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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-0226\UNC-IMC-022

Report Generated On : 5/9/2017 10:40:10 AM

Sample Title : UNC-IMC-0226-S-P-8

Sample Description :

Sample Identification : IMC-0226-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 : 2.486E+002 grams

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

Acquisition Started : 5/1/2017 3:46:03 PM

Live Time : 1800.0 seconds

Real Time : 1800.4 seconds

Dead Time : 0.02 %

Energy Calibration Used Done On : 4/13/2017

Efficiency Calibration Used Done On : 5/9/2017

Efficiency ID : H-IMC-0226-S-P-8

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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-0226-S-P-8

Peak Analysis Performed on: 5/9/2017 10:40:04 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
M	1	295-	314	299.76	75.12	0.64	8.31E+001	21.42	1.02E+002
m	2	295-	314	308.37	77.28	0.65	5.48E+001	17.74	1.01E+002
F	3	365-	377	372.56	93.34	0.78	7.77E+001	64.99	7.80E+001
F	4	569-	579	574.04	143.76	0.77	6.00E+001	17.34	5.50E+001
F	5	734-	749	741.55	185.68	0.92	2.77E+002	77.14	6.20E+001
F	6	946-	960	953.09	238.62	1.16	9.61E+001	64.29	5.25E+001
F	7	1174-	1183	1178.69	295.07	0.86	2.64E+001	13.63	2.80E+001
F	8	1397-	1411	1405.71	351.88	0.92	5.56E+001	49.25	2.40E+001
F	9	2033-	2043	2038.94	510.34	0.92	2.59E+001	11.16	3.76E+001
F	10	5824-	5848	5835.39	1460.39	2.41	1.51E+002	25.53	1.25E+001

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-0226-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	0.970	1460.82*	10.66	1.06157E+001	2.01249E+000
Pb-212	0.997	74.82*	10.28	7.45536E-001	2.43915E-001
		77.11*	17.10	2.89540E-001	1.10411E-001
		86.83	2.07		
		87.35	3.97		
		89.78	1.46		
		115.18	0.60		
		238.63*	43.60	2.85500E-001	1.96281E-001
		300.09	3.30		
PB-214	0.851	74.82*	5.80	1.32140E+000	4.48194E-001
		77.11*	9.70	5.10426E-001	1.99993E-001
		86.83	1.70		
		87.35	2.24		
		89.78	0.82		
		241.99	7.25		
		258.76	0.53		
		295.22*	18.42	2.28997E-001	1.23573E-001
		351.93*	35.60	3.00183E-001	2.69405E-001
		785.96	1.06		
		839.07	0.58		
Ra-226	0.961	81.07	0.20		
		83.79	0.32		
		186.21*	3.64	7.94618E+000	2.58961E+000
U-235	0.779	89.96	3.43		
		93.35*	5.54	1.16652E+000	1.00388E+000
		104.82	0.69		
		105.60	1.31		
		108.58	0.50		
		109.19	1.66		
		143.76*	10.96	4.86258E-001	1.70173E-001
		163.36	5.08		
		194.94	0.63		
		202.12	1.08		
		205.32	5.02		

\* = 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	1.061565E+001	2.012491E+000
Pb-212	0.997	2.454580E-001	1.013493E-001
PB-214	0.851	2.336818E-001	1.078963E-001
Ra-226	0.961	7.946184E+000	2.589611E+000
U-235	0.779	5.052590E-001	1.677791E-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: 5/9/2017 10:40:04 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 9	510.34	1.4396E-002	43.05		

