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\*\*\*\*\* G A M M A S P E C T R U M A N A L Y S I S \*\*\*\*\*  
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Filename: C:\GENIE2K\CAMFILES\UNC 2017\IMC Samples\IMC-0312\W3H-IMC-000

Report Generated On : 7/6/2017 9:28:18 AM

Sample Title : UNC-IMC-000312-S-P-1

Sample Description :

Sample Identification : -IMC-000312-S-P-

Sample Type :

Sample Geometry : cylinder

Peak Locate Threshold : 3.00

Peak Locate Range (in channels) : 40 - 8192

Peak Area Range (in channels) : 40 - 8192

Identification Energy Tolerance : 1.000 keV

Sample Size : 2.443E+002 grams

Sample Taken On : 4/28/2017 12:00:00 AM

Acquisition Started : 5/3/2017 10:02:02 AM

Live Time : 1800.0 seconds

Real Time : 1800.5 seconds

Dead Time : 0.03 %

Energy Calibration Used Done On : 4/13/2017

Efficiency Calibration Used Done On : 7/6/2017

Efficiency ID : H-IMC-2002-S-P-5

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\*\*\*\*\* P E A K A N A L Y S I S R E P O R T \*\*\*\*\*  
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Detector Name: 8566

Sample Title: UNC-IMC-000312-S-P-1

Peak Analysis Performed on: 7/6/2017 9:28:11 AM

Peak Analysis From Channel: 40

Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
F	1	57-	70	65.19	16.43	0.74	3.19E+002	34.43	1.68E+002
F	2	181-	192	186.29	46.73	0.71	7.16E+001	64.54	7.00E+001
F	3	207-	216	212.93	53.40	0.61	8.60E+001	20.09	6.50E+001
M	4	282-	305	291.48	73.05	0.68	1.20E+002	51.43	1.39E+002
m	5	282-	305	299.59	75.08	0.68	1.77E+002	72.16	1.65E+002
F	6	332-	345	337.26	84.51	0.88	2.97E+002	32.09	1.63E+002
F	7	354-	365	359.63	90.11	0.65	8.61E+001	22.25	1.34E+002
F	8	365-	377	372.71	93.38	0.80	1.53E+002	90.42	1.41E+002
F	9	429-	446	436.46	109.33	0.97	1.15E+002	96.36	1.32E+002
F	10	565-	582	574.47	143.87	0.90	3.29E+002	29.75	1.37E+002
F	11	646-	659	652.28	163.34	0.94	1.50E+002	24.62	7.70E+001
F	12	733-	750	741.87	185.76	0.91	1.71E+003	77.11	9.00E+001
M	13	801-	828	807.24	202.12	0.95	4.17E+001	23.40	3.17E+001
m	14	801-	828	820.21	205.36	0.95	1.33E+002	60.17	3.40E+001
F	15	945-	958	952.57	238.49	0.88	3.51E+001	31.08	3.50E+001
F	16	5823-	5849	5835.38	1460.38	3.08	1.25E+002	22.45	3.00E+000

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.960 sigma

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 \*\*\*\*\* N U C L I D E I D E N T I F I C A T I O N R E P O R T \*\*\*\*\*  
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Sample Title: UNC-IMC-000312-S-P-1  
 Nuclide Library Used: C:\GENIE2K\CAMFILES\UNC 2017 NLB 0328201

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

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gram)	Activity Uncertainty
K-40	0.970	1460.82*	10.66	8.45728E+000	1.63832E+000
Pb-210	0.994	46.54*	4.25	3.08874E+000	2.87661E+000
Pb-212	0.632	74.82*	10.28	1.58854E+000	6.80427E-001
		77.11	17.10		
		86.83	2.07		
		87.35	3.97		
		89.78*	1.46	4.90087E+000	1.40309E+000
		115.18	0.60		
		238.63*	43.60	1.01267E-001	9.02127E-002
		300.09	3.30		
Ra-226	0.885	81.07	0.20		
		83.79*	0.32	7.84392E+001	1.31262E+001
		186.21*	3.64	4.76283E+001	5.48753E+000
U-234	0.995	53.20*	0.12	9.84142E+001	2.77155E+001
		120.90	0.04		
U-235	0.999	89.96*	3.43	2.08607E+000	6.00947E-001
		93.35*	5.54	2.27697E+000	1.37082E+000
		104.82	0.69		
		105.60	1.31		
		108.58	0.50		
		109.19*	1.66	5.57509E+000	4.79923E+000
		143.76*	10.96	2.60681E+000	3.61653E-001
		163.36*	5.08	2.75266E+000	5.37014E-001
		194.94	0.63		
		202.12*	1.08	4.19762E+000	2.40031E+000
		205.32*	5.02	2.91021E+000	1.35472E+000

\* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.10

Errors quoted at 1.960 sigma

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\*\*\*\*\* I N T E R F E R E N C E C O R R E C T E D R E P O R T \*\*\*\*\*  
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Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/gram)	Wt mean Activity Uncertainty
K-40	0.970	8.457279E+000	1.638316E+000
Pb-210	0.994	3.088742E+000	2.876608E+000
Pb-212	0.632	1.221401E-001	8.924168E-002
Ra-226	0.885	5.221212E+001	5.062902E+000
U-234	0.995	9.841423E+001	2.771550E+001
U-235	0.999	2.560252E+000	2.534289E-001

? = 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 1.960 sigma

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

Peak Locate Performed on: 7/6/2017 9:28:11 AM  
Peak Locate From Channel: 40  
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
F	1	16.43	1.7699E-001	10.81		
M	4	73.05	6.6882E-002	42.72		

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.960 sigma

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\*\*\*\*\* N U C L I D E M D A R E P O R T \*\*\*\*\*  
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Detector Name: 8566  
Sample Geometry: cylinder  
Sample Title: UNC-IMC-000312-S-P-1  
Nuclide Library Used: C:\GENIE2K\CAMFILES\UNC 2017 NLB 0328201

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gram)	Nuclide MDA (pCi/gram)	Activity (pCi/gram)	Dec. Leve (pCi/gram)
+	K-40	1460.82*	10.66	7.920E-001	7.92E-001	8.457E+000	3.045E-00
+	Pb-210	46.54*	4.25	2.173E+000	2.17E+000	3.089E+000	1.028E+00
	BI-212	727.33	6.67	2.230E+000	2.23E+000	1.140E+000	1.036E+00
		785.37	1.10	1.403E+001		-7.169E+000	6.499E+00
		1078.62	0.56	3.375E+001		-3.817E+000	1.554E+00
		1620.50	1.47	1.047E+001		-6.449E-001	4.508E+00
+	Pb-212	74.82*	10.28	5.589E-001	1.01E-001	1.589E+000	2.674E-00
		77.11	17.10	5.280E-001		6.506E-002	2.568E-00
		86.83	2.07	3.933E+000		1.276E+000	1.911E+00
		87.35	3.97	1.724E+000		6.637E-001	8.334E-00
		89.78*	1.46	3.908E+000		4.901E+000	1.877E+00
		115.18	0.60	9.385E+000		-1.587E+000	4.509E+00
		238.63*	43.60	1.009E-001		1.013E-001	4.654E-00
		300.09	3.30	2.015E+000		-3.248E+000	9.429E-00
	BI-214	76.86	0.55	1.675E+001	3.22E-001	1.548E+000	8.150E+00
		79.29	0.91	7.180E+000		-7.027E+000	3.458E+00
		609.32	45.49	3.220E-001		2.058E-001	1.512E-00
		665.45	1.53	8.557E+000		3.760E+000	3.962E+00
		768.36	4.89	2.726E+000		-1.756E+000	1.250E+00
		806.18	1.26	1.186E+001		2.183E-001	5.473E+00
		934.06	3.11	5.239E+000		-8.083E-001	2.406E+00
		1120.29	14.92	1.250E+000		-1.827E-001	5.731E-00
		1155.21	1.63	1.017E+001		-1.394E+001	4.598E+00
		1238.11	5.83	3.781E+000		1.454E+000	1.745E+00
		1280.98	1.43	1.227E+001		-4.713E+000	5.526E+00
		1377.67	3.99	4.541E+000		6.300E-001	2.038E+00
		1385.31	0.79	2.295E+001		-6.511E+000	1.030E+00
		1401.52	1.33	1.560E+001		2.614E-001	7.092E+00
		1407.99	2.39	8.817E+000		3.694E+000	4.014E+00
		1509.21	2.13	7.217E+000		1.219E+000	3.137E+00
		1583.20	0.70	2.901E+001		1.122E+001	1.302E+00
		1661.27	1.05	1.645E+001		1.235E+001	7.181E+00
		1729.59	2.88	5.484E+000		-1.821E+000	2.348E+00
		1764.49	15.30	1.157E+000		2.261E-001	5.030E-00
		1847.43	2.03	8.293E+000		1.982E-001	3.550E+00
>		2118.51	1.16	0.000E+000		0.000E+000	0.000E+00
>		2204.06	4.92	0.000E+000		0.000E+000	0.000E+00
>		2447.70	1.55	0.000E+000		0.000E+000	0.000E+00
	PB-214	74.82	5.80	1.824E+000	2.62E-001	2.652E-002	8.906E-00
		77.11	9.70	9.307E-001		1.147E-001	4.528E-00
		86.83	1.70	4.789E+000		1.554E+000	2.327E+00
		87.35	2.24	3.056E+000		1.176E+000	1.477E+00

