ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Daily QC's						
Date	Bkgd	Source #1 (Cs-137) α / β / γ	Source #2 (N/A) α / β / γ	Source #3 (N/A) α / β / γ	Battery OK	Tech
3/19/08	5	1,100	—	—	(Yes) / No	KMA
3/20/08	5	1,100	—	—	(Yes) / No	KMA
3/21/08	5	1100	—	—	(Yes) / No	GB
3/24/08	5	1,100	—	—	(Yes) / No	KMA
3/25/08	5	1,000	—	—	(Yes) / No	KMA
3/26/08	5	1,100	—	—	(Yes) / No	KMA
3/27/08	5	1,050	—	—	(Yes) / No	KMA
3/28/08	5	1,100	—	—	(Yes) / No	KMA
3/31/08	5	1,100	—	—	(Yes) / No	KMA
04/01/08	5	1,100	—	—	(Yes) / No	KMA
04/02/08	5	1,100	—	—	(Yes) / No	KMA
04/03/08	5	1,100	—	—	(Yes) / No	KMA
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum	2360	193675	43-37	216984	5/30/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
	1	Th-230 1149	Tc-99 1130	N/A	5/30/08

Date 3/10/08

Intial QC's	1	2	3	4	5	6	7	8	9	10	Tech
Bkgd	11/364	9/387	8/412	9/362	10/339	6/377	9/325	8/398	13/332	8/322	GB
Source #1	3104	2948	3340	2869	2754	3017	3301	2916	2904	2760	GB
Source #2	2592	2551	2478	2366	2434	2689	2370	2559	2506	2624	GB
Source #3	—	—	—	—	N/A	—	—	—	—	—	KMA

Daily QC's

Date	Bkgd	Source #1 (Th-230) α / β / γ	Source #2 (Tc-99) α / β / γ	Source #3 (N/A) α / β / γ	Battery OK	Tech
3/10/08	9/339	2911	2509	—	(Yes) / No	GB
3/11/08	8/359	3243	2642	—	(Yes) / No	KMA
3/12/08	9/424	3338	2653	—	(Yes) / No	KMA
3/13/08	7/325	2762	2583	—	(Yes) / No	KMA
3/14/08	7/363	2909	2590	—	(Yes) / No	KMA
3/17/08	8/322	2837	2507	—	(Yes) / No	KMA
3/18/08	7/370	2725	2662	—	(Yes) / No	KMA
3/19/08	6/391	2755	2759	—	(Yes) / No	KMA
3/20/08	8/370	2802	2674	—	(Yes) / No	KMA
3/21/08	9/404	3318	2645	—	(Yes) / No	KMA
3/24/08	NOT SOURCE CHECKED	—	—	—	(Yes) / No	KMA
3/25/08	7/371	3015	GB 3/26/08 2765	—	(Yes) / No	KMA
3/26/08	6/329	2971	2388	—	(Yes) / No	KMA
3/28/08	3/415	2887	FAILED	—	(Yes) / No	KMA
3/31/08	3/381	2898	N/A	—	(Yes) / No	KMA
4/02/08	7/332	3030	2615	—	(Yes) / No	KMA

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Daily QC's						
Date	**Bkgd**	**Source #1** (Th-230) α / β / γ	**Source #2** (Tc-99) α / β / γ	**Source #3** (—) α / β / γ	**Battery OK**	**Tech**
04/03/08	2/344			—	Yes / No	KMA
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum	2360	193675	43-37	216984	05/30/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
1	1	Th-230 1149	Tc-99 1130	N/A	05/30/08

Date	2/26/08										
Intial QC's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tech**
Bkgd	9/444	8/506	10/429	5/446	4/452	4/447	6/483	5/471	9/498	6/499	GB
Source #1	~~3418~~ 3412	3039	3624	3059	3178	3216	3553	3338	3135	3438	GB
Source #2	2881	2975	3001	2971	2993	2904	2981	3161	2937	2952	GB
Source #3	—	—	—	—	— N/A	—	—	—	—	—	—

Daily QC's							
Date	**Bkgd**	**Source #1** (Pu-230) α / β / γ	**Source #2** (Tc-99) α / β / γ	**Source #3** ( ) α / β / γ	**Battery OK**	**Tech**
2/26/08	9/495	3241	2966	—	(Yes) / No	GB
2/27/08	7/496	3051	3006	—	(Yes) / No	KMA
2/28/08	9/450	3367	2873	—	(Yes) / No	KMA
2/29/08	10/418	2907	2850	—	(Yes) / No	RLS
3/3/08	9/437	2906	2878	—	(Yes) / No	KMA
3/4/08	10/449	3059	2970	—	(Yes) / No	KMA
3/5/08	12/424	3204	3135	—	(Yes) / No	KMA
3/6/08	5/477	2912	2845	—	(Yes) / No	RLS
3/7/08	12/413	3539	2775	—	(Yes) / No	KMA
3/10/08	Changed mylar, instrument would not fall in, re-did initial QC measurements				Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum	2360	184938	43-37	178371	7/19/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
1	1	Th-230 1149	Tc-99 1130	N/A	7/19/07

Date	3/13/08										
Intial QC's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tech**
Bkgd	2/407	1/452	1/411	4/516	3/438	2/428	5/409	5/442	2/413	3/390	GB
Source #1	3522	2951	3295	3085	3758	2855	3051	3039	3396	2978	GB
Source #2	2788	2692	2865	3188	2897	2782	3392	2954	2972	3095	GB
Source #3	—	—	—	—	N/A	—	—	—	—	—	KMA

Daily QC's						
Date	**Bkgd**	**Source #1** (Th 230) α / β / γ	**Source #2** (Tc-99) α / β / γ	**Source #3** ( ) α / β / γ	**Battery OK**	**Tech**
3/13/08	3/422	2991	3156	—	(Yes) / No	GB
3/14/08	2/467	3372	2938	—	(Yes) / No	KMA
3/21/08	3/391	2995	2929	—	(Yes) / No	KMA
3/24/08	3/405	3195	3254	—	(Yes) / No	KMA
3/25/08	3/360	3069	2765	—	(Yes) / No	KMA
3/26/08	1/418	3006	2845	—	(Yes) / No	KMA
3/27/08	4/387	2961	2770	—	(Yes) / No	KMA
3/28/08	5/430	3081	KMA ~~3040~~ 2967	—	(Yes) / No	KMA
3/31/08	1/384	2962	2726	—	(Yes) / No	KMA
4/01/08	1/371	2728	2756	—	(Yes) / No	KMA
4/2/08	3/374	3030	2750	—	(Yes) / No	KMA
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY . .LD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum	2360	184938	43-37	PR178371	07/19/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
1	1	Th-230 1149	Tc-99 1136	—	07/19/08

Date	2/26/08										
Intial QC's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tech**
Bkgd	1/518	2/496	5/516	1/538	2/557	5/539	6/492	2/517	4/511	3/516	GB
Source #1	3225	3256	4087	3095	3187	3907	3139	3404	3083	2948	GB
Source #2	3128	3466	3075	3119	3016	3554	3228	3091	3057	3149	GB
Source #3	—	—	—	—	— N	A —	—	—	—	—	

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α / β / γ**	**Source #2 ( ) α / β / γ**	**Source #3 ( ) α / β / γ**	**Battery OK**	**Tech**
2/26/08	0/528	3168	3197	—	(Yes) / No	GB
2/27/08	2/532	3287	3167	—	(Yes) / No	KMA
2/28/08	4/501	3135	3102	—	(Yes) / No	KMA
3/13/08					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum RLS	~~2360~~ 2224	183048	43-68	PR161781	12/19/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
1 min	1 min	Th^{230} 1149	Tc^{99} 1130	NA	12/19/08

Date 2/27/08

Intial QC's	1	2	3	4	5	6	7	8	9	10	Tech
Bkgd	3/170	5/167	2/165	3/178	2/170	2/172	5/158	2/149	4/171	0/151	RLS
Source #1	3802	3766	3855	3711	3808	3816	3949	3770	3834	3726	GTB
Source #2	3058	3160	3103	3237	3040	3162	3117	3125	3071	2996	GTB
Source #3	—	—	—	—	— N/A	—	—	—	—	—	—

Daily QC's

Date	Bkgd	Source #1 (Th^{230}) α / β / γ	Source #2 (Tc^{99}) α / β / γ	Source #3 ( ) α / β / γ	Battery OK	Tech
2/27/08	2/170	3821	3176	—	(Yes) / No	GTB
2/28/08	OUT OF	SLUICE	— N/A —		Yes / No	KMA
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Make	Model	S/N	Probe	S/N	DOC
Ludlum	2360	193667	43-68	120548	8/15/07
Bkgd Count	**Source Count**	**Source #1 ID**	**Source #2 ID**	**Source #3 ID**	**CDD**
1 MIN	1 MIN	Th^{232}	Tc^{99} 1130	NA	8/15/08

Date	2/28/08										
Intial QC's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tech**
Bkgd	0/133	0/135	1/140	0/123	1/145	1/124	0/138	0/130	0/158	0/132	RLS
Source #1	1077	1097	1039	1095	1143	1088	1129	1081	1181	1146	GTB
Source #2	2899	3044	2920	3004	3020	3035	2931	2945	2854	2980	RLS
Source #3	—	—	—	—	N/A	—	—	—	—	—	—

Daily QC's

Date	Bkgd	Source #1 (Th^{230}) α / β / γ	Source #2 (Tc^{99}) α / β / γ	Source #3 ( ) α / β / γ	Battery OK	Tech
2/28/08	1/130	1122	2930	—	Yes / No	RLS
2/29/08	0/121	1085	2902	—	Yes / No	KMA
03/03/08	1/149	1178	2951	—	Yes / No	KMA
03/04/08	0/146	1081	2861	—	Yes / No	KMA
03/05/08	0/153	1231	2905	—	Yes / No	KMA
3/06/08	0/138	1108	2978	—	Yes / No	RLS
3/07/08	0/143	1163	2916	—	Yes / No	KMA
3/10/08	1/147	1079	2933	—	Yes / No	KMA
3/11/08	0/132	1253	2913	—	Yes / No	KMA
3/12/08	KMA ~~0/168~~ 0/153	1190	2939	—	Yes / No	KMA
3/13/08	1/152	1183	2893	—	Yes / No	KMA
3/14/08	0/~~136~~ GB 3/14/08	1238	2979	—	Yes / No	KMA
3/17/08	0/140	1251	2981	—	Yes / No	KMA
3/18/08	1/144	1201	2918	—	Yes / No	KMA
3/19/08	0/139	1199 - Question	2944	—	Yes / No	KMA
3/20/08	0/125	1195 - Question	2970	—	Yes / No	KMA

ABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

DAILY FIELD LOG
Instrument QC

units are cpm or ur/hr

Daily QC's						
Date	Bkgd	Source #1 (Th-230) α / β / γ	Source #2 (Tc-99) α / β / γ	Source #3 (N/A) α / β / γ	Battery OK	Tech
3/21/08	1/138	1197	2946	—	(Yes) / No	GB
3/24/08	0/133	1227	2970	—	(Yes) / No	KMA
3/25/08	1/122	1171	2982	—	(Yes) / No	KMA
3/26/08	0/136	1100	3025	—	(Yes) / No	KMA
3/27/08	0/144	1059	2895	—	(Yes) / No	KMA
3/28/08	0/150	1190	3040	—	(Yes) / No	KMA
3/31/08	0/129	1190	2949	—	(Yes) / No	KMA
4/01/08	1 GB 4/1/08 / 125	1103	2911	—	(Yes) / No	KMA
4/02/08	0/146	1187	2936	—	(Yes) / No	KMA
4/03/08	1 GB 4/3/08 / 149	1084	2975	—	(Yes) / No	KMA
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2929	Detector:	43-10-1	Calibration Date:	2/3/2009
Serial #:	180830	Serial #:	PR207849	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	100				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.3440	Th-230	99TH470 0992	5,070	7/18/2006	7.54E+04	5,070	20	20	1	0.04	0.05	1743.0	31.63
Beta	0.2390	Tc-99	5649-06	14,800	2/28/2006	2.11E+05	14,800	200	20	1	42.98	1.24	3538.0	70.17

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
2/24/2009	0	868	1800	3625	0.0	43.4	1800.0	3581.6	PASS	PASS	PASS	PASS	8.72	105	Yes	Yes		
2/25/2009	3	794	1708	3513	0.2	39.7	1707.9	3473.3	*QUESTION*	*QUESTION*	PASS	PASS	12.52	101	Yes	Yes		
2/26/2009	3	830	1680	3647	0.2	41.5	1679.9	3605.5	*QUESTION*	PASS	PASS	PASS	12.52	103	Yes	Yes		
2/27/2009	1	803	1758	3641	0.1	40.2	1758.0	3600.9	PASS	*QUESTION*	PASS	PASS	10.91	102	Yes	Yes		
3/2/2009	1	834	1716	3595	0.1	41.7	1716.0	3553.3	PASS	PASS	PASS	PASS	10.91	104	Yes	Yes		
3/3/2009	3	854	1783	3760	0.2	42.7	1782.9	3717.3	*QUESTION*	PASS	PASS	*QUESTION*	12.52	105	Yes	Yes		
3/4/2009	0	831	1786	3678	0.0	41.6	1786.0	3636.5	PASS	PASS	PASS	PASS	8.72	103	Yes	Yes		
3/5/2009	1	855	1782	3545	0.1	42.8	1782.0	3502.3	PASS	PASS	PASS	PASS	10.91	105	Yes	Yes		
3/6/2009	1	861	1702	3743	0.1	43.1	1702.0	3700.0	PASS	PASS	PASS	*QUESTION*	10.91	105	Yes	Yes		
3/9/2009	1	835	1763	3532	0.1	41.8	1763.0	3490.3	PASS	PASS	PASS	PASS	10.91	104	Yes	Yes		
3/10/2009	2	889	1705	3721	0.1	44.5	1704.9	3676.6	PASS	PASS	PASS	PASS	11.82	107	Yes	Yes		
3/11/2009	3	866	1763	3709	0.2	43.3	1762.9	3665.7	*QUESTION*	PASS	PASS	PASS	12.52	105	Yes	Yes		
3/12/2009	1	912	1735	3595	0.1	45.6	1735.0	3549.4	PASS	*QUESTION*	PASS	PASS	10.91	108	Yes	Yes		
3/13/2009	2	864	1666	3652	0.1	43.2	1665.9	3608.8	PASS	PASS	*QUESTION*	PASS	11.82	105	Yes	Yes		

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart									
	Initial bkg counts				Initial source plus bkg counts				
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm	
1	1	0.05	859	42.95	1725	1725	3688	3688	
2	0	0	853	42.65	1713	1713	3599	3599	
3	0	0	882	44.1	1728	1728	3479	3479	
4	0	0	816	40.8	1692	1692	3655	3655	
5	1	0.05	858	42.9	1782	1782	3498	3498	
6	3	0.15	900	45	1760	1760	3587	3587	
7	1	0.05	853	42.65	1738	1738	3657	3657	
8	0	0	871	43.55	1771	1771	3550	3550	
9	0	0	876	43.8	1731	1731	3562	3562	
10	2	0.1	828	41.4	1790	1790	3535	3535	
Mean		0.04		43.0		1743.0		3581.0	
$S_{(n-1)}$		0.05		1.24		31.66		69.76	
-3 sigma		-0.11		39.26		1648.02		3371.73	
+3 sigma		0.19		46.70		1837.98		3790.27	
-2 sigma		-0.06		40.50		1679.68		3441.49	
+2 sigma		0.14		45.46		1806.32		3720.51	
					Mean-bkg	1743.0		3538.0	
					$S_{(n-1)}$	31.63		70.17	
				Mean-bkg	-3 sigma	1648.06		3327.52	
				Mean-bkg	+3 sigma	1837.86		3748.52	
				Mean-bkg	-2 sigma	1679.69		3397.69	
				Mean-bkg	+2 sigma	1806.23		3678.35	
						1724.95		3645.05	
						1713		3556.35	
						1728		3434.9	
						1692		3614.2	
						1781.95		3455.1	
						1759.85		3542	
						1737.95		3614.35	
						1771		3506.45	
						1731		3518.2	
						1789.9		3493.6	

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2360	Detector:	43-37	Calibration Date:	7/24/2008
Serial #:	184938	Serial #:	PR178371	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	582				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.1260	Th-230	99TH470 0992	5,070	7/18/2006	7.54E+04	5,070	100	1	1	2.50	1.18	640.5	205.14
Beta	0.2470	Tc-99	5649-06	14,800	2/28/2006	2.11E+05	14,800	1500	1	1	499.50	56.48	3660.8	101.24

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
3/10/2009	2	555	683	4136	2.0	555.0	681.0	3581.0	PASS	PASS	PASS	PASS	13.06	78	Yes	Yes		
3/11/2009	3	634	747	4141	3.0	634.0	744.0	3507.0	PASS	*QUESTION*	PASS	PASS	15.08	84	Yes	Yes		
3/12/2009	2	543	692	4176	2.0	543.0	690.0	3633.0	PASS	PASS	PASS	PASS	13.06	78	Yes	Yes		
3/13/2009	2	651	702	4144	2.0	651.0	700.0	3493.0	PASS	*QUESTION*	PASS	PASS	13.06	85	Yes	Yes		

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart								
	Initial bkg counts				Initial source plus bkg counts			
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm
1	1	1	405	405	709	709	4083	4083
2	3	3	408	408	764	764	4249	4249
3	1	1	462	462	729	729	4137	4137
4	3	3	509	509	694	694	4148	4148
5	3	3	534	534	696	696	4360	4360
6	3	3	571	571	707	707	4132	4132
7	4	4	547	547	702	702	4169	4169
8	2	2	528	528	66	66	4081	4081
9	1	1	512	512	635	635	4083	4083
10	4	4	519	519	728	728	4161	4161
Mean		2.50		499.5		643.0		4160.3
$S_{(n-1)}$		1.18		56.48		205.37		86.64
-3 sigma		-1.04		330.07		26.88		3900.38
+3 sigma		6.04		668.93		1259.12		4420.22
-2 sigma		0.14		386.55		232.26		3987.02
+2 sigma		4.86		612.45		1053.74		4333.58
					Mean-bkg	640.5		3660.8
					$S_{(n-1)}$	205.14		101.24
				Mean-bkg	-3 sigma	25.08		3357.09
				Mean-bkg	+3 sigma	1255.92		3964.51
				Mean-bkg	-2 sigma	230.22		3458.33
				Mean-bkg	+2 sigma	1050.78		3863.27
						708		3678
						761		3841
						728		3675
						691		3639
						693		3826
						704		3561
						698		3622
						64		3553
						634		3571
						724		3642

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2360	Detector:	43-89	Calibration Date:	11/13/2008
Serial #:	145481	Serial #:	PR154732	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	125				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.1620	Th-230	99TH470 0992	5,070	7/18/2006	7.54E+04	5,070	100	1	1	0.50	0.71	820.2	71.38
Beta	0.0510	Tc-99	5649-06	14,800	2/28/2006	2.11E+05	14,800	1500	1	1	112.30	10.66	760.1	36.62

