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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 9:32:57 AM

Sample Title : W3H-IMC-0312-S-P-8

Sample Description :

Sample Identification : IMC-0312-S-P-8

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 : 4.272E+002 grams

Sample Taken On : 4/18/2017 12:00:00 AM

Acquisition Started : 5/4/2017 7:21:36 AM

Live Time : 1800.0 seconds

Real Time : 1800.6 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: W3H-IMC-0312-S-P-8

Peak Analysis Performed on: 7/6/2017 9:32:51 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	59-	71	65.32	16.46	0.78	4.18E+002	115.86	1.95E+002
F	2	72-	85	76.90	19.36	0.89	1.51E+002	101.79	1.54E+002
F	3	98-	109	102.95	25.87	0.53	8.18E+001	22.63	1.44E+002
F	4	209-	219	213.27	53.48	0.68	1.73E+002	26.47	1.19E+002
M	5	282-	313	291.26	73.00	0.84	1.75E+002	70.56	2.67E+002
m	6	282-	313	299.50	75.06	0.85	3.32E+002	121.22	2.73E+002
m	7	282-	313	308.74	77.37	0.86	1.02E+002	45.06	2.80E+002
F	8	331-	344	336.99	84.44	0.83	4.06E+002	40.38	2.73E+002
F	9	355-	365	359.76	90.14	0.66	1.60E+002	29.84	2.18E+002
F	10	366-	379	373.35	93.54	0.79	2.74E+002	155.27	2.31E+002
F	11	431-	440	436.23	109.28	0.74	9.88E+001	24.39	1.42E+002
F	12	478-	488	483.19	121.03	0.49	4.43E+001	76.80	1.44E+002
F	13	570-	580	574.50	143.88	0.83	5.18E+002	44.71	1.38E+002
F	14	647-	659	652.88	163.49	0.84	2.00E+002	94.65	1.30E+002
F	15	735-	749	741.94	185.78	0.90	2.23E+003	88.61	1.46E+002
M	16	800-	827	806.57	201.95	1.00	4.79E+001	23.69	6.68E+001
m	17	800-	827	819.88	205.28	1.00	2.02E+002	70.15	6.29E+001
F	18	947-	958	953.47	238.71	0.90	1.27E+002	24.73	6.90E+001
F	19	1347-	1356	1351.45	338.30	0.92	2.63E+001	14.02	2.80E+001
F	20	1398-	1413	1405.50	351.83	1.03	5.71E+001	18.50	5.60E+001
F	21	2323-	2338	2329.83	583.14	1.23	3.12E+001	15.31	3.60E+001
F	22	5825-	5849	5836.71	1460.71	2.49	1.95E+002	28.22	8.33E+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: W3H-IMC-0312-S-P-8  
 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	0.998	1460.82*	10.66	7.53253E+000	1.22195E+000
Pb-212	0.855	74.82*	10.28	1.69805E+000	6.61433E-001
		77.11*	17.10	3.06208E-001	1.41583E-001
		86.83	2.07		
		87.35	3.97		
		89.78*	1.46	5.21904E+000	1.16484E+000
		115.18	0.60		
		238.63*	43.60	2.09737E-001	4.59812E-002
		300.09	3.30		
PB-214	0.456	74.82*	5.80	3.00965E+000	1.20286E+000
		77.11*	9.70	5.39810E-001	2.54282E-001
		86.83	1.70		
		87.35	2.24		
		89.78*	0.82	9.29244E+000	2.22501E+000
		241.99	7.25		
		258.76	0.53		
		295.22	18.42		
		351.93*	35.60	1.70645E-001	5.71017E-002
		785.96	1.06		
		839.07	0.58		
Ra-226	0.888	81.07	0.20		
		83.79*	0.32	6.13672E+001	9.93669E+000
		186.21*	3.64	3.56888E+001	4.03820E+000
U-234	0.990	53.20*	0.12	1.13040E+002	2.47372E+001
		120.90*	0.04	5.91112E+001	1.04096E+002
U-235	0.997	89.96*	3.43	2.22147E+000	5.00874E-001
		93.35*	5.54	2.32558E+000	1.34795E+000
		104.82	0.69		
		105.60	1.31		
		108.58	0.50		
		109.19*	1.66	2.74787E+000	8.49719E-001
		143.76*	10.96	2.34698E+000	3.19407E-001
		163.36*	5.08	2.09645E+000	1.01631E+000
		194.94	0.63		
		202.12*	1.08	2.75418E+000	1.39606E+000
		205.32*	5.02	2.52920E+000	9.18954E-001

\* = 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	0.998	7.532526E+000	1.221946E+000
Pb-212	0.855	2.147049E-001	4.349971E-002
Pb-214	0.456	1.750133E-001	5.571472E-002
Ra-226	0.888	3.932858E+001	3.741070E+000
U-234	0.990	1.101569E+002	2.406703E+001
U-235	0.997	2.337758E+000	2.269806E-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 9:32:51 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	16.46	2.3238E-001	27.70		
F	2	19.36	8.3849E-002	67.44		
F	3	25.87	4.5458E-002	27.66		
M	5	73.00	9.7383E-002	40.25		
F	19	338.30	1.4587E-002	53.38		
F	21	583.14	1.7348E-002	49.04		

