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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-2123\UNC-GFLU-21

Report Generated On : 7/6/2017 10:11:43 AM

Sample Title : UNC-GFLU-2123-S-P-3

Sample Description :

Sample Identification : UNC-GFLU-2123-S-

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 : 3.602E+002 grams

Sample Taken On : 6/1/2017 2:00:00 PM

Acquisition Started : 6/5/2017 9:32:58 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: UNC-GFLU-2123-S-P-3

Peak Analysis Performed on: 7/6/2017 10:11:40 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	295-	312	300.20	75.23	0.55	8.52E+001	81.61	2.94E+002
M	2	331-	353	336.85	84.41	0.68	7.24E+001	59.94	7.08E+001
m	3	331-	353	348.98	87.44	0.69	3.63E+001	32.14	7.98E+001
F	4	365-	376	373.44	93.56	0.44	8.03E+001	80.22	8.00E+001
F	5	567-	579	574.27	143.82	0.70	8.12E+001	54.02	7.48E+001
F	6	734-	749	741.83	185.75	1.04	4.26E+002	100.43	7.20E+001
F	7	947-	958	952.36	238.43	1.12	6.92E+001	26.76	5.25E+001
F	8	1173-	1184	1178.89	295.12	0.96	3.15E+001	14.87	3.96E+001
F	9	1320-	1327	1323.79	331.38	0.62	1.17E+001	8.01	1.28E+001
F	10	1400-	1410	1405.07	351.72	0.81	4.98E+001	16.82	3.19E+001
F	11	2424-	2439	2432.11	608.73	1.46	4.74E+001	43.09	1.73E+001
F	12	5823-	5848	5836.08	1460.56	2.72	1.67E+002	25.99	5.78E+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-GFLU-2123-S-P-3  
 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	0.989	1460.82*	10.66	7.64619E+000	1.31575E+000
Pb-212	0.629	74.82*	10.28	5.16171E-001	4.99521E-001
		77.11	17.10		
		86.83	2.07		
		87.35*	3.97	5.21163E-001	4.66278E-001
		89.78	1.46		
		115.18	0.60		
		238.63*	43.60	1.35385E-001	5.40902E-002
		300.09	3.30		
BI-214	0.980	76.86	0.55		
		79.29	0.91		
		609.32*	45.49	2.31772E-001	2.11621E-001
		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	0.615	74.82*	5.80	9.14868E-001	8.89135E-001
		77.11	9.70		
		86.83	1.70		
		87.35*	2.24	9.23669E-001	8.30148E-001
		89.78	0.82		
		241.99	7.25		
		258.76	0.53		
		295.22*	18.42	1.79795E-001	8.63448E-002
		351.93*	35.60	1.76345E-001	6.13964E-002

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gram)	Activity Uncertainty
PB-214	0.615	785.96	1.06		
		839.07	0.58		
Ra-226	0.966	81.07	0.20		
		83.79*	0.32	1.29913E+001	1.08777E+001
		186.21*	3.64	8.07160E+000	2.08576E+000
U-235	0.777	89.96	3.43		
		93.35*	5.54	8.07245E-001	8.12892E-001
		104.82	0.69		
		105.60	1.31		
		108.58	0.50		
		109.19	1.66		
		143.76*	10.96	4.36015E-001	2.93633E-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	0.989	7.646189E+000	1.315753E+000
Pb-212	0.629	1.422924E-001	5.334210E-002
BI-214	0.980	2.317724E-001	2.116208E-001
PB-214	0.615	1.808493E-001	4.986686E-002
Ra-226	0.966	8.246065E+000	2.048443E+000
U-235	0.777	4.788620E-001	2.761677E-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 10:11:40 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	331.38	6.5258E-003	68.16	Sum	