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gram)	Nuclide MDA (pCi/gram)	Activity (pCi/gram)	Dec. Leve (pCi/gram)
	PB-214	89.78	0.82	8.146E+000	2.62E-001	1.150E+001	3.936E+00
		241.99	7.25	9.837E-001		2.417E-001	4.681E-00
		258.76	0.53	1.141E+001		8.830E+000	5.359E+00
		295.22	18.42	3.983E-001		1.633E-001	1.878E-00
		351.93	35.60	2.621E-001		2.508E-001	1.240E-00
		785.96	1.06	1.447E+001		-4.972E+000	6.699E+00
		839.07	0.58	2.793E+001		7.090E+000	1.293E+00
+	Ra-226	81.07	0.20	3.271E+001	1.65E+000	-2.227E+000	1.575E+00
		83.79*	0.32	2.100E+001		7.844E+001	1.014E+00
		186.21*	3.64	1.647E+000		4.763E+001	7.857E-00
	AC-228	89.96	1.90	8.934E+006	1.48E+006	1.182E+007	4.326E+00
		93.35	3.10	5.817E+006		-6.759E+006	2.823E+00
		99.51	1.26	9.442E+006		-4.985E+006	4.513E+00
		105.60	0.74	1.963E+007		7.449E+006	9.462E+00
		129.07	2.42	5.347E+006		-1.187E+006	2.563E+00
		153.98	0.72	1.792E+007		2.113E+006	8.560E+00
		209.25	3.89	3.971E+006		-1.113E+005	1.893E+00
		214.85	0.76	1.681E+007		-2.242E+005	7.918E+00
		270.24	3.46	3.900E+006		-1.074E+005	1.818E+00
		328.00	2.95	5.654E+006		-2.024E+006	2.638E+00
		338.32	11.27	1.485E+006		9.434E+004	6.913E+00
		409.46	1.92	1.016E+007		-8.071E+006	4.715E+00
		463.00	4.40	5.046E+006		1.793E+005	2.341E+00
		562.50	0.87	3.482E+007		2.908E+006	1.628E+00
		674.75	2.10	1.493E+007		7.590E+006	6.910E+00
		726.86	0.62	5.758E+007		4.119E+007	2.676E+00
		755.32	1.00	3.129E+007		-6.120E+006	1.434E+00
		772.29	1.49	2.191E+007		-1.970E+007	1.006E+00
		794.95	4.25	8.379E+006		-1.340E+006	3.868E+00
		830.49	0.54	6.394E+007		1.084E+007	2.934E+00
		835.71	1.61	2.443E+007		1.936E+007	1.132E+00
		840.38	0.91	4.117E+007		-2.785E+007	1.901E+00
		904.20	0.77	6.215E+007		-3.894E+006	2.908E+00
		911.20	25.80	1.806E+006		9.487E+003	8.431E+00
		964.77	4.99	7.997E+006		-4.229E+006	3.673E+00
		968.97	15.80	2.667E+006		-6.870E+005	1.230E+00
		1247.08	0.50	1.017E+008		-3.036E+007	4.679E+00
		1459.14	0.83	1.190E+008		2.720E+008	5.670E+00
		1495.91	0.86	3.972E+007		1.892E+007	1.710E+00
		1588.20	3.22	1.569E+007		4.753E+006	7.068E+00
		1630.63	1.51	2.442E+007		-1.041E+007	1.052E+00
	TH-230	67.67	0.38	1.824E+001	1.82E+001	5.192E+000	8.761E+00
	PA-234	742.81	0.11	1.329E+002	1.99E+001	9.862E+000	6.138E+00
		766.42	0.32	4.382E+001		1.107E+001	2.016E+00
		1001.03	0.84	1.987E+001		-1.272E+001	9.100E+00
	TH-234	63.29	3.70	1.861E+000	1.86E+000	-3.691E-001	8.904E-00
		92.38	2.13	3.937E+000		8.456E+000	1.916E+00
		92.80	2.10	3.835E+000		1.842E+000	1.865E+00
		112.81	0.21	2.707E+001		6.355E+000	1.302E+00
+	U-234	53.20*	0.12	5.269E+001	5.27E+001	9.841E+001	2.480E+00
		120.90	0.04	1.788E+002		1.722E+002	8.625E+00