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
2/24/2009	1	106	778	882	1.0	106.0	777.0	776.0	PASS	PASS	PASS	PASS	37.79	798	Yes	Yes		
2/25/2009	0	115	781	949	0.0	115.0	781.0	834.0	PASS	PASS	PASS	*QUESTION*	14.81	830	Yes	Yes		
2/26/2009	0	108	867	834	0.0	108.0	867.0	726.0	PASS	PASS	PASS	PASS	14.81	806	Yes	Yes		
2/27/2009	0	117	855	888	0.0	117.0	855.0	771.0	PASS	PASS	PASS	PASS	14.81	837	Yes	Yes		
3/2/2009	0	99	774	896	0.0	99.0	774.0	797.0	PASS	PASS	PASS	PASS	14.81	773	Yes	Yes		
3/3/2009	0	86	812	906	0.0	86.0	812.0	820.0	PASS	*QUESTION*	PASS	PASS	14.81	724	Yes	Yes		
3/4/2009	1	101	810	963	1.0	101.0	809.0	862.0	PASS	PASS	PASS	*QUESTION*	37.79	781	Yes	Yes		
3/5/2009	1	97	752	974	1.0	97.0	751.0	877.0	PASS	PASS	PASS	**FAIL**	37.79	766	Yes	Yes		
3/5/09-R	0	98	787	832	0.0	98.0	787.0	734.0	PASS	PASS	PASS	PASS	14.81	770	Yes	Yes		
3/6/2009	1	114	779	899	1.0	114.0	778.0	785.0	PASS	PASS	PASS	PASS	37.79	826	Yes	Yes		
3/9/2009	0	93	784	869	0.0	93.0	784.0	776.0	PASS	PASS	PASS	PASS	14.81	751	Yes	Yes		
3/10/2009	0	92	745	847	0.0	92.0	745.0	755.0	PASS	PASS	PASS	PASS	14.81	747	Yes	Yes		
3/11/2009	0	98	766	836	0.0	98.0	766.0	738.0	PASS	PASS	PASS	PASS	14.81	770	Yes	Yes		
3/12/2009	1	104	827	866	1.0	104.0	826.0	762.0	PASS	PASS	PASS	PASS	37.79	791	Yes	Yes		
3/13/2009	0	113	748	832	0.0	113.0	748.0	719.0	PASS	PASS	PASS	PASS	14.81	823	Yes	Yes		

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart								
	Initial bkg counts				Initial source plus bkg counts			
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm
1	0	0	124	124	806	806	864	864
2	0	0	106	106	778	778	816	816
3	1	1	103	103	773	773	869	869
4	2	2	114	114	779	779	922	922
5	0	0	107	107	774	774	834	834
6	1	1	116	116	816	816	879	879
7	0	0	123	123	790	790	835	835
8	1	1	128	128	785	785	903	903
9	0	0	108	108	949	949	908	908
10	0	0	94	94	957	957	894	894
Mean		0.50		112.3		820.7		872.4
$S_{(n-1)}$		0.71		10.66		71.11		35.45
-3 sigma		-1.62		80.33		607.36		766.05
+3 sigma		2.62		144.27		1034.04		978.75
-2 sigma		-0.91		90.99		678.48		801.50
+2 sigma		1.91		133.61		962.92		943.30
					Mean-bkg	820.2		760.1
					$S_{(n-1)}$	71.38		36.62
				Mean-bkg	-3 sigma	606.05		650.25
				Mean-bkg	+3 sigma	1034.35		869.95
				Mean-bkg	-2 sigma	677.43		686.87
				Mean-bkg	+2 sigma	962.97		833.33
						806		740
						778		710
						772		766
						777		808
						774		727
						815		763
						790		712
						784		775
						949		800
						957		800

MJW Technical Services
243 Root St.
Suite 100
Olean, New York 14760
Voice: (716) 372-5300
Fax: (716) 372-5307

Certificate Of Calibration

This Certificate will be accompanied by Calibration Charts or Readings where Applicable

Customer

Customer Name: Cabrera Services Inc

Address: 473 Silver Lane
East Hartford, CT 06118

Contact Name: Chuck Mikaitis

Customer PO/
CC. Number: 09-1154

Work Order
Number: 2008-890

Instrument

Manufacturer: Ludlum Measurements

Model: 2360 Serial Number: 145481

Detector Manufacturer: Ludlum Measurements

Det. Model: 43-89 Serial Number: PR154732

Meterface: 202-855 Calibration Method: Electronic

Instrument Received: ☑ Within Toler. +-10% ☐ Within 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other (See Comments)

☑ Geotropism ☑ Meter Zero ☑ Mech. Ck. ☑ HV Readout ☑ Battery Check ☑ Reset

☑ Audio ☑ Window Status ☐ FS Response ☐ Linearity ☐ Background Subtract ☑ Alarm Set

Temperature: 70.9 F Humidity: 37 % Pressure: 731.5 mm Hg Altitude: 1450 ft

Instrument Calibration

Multiplier\Range	Calibration Point	Instrument Response	
		Before Calibration	After Calibration
X 1	100 cpm	96 cpm	96 cpm
X 1	400 cpm	397 cpm	397 cpm
X 10	1 Kcpm	0.96 Kcpm	0.96 Kcpm
X 10	4 Kcpm	3.98 Kcpm	3.98 Kcpm
X 100	10 Kcpm	9.5 Kcpm	9.5 Kcpm
X 100	40 Kcpm	39.8 Kcpm	39.8 Kcpm
X 1K	100 Kcpm	96 Kcpm	96 Kcpm
X 1K	400 Kcpm	398 Kcpm	398 Kcpm
Digital Scaler	40 cpm	40 cpm	40 cpm
Digital Scaler	400 cpm	398 cpm	398 cpm
Digital Scaler	4 Kcpm	3.984 Kcpm	3.984 Kcpm
Digital Scaler	40 Kcpm	39.847 Kcpm	39.847 Kcpm
Digital Scaler	400 Kcpm	398.47 Kcpm	398.47 Kcpm

Reference instruments and / or Sources

Pulser: 500-2	220100		
Pu-239	C7-640	Th-230	C7-643
C-14	C7-804	SrY-90	C7-638
Tc-99	C7-642		

Comments

Inst. Voltage: 836 V

Alpha threshold: 126 mV
Beta threshold: 3.4 mV
Beta window: 33.4 mV

4pi efficiencies on contact
C14 = 0.4%
Sr90 = 15.6%
Tc99 = 6.1%
Th230 = 17%

Alpha crosstalk in the Beta channel is <10%
Beta crosstalk in the Alpha channel is <1%

Statement of Certification

MJW Technical Sevices, Inc certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ISO/IEC 17025 and ANSI N323. The Instrument listed above was inspected prior to shipment and it met all the manufacturer's published operating specifications. (MJW technical Services is not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: K T Rakyua

Reviewed By: [signature] Date 11-13-08

Calibration Date: 11/12/2008

Calibration Due: 11/12/2009

MJW Technical Services
243 Root St.
Suite 100
Olean, New York 14760
Voice: (716) 372-5300
Fax: (716) 372-5307

Certificate Of Calibration

This Certificate will be accompanied by Calibration Charts or Readings where Applicable

Customer	Instrument
Customer Name: Cabrera Services Inc	Manufacturer: Ludlum Measurements
Address: 473 Silver Lane East Hartford, CT 06118	Model: 2360 Serial Number: 184938 Detector Manufacturer: Ludlum Measurements
Contact Name: Chuck Mikaitis	Det. Model: 43-37 Serial Number: PR178371
Customer PO/ CC. Number: 09-1008 Work Order Number: 2008-687	Meterface: 202-855 Calibration Method: Electronic

Instrument Received: ☑ Within Toler. +-10% ☐ Within 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other (See Comments)

☑ Geotropism ☑ Meter Zero ☑ Mech. Ck. ☐ HV Readout ☑ Battery Check ☑ Reset

☑ Audio ☐ Window Status ☐ FS Response ☑ Linearity ☐ Background Subtract ☐ Alarm Set

Temperature: 72.4 F Humidity: 57 % Pressure: 721.4 mm Hg Altitude: 1455 ft

Instrument Calibration

Multiplier\Range	Calibration Point	Instrument Response	
		Before Calibration	After Calibration
X 1	100 cpm	100 cpm	100 cpm
X 1	400 cpm	400 cpm	400 cpm
X 10	1 Kcpm	1 Kcpm	1 Kcpm
X 10	4 Kcpm	4 Kcpm	4 Kcpm
X 100	10 Kcpm	10 Kcpm	10 Kcpm
X 100	40 Kcpm	40 Kcpm	40 Kcpm
X 1K	100 Kcpm	100 Kcpm	100 Kcpm
X 1K	400 Kcpm	400 Kcpm	400 Kcpm
Digital Scaler	40 cpm	40 cpm	40 cpm
Digital Scaler	400 cpm	398 cpm	398 cpm
Digital Scaler	4 Kcpm	3.987 Kcpm	3.987 Kcpm
Digital Scaler	40 Kcpm	39.867 Kcpm	39.867 Kcpm
Digital Scaler	400 Kcpm	398.65 Kcpm	398.65 Kcpm

Reference instruments and / or Sources

Pulser: 500-2	220106		
Pu-239	C7-636	Th-230	C7-643
C-14	C7-804	SrY-90	C7-638
Tc-99	C7-642		

Comments

Inst. Voltage: 1700 V

Alpha threshold: 100 mV
Beta threshold: 4 mV
Beta window: 40 mV

4pi efficiencies on contact with detector surface
C14 = 7.9%
Sr90 = 24.0%
Tc99 = 20.2%
Th230 = 17.6%

Gas proportional count rate decrease:
<10% after 5 hour static check using 60" cable

Statement of Certification

MJW Technical Sevices, Inc certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANS/NCSL Z540-1-1994 and ANSI N323. The Instrument listed above was inspected prior to shipment and it met all the manufacturer's published operating specifications. (MJW technical Services is not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: [signature] Reviewed By: [signature] Date 7/24/08

Calibration Date: 07/24/2008 Calibration Due: 07/24/2009

MJW Technical Services
243 Root St.
Suite 100
Olean, New York 14760
Voice: (716) 372-5300
Fax: (716) 372-5307

Certificate Of Calibration

This Certificate will be accompanied by Calibration Charts or Readings where Applicable

Customer

Customer Name: Cabrera Services Inc

Address: 473 Silver Lane
East Hartford, CT 06118

Contact Name: Chuck Mikaitis

Customer PO/
CC. Number: 09-1239

Work Order
Number: 2009-1018

Instrument

Manufacturer: Ludlum Measurements

Model: 2929 Serial Number: 180830

Detector Manufacturer: Ludlum Measurements

Det. Model: 43-10-1 Serial Number: PR207849

Calibration Method: Electronic

Instrument Received: ☑ Within Tolerance ☐ Out of Tolerance ☐ Repairs required ☐ Other (See Comments)

