E-02		3.86E-01

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	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	RA-223	154.19		5.59	6.14E-02	8.45E-02	2.17E-01
		269.41		13.60	-1.98E-02		8.45E-02
		323.89		3.90	-2.21E-01		2.83E-01
		338.32		2.78	7.50E-01		4.55E-01
		444.94		1.27	3.65E-01		8.59E-01
+	RA-226	186.21	*	3.28	3.86E-01	3.49E-01	3.49E-01
+	AC-228	129.08		2.80	2.81E-01	6.33E-02	4.77E-01
		209.28		4.40	-1.46E-02		2.76E-01
		270.23		3.60	4.18E-01		3.23E-01
		327.64		3.20	2.99E-01		3.53E-01
		338.32		11.40	1.82E-01		1.10E-01
		409.51		2.13	4.23E-01		5.13E-01
		463.00		4.40	-1.48E-02		2.64E-01
		794.70		4.60	4.97E-02		2.67E-01
		911.60		27.70	2.28E-01		6.33E-02
		964.60		5.20	8.95E-01		3.27E-01
		969.11		16.60	2.80E-01		1.03E-01
		1587.90		3.71	3.66E-01		2.75E-01
+	Th-230	12.30		8.43	0.00E+00	9.76E+00	9.04E+10
		67.60		0.37	-1.80E+00		9.76E+00
		168.10		0.07	-2.07E-01		1.68E+01
+	PA-234M	766.36		0.29	5.64E-01	1.57E+00	4.10E+00
		1001.03		0.84	-5.81E-02		1.57E+00
+	TH-234	63.29		4.50	-8.25E-02	7.60E-01	1.00E+00
		92.38		2.60	-4.37E-01		7.66E-01
		92.80		2.60	-4.26E-01		7.60E-01
+	AM-241	59.54		36.30	-9.97E-02	1.61E-01	1.61E-01
+	CM-243	99.55		14.30	-1.56E-01	6.77E-02	1.19E-01
		103.76		23.00	7.73E-03		6.77E-02
		117.00		10.80	-1.09E-02		1.29E-01
		228.18		10.60	-1.16E-01		1.11E-01
		277.60		14.00	3.27E-02		8.20E-02

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level