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: W3H-IMC-0312-S-P-8  
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	6.722E-001	6.72E-001	7.533E+000	2.838E-00
	Pb-210	46.54	4.25	1.657E+000	1.66E+000	5.108E-001	7.948E-00
	BI-212	727.33	6.67	1.315E+000	1.32E+000	4.346E-001	6.124E-00
		785.37	1.10	9.407E+000		4.643E+000	4.409E+00
		1078.62	0.56	1.851E+001		1.584E+000	8.493E+00
		1620.50	1.47	5.575E+000		-9.835E-001	2.371E+00
+	Pb-212	74.82*	10.28	4.077E-001	7.58E-002	1.698E+000	1.969E-00
		77.11*	17.10	2.427E-001		3.062E-001	1.173E-00
		86.83	2.07	2.766E+000		1.390E+000	1.351E+00
		87.35	3.97	1.228E+000		7.228E-001	5.978E-00
		89.78*	1.46	2.750E+000		5.219E+000	1.331E+00
		115.18	0.60	6.825E+000		-4.434E+000	3.307E+00
		238.63*	43.60	7.579E-002		2.097E-001	3.566E-00
		300.09	3.30	1.389E+000		-2.909E+000	6.573E-00
	BI-214	76.86	0.55	1.290E+001	2.02E-001	9.803E-001	6.320E+00
		79.29	0.91	5.957E+000		-1.060E+000	2.903E+00
		609.32	45.49	2.024E-001		1.301E-001	9.561E-00
		665.45	1.53	5.457E+000		-9.174E-001	2.548E+00
		768.36	4.89	2.163E+000		6.613E-001	1.017E+00
		806.18	1.26	7.406E+000		4.189E+000	3.440E+00
		934.06	3.11	3.548E+000		1.872E+000	1.652E+00
		1120.29	14.92	9.281E-001		4.936E-001	4.343E-00
		1155.21	1.63	8.058E+000		4.721E+000	3.750E+00
		1238.11	5.83	2.465E+000		1.571E+000	1.150E+00
		1280.98	1.43	9.224E+000		5.134E-001	4.265E+00
		1377.67	3.99	3.228E+000		1.201E+000	1.481E+00
		1385.31	0.79	1.684E+001		1.125E+001	7.748E+00
		1401.52	1.33	8.038E+000		-8.306E-001	3.614E+00
		1407.99	2.39	4.483E+000		1.399E+000	2.016E+00
		1509.21	2.13	5.171E+000		1.925E+000	2.316E+00
		1583.20	0.70	1.508E+001		5.753E+000	6.691E+00
		1661.27	1.05	9.661E+000		4.281E+000	4.233E+00
		1729.59	2.88	3.351E+000		1.116E+000	1.450E+00
		1764.49	15.30	9.525E-001		7.359E-001	4.331E-00
		1847.43	2.03	4.908E+000		-6.047E-001	2.113E+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	7.227E-001	1.27E-001	3.010E+000	3.491E-00
		77.11*	9.70	4.278E-001		5.398E-001	2.067E-00
		86.83	1.70	3.368E+000		1.692E+000	1.645E+00
		87.35	2.24	2.177E+000		1.281E+000	1.059E+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	4.896E+000	1.27E-001	9.292E+000	2.370E+00
		241.99	7.25	8.223E-001		-8.356E-001	3.976E-00
		258.76	0.53	7.571E+000		-2.356E+000	3.587E+00
		295.22	18.42	2.722E-001		4.139E-002	1.296E-00
		351.93*	35.60	1.267E-001		1.706E-001	5.930E-00
		785.96	1.06	9.787E+000		4.831E+000	4.587E+00
		839.07	0.58	1.481E+001		5.333E+000	6.814E+00
+	Ra-226	81.07	0.20	2.445E+001	1.12E+000	4.034E+000	1.188E+00
		83.79*	0.32	1.542E+001		6.137E+001	7.503E+00
		186.21*	3.64	1.121E+000		3.569E+001	5.388E-00
	AC-228	89.96	1.90	4.296E+019	6.94E+018	5.201E+019	2.098E+01
		93.35	3.10	2.691E+019		-4.626E+019	1.315E+01
		99.51	1.26	4.279E+019		-5.019E+019	2.066E+01
		105.60	0.74	8.738E+019		4.320E+019	4.245E+01
		129.07	2.42	2.515E+019		6.444E+018	1.218E+01
		153.98	0.72	8.362E+019		-2.399E+019	4.039E+01
		209.25	3.89	1.711E+019		-2.484E+018	8.229E+01
		214.85	0.76	7.380E+019		-1.301E+019	3.518E+01
		270.24	3.46	1.912E+019		4.595E+018	9.093E+01
		328.00	2.95	2.510E+019		4.444E+018	1.188E+01