☐ Geotropism ☐ Meter Zero ☑ Mech. Ck. ☑ HV Readout ☐ Battery Check ☐ Reset

☑ Audio ☐ Window Status ☐ FS Response ☐ Linearity ☐ Background Subtract ☐ Alarm Set

Temperature: 70.9 F Humidity: 26 % Pressure: 721.4 mm Hg Altitude: 1450 ft

Instrument Calibration

Multiplier\Range	Calibration Point	Instrument Response	
		Before Calibration	After Calibration
Alpha	40 cpm	40 cpm	40 cpm
Alpha	400 cpm	401 cpm	401 cpm
Alpha	4000 cpm	4001 cpm	4001 cpm
Alpha	40000 cpm	40008 cpm	40008 cpm
Alpha	400000 cpm	400028 cpm	400028 cpm
Beta-Gamma	40 cpm	40 cpm	40 cpm
Beta-Gamma	400 cpm	400 cpm	400 cpm
Beta-Gamma	4000 cpm	4000 cpm	4000 cpm
Beta-Gamma	40000 cpm	39991 cpm	39991 cpm
Beta-Gamma	400000 cpm	399892 cpm	399892 cpm

Reference instruments and / or Sources

Pulser: 500-2	220110	Oscilloscope: TDS1002	C062886
Pu-239	C7-639	C-14	C7-804
SrY-90	C7-661	Th-230	C7-644
Tc-99	C7-641		

Comments

Ref. Voltage1: 500 V Inst. Voltage1: 500 V

Ref. Voltage2: 1000 V Inst. Voltage 2: 992 V

Amplifier gain: 25

Window status: Beta threshold - 4 mV
Beta window - 50 mV
Alpha threshold - 175 mV

Instrument Voltage set @ 635 = 2.62 on High Voltage dial

Alpha background is 0 cpm, Beta background is 45 cpm

Alpha crosstalk in the Beta channel is <10% with insert in place

Beta crosstalk in the Alpha channel is <1% with insert in place

4 pi Efficiency with insert in place

C14 = 7.0%

SrY90 = 42.8%

Th230 = 38.7%

Tc99 = 22.4%

Statement of Certification

MJW Technical Sevices, Inc certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ISO/IEC 17025 and ANSI N323. The Instrument listed above was inspected prior to shipment and it met all the manufacturer's published operating specifications. (MJW technical Services is not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: [signature]

Reviewed By: KT Ralyea Date 2/3/09

Calibration Date: 02/03/2009

Calibration Due: 02/03/2010

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2360	Detector:	Ludlum 43-10-1	Calibration Date:	8/11/2011
Serial #:	202461	Serial #:	PR191325	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	100				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.3156	Th-230	3973-02	17500	4/29/2002	7.54E+04	17,498	100	1	1	0.30	0.67	5523.2	76.15
Beta	0.2308	Tc-99	3975-02	17700	4/25/2002	2.11E+05	17,699	1000	1	1	36.60	5.80	4084.6	68.12

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
12/1/2011	0	29	5668	4130	0.0	29.0	5668.0	4101.0	PASS	PASS	PASS	PASS	9.51	122	Yes	Yes	N. Berliner	NMB
12/2/2011	0	31	5646	4139	0.0	31.0	5646.0	4108.0	PASS	PASS	PASS	PASS	9.51	125	Yes	Yes	C. Wright	CLW

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart								
	Initial bkg counts				Initial source plus bkg counts			
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm
1	0	0	30	30	5601	5601	4063	4063
2	0	0	32	32	5443	5443	4079	4079
3	0	0	40	40	5564	5564	4200	4200
4	0	0	35	35	5484	5484	4144	4144
5	0	0	44	44	5468	5468	4246	4246
6	2	2	39	39	5380	5380	4110	4110
7	0	0	36	36	5537	5537	4033	4033
8	0	0	28	28	5592	5592	4173	4173
9	0	0	36	36	5597	5597	4043	4043
10	1	1	46	46	5569	5569	4121	4121
Mean		0.30		36.6		5523.5		4121.2
$S_{(n-1)}$		0.67		5.80		75.80		70.06
-3 sigma		-1.72		19.21		5296.11		3911.02
+3 sigma		2.32		53.99		5750.89		4331.38
-2 sigma		-1.05		25.01		5371.91		3981.08
+2 sigma		1.65		48.19		5675.09		4261.32
					Mean-bkg	5523.2		4084.6
					$S_{(n-1)}$	76.15		68.12
				Mean-bkg	-3 sigma	5294.74		3880.25
				Mean-bkg	+3 sigma	5751.66		4288.95
				Mean-bkg	-2 sigma	5370.89		3948.36
				Mean-bkg	+2 sigma	5675.51		4220.84
						5601		4033
						5443		4047
						5564		4160
						5484		4109
						5468		4202
						5378		4071
						5537		3997
						5592		4145
						5597		4007
						5568		4075

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2360	Detector:	Ludlum 43-37	Calibration Date:	6/30/2011
Serial #:	184938	Serial #:	PR178371	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	582				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.1995	Th-230	3973-02	17500	4/29/2002	7.54E+04	17,498	100	1	1	12.40	2.32	1846.7	31.31
Beta	0.3148	Tc-99	3975-02	17700	4/25/2002	2.11E+05	17,699	1000	1	1	481.00	26.32	2957.5	47.22

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
12/1/2011	8	480	1863	3500	8.0	480.0	1855.0	3020.0	PASS	PASS	PASS	PASS	13.92	57	Yes	Yes	N. Berliner	NMB
12/2/2011	9	473	1844	3449	9.0	473.0	1835.0	2976.0	PASS	PASS	PASS	PASS	14.61	57	Yes	Yes	W. Fillingame	WWF

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart

#	Initial bkg counts				Initial source plus bkg counts			
	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm
1	14	14	457	457	1878	1878	3463	3463
2	10	10	499	499	1835	1835	3528	3528
3	13	13	497	497	1883	1883	3459	3459
4	16	16	455	455	1845	1845	3401	3401
5	15	15	520	520	1856	1856	3490	3490
6	10	10	449	449	1859	1859	3317	3317
7	9	9	501	501	1906	1906	3502	3502
8	13	13	484	484	1793	1793	3415	3415
9	11	11	448	448	1865	1865	3367	3367
10	13	13	500	500	1871	1871	3443	3443
Mean		12.40		481.0		1859.1		3438.5
$S_{(n-1)}$		2.32		26.32		30.66		64.61
-3 sigma		5.44		402.03		1767.11		3244.67
+3 sigma		19.36		559.97		1951.09		3632.33
-2 sigma		7.76		428.35		1797.77		3309.28
+2 sigma		17.04		533.65		1920.43		3567.72
					Mean-bkg	1846.7		2957.5
					$S_{(n-1)}$	31.31		47.22
				Mean-bkg	-3 sigma	1752.76		2815.83
				Mean-bkg	+3 sigma	1940.64		3099.17
				Mean-bkg	-2 sigma	1784.08		2863.05
				Mean-bkg	+2 sigma	1909.32		3051.95
						1864		3006
						1825		3029
						1870		2962
						1829		2946
						1841		2970
						1849		2868
						1897		3001
						1780		2931
						1854		2919
						1858		2943

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER CABRERA SERVICES - EH ORDER NO. 20181701/366626

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 202461

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR191325

Cal. Date 11-Aug-11 Cal Due Date 11-Aug-12 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 37 % Alt 698.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☑ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC ☐ RS-232 Port OK
☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 700 V

☑ HV Readout (2 points) Ref./Inst. 500 / 501 V Ref./Inst. 1500 / 1504 V

Firmware Version: J90/0127
Alpha Threshold: 120mV
Beta Threshold: 4mV
Beta Window: 50mV
Overload checked but not set
Instrument calibrated with a 37" cable.
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 50000
Beta Alarm: 50000
A/B Alarm: 50000
Model 2360 Date: 11-Aug-11
Calibration Date Due: 11-Aug-12

COMMENTS:

4 pi Eff. for Th230≈19,800dpm is:38.73%
Background: 0cpm Reading: 7,669cpm
4 pi Eff. for SrY90≈100,702dpm is:51.53%
Background: 34cpm Reading: 51,931cpm
4 pi Eff. for Tc99≈22,700dpm is:33.26%
Background: 34cpm Reading: 7,586cpm
4 pi Eff. for Ni63≈280,548dpm is:1.47%
Background: 34 cpm Reading: 4,183cpm

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	400k cpm	400	400
x1000	100k cpm	100	100
x100	40k cpm	400	400
x100	10k cpm	100	100
x10	4k cpm	400	400
x10	1k cpm	100	100
x1	400 cpm	400	400
x1	100 cpm	100	100

*Uncertainty within ± 10% C.F. within ± 20%

ALL **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39981 (01)	39981 (01)
	40kcpm	3998	3998
	4kcpm	400	400
	400cpm	40	40
	40cpm	4	4
Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978

State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: ☐ 73410 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646 ☐ 70897
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th230:E121495 ☑ Beta S/N Tc99:NI-EV,SrY90:5281 ☑ Other Ni63:4017

☑ m 500 S/N 63893 ☐ Oscilloscope S/N ☑ Multimeter S/N 93870637

Calibrated By: Jeramy Thompson Date 11-Aug-11

Reviewed By: Richard Hinojosa Date 11Aug11

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR191325 Order #. 20181701/366626

Customer CABRERA SERVICES - EH Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 202461 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 50 mV

Other _____ Distance Source to Detector Tray

High Voltage	Background		Isotope Th230 Size =14,700dpm		Isotope Tc99 Size =22,700dpm		Isotope Sr/Y90 Size =100,702dpm		Isotope Ni 63 Size =280,548dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
675	0	25	7743	458	3	6485	1	48922	1	1158
*700	0	34	7669	619	3	7586	2	51431	1	4182
725	1	56	7658	856	3	8281	24	51209	2	9810

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jeramy Thompson Date 11-Aug-11