	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gram)	Nuclide MDA (pCi/gram)	Activity (pCi/gram)	Dec. Leve (pCi/gram)
+	U-235	89.96*	3.43	1.664E+000	5.72E-001	2.086E+000	7.990E-00
		93.35*	5.54	1.071E+000		2.277E+000	5.153E-00
		104.82	0.69	8.831E+000		6.285E+000	4.256E+00
		105.60	1.31	4.653E+000		1.766E+000	2.243E+00
		108.58	0.50	1.379E+001		-4.089E+000	6.674E+00
		109.19*	1.66	3.807E+000		5.575E+000	1.838E+00
		143.76*	10.96	5.716E-001		2.607E+000	2.751E-00
		163.36*	5.08	9.262E-001		2.753E+000	4.383E-00
		194.94	0.63	7.553E+000		-9.171E+000	3.550E+00
		202.12*	1.08	2.906E+000		4.198E+000	1.317E+00
		205.32*	5.02	6.547E-001		2.910E+000	2.977E-00

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

> = MDA value not calculated

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

\*\*\*\*\*  
 \*\*\* LINE ACTIVITY CONSISTENCY EVALUATOR \*\*\*  
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 Analysis using Key Line Activities  
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Filename: C:\GENIE2K\CAMFILES\UNC 2017\IMC Samples\IMC-0312\W3H-IMC-000

Equation used to calculate plot:  $\ln(\text{Ratio}) = A + B \cdot \ln(\text{Energy})$

where: Ratio = Activity/KL Activity

Notes:

'^' Denotes Key Line energy

\* All uncertainties quoted at 1.96 sigma

Nuclide	Energy (keV)		Activity (pCi/gram)	Activity %Uncert*	Ratio[%Uncert]	A	B [uncert]
-----	-----		-----	-----	-----	-----	-----
K-40	1460.8	^	8.46E+000	19.372			
Pb-210	46.5	^	3.09E+000	93.132			
Pb-212	74.8		1.59E+000	42.833	15.687[98.847]	15.86	-2.853
	89.8		4.90E+000	28.629	48.396[93.571]		[ 1.324]
	238.6	^	1.01E-001	89.084	1.000[125.98]		
Ra-226	83.8		7.84E+001	16.734	1.647[20.317]	3.27	-0.625
	186.2	^	4.76E+001	11.522	1.000[16.294]		[ 0.326]
U-234	53.2	^	9.84E+001	28.162			
U-235	90.0		2.09E+000	28.808	0.800[31.974]	-2.13	0.435
	93.3		2.28E+000	60.204	0.873[61.782]		[ 0.508]
	109.2		5.58E+000	86.083	2.139[87.194]		
	143.8	^	2.61E+000	13.873	1.000[19.620]		
	163.4		2.75E+000	19.509	1.056[23.939]		
	202.1		4.20E+000	57.183	1.610[58.842]		
	205.3		2.91E+000	46.550	1.116[48.574]		