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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 10:33:02 AM

Sample Title : UNC-IMC-0226-S-P-5

Sample Description :

Sample Identification : IMC-0226-S-P-5

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 : 3.898E+002 grams

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

Acquisition Started : 5/1/2017 11:15:36 AM

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-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-0226-S-P-5

Peak Analysis Performed on: 5/9/2017 10:32:54 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-	319	299.68	75.10	0.70	1.33E+002	25.24	1.28E+002
m	2	295-	319	308.37	77.28	0.71	1.20E+002	23.67	1.44E+002
F	3	344-	353	348.68	87.37	0.72	5.21E+001	56.06	8.83E+001
F	4	734-	747	741.42	185.65	0.94	1.29E+002	76.15	8.23E+001
F	5	947-	960	952.92	238.57	0.85	1.67E+002	28.01	9.45E+001
F	6	1345-	1357	1350.85	338.15	0.83	3.08E+001	43.85	2.86E+001
F	7	1400-	1410	1405.14	351.74	0.89	7.35E+001	20.01	3.85E+001
F	8	2322-	2336	2328.77	582.87	1.24	4.27E+001	17.23	3.88E+001
F	9	2425-	2439	2431.65	608.62	1.34	5.10E+001	16.33	2.13E+001
F	10	5822-	5850	5835.27	1460.35	2.82	2.12E+002	29.17	4.83E+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-0226-S-P-5  
 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	0.966	1460.82*	10.66	9.96629E+000	1.61194E+000
Pb-212	0.997	74.82*	10.28	9.60444E-001	2.65784E-001
		77.11*	17.10	5.05820E-001	1.42644E-001
		86.83	2.07		
		87.35*	3.97	8.67208E-001	9.48778E-001
		89.78	1.46		
		115.18	0.60		
		238.63*	43.60	3.48047E-001	8.03730E-002
		300.09	3.30		
BI-214	0.191	76.86*	0.55	1.58707E+001	4.49829E+000
		79.29	0.91		
		609.32*	45.49	2.60848E-001	8.90458E-002
		665.45	1.53		
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29	14.92		
		1155.21	1.63		
		1238.11	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2.13		
		1583.20	0.70		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		
		2204.06	4.92		
		2447.70	1.55		
PB-214	0.504	74.82*	5.80	1.70230E+000	4.95092E-001
		77.11*	9.70	8.91704E-001	2.63968E-001
		86.83	1.70		
		87.35*	2.24	1.53697E+000	1.68665E+000
		89.78	0.82		
		241.99	7.25		
		258.76	0.53		
		295.22	18.42		
		351.93*	35.60	2.75207E-001	8.50701E-002

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gram)	Activity Uncertainty
PB-214	0.504	785.96	1.06		
		839.07	0.58		
Ra-226	0.957	81.07	0.20		
		83.79	0.32		
		186.21*	3.64	2.62724E+000	1.61724E+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	0.966	9.966288E+000	1.611940E+000
Pb-212	0.997	3.754051E-001	6.841711E-002
BI-214	0.191	2.602887E-001	8.901459E-002
PB-214	0.504	2.926130E-001	8.081325E-002
Ra-226	0.957	2.627243E+000	1.617240E+000

? = 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 10:32:54 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 6	338.15	1.7120E-002	142.28	Tol.	AC-228
F 8	582.87	2.3732E-002	40.34		