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES - EH ORDER NO. 20177939/364424

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 184938

Mfg. Ludlum Measurements, Inc. Model 43-37 Serial No. PR178371

Cal. Date 30-Jun-11 Cal Due Date 30-Jun-12 Cal. Interval 1 Year Meterface 202-855

Check mark ✓ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 38 % Alt 702.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

- ✓ Mechanical ck.
- ☐ F/S Resp. ck
- ✓ Audio ck.
- ✓ Meter Zeroed
- ✓ Reset ck.
- ✓ Alarm Setting ck.
- ☐ Background Subtract
- ✓ Window Operation
- ✓ Batt. ck. (Min. Volt) 2.2 VDC
- ☐ Input Sens. Linearity
- ☐ Geotropism
- ☐ RS-232 Port OK

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 1675 V

✓ HV Readout (2 points) Ref./Inst. 500 / 505 V Ref./Inst. 2000 / 2011 V

Firmware Version: 39010v25
Alpha Threshold: 100 mv
Beta Threshold: 4 mv
Beta Window: 40 mv
Overload Checked but not set.
Instrument calibrated with a 5 ft cable.
High voltage set with detector NOT connected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 50000
Beta Alarm: 50000
A/B Alarm: 50000
Model 2360 Date: 6/30/2011
Calibration Date Due: 6/30/2012

COMMENTS:

Th230 SN:E121495 Size:19800dpm, Counts:3954cpm, Background:3cpm, 4pi Eff:19.95%
SrY90 SN:5281 Size:102085dpm, Counts:33192cpm, Background:791cpm, 4pi Eff:31.73%
Tc99 SN:5280 Size:93200dpm, Counts:30137cpm, Background:791cpm, 4pi Eff:31.48%
Ni60 SN:4017 Size:281620dpm, Counts:16552cpm, Background:791cpm, 4pi Eff:5.59%

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	400k cpm	400	400
x1000	100k cpm	100	100
x100	40k cpm	400	400
x100	10k cpm	100	100
x10	4k cpm	400	400
x10	1k cpm	100	100
x1	400 cpm	400	400
x1	100 cpm	100	100

*Uncertainty within ± 10% C.F. within ± 20% ALL **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39984(0)	39984(0)
	40kcpm	3998	3998
	4kcpm	400	400
	400cpm	40	40
	40cpm	4	4
Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: ☐ 73410 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646 ☐ 70897

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ☐ Beta S/N ☐ Other

✓ m 500 S/N 190566 ☐ Oscilloscope S/N ✓ Multimeter S/N 86250390

Calibrated By: Jason Flores Date 30-Jun-11

Reviewed By: Richard Haines Date 30 Jun 11

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-37 Serial No. PR178371 Order #. 20177939/364424

Customer CABRERA SERVICES - EH Alpha Input Sensitivity 100 mV

Counter 2360 Serial No. 184938 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 40 mV

Other _____ Distance Source to Detector Surface

High Voltage	Background		Isotope TH230 Size 19800dpm		Isotope Tc99 Size 93200dpm		Isotope Sr/90 Size 102085dpm		Isotope Ni 63 Size 281620dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
1625	7	457	3695	1620	20	27571	4	25308	5	13668
1650	5	635	3897	1861	25	29044	4	29950	4	15902
1675	3	791	3954	1989	49	30137	19	33192	6	16552
1700	2	948	4090	2025	126	28749	94	35575	12	16748

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jason Flores Date 30-Jun-11

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 3863
P.O.# 02-055

Description of Standard:

Model No. DNS-11 Serial No. 3973-02 Isotope Th-230

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated alpha source S/N 2393/91.

Measurement Result:

The observed alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was:

8,860 ± 265

The total disintegration rate (dpm) assuming 1.5% backscatter of alpha particles from the surface of the disc, was:

17,500 ± 523 (0.00786 μCi)

The uncertainty of the measurement is 3 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by:

Calibration Technician: Art Reust Q.A. Representative:

Calibration Date: 4-29-2002 Reviewed Date: 4-29-02

Analytical Services
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 345-3461 Fax (505) 761-5416
Toll Free (866) RAD-LABS (723-5227)
www.eberlineservices.com

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Beta Standard

S.O.# 3863
P.O.# 02-055

Description of Standard:

Model No. DNS-12 Serial No. 3975-02 Isotope Tc-99

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated beta source S/N 2148/90.

Measurement Result:

The observed beta count rate from the surface of the disc per minute (cpm) on the calibration date was:

11,000 ± 441

The total disintegration rate (dpm) assuming 25 % backscatter of beta particles from the surface of the disc, was:

17,700 ± 706 (0.00796 μCi)

The uncertainty of the measurement is 4 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by:

Calibration Technician: Q.A. Representati

Calibration Date: 4-25-2002 Reviewed Date: 4-29-02

Analytical Services
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 345-3461 Fax (505) 761-5416
Toll Free (866) RAD-LABS (723-5227)
www.eberlineservices.com

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	2360	Detector:	43-10-1	Calibration Date:	6/7/2011
Serial #:	193635	Serial #:	PR202583	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	100				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.3434	Th-230	7104-10	-	-	-	#VALUE!	20	10	1	0.22	0.19	5941.0	83.29
Beta	0.2171	Tc-99	7102-10	-	-	-	#VALUE!	200	10	1	38.35	2.51	2656.4	43.79

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
12/20/2011	0	381	6038	2666	0.0	38.1	6038.0	2627.9	PASS	PASS	PASS	PASS	8.74	112	Yes	Yes	Gbright	GB
12/21/2011	3	358	6033	2724	0.3	35.8	6032.7	2688.2	PASS	PASS	PASS	PASS	14.24	109	Yes	Yes	Gbright	GB
12/22/2011	6	364	6077	2654	0.6	36.4	6076.4	2617.6	PASS	PASS	PASS	PASS	16.52	110	Yes	Yes	Gbright	GB
1/3/2012	2	385	6005	2710	0.2	38.5	6004.8	2671.5	PASS	PASS	PASS	PASS	13.23	112	Yes	Yes	Nberliner	NMB
1/4/2012	5	397	6034	2781	0.5	39.7	6033.5	2741.3	PASS	PASS	PASS	PASS	15.84	114	Yes	Yes	Ddavis	DD
1/5/2012	3	354	5968	2644	0.3	35.4	5967.7	2608.6	PASS	PASS	PASS	PASS	14.24	108	Yes	Yes	Ddavis	DD
1/6/2012	1	347	5892	2668	0.1	34.7	5891.9	2633.3	PASS	PASS	PASS	PASS	11.91	107	Yes	Yes	Ddavis	DD
1/9/2012	2	390	6022	2714	0.2	39.0	6021.8	2675.0	PASS	PASS	PASS	PASS	13.23	113	Yes	Yes	Davis	DD
1/10/2012	1	420	5990	2679	0.1	42.0	5989.9	2637.0	PASS	PASS	PASS	PASS	11.91	117	Yes	Yes	Davis	DD
1/11/2012	3	414	6047	2716	0.3	41.4	6046.7	2674.6	PASS	PASS	PASS	PASS	14.24	116	Yes	Yes	Davis	DD
1/12/2012	1	394	6080	2765	0.1	39.4	6079.9	2725.6	PASS	PASS	PASS	PASS	11.91	114	Yes	Yes	Davis	DD
1/13/2012	2	395	6104	2764	0.2	39.5	6103.8	2724.5	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DD
1/16/2012	2	401	6045	2736	0.2	40.1	6044.8	2695.9	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DD
1/17/2012	3	431	5945	2702	0.3	43.1	5944.7	2658.9	PASS	PASS	PASS	PASS	14.24	118	Yes	Yes	Davis	DD
1/18/2012	3	401	6027	2690	0.3	40.1	6026.7	2649.9	PASS	PASS	PASS	PASS	14.24	114	Yes	Yes	Davis	DD
1/19/2012	1	393	5980	2694	0.1	39.3	5979.9	2654.7	PASS	PASS	PASS	PASS	11.91	113	Yes	Yes	Davis	DD
1/20/2012	2	400	5999	2656	0.2	40.0	5998.8	2616.0	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DD
1/23/2012	3	430	5994	2645	0.3	43.0	5993.7	2602.0	PASS	PASS	PASS	PASS	14.24	118	Yes	Yes	Davis	DD
1/24/2012	1	396	5931	2713	0.1	39.6	5930.9	2673.4	PASS	PASS	PASS	PASS	11.91	114	Yes	Yes	Davis	DD
1/25/2012	3	427	5939	2641	0.3	42.7	5938.7	2598.3	PASS	PASS	PASS	PASS	14.24	118	Yes	Yes	Davis	DD
1/26/2012	2	389	5962	2714	0.2	38.9	5961.8	2675.1	PASS	PASS	PASS	PASS	13.23	113	Yes	Yes	Davis	DD
1/27/2012	2	390	5843	2623	0.2	39.0	5842.8	2584.0	PASS	PASS	PASS	PASS	13.23	113	Yes	Yes	Davis	DD
1/30/2012	3	386	5962	2692	0.3	38.6	5961.7	2653.4	PASS	PASS	PASS	PASS	14.24	113	Yes	Yes	Davis	DD
1/31/2012	2	417	5996	2648	0.2	41.7	5995.8	2606.3	PASS	PASS	PASS	PASS	13.23	116	Yes	Yes	Davis	DD
2/1/2012	1	410	5964	2673	0.1	41.0	5963.9	2632.0	PASS	PASS	PASS	PASS	11.91	116	Yes	Yes	Davis	DD
2/2/2012	3	407	6024	2774	0.3	40.7	6023.7	2733.3	PASS	PASS	PASS	PASS	14.24	115	Yes	Yes	Davis	DD
2/3/2012	3	397	5920	2641	0.3	39.7	5919.7	2601.3	PASS	PASS	PASS	PASS	14.24	114	Yes	Yes	Davis	DD
2/6/2012	4	391	6036	2679	0.4	39.1	6035.6	2639.9	PASS	PASS	PASS	PASS	15.09	113	Yes	Yes	Davis	DD
2/7/2012	1	418	5846	2644	0.1	41.8	5845.9	2602.2	PASS	PASS	PASS	PASS	11.91	117	Yes	Yes	Davis	DD
2/8/2012	2	404	5990	2719	0.2	40.4	5989.8	2678.6	PASS	PASS	PASS	PASS	13.23	115	Yes	Yes	Davis	DD
2/9/2012	2	379	6053	2670	0.2	37.9	6052.8	2632.1	PASS	PASS	PASS	PASS	13.23	112	Yes	Yes	Davis	DD
2/10/2012	1	377	5999	2676	0.1	37.7	5998.9	2638.3	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DD
2/13/2012	1	433	5952	2695	0.1	43.3	5951.9	2651.7	PASS	PASS	PASS	PASS	11.91	118	Yes	Yes	Davis	DD
2/14/2012	1	391	5968	2711	0.1	39.1	5967.9	2671.9	PASS	PASS	PASS	PASS	11.91	113	Yes	Yes	Davis	DD
2/15/2012	3	405	5848	2661	0.3	40.5	5847.7	2620.5	PASS	PASS	PASS	PASS	14.24	115	Yes	Yes	Davis	DD
2/16/2012	2	390	5879	2669	0.2	39.0	5878.8	2630.0	PASS	PASS	PASS	PASS	13.23	113	Yes	Yes	Davis	DD
2/17/2012	3	378	6100	2692	0.3	37.8	6099.7	2654.2	PASS	PASS	PASS	PASS	14.24	112	Yes	Yes	N. Berliner	NMB
2/20/2012	3	394	5910	2664	0.3	39.4	5909.7	2624.6	PASS	PASS	PASS	PASS	14.24	114	Yes	Yes	Davis	DAD