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-GFLU-2123-S-P-3  
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	6.911E-001	6.91E-001	7.646E+000	2.835E-00
	Pb-210	46.54	4.25	1.404E+000	1.40E+000	6.051E-001	6.622E-00
	BI-212	727.33	6.67	1.629E+000	1.63E+000	7.534E-001	7.607E-00
		785.37	1.10	1.037E+001		3.610E+000	4.836E+00
		1078.62	0.56	2.122E+001		2.255E+000	9.706E+00
		1620.50	1.47	7.770E+000		-4.520E+000	3.392E+00
+	Pb-212	74.82*	10.28	7.003E-001	7.90E-002	5.162E-001	3.419E-00
		77.11	17.10	3.255E-001		3.578E-003	1.579E-00
		86.83	2.07	1.972E+000		9.208E-003	9.488E-00
		87.35*	3.97	6.355E-001		5.212E-001	2.983E-00
		89.78	1.46	2.537E+000		1.591E+000	1.216E+00
		115.18	0.60	4.873E+000		4.459E-001	2.312E+00
		238.63*	43.60	7.899E-002		1.354E-001	3.685E-00
		300.09	3.30	1.572E+000		-1.195E+000	7.422E-00
+	BI-214	76.86	0.55	1.048E+001	1.16E-001	6.751E-001	5.089E+00
		79.29	0.91	4.524E+000		-1.842E+000	2.172E+00
		609.32*	45.49	1.156E-001		2.318E-001	5.120E-00
		665.45	1.53	6.381E+000		7.253E-001	2.976E+00
		768.36	4.89	2.153E+000		1.341E-001	9.993E-00
		806.18	1.26	8.497E+000		1.530E+000	3.937E+00
		934.06	3.11	3.947E+000		-1.070E-001	1.829E+00
		1120.29	14.92	1.072E+000		2.821E-001	5.006E-00
		1155.21	1.63	8.216E+000		-5.094E+000	3.777E+00
		1238.11	5.83	2.588E+000		1.059E+000	1.196E+00
		1280.98	1.43	8.320E+000		1.066E+000	3.748E+00
		1377.67	3.99	2.971E+000		1.062E+000	1.328E+00
		1385.31	0.79	1.473E+001		-3.991E+000	6.569E+00
		1401.52	1.33	8.151E+000		-1.182E+000	3.596E+00
		1407.99	2.39	4.651E+000		-1.198E+000	2.058E+00
		1509.21	2.13	6.022E+000		2.952E+000	2.692E+00
		1583.20	0.70	1.543E+001		5.293E+000	6.707E+00
		1661.27	1.05	1.146E+001		6.988E+000	5.021E+00
		1729.59	2.88	4.212E+000		9.978E-001	1.839E+00
		1764.49	15.30	9.473E-001		7.327E-001	4.224E-00
		1847.43	2.03	4.979E+000		-7.619E-001	2.085E+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	1.241E+000	1.05E-001	9.149E-001	6.060E-00
		77.11	9.70	5.739E-001		6.307E-003	2.784E-00
		86.83	1.70	2.402E+000		1.121E-002	1.155E+00
		87.35*	2.24	1.126E+000		9.237E-001	5.287E-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	4.518E+000	1.05E-001	2.833E+000	2.166E+00
		241.99	7.25	7.969E-001		-1.922E-001	3.823E-00
		258.76	0.53	8.746E+000		5.850E+000	4.138E+00
		295.22*	18.42	1.906E-001		1.798E-001	8.760E-00
		351.93*	35.60	1.050E-001		1.763E-001	4.769E-00
		785.96	1.06	1.047E+001		-3.181E+000	4.874E+00
		839.07	0.58	1.943E+001		-4.957E+000	9.015E+00
+	Ra-226	81.07	0.20	1.780E+001	9.67E-001	9.114E+000	8.493E+00
		83.79*	0.32	7.506E+000		1.299E+001	3.510E+00
		186.21*	3.64	9.671E-001		8.072E+000	4.579E-00
	AC-228	89.96	1.90	6.512E+004	1.51E+004	3.805E+004	3.131E+00
		93.35	3.10	4.068E+004		7.000E+003	1.958E+00
		99.51	1.26	7.959E+004		4.827E+004	3.795E+00
		105.60	0.74	1.298E+005		-6.450E+004	6.180E+00
		129.07	2.42	4.192E+004		3.484E+004	1.998E+00
		153.98	0.72	1.411E+005		-3.778E+004	6.698E+00
		209.25	3.89	3.286E+004		-4.700E+004	1.561E+00