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-5  
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	6.765E-001	6.77E-001	9.966E+000	2.747E-00
	Pb-210	46.54	4.25	2.452E+000	2.45E+000	3.140E+000	1.173E+00
	BI-212	727.33	6.67	1.904E+000	1.90E+000	-3.098E-001	8.963E-00
		785.37	1.10	1.174E+001		7.240E+000	5.510E+00
		1078.62	0.56	2.386E+001		-6.896E+000	1.100E+00
		1620.50	1.47	7.503E+000		-2.723E+000	3.247E+00
+	Pb-212	74.82*	10.28	3.985E-001	1.16E-001	9.604E-001	1.895E-00
		77.11*	17.10	2.469E-001		5.058E-001	1.177E-00
		86.83	2.07	2.494E+000		1.361E+000	1.204E+00
		87.35*	3.97	8.851E-001		8.672E-001	4.201E-00
		89.78	1.46	3.083E+000		-1.991E+000	1.481E+00
		115.18	0.60	6.038E+000		2.235E-001	2.880E+00
		238.63*	43.60	1.164E-001		3.480E-001	5.537E-00
		300.09	3.30	2.024E+000		-2.559E+000	9.654E-00
+	BI-214	76.86*	0.55	7.746E+000	1.30E-001	1.587E+001	3.694E+00
		79.29	0.91	6.589E+000		1.479E+000	3.189E+00
		609.32*	45.49	1.302E-001		2.608E-001	5.820E-00
		665.45	1.53	6.564E+000		3.206E+000	3.058E+00
		768.36	4.89	2.329E+000		-8.584E-001	1.084E+00
		806.18	1.26	8.755E+000		-4.753E+000	4.054E+00
		934.06	3.11	4.359E+000		1.537E+000	2.030E+00
		1120.29	14.92	1.142E+000		6.306E-001	5.348E-00
		1155.21	1.63	9.619E+000		5.974E+000	4.468E+00
		1238.11	5.83	3.093E+000		2.215E+000	1.445E+00
		1280.98	1.43	1.083E+001		4.694E-001	4.991E+00
		1377.67	3.99	3.161E+000		-6.644E-003	1.419E+00
		1385.31	0.79	1.754E+001		5.841E+000	7.952E+00
		1401.52	1.33	8.555E+000		-1.033E+001	3.785E+00
		1407.99	2.39	4.664E+000		-2.187E+000	2.058E+00
		1509.21	2.13	4.713E+000		-5.645E-001	2.029E+00
		1583.20	0.70	1.943E+001		2.540E-001	8.684E+00
		1661.27	1.05	1.141E+001		-1.205E+000	4.982E+00
		1729.59	2.88	3.802E+000		9.494E-001	1.628E+00
		1764.49	15.30	1.040E+000		7.624E-001	4.678E-00
		1847.43	2.03	6.507E+000		1.832E-001	2.841E+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	7.064E-001	1.21E-001	1.702E+000	3.359E-00
		77.11*	9.70	4.352E-001		8.917E-001	2.076E-00
		86.83	1.70	3.036E+000		1.657E+000	1.465E+00
		87.35*	2.24	1.569E+000		1.537E+000	7.445E-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	5.490E+000	1.21E-001	-3.546E+000	2.638E+00
		241.99	7.25	1.151E+000		5.436E-001	5.582E-00
		258.76	0.53	9.759E+000		4.250E+000	4.629E+00
		295.22	18.42	3.659E-001		5.327E-002	1.748E-00
		351.93*	35.60	1.208E-001		2.752E-001	5.535E-00
		785.96	1.06	1.185E+001		-1.993E+000	5.545E+00
		839.07	0.58	2.239E+001		4.340E+000	1.047E+00
+	Ra-226	81.07	0.20	2.257E+001	1.07E+000	3.010E+000	1.080E+00
		83.79	0.32	1.475E+001		-2.239E+000	7.092E+00
		186.21*	3.64	1.066E+000		2.627E+000	5.051E-00
	AC-228	89.96	1.90	1.701E+016	3.95E+015	-1.733E+016	8.188E+01
		93.35	3.10	1.003E+016		5.291E+015	4.824E+01
		99.51	1.26	1.908E+016		-3.906E+015	9.079E+01
		105.60	0.74	3.474E+016		-2.476E+016	1.660E+01
		129.07	2.42	1.082E+016		-3.900E+015	5.171E+01
		153.98	0.72	3.956E+016		1.070E+016	1.893E+01