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm				
Alpha	0.3434	Th-230	7104-10	-	-	-	#VALUE!	20	10	1	0.22	0.19	5941.0	83.29				
Beta	0.2171	Tc-99	7102-10	-	-	-	#VALUE!	200	10	1	38.35	2.51	2656.4	43.79				

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
2/21/2012	3	409	5889	2669	0.3	40.9	5888.7	2628.1	PASS	PASS	PASS	PASS	14.24	115	Yes	Yes	Davis	DAD
2/22/2012	2	399	5967	2703	0.2	39.9	5966.8	2663.1	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DAD
2/23/2012	2	409	5858	2639	0.2	40.9	5857.8	2598.1	PASS	PASS	PASS	PASS	13.23	115	Yes	Yes	Davis	DAD
2/24/2012	2	400	5844	2637	0.2	40.0	5843.8	2597.0	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DAD
2/27/2012	4	377	5915	2631	0.4	37.7	5914.6	2593.3	PASS	PASS	PASS	PASS	15.09	111	Yes	Yes	Davis	DAD
2/28/2012	2	385	5879	2667	0.2	38.5	5878.8	2628.5	PASS	PASS	PASS	PASS	13.23	112	Yes	Yes	Davis	DAD
2/29/2012	3	381	5909	2715	0.3	38.1	5908.7	2676.9	PASS	PASS	PASS	PASS	14.24	112	Yes	Yes	Davis	DAD
3/1/2012	4	405	5883	2677	0.4	40.5	5882.6	2636.5	PASS	PASS	PASS	PASS	15.09	115	Yes	Yes	Davis	DAD
3/2/2012	1	362	5932	2669	0.1	36.2	5931.9	2632.8	PASS	PASS	PASS	PASS	11.91	109	Yes	Yes	Davis	DAD
3/5/2012	1	387	6009	2727	0.1	38.7	6008.9	2688.3	PASS	PASS	PASS	PASS	11.91	113	Yes	Yes	Davis	DAD
3/6/2012	1	392	5963	2724	0.1	39.2	5962.9	2684.8	PASS	PASS	PASS	PASS	11.91	113	Yes	Yes	Davis	DAD
3/7/2012	2	430	5920	2662	0.2	43.0	5919.8	2619.0	PASS	PASS	PASS	PASS	13.23	118	Yes	Yes	Davis	DAD
3/8/2012	3	390	6031	2724	0.3	39.0	6030.7	2685.0	PASS	PASS	PASS	PASS	14.24	113	Yes	Yes	Davis	DAD
3/9/2012	3	388	6018	2677	0.3	38.8	6017.7	2638.2	PASS	PASS	PASS	PASS	14.24	113	Yes	Yes	Davis	DAD
3/12/2012	1	426	5887	2701	0.1	42.6	5886.9	2658.4	PASS	PASS	PASS	PASS	11.91	118	Yes	Yes	Davis	DAD
3/13/2012	1	383	5889	2645	0.1	38.3	5888.9	2606.7	PASS	PASS	PASS	PASS	11.91	112	Yes	Yes	Davis	DAD
3/14/2012	1	376	6024	2663	0.1	37.6	6023.9	2625.4	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DAD
3/15/2012	1	412	5938	2616	0.1	41.2	5937.9	2574.8	PASS	PASS	PASS	PASS	11.91	116	Yes	Yes	Davis	DAD
3/16/2012	3	383	5961	2686	0.3	38.3	5960.7	2647.7	PASS	PASS	PASS	PASS	14.24	112	Yes	Yes	Davis	DAD
3/19/2012	3	397	5922	2705	0.3	39.7	5921.7	2665.3	PASS	PASS	PASS	PASS	14.24	114	Yes	Yes	Davis	DAD
3/20/2012	4	428	5907	2641	0.4	42.8	5906.6	2598.2	PASS	PASS	PASS	PASS	15.09	118	Yes	Yes	Davis	DAD
3/21/2012	2	396	5924	2626	0.2	39.6	5923.8	2586.4	PASS	PASS	PASS	PASS	13.23	114	Yes	Yes	Davis	DAD
3/22/2012	1	365	6034	2660	0.1	36.5	6033.9	2623.5	PASS	PASS	PASS	PASS	11.91	110	Yes	Yes	Davis	DAD
3/23/2012	1	368	5890	2643	0.1	36.8	5889.9	2606.2	PASS	PASS	PASS	PASS	11.91	110	Yes	Yes	Davis	DAD
3/26/2012	2	404	5980	2666	0.2	40.4	5979.8	2625.6	PASS	PASS	PASS	PASS	13.23	115	Yes	Yes	Davis	DAD
3/27/2012	1	364	5857	2648	0.1	36.4	5856.9	2611.6	PASS	PASS	PASS	PASS	11.91	110	Yes	Yes	Davis	DAD
3/28/2012	1	377	6070	2714	0.1	37.7	6069.9	2676.3	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DAD
3/29/2012	2	365	5911	2685	0.2	36.5	5910.8	2648.5	PASS	PASS	PASS	PASS	13.23	110	Yes	Yes	Davis	DAD
4/2/2012	1	399	6055	2782	0.1	39.9	6054.9	2742.1	PASS	PASS	PASS	PASS	11.91	114	Yes	Yes	N. Berliner	NMB
4/3/2012	1	375	5898	2642	0.1	37.5	5897.9	2604.5	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DAD
4/4/2012	4	407	5912	2691	0.4	40.7	5911.6	2650.3	PASS	PASS	PASS	PASS	15.09	115	Yes	Yes	Davis	DAD
4/5/2012	1	386	5842	2632	0.1	38.6	5841.9	2593.4	PASS	PASS	PASS	PASS	11.91	113	Yes	Yes	Davis	DAD
4/9/2012	2	412	5894	2734	0.2	41.2	5893.8	2692.8	PASS	PASS	PASS	PASS	13.23	116	Yes	Yes	Davis	DAD
4/10/2012	4	378	6020	2676	0.4	37.8	6019.6	2638.2	PASS	PASS	PASS	PASS	15.09	112	Yes	Yes	Davis	DAD
4/11/2012	1	374	5896	2632	0.1	37.4	5895.9	2594.6	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DAD
4/12/2012	2	403	6051	2653	0.2	40.3	6050.8	2612.7	PASS	PASS	PASS	PASS	13.23	115	Yes	Yes	Davis	DAD
4/13/2012	1	373	5919	2618	0.1	37.3	5918.9	2580.7	PASS	PASS	PASS	PASS	11.91	111	Yes	Yes	Davis	DAD
4/16/2012	4	400	5840	2685	0.4	40.0	5839.6	2645.0	PASS	PASS	PASS	PASS	15.09	114	Yes	Yes	Davis	DAD
4/17/2012	4	417	6010	2665	0.4	41.7	6009.6	2623.3	PASS	PASS	PASS	PASS	15.09	116	Yes	Yes	Davis	DAD
4/18/2012	3	389	6014	2713	0.3	38.9	6013.7	2674.1	PASS	PASS	PASS	PASS	14.24	113	Yes	Yes	Davis	DAD
4/19/2012	2	402	5862	2675	0.2	40.2	5861.8	2634.8	PASS	PASS	PASS	PASS	13.23	115	Yes	Yes	N. Berliner	NMB
4/20/2012	5	404	6013	2702	0.5	40.4	6012.5	2661.6	PASS	PASS	PASS	PASS	15.84	115	Yes	Yes	N. Berliner	NMB

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart									
	Initial bkg counts				Initial source plus bkg counts				
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm	
1	1	0.1	363	36.3	6048	6048	2628	2628	
2	1	0.1	351	35.1	5897	5897	2721	2721	
3	1	0.1	396	39.6	5913	5913	2680	2680	
4	1	0.1	361	36.1	5899	5899	2654	2654	
5	2	0.2	410	41	5929	5929	2688	2688	
6	2	0.2	402	40.2	5936	5936	2743	2743	
7	2	0.2	389	38.9	5981	5981	2653	2653	
8	4	0.4	384	38.4	5929	5929	2730	2730	
9	1	0.1	355	35.5	6089	6089	2763	2763	
10	7	0.7	424	42.4	5791	5791	2687	2687	
Mean		0.22		38.4		5941.2		2694.7	
$S_{(n-1)}$		0.19		2.51		83.17		43.59	
-3 sigma		-0.36		30.82		5691.70		2563.93	
+3 sigma		0.80		45.88		6190.70		2825.47	
-2 sigma		-0.17		33.33		5774.87		2607.52	
+2 sigma		0.61		43.37		6107.53		2781.88	
					Mean-bkg	5941.0		2656.4	
					$S_{(n-1)}$	83.29		43.79	
				Mean-bkg	-3 sigma	5691.11		2524.98	
				Mean-bkg	+3 sigma	6190.85		2787.72	
				Mean-bkg	-2 sigma	5774.40		2568.77	
				Mean-bkg	+2 sigma	6107.56		2743.93	
						6047.9		2591.7	
						5896.9		2685.9	
						5912.9		2640.4	
						5898.9		2617.9	
						5928.8		2647	
						5935.8		2702.8	
						5980.8		2614.1	
						5928.6		2691.6	
						6088.9		2727.5	
						5790.3		2644.6	

Trial MDA Calculator	α	β
Sample Count Time (min)	1	
Bkg Count Rate (cpm)	0.1	
Bkg Count Time (min)	1	
Counter Efficiency	0.3434	0.2171
MDCR (cpm)	4.471333	#DIV/0!
MDA (dpm)	13.02077	#DIV/0!