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-0226-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	1.457E+000	1.46E+000	1.062E+001	6.331E-00
	Pb-210	46.54	4.25	2.247E+000	2.25E+000	2.269E+000	1.067E+00
	BI-212	727.33	6.67	2.526E+000	2.53E+000	6.371E-001	1.181E+00
		785.37	1.10	1.353E+001		-1.060E+001	6.229E+00
		1078.62	0.56	3.546E+001		1.531E+001	1.634E+00
		1620.50	1.47	8.411E+000		-5.602E-002	3.448E+00
+	Pb-212	74.82*	10.28	4.454E-001	1.28E-001	7.455E-001	2.105E-00
		77.11*	17.10	2.612E-001		2.895E-001	1.234E-00
		86.83	2.07	2.789E+000		-1.370E-002	1.339E+00
		87.35	3.97	1.328E+000		-3.692E+000	6.351E-00
		89.78	1.46	3.427E+000		2.361E+000	1.635E+00
		115.18	0.60	7.258E+000		4.642E+000	3.442E+00
		238.63*	43.60	1.281E-001		2.855E-001	6.004E-00
		300.09	3.30	2.403E+000		-2.385E+000	1.135E+00
	BI-214	76.86	0.55	1.420E+001	3.72E-001	2.819E+001	6.874E+00
		79.29	0.91	6.622E+000		-1.226E+000	3.178E+00
		609.32	45.49	3.721E-001		4.548E-001	1.759E-00
		665.45	1.53	1.043E+001		5.165E+000	4.889E+00
		768.36	4.89	3.503E+000		9.020E-001	1.633E+00
		806.18	1.26	1.323E+001		1.763E+000	6.139E+00
		934.06	3.11	5.837E+000		1.998E+000	2.697E+00
		1120.29	14.92	1.587E+000		6.905E-001	7.392E-00
		1155.21	1.63	1.179E+001		-5.774E+000	5.386E+00
		1238.11	5.83	3.706E+000		-1.353E+000	1.702E+00
		1280.98	1.43	1.395E+001		-4.674E-001	6.340E+00
		1377.67	3.99	4.563E+000		-3.678E-001	2.039E+00
		1385.31	0.79	2.549E+001		6.933E+000	1.152E+00
		1401.52	1.33	1.281E+001		-7.352E+000	5.666E+00
		1407.99	2.39	7.600E+000		-9.282E-001	3.389E+00
		1509.21	2.13	8.531E+000		-2.479E+000	3.775E+00
		1583.20	0.70	2.862E+001		3.749E+000	1.276E+00
		1661.27	1.05	1.208E+001		5.631E+000	4.951E+00
		1729.59	2.88	5.717E+000		3.189E-001	2.447E+00
		1764.49	15.30	1.369E+000		3.143E-001	6.055E-00
		1847.43	2.03	8.647E+000		3.744E+000	3.702E+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	7.894E-001	1.52E-001	1.321E+000	3.732E-00
		77.11*	9.70	4.605E-001		5.104E-001	2.176E-00
		86.83	1.70	3.395E+000		-1.668E-002	1.630E+00
		87.35	2.24	2.354E+000		-6.543E+000	1.126E+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	6.101E+000	1.52E-001	4.204E+000	2.912E+00
		241.99	7.25	1.258E+000		4.820E-001	6.045E-00
		258.76	0.53	1.183E+001		3.639E+000	5.556E+00
		295.22*	18.42	2.371E-001		2.290E-001	1.068E-00
		351.93*	35.60	1.521E-001		3.002E-001	6.876E-00
		785.96	1.06	1.462E+001		-1.907E+000	6.756E+00
		839.07	0.58	2.606E+001		4.419E+000	1.196E+00
+	Ra-226	81.07	0.20	2.308E+001	1.36E+000	-2.151E+001	1.094E+00
		83.79	0.32	1.756E+001		1.422E+001	8.417E+00
		186.21*	3.64	1.364E+000		7.946E+000	6.434E-00
	AC-228	89.96	1.90	3.204E+016	8.89E+015	2.062E+016	1.534E+01
		93.35	3.10	2.059E+016		4.728E+015	9.885E+01
		99.51	1.26	3.774E+016		-1.410E+016	1.786E+01
		105.60	0.74	6.974E+016		-3.192E+016	3.316E+01
		129.07	2.42	2.055E+016		-1.117E+016	9.736E+01
		153.98	0.72	7.903E+016		3.932E+016	3.755E+01