		338.32	11.27	7.165E+018		2.002E+018	3.402E+01
		409.46	1.92	4.465E+019		-8.143E+018	2.103E+01
		463.00	4.40	2.240E+019		1.078E+019	1.056E+01
		562.50	0.87	1.173E+020		-2.130E+019	5.469E+01
		674.75	2.10	5.943E+019		-9.990E+018	2.774E+01
		726.86	0.62	2.069E+020		7.947E+018	9.626E+01
		755.32	1.00	1.360E+020		-5.351E+018	6.338E+01
		772.29	1.49	1.058E+020		2.600E+019	4.975E+01
		794.95	4.25	3.179E+019		1.981E+018	1.476E+01
		830.49	0.54	2.451E+020		-8.211E+019	1.132E+02
		835.71	1.61	7.375E+019		-2.786E+019	3.373E+01
		840.38	0.91	1.386E+020		-8.906E+019	6.371E+01
		904.20	0.77	2.081E+020		-3.216E+020	9.699E+01
		911.20	25.80	6.941E+018		5.761E+018	3.259E+01
		964.77	4.99	3.169E+019		2.257E+019	1.469E+01
		968.97	15.80	1.005E+019		2.346E+018	4.658E+01
		1247.08	0.50	3.706E+020		4.971E+019	1.709E+02
		1459.14	0.83	5.279E+020		1.549E+021	2.540E+02
		1495.91	0.86	1.696E+020		3.686E+019	7.504E+01
		1588.20	3.22	5.368E+019		4.480E+019	2.409E+01
		1630.63	1.51	7.390E+019		-7.317E+018	3.095E+01
	TH-230	67.67	0.38	1.449E+001	1.45E+001	6.624E+000	7.041E+00
	PA-234	742.81	0.11	8.073E+001	1.34E+001	-2.744E+000	3.748E+00
		766.42	0.32	3.275E+001		-2.797E+000	1.537E+00
		1001.03	0.84	1.338E+001		-2.520E+000	6.212E+00
	TH-234	63.29	3.70	1.513E+000	1.51E+000	3.856E-001	7.339E-00
		92.38	2.13	2.965E+000		9.173E+000	1.453E+00
		92.80	2.10	2.888E+000		2.746E+000	1.414E+00
		112.81	0.21	1.977E+001		-8.810E-001	9.586E+00
+	U-234	53.20*	0.12	4.124E+001	4.12E+001	1.130E+002	1.974E+00
		120.90*	0.04	8.500E+001		5.911E+001	4.069E+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	1.171E+000	2.81E-001	2.221E+000	5.665E-00
		93.35*	5.54	7.970E-001		2.326E+000	3.870E-00
		104.82	0.69	6.477E+000		8.558E+000	3.147E+00
		105.60	1.31	3.349E+000		1.656E+000	1.627E+00
		108.58	0.50	9.400E+000		-6.568E+000	4.575E+00
		109.19*	1.66	1.853E+000		2.748E+000	8.890E-00
		143.76*	10.96	2.815E-001		2.347E+000	1.346E-00
		163.36*	5.08	6.652E-001		2.096E+000	3.184E-00
		194.94	0.63	5.949E+000		-2.443E+000	2.845E+00
		202.12*	1.08	2.342E+000		2.754E+000	1.093E+00
		205.32*	5.02	4.965E-001		2.529E+000	2.313E-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 ^	7.53E+000	16.222			
Pb-212	74.8	1.70E+000	38.952	8.096[44.698]	11.13	-2.005 [ 0.362]
	77.1	3.06E-001	46.237	1.460[51.172]		
	89.8	5.22E+000	22.319	24.884[31.285]		
	238.6 ^	2.10E-001	21.923	1.000[31.004]		
PB-214	74.8	3.01E+000	39.967	17.637[52.126]	11.30	-1.898 [ 0.376]
	77.1	5.40E-001	47.106	3.163[57.781]		
	89.8	9.29E+000	23.944	54.455[41.147]		
	351.9 ^	1.71E-001	33.462	1.000[47.323]		
Ra-226	83.8	6.14E+001	16.192	1.720[19.754]	3.55	-0.679 [ 0.318]
	186.2 ^	3.57E+001	11.315	1.000[16.002]		
U-234	53.2 ^	1.13E+002	21.884	1.000[30.948]	3.14	-0.790 [ 2.194]
	120.9	5.91E+001	176.10	0.523[177.45]		
U-235	90.0	2.22E+000	22.547	0.947[26.336]	-0.40	0.085 [ 0.443]
	93.3	2.33E+000	57.962	0.991[59.538]		
	109.2	2.75E+000	30.923	1.171[33.785]		
	143.8 ^	2.35E+000	13.609	1.000[19.246]		
	163.4	2.10E+000	48.478	0.893[50.352]		
	202.1	2.75E+000	50.689	1.173[52.484]		
	205.3	2.53E+000	36.334	1.078[38.799]		