		209.25	3.89	8.861E+015		-1.717E+015	4.237E+01
		214.85	0.76	4.278E+016		7.577E+015	2.038E+01
		270.24	3.46	1.098E+016		4.185E+015	5.216E+01
		328.00	2.95	1.442E+016		-2.300E+015	6.822E+01
		338.32	11.27	3.950E+015		2.603E+015	1.870E+01
		409.46	1.92	2.630E+016		5.611E+015	1.240E+01
		463.00	4.40	1.107E+016		-5.618E+015	5.161E+01
		562.50	0.87	7.768E+016		3.134E+016	3.655E+01
		674.75	2.10	3.341E+016		1.423E+016	1.557E+01
		726.86	0.62	1.408E+017		1.215E+016	6.630E+01
		755.32	1.00	8.014E+016		3.317E+016	3.743E+01
		772.29	1.49	5.413E+016		5.441E+015	2.526E+01
		794.95	4.25	2.002E+016		2.130E+015	9.360E+01
		830.49	0.54	1.525E+017		-2.193E+016	7.092E+01
		835.71	1.61	5.563E+016		1.204E+016	2.602E+01
		840.38	0.91	9.891E+016		1.281E+016	4.626E+01
		904.20	0.77	1.187E+017		-1.952E+017	5.534E+01
		911.20	25.80	4.097E+015		3.472E+015	1.928E+01
		964.77	4.99	2.176E+016		1.904E+016	1.022E+01
		968.97	15.80	6.975E+015		5.797E+015	3.279E+01
		1247.08	0.50	2.345E+017		5.892E+016	1.091E+01
		1459.14	0.83	3.074E+017		9.053E+017	1.481E+01
		1495.91	0.86	8.432E+016		1.559E+016	3.665E+01
		1588.20	3.22	3.127E+016		2.301E+016	1.409E+01
		1630.63	1.51	5.467E+016		6.993E+015	2.396E+01
	TH-230	67.67	0.38	1.524E+001	1.52E+001	5.105E+000	7.323E+00
	PA-234	742.81	0.11	1.082E+002	1.63E+001	-4.160E+001	5.055E+00
		766.42	0.32	3.745E+001		-1.107E+000	1.749E+00
		1001.03	0.84	1.628E+001		1.111E+000	7.551E+00
	TH-234	63.29	3.70	1.657E+000	1.66E+000	8.530E-001	7.952E-00
		92.38	2.13	2.232E+000		2.231E+000	1.075E+00
		92.80	2.10	2.213E+000		8.852E-001	1.065E+00
		112.81	0.21	1.855E+001		1.273E+001	8.879E+00
	U-234	53.20	0.12	5.641E+001	5.64E+001	5.504E+000	2.685E+00
		120.90	0.04	1.114E+002		4.956E+001	5.330E+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	1.377E+000	4.04E-001	-1.403E+000	6.630E-00
	93.35	5.54	8.205E-001		4.328E-001	3.946E-00
	104.82	0.69	5.593E+000		2.514E+000	2.674E+00
	105.60	1.31	2.869E+000		-2.044E+000	1.371E+00
	108.58	0.50	8.066E+000		2.115E+000	3.866E+00
	109.19	1.66	2.390E+000		4.141E-001	1.145E+00
	143.76	10.96	4.040E-001		9.781E-002	1.940E-00
	163.36	5.08	8.693E-001		3.929E-001	4.164E-00
	194.94	0.63	7.083E+000		1.283E+000	3.376E+00
	202.12	1.08	4.444E+000		1.530E+000	2.123E+00
	205.32	5.02	1.006E+000		-3.791E-002	4.813E-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]
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K-40	1460.8 ^	9.97E+000	16.174			
Pb-212	74.8	9.60E-001	27.673	2.760[36.043]	3.43	-0.628
	77.1	5.06E-001	28.200	1.453[36.449]		[ 0.361]
	87.3	8.67E-001	109.40	2.492[111.81]		
	238.6 ^	3.48E-001	23.093	1.000[32.658]		
BI-214	76.9	1.59E+001	28.343	60.843[44.370]	12.72	-1.984
	609.3 ^	2.61E-001	34.137	1.000[48.277]		[ 0.317]
PB-214	74.8	1.70E+000	29.084	6.186[42.443]	5.84	-0.996
	77.1	8.92E-001	29.603	3.240[42.800]		[ 0.344]
	87.3	1.54E+000	109.73	5.585[114.00]		
	351.9 ^	2.75E-001	30.911	1.000[43.715]		
Ra-226	186.2 ^	2.63E+000	61.557			