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	Ludlum 2224-1	Detector:	Ludlum 43-93	Calibration Date:	9/7/2011
Serial #:	162426	Serial #:	PR193921	12 month calibration:	OK
Detector Active Area or Area Covered by Smear (cm^2):	100				

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm
Alpha	0.0714	Th-230	7104-10	-	-	-	#VALUE!	500	1	1	1.10	0.74	2591.2	172.29
Beta	0.1037	Tc-99	7102-10	-	-	-	#VALUE!	1000	1	1	192.40	18.11	1626.2	234.63

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail							
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
12/20/2011	1	170	2752	2132	1.0	170.0	2751.0	1962.0	PASS	PASS	PASS	PASS	107.25	614	Yes	Yes	Gbright	GB
12/21/2011	3	188	2529	1750	3.0	188.0	2526.0	1562.0	*QUESTION*	PASS	PASS	PASS	154.99	644	Yes	Yes	Gbright	GB
12/22/2011	0	190	2425	1763	0.0	190.0	2425.0	1573.0	PASS	PASS	PASS	PASS	42.04	648	Yes	Yes	Gbright	GB
1/3/2012	1	204	2702	1972	1.0	204.0	2701.0	1768.0	PASS	PASS	PASS	PASS	107.25	670	Yes	Yes	Gbright	GB
1/4/2012	2	191	2526	1919	2.0	191.0	2524.0	1728.0	PASS	PASS	PASS	PASS	134.26	649	Yes	Yes	Davis	DD
1/5/2012	2	179	2624	1965	2.0	179.0	2622.0	1786.0	PASS	PASS	PASS	PASS	134.26	629	Yes	Yes	Davis	DD
1/6/2012	3	186	2596	1875	3.0	186.0	2593.0	1689.0	*QUESTION*	PASS	PASS	PASS	154.99	641	Yes	Yes	Davis	DD
1/9/2012	2	183	2510	1763	2.0	183.0	2508.0	1580.0	PASS	PASS	PASS	PASS	134.26	636	Yes	Yes	Davis	DD
1/10/2012	1	186	2587	1888	1.0	186.0	2586.0	1702.0	PASS	PASS	PASS	PASS	107.25	641	Yes	Yes	Davis	DD
1/11/2012	0	184	2539	1865	0.0	184.0	2539.0	1681.0	PASS	PASS	PASS	PASS	42.04	638	Yes	Yes	Davis	DD
1/12/2012	1	182	2549	1806	1.0	182.0	2548.0	1624.0	PASS	PASS	PASS	PASS	107.25	634	Yes	Yes	Davis	DD
1/13/2012	1	185	2638	1772	1.0	185.0	2637.0	1587.0	PASS	PASS	PASS	PASS	107.25	639	Yes	Yes	Davis	DD
1/16/2012	2	172	2422	1896	2.0	172.0	2420.0	1724.0	PASS	PASS	PASS	PASS	134.26	618	Yes	Yes	Davis	DD
1/17/2012	1	170	2572	1899	1.0	170.0	2571.0	1729.0	PASS	PASS	PASS	PASS	107.25	614	Yes	Yes	Davis	DD
1/18/2012	2	190	2533	1911	2.0	190.0	2531.0	1721.0	PASS	PASS	PASS	PASS	134.26	648	Yes	Yes	Davis	DD
1/19/2012	3	177	2449	1775	3.0	177.0	2446.0	1598.0	*QUESTION*	PASS	PASS	PASS	154.99	626	Yes	Yes	Davis	DD
1/20/2012	3	188	2568	1847	3.0	188.0	2565.0	1659.0	*QUESTION*	PASS	PASS	PASS	154.99	644	Yes	Yes	Davis	DD
1/23/2012	3	174	2587	1812	3.0	174.0	2584.0	1638.0	*QUESTION*	PASS	PASS	PASS	154.99	621	Yes	Yes	Davis	DD
1/24/2012	3	182	2665	1874	3.0	182.0	2662.0	1692.0	*QUESTION*	PASS	PASS	PASS	154.99	634	Yes	Yes	Davis	DD
1/25/2012	1	195	2545	1765	1.0	195.0	2544.0	1570.0	PASS	PASS	PASS	PASS	107.25	656	Yes	Yes	Davis	DD
1/26/2012	1	185	2563	1846	1.0	185.0	2562.0	1661.0	PASS	PASS	PASS	PASS	107.25	639	Yes	Yes	Davis	DD
1/27/2012	1	180	2505	1770	1.0	180.0	2504.0	1590.0	PASS	PASS	PASS	PASS	107.25	631	Yes	Yes	Davis	DD
1/30/2012	2	191	2523	1845	2.0	191.0	2521.0	1654.0	PASS	PASS	PASS	PASS	134.26	649	Yes	Yes	Davis	DD
1/31/2012	2	170	2594	1772	2.0	170.0	2592.0	1602.0	PASS	PASS	PASS	PASS	134.26	614	Yes	Yes	Davis	DD
2/1/2012	1	197	2673	1885	1.0	197.0	2672.0	1688.0	PASS	PASS	PASS	PASS	107.25	659	Yes	Yes	Davis	DD
2/2/2012	2	191	2653	1942	2.0	191.0	2651.0	1751.0	PASS	PASS	PASS	PASS	134.26	649	Yes	Yes	Davis	DD
2/3/2012	2	167	2613	1906	2.0	167.0	2611.0	1739.0	PASS	PASS	PASS	PASS	134.26	609	Yes	Yes	Davis	DD
2/6/2012	2	173	2630	1824	2.0	173.0	2628.0	1651.0	PASS	PASS	PASS	PASS	134.26	619	Yes	Yes	Davis	DD
2/7/2012	2	194	2645	1838	2.0	194.0	2643.0	1644.0	PASS	PASS	PASS	PASS	134.26	654	Yes	Yes	Davis	DD
2/8/2012	1	180	2616	1920	1.0	180.0	2615.0	1740.0	PASS	PASS	PASS	PASS	107.25	631	Yes	Yes	Davis	DD
2/9/2012	1	168	2551	1787	1.0	168.0	2550.0	1619.0	PASS	PASS	PASS	PASS	107.25	611	Yes	Yes	Davis	DD
2/10/2012	1	184	2554	1806	1.0	184.0	2553.0	1622.0	PASS	PASS	PASS	PASS	107.25	638	Yes	Yes	Davis	DD
2/13/2012	2	195	2512	1827	2.0	195.0	2510.0	1632.0	PASS	PASS	PASS	PASS	134.26	656	Yes	Yes	Davis	DD
2/14/2012	2	180	2614	1876	2.0	180.0	2612.0	1696.0	PASS	PASS	PASS	PASS	134.26	631	Yes	Yes	Davis	DD
2/15/2012	1	204	2579	1820	1.0	204.0	2578.0	1616.0	PASS	PASS	PASS	PASS	107.25	670	Yes	Yes	Davis	DD
2/16/2012	2	187	2584	1794	2.0	187.0	2582.0	1607.0	PASS	PASS	PASS	PASS	134.26	643	Yes	Yes	Davis	DD
2/17/2012	2	172	2649	1912	2.0	172.0	2647.0	1740.0	PASS	PASS	PASS	PASS	134.26	618	Yes	Yes	N. Berliner	NMB
2/20/2012	2	187	2550	1858	2.0	187.0	2548.0	1671.0	PASS	PASS	PASS	PASS	134.26	643	Yes	Yes	Davis	DD

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	$T_{1/2}$ (yr)	Source Decayed Activity	Required MDA (DPM/100cm^2)	Control Chart & Daily Bkg Count Time	Control Chart & Daily Source-Sample Count Time	Control Chart bkg Average α/β cpm	Control Chart bkg 1 sigma, cpm	Control Chart Source-bkg Average α/β cpm	Control Chart source 1 sigma, cpm				
Alpha	0.0714	Th-230	7104-10	-	-	-	#VALUE!	500	1	1	1.10	0.74	2591.2	172.29				
Beta	0.1037	Tc-99	7102-10	-	-	-	#VALUE!	1000	1	1	192.40	18.11	1626.2	234.63				