		214.85	0.76	1.631E+005		9.302E+004	7.724E+00
		270.24	3.46	4.381E+004		5.194E+002	2.074E+00
		328.00	2.95	5.735E+004		-1.522E+004	2.700E+00
		338.32	11.27	1.508E+004		3.178E+003	7.090E+00
		409.46	1.92	1.119E+005		2.641E+004	5.269E+00
		463.00	4.40	4.689E+004		1.281E+004	2.183E+00
		562.50	0.87	2.919E+005		4.971E+004	1.360E+00
		674.75	2.10	1.458E+005		7.824E+002	6.795E+00
		726.86	0.62	5.378E+005		8.630E+004	2.509E+00
		755.32	1.00	3.281E+005		9.936E+004	1.525E+00
		772.29	1.49	2.248E+005		4.177E+003	1.045E+00
		794.95	4.25	7.634E+004		-1.323E+004	3.532E+00
		830.49	0.54	6.526E+005		-2.107E+005	3.030E+00
		835.71	1.61	2.306E+005		6.982E+004	1.074E+00
		840.38	0.91	4.009E+005		1.308E+005	1.864E+00
		904.20	0.77	5.437E+005		-5.737E+005	2.542E+00
		911.20	25.80	1.819E+004		1.449E+004	8.565E+00
		964.77	4.99	8.945E+004		4.509E+004	4.184E+00
		968.97	15.80	2.798E+004		1.294E+004	1.308E+00
		1247.08	0.50	8.034E+005		-6.395E+005	3.658E+00
		1459.14	0.83	1.222E+006		3.191E+006	5.861E+00
		1495.91	0.86	4.343E+005		1.105E+005	1.927E+00
		1588.20	3.22	1.055E+005		1.612E+004	4.586E+00
		1630.63	1.51	2.235E+005		-2.223E+003	9.674E+00
	TH-230	67.67	0.38	1.047E+001	1.05E+001	-1.415E+000	4.989E+00
	PA-234	742.81	0.11	8.927E+001	1.49E+001	-3.272E+001	4.121E+00
		766.42	0.32	3.369E+001		7.010E+000	1.566E+00
		1001.03	0.84	1.494E+001		-2.936E+000	6.900E+00
	TH-234	63.29	3.70	1.203E+000	1.20E+000	3.171E-001	5.744E-00
		92.38	2.13	1.998E+000		1.850E+000	9.635E-00
		92.80	2.10	2.004E+000		1.183E+000	9.662E-00
		112.81	0.21	1.385E+001		-1.249E+001	6.573E+00
	U-234	53.20	0.12	4.326E+001	4.33E+001	4.689E+001	2.057E+00
		120.90	0.04	8.831E+001		5.544E+000	4.201E+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	1.158E+000	2.62E-001	6.768E-001	5.569E-00
		93.35*	5.54	5.397E-001		8.072E-001	2.563E-00
		104.82	0.69	4.537E+000		3.730E-001	2.160E+00
		105.60	1.31	2.355E+000		-1.170E+000	1.121E+00
		108.58	0.50	6.759E+000		4.196E-001	3.231E+00
		109.19	1.66	1.993E+000		2.198E-002	9.520E-00
		143.76*	10.96	2.620E-001		4.360E-001	1.237E-00
		163.36	5.08	7.915E-001		7.778E-001	3.790E-00
		194.94	0.63	5.593E+000		-1.818E+000	2.643E+00
		202.12	1.08	4.008E+000		1.732E+000	1.912E+00
		205.32	5.02	8.934E-001		5.894E-001	4.266E-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-2123\UNC-GFLU-21

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 ^	7.65E+000	17.208			
Pb-212	74.8	5.16E-001	96.774	3.813[104.69]	6.77	-1.236
	87.3	5.21E-001	89.469	3.850[97.984]		[ 0.843]
	238.6 ^	1.35E-001	39.953	1.000[56.502]		
BI-214	609.3 ^	2.32E-001	91.305			
PB-214	74.8	9.15E-001	97.187	5.188[103.23]	6.71	-1.156
	87.3	9.24E-001	89.875	5.238[96.383]		[ 0.568]
	295.2	1.80E-001	48.024	1.020[59.317]		
	351.9 ^	1.76E-001	34.816	1.000[49.237]		
Ra-226	83.8	1.30E+001	83.731	1.610[87.628]	3.11	-0.596
	186.2 ^	8.07E+000	25.841	1.000[36.544]		[ 1.189]
U-235	93.3	8.07E-001	100.70	1.851[121.14]	7.09	-1.427
	143.8 ^	4.36E-001	67.345	1.000[95.240]		[ 3.569]