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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-0310\W3H-ERRU-03

Report Generated On : 7/6/2017 10:02:03 AM

Sample Title : W3H-ERRU-0310-S-P-6

Sample Description :

Sample Identification : 0310-S-P-6

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 : 2.800E+002 grams

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

Acquisition Started : 6/7/2017 10:03:46 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 : 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-ERRU-0310-S-P-6

Peak Analysis Performed on: 7/6/2017 10:02:00 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-	304	299.63	75.09	0.69	1.03E+002	23.05	1.13E+002
F	2	355-	364	360.17	90.24	0.34	4.02E+001	34.69	5.00E+001
F	3	569-	582	574.62	143.91	0.47	9.79E+001	44.77	8.58E+001
F	4	645-	659	651.96	163.26	0.65	6.28E+001	45.08	7.50E+001
F	5	735-	751	741.57	185.69	0.88	4.41E+002	40.44	7.65E+001
F	6	947-	957	952.13	238.38	0.95	4.63E+001	16.31	3.71E+001
F	7	2427-	2439	2433.38	609.05	1.09	2.43E+001	12.34	1.52E+001
F	8	5824-	5847	5834.97	1460.28	2.51	1.25E+002	22.64	4.00E+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: W3H-ERRU-0310-S-P-6  
 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	0.954	1460.82*	10.66	7.37738E+000	1.43977E+000
Pb-212	0.628	74.82*	10.28	8.03521E-001	2.10021E-001
		77.11	17.10		
		86.83	2.07		
		87.35	3.97		
		89.78*	1.46	1.99429E+000	1.73898E+000
		115.18	0.60		
		238.63*	43.60	1.16363E-001	4.26692E-002
		300.09	3.30		
BI-214	0.996	76.86	0.55		
		79.29	0.91		
		609.32*	45.49	1.52965E-001	7.86034E-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		
Ra-226	0.962	81.07	0.20		
		83.79	0.32		
		186.21*	3.64	1.07538E+001	1.50645E+000
U-235	0.740	89.96*	3.43	8.48874E-001	7.40701E-001
		93.35	5.54		
		104.82	0.69		
		105.60	1.31		
		108.58	0.50		
		109.19	1.66		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gram)	Activity Uncertainty
U-235	0.740	143.76*	10.96	6.76500E-001	3.17401E-001
		163.36*	5.08	1.00327E+000	7.27781E-001
		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	0.954	7.377378E+000	1.439773E+000
Pb-212	0.628	1.444684E-001	4.170069E-002
BI-214	0.996	1.529652E-001	7.860337E-002
Ra-226	0.962	1.075375E+001	1.506451E+000
U-235	0.740	7.364969E-001	2.704435E-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 10:01:59 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
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All peaks were identified.