Date	Daily Bkg Counts		Daily Check Source Counts		Daily Bkg Rate (cpm)		Net Daily Source Rate (cpm)		Bkg QC Pass/Fail		Source QC Pass/Fail		MDA α (dpm)	MDA β (dpm)	α MDA OK?	β MDA OK?	H.P. Technician	Technician Initials
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
2/21/2012	1	185	2572	1825	1.0	185.0	2571.0	1640.0	PASS	PASS	PASS	PASS	107.25	639	Yes	Yes	Davis	DD
2/22/2012	1	179	2602	1761	1.0	179.0	2601.0	1582.0	PASS	PASS	PASS	PASS	107.25	629	Yes	Yes	Davis	DD
2/23/2012	2	190	2655	1841	2.0	190.0	2653.0	1651.0	PASS	PASS	PASS	PASS	134.26	648	Yes	Yes	Davis	DD
2/24/2012	2	174	2609	1820	2.0	174.0	2607.0	1646.0	PASS	PASS	PASS	PASS	134.26	621	Yes	Yes	Davis	DD
2/27/2012	2	185	2512	1759	2.0	185.0	2510.0	1574.0	PASS	PASS	PASS	PASS	134.26	639	Yes	Yes	Davis	DD
2/28/2012	1	181	2600	1885	1.0	181.0	2599.0	1704.0	PASS	PASS	PASS	PASS	107.25	633	Yes	Yes	Davis	DD
2/29/2012	2	172	2517	1796	2.0	172.0	2515.0	1624.0	PASS	PASS	PASS	PASS	134.26	618	Yes	Yes	Davis	DD
3/1/2012	1	174	2568	1849	1.0	174.0	2567.0	1675.0	PASS	PASS	PASS	PASS	107.25	621	Yes	Yes	Davis	DD
3/2/2012	1	171	2511	1835	1.0	171.0	2510.0	1664.0	PASS	PASS	PASS	PASS	107.25	616	Yes	Yes	Davis	DD
3/5/2012	1	186	2527	1860	1.0	186.0	2526.0	1674.0	PASS	PASS	PASS	PASS	107.25	641	Yes	Yes	Davis	DD
3/6/2012	1	186	2501	1825	1.0	186.0	2500.0	1639.0	PASS	PASS	PASS	PASS	107.25	641	Yes	Yes	Davis	DD
3/7/2012	2	171	2622	1801	2.0	171.0	2620.0	1630.0	PASS	PASS	PASS	PASS	134.26	616	Yes	Yes	Davis	DD
3/8/2012	2	174	2572	1794	2.0	174.0	2570.0	1620.0	PASS	PASS	PASS	PASS	134.26	621	Yes	Yes	Davis	DD
3/9/2012	1	173	2587	1777	1.0	173.0	2586.0	1604.0	PASS	PASS	PASS	PASS	107.25	619	Yes	Yes	Davis	DD
3/12/2012	2	188	2525	1797	2.0	188.0	2523.0	1609.0	PASS	PASS	PASS	PASS	134.26	644	Yes	Yes	Davis	DD
3/13/2012	1	184	2545	1814	1.0	184.0	2544.0	1630.0	PASS	PASS	PASS	PASS	107.25	638	Yes	Yes	Davis	DD
3/14/2012	2	190	2623	1843	2.0	190.0	2621.0	1653.0	PASS	PASS	PASS	PASS	134.26	648	Yes	Yes	Davis	DD
3/15/2012	2	184	2524	1865	2.0	184.0	2522.0	1681.0	PASS	PASS	PASS	PASS	134.26	638	Yes	Yes	Davis	DD
3/16/2012	2	183	2532	1868	2.0	183.0	2530.0	1685.0	PASS	PASS	PASS	PASS	134.26	636	Yes	Yes	Davis	DD
3/19/2012	1	174	2490	1721	1.0	174.0	2489.0	1547.0	PASS	PASS	PASS	PASS	107.25	621	Yes	Yes	Davis	DD
3/20/2012	2	174	2630	2000	2.0	174.0	2628.0	1826.0	PASS	PASS	PASS	PASS	134.26	621	Yes	Yes	Davis	DD
3/21/2012	2	172	2590	1819	2.0	172.0	2588.0	1647.0	PASS	PASS	PASS	PASS	134.26	618	Yes	Yes	Davis	DD
3/22/2012	2	181	2546	1873	2.0	181.0	2544.0	1692.0	PASS	PASS	PASS	PASS	134.26	633	Yes	Yes	Davis	DD
3/23/2012	1	194	2526	1796	1.0	194.0	2525.0	1602.0	PASS	PASS	PASS	PASS	107.25	654	Yes	Yes	Davis	DD
3/26/2012	1	180	2521	1794	1.0	180.0	2520.0	1614.0	PASS	PASS	PASS	PASS	107.25	631	Yes	Yes	Davis	DD
3/27/2012	1	173	2456	1788	1.0	173.0	2455.0	1615.0	PASS	PASS	PASS	PASS	107.25	619	Yes	Yes	Davis	DD
3/28/2012	1	178	2527	1845	1.0	178.0	2526.0	1667.0	PASS	PASS	PASS	PASS	107.25	628	Yes	Yes	Davis	DD
3/29/2012	2	173	2521	1882	2.0	173.0	2519.0	1709.0	PASS	PASS	PASS	PASS	134.26	619	Yes	Yes	Davis	DD
4/2/2012	1	172	2575	1785	1.0	172.0	2574.0	1613.0	PASS	PASS	PASS	PASS	107.25	618	Yes	Yes	N. Berliner	NMB
4/3/2012	1	199	2493	1835	1.0	199.0	2492.0	1636.0	PASS	PASS	PASS	PASS	107.25	662	Yes	Yes	Davis	DD
4/4/2012	2	195	2618	1814	2.0	195.0	2616.0	1619.0	PASS	PASS	PASS	PASS	134.26	656	Yes	Yes	Davis	DD
4/5/2012	2	177	2464	1937	2.0	177.0	2462.0	1760.0	PASS	PASS	PASS	PASS	134.26	626	Yes	Yes	Davis	DD
4/9/2012	1	170	2642	1894	1.0	170.0	2641.0	1724.0	PASS	PASS	PASS	PASS	107.25	614	Yes	Yes	Davis	DD
4/10/2012	1	175	2587	1846	1.0	175.0	2586.0	1671.0	PASS	PASS	PASS	PASS	107.25	623	Yes	Yes	Davis	DD
4/11/2012	2	192	2593	1869	2.0	192.0	2591.0	1677.0	PASS	PASS	PASS	PASS	134.26	651	Yes	Yes	Davis	DD
4/12/2012	1	175	2578	1798	1.0	175.0	2577.0	1623.0	PASS	PASS	PASS	PASS	107.25	623	Yes	Yes	Davis	DD
4/13/2012	1	175	2574	1796	1.0	175.0	2573.0	1621.0	PASS	PASS	PASS	PASS	107.25	623	Yes	Yes	Davis	DD
4/16/2012	2	174	2490	1797	2.0	174.0	2488.0	1623.0	PASS	PASS	PASS	PASS	134.26	621	Yes	Yes	Davis	DD
4/17/2012	2	194	2502	1844	2.0	194.0	2500.0	1650.0	PASS	PASS	PASS	PASS	134.26	654	Yes	Yes	Davis	DD
4/18/2012	1	174	2539	1799	1.0	174.0	2538.0	1625.0	PASS	PASS	PASS	PASS	107.25	621	Yes	Yes	Davis	DD
4/19/2012	2	171	2457	1917	2.0	171.0	2455.0	1746.0	PASS	PASS	PASS	PASS	134.26	616	Yes	Yes	N. Berliner	NMB
4/20/2012	1	157	2546	1946	1.0	157.0	2545.0	1789.0	PASS	PASS	PASS	PASS	107.25	591	Yes	Yes	N. Berliner	NMB

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Initial Background and Source Counts for Control Chart									
	Initial bkg counts				Initial source plus bkg counts				
#	Alpha	cpm	Beta	cpm	Alpha	cpm	Beta	cpm	
1	1	1	199	199	2493	2493	2000	2000	
2	1	1	171	171	2576	2576	1778	1778	
3	1	1	170	170	2927	2927	2248	2248	
4	0	0	207	207	2337	2337	1855	1855	
5	1	1	194	194	2607	2607	1759	1759	
6	2	2	205	205	2451	2451	1547	1547	
7	2	2	203	203	2809	2809	1774	1774	
8	2	2	219	219	2543	2543	1479	1479	
9	1	1	165	165	2517	2517	1980	1980	
10	0	0	191	191	2663	2663	1766	1766	
Mean		1.10		192.4		2592.3		1818.6	
$S_{(n-1)}$		0.74		18.11		172.42		222.04	
-3 sigma		-1.11		138.08		2075.03		1152.48	
+3 sigma		3.31		246.72		3109.57		2484.72	
-2 sigma		-0.38		156.19		2247.45		1374.52	
+2 sigma		2.58		228.61		2937.15		2262.68	
					Mean-bkg	2591.2		1626.2	
					$S_{(n-1)}$	172.29		234.63	
				Mean-bkg	-3 sigma	2074.33		922.32	
				Mean-bkg	+3 sigma	3108.07		2330.08	
				Mean-bkg	-2 sigma	2246.62		1156.94	
				Mean-bkg	+2 sigma	2935.78		2095.46	
						2492		1801	
						2575		1607	
						2926		2078	
						2337		1648	
						2606		1565	
						2449		1342	
						2807		1571	
						2541		1260	
						2516		1815	
						2663		1575	

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES - EH ORDER NO. 20183503/367657

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162426

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR193921

Cal. Date 7-Sep-11 Cal Due Date 7-Sep-12 Cal. Interval 1 Year Meterface 202-848

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 36 % Alt 701.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☑ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC
☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 825 V Input Sens. Comment mV Det. Oper. 825 V at Comment mV Threshold Dial Ratio = mV

☑ HV Readout (2 points) Ref./Inst. 500 / 499 V Ref./Inst. 1000 / 999 V

COMMENTS:

Alpha Threshold: 120mv
Beta Threshold: 3.5mv
Beta Window: 30mv

Firmware:390096 Cal'd with 5ft cable
Overload set to simulate light leak.
HV set with detector not connected.

Tc99 SN:5280 Size:93200dpm, Background:256cpm, Counts:20080cpm, 4pi Eff:21.27%
SrY90 SN:5281 Size:102085dpm, Background:256cpm, Counts:38074cpm, 4pi Eff:37.04%
Ni63 SN:4017 Size:280409dpm, Background:256cpm, Counts:400cpm, 4pi Eff:0.05%
Th230 SN:E121495 Size:19800dpm, Background:1cpm, Counts:4081cpm, 4pi Eff:20.60%

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	800k cpm	800	800
x1000	200k cpm	200	200
x100	80k cpm	800	800
x100	20k cpm	200	