		209.25	3.89	1.791E+016		4.329E+015	8.498E+01
		214.85	0.76	8.378E+016		-5.966E+016	3.951E+01
		270.24	3.46	2.274E+016		-3.459E+015	1.072E+01
		328.00	2.95	2.993E+016		7.218E+015	1.403E+01
		338.32	11.27	8.890E+015		5.113E+015	4.193E+01
		409.46	1.92	5.525E+016		3.607E+015	2.582E+01
		463.00	4.40	2.801E+016		2.738E+016	1.310E+01
		562.50	0.87	1.541E+017		-7.803E+016	7.149E+01
		674.75	2.10	7.457E+016		1.223E+016	3.453E+01
		726.86	0.62	3.088E+017		7.788E+016	1.444E+01
		755.32	1.00	1.804E+017		-2.350E+016	8.375E+01
		772.29	1.49	1.314E+017		5.765E+016	6.129E+01
		794.95	4.25	4.229E+016		-1.286E+016	1.955E+01
		830.49	0.54	3.203E+017		1.688E+017	1.471E+01
		835.71	1.61	1.009E+017		-9.992E+015	4.604E+01
		840.38	0.91	1.982E+017		5.537E+016	9.128E+01
		904.20	0.77	3.122E+017		-3.491E+017	1.462E+01
		911.20	25.80	1.029E+016		1.027E+016	4.846E+01
		964.77	4.99	4.769E+016		8.361E+015	2.223E+01
		968.97	15.80	1.409E+016		5.917E+014	6.533E+01
		1247.08	0.50	4.947E+017		-6.329E+016	2.272E+01
		1459.14	0.83	6.903E+017		1.935E+018	3.313E+01
		1495.91	0.86	2.219E+017		-1.295E+017	9.723E+01
		1588.20	3.22	7.415E+016		1.507E+016	3.321E+01
		1630.63	1.51	1.039E+017		1.185E+016	4.351E+01
	TH-230	67.67	0.38	1.384E+001	1.38E+001	4.775E+000	6.560E+00
	PA-234	742.81	0.11	1.602E+002	1.94E+001	1.328E+001	7.485E+00
		766.42	0.32	5.356E+001		1.255E+001	2.496E+00
		1001.03	0.84	1.944E+001		-2.693E+000	8.852E+00
	TH-234	63.29	3.70	1.609E+000	1.61E+000	6.296E-001	7.647E-00
		92.38	2.13	2.796E+000		3.465E+000	1.345E+00
		92.80	2.10	2.756E+000		1.091E+000	1.324E+00
		112.81	0.21	2.011E+001		-6.862E+000	9.524E+00
	U-234	53.20	0.12	5.829E+001	5.83E+001	5.485E+001	2.762E+00
		120.90	0.04	1.195E+002		1.489E+001	5.651E+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	1.561E+000	3.27E-001	1.004E+000	7.474E-00
		93.35*	5.54	8.170E-001		1.167E+000	3.882E-00
		104.82	0.69	6.651E+000		-3.831E+000	3.163E+00
		105.60	1.31	3.465E+000		-1.586E+000	1.648E+00
		108.58	0.50	9.186E+000		-3.037E+000	4.371E+00
		109.19	1.66	2.737E+000		-3.050E-001	1.302E+00
		143.76*	10.96	3.265E-001		4.863E-001	1.523E-00
		163.36	5.08	1.032E+000		4.883E-001	4.904E-00
		194.94	0.63	8.314E+000		3.013E-001	3.924E+00
		202.12	1.08	5.661E+000		-9.439E-001	2.691E+00
		205.32	5.02	1.262E+000		9.105E-001	6.004E-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-0226\UNC-IMC-022

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	^	1.06E+001	18.958			
Pb-212	74.8		7.46E-001	32.717	2.611[76.138]	2.50	-0.461
	77.1		2.90E-001	38.133	1.014[78.617]		[ 0.974]
	238.6	^	2.85E-001	68.750	1.000[97.227]		
PB-214	74.8		1.32E+000	33.918	4.402[95.942]	4.55	-0.817
	77.1		5.10E-001	39.182	1.700[97.927]		[ 0.739]
	295.2		2.29E-001	53.963	0.763[104.72]		
	351.9	^	3.00E-001	89.747	1.000[126.92]		
Ra-226	186.2	^	7.95E+000	32.589			
U-235	93.3		1.17E+000	86.058	2.399[92.902]	10.07	-2.027
	143.8	^	4.86E-001	34.996	1.000[49.492]		[ 2.438]