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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-ERRU-0310-S-P-6  
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	7.524E-001	7.52E-001	7.377E+000	2.964E-00
	Pb-210	46.54	4.25	2.118E+000	2.12E+000	2.089E+000	1.007E+00
	BI-212	727.33	6.67	1.833E+000	1.83E+000	6.376E-001	8.475E-00
		785.37	1.10	1.224E+001		2.203E+000	5.671E+00
		1078.62	0.56	3.003E+001		1.450E+000	1.385E+00
		1620.50	1.47	1.127E+001		3.189E+000	4.999E+00
+	Pb-212	74.82*	10.28	4.678E-001	8.45E-002	8.035E-001	2.233E-00
		77.11	17.10	3.771E-001		4.603E-002	1.823E-00
		86.83	2.07	2.503E+000		2.132E-001	1.204E+00
		87.35	3.97	1.204E+000		-1.540E+000	5.768E-00
		89.78*	1.46	2.020E+000		1.994E+000	9.428E-00
		115.18	0.60	6.268E+000		-4.886E+000	2.974E+00
		238.63*	43.60	8.450E-002		1.164E-001	3.885E-00
		300.09	3.30	1.792E+000		-2.563E+000	8.396E-00
+	BI-214	76.86	0.55	1.198E+001	1.34E-001	1.592E+000	5.793E+00
		79.29	0.91	5.273E+000		1.121E+000	2.521E+00
		609.32*	45.49	1.335E-001		1.530E-001	5.825E-00
		665.45	1.53	8.498E+000		1.268E+000	3.973E+00
		768.36	4.89	2.836E+000		1.192E+000	1.319E+00
		806.18	1.26	1.055E+001		7.258E+000	4.873E+00
		934.06	3.11	4.050E+000		-2.081E+000	1.839E+00
		1120.29	14.92	1.138E+000		2.308E-001	5.238E-00
		1155.21	1.63	1.181E+001		-3.739E-001	5.481E+00
		1238.11	5.83	3.172E+000		-3.156E+000	1.459E+00
		1280.98	1.43	1.087E+001		-3.721E+000	4.907E+00
		1377.67	3.99	3.751E+000		-1.016E+000	1.672E+00
		1385.31	0.79	1.820E+001		-3.829E+000	8.075E+00
		1401.52	1.33	1.163E+001		4.156E+000	5.199E+00
		1407.99	2.39	6.608E+000		-2.686E-001	2.960E+00
		1509.21	2.13	6.297E+000		-1.013E-001	2.737E+00
		1583.20	0.70	2.149E+001		2.128E+000	9.451E+00
		1661.27	1.05	1.548E+001		2.963E+000	6.828E+00
		1729.59	2.88	5.977E+000		4.156E+000	2.644E+00
		1764.49	15.30	1.195E+000		8.938E-001	5.315E-00
		1847.43	2.03	6.972E+000		-2.114E-001	2.966E+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	1.198E+000	2.19E-001	1.538E+000	5.804E-00
		77.11	9.70	6.649E-001		8.114E-002	3.215E-00
		86.83	1.70	3.048E+000		2.596E-001	1.466E+00
		87.35	2.24	2.133E+000		-2.730E+000	1.022E+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	5.368E+000	2.19E-001	-7.023E+000	2.564E+00
		241.99	7.25	8.767E-001		-4.908E-001	4.176E-00
		258.76	0.53	1.007E+001		3.305E+000	4.733E+00
		295.22	18.42	3.649E-001		2.886E-001	1.725E-00
		351.93	35.60	2.191E-001		9.803E-002	1.034E-00
		785.96	1.06	1.273E+001		3.550E+000	5.899E+00
		839.07	0.58	2.328E+001		-1.999E+000	1.074E+00
+	Ra-226	81.07	0.20	2.175E+001	1.31E+000	-9.393E+000	1.035E+00
		83.79	0.32	1.722E+001		2.995E+001	8.295E+00
		186.21*	3.64	1.305E+000		1.075E+001	6.196E-00
	AC-228	89.96	1.90	1.864E+007	4.47E+006	-2.057E+007	8.938E+00
		93.35	3.10	1.115E+007		1.297E+007	5.342E+00
		99.51	1.26	1.921E+007		-7.045E+006	9.044E+00
		105.60	0.74	3.768E+007		-2.340E+007	1.789E+00
		129.07	2.42	1.110E+007		2.655E+006	5.248E+00
		153.98	0.72	4.179E+007		-4.606E+006	1.981E+00
		209.25	3.89	9.698E+006		-1.782E+007	4.598E+00
		214.85	0.76	4.420E+007		-5.452E+006	2.079E+00
		270.24	3.46	1.217E+007		8.233E+006	5.726E+00
		328.00	2.95	1.527E+007		-2.828E+006	7.127E+00
		338.32	11.27	4.466E+006		-6.118E+005	2.095E+00
		409.46	1.92	2.791E+007		2.488E+006	1.296E+00
		463.00	4.40	1.533E+007		2.573E+006	7.172E+00
		562.50	0.87	8.830E+007		-3.928E+006	4.111E+00
		674.75	2.10	3.888E+007		-1.009E+007	1.794E+00
		726.86	0.62	1.414E+008		1.012E+007	6.522E+00
		755.32	1.00	8.547E+007		-3.289E+007	3.922E+00
		772.29	1.49	6.743E+007		4.315E+007	3.130E+00
		794.95	4.25	2.109E+007		-1.045E+007	9.676E+00
		830.49	0.54	1.783E+008		-3.154E+007	8.205E+00
		835.71	1.61	6.197E+007		2.052E+007	2.858E+00
		840.38	0.91	1.102E+008		1.352E+007	5.083E+00
		904.20	0.77	1.494E+008		-7.421E+007	6.930E+00
		911.20	25.80	4.526E+006		2.589E+006	2.101E+00
		964.77	4.99	2.690E+007		3.098E+007	1.257E+00
		968.97	15.80	8.113E+006		6.174E+006	3.778E+00
		1247.08	0.50	2.632E+008		-1.873E+007	1.207E+00
		1459.14	0.83	3.345E+008		8.018E+008	1.597E+00
		1495.91	0.86	1.237E+008		3.764E+007	5.437E+00
		1588.20	3.22	3.482E+007		-8.791E+006	1.531E+00
		1630.63	1.51	7.415E+007		-2.540E+006	3.249E+00
	TH-230	67.67	0.38	1.207E+001	1.21E+001	-4.879E+000	5.720E+00
	PA-234	742.81	0.11	1.191E+002	1.90E+001	6.581E+001	5.514E+00
		766.42	0.32	4.195E+001		4.026E-001	1.945E+00
		1001.03	0.84	1.904E+001		3.373E+000	8.788E+00
	TH-234	63.29	3.70	1.431E+000	1.43E+000	7.944E-001	6.807E-00
		92.38	2.13	2.416E+000		2.836E+000	1.162E+00
		92.80	2.10	2.377E+000		2.542E+000	1.142E+00
		112.81	0.21	1.825E+001		-1.277E+001	8.670E+00
	U-234	53.20	0.12	5.502E+001	5.50E+001	2.882E+001	2.615E+00
		120.90	0.04	1.040E+002		-8.405E+000	4.926E+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	8.597E-001	3.68E-001	8.489E-001	4.013E-00
		93.35	5.54	8.452E-001		9.837E-001	4.051E-00
		104.82	0.69	5.341E+000		-2.279E+000	2.531E+00
		105.60	1.31	2.885E+000		-1.792E+000	1.370E+00
		108.58	0.50	8.161E+000		-2.816E+000	3.890E+00
		109.19	1.66	2.459E+000		-3.606E-001	1.172E+00
		143.76*	10.96	3.677E-001		6.765E-001	1.745E-00
		163.36*	5.08	8.149E-001		1.003E+000	3.858E-00
		194.94	0.63	7.127E+000		2.667E+000	3.366E+00
		202.12	1.08	4.876E+000		-2.041E+000	2.319E+00
		205.32	5.02	1.120E+000		4.664E-001	5.341E-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-0310\W3H-ERRU-03

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	^	7.38E+000	19.516			
Pb-212	74.8		8.04E-001	26.138	6.905[45.031]	9.87	-1.795
	89.8		1.99E+000	87.198	17.138[94.595]		[ 0.582]
	238.6	^	1.16E-001	36.669	1.000[51.858]		
BI-214	609.3	^	1.53E-001	51.386			
Ra-226	186.2	^	1.08E+001	14.009			
U-235	90.0		8.49E-001	87.257	1.255[99.071]	-0.04	0.041
	143.8	^	6.76E-001	46.918	1.000[66.352]		[ 2.106]
	163.4		1.00E+000	72.541	1.483[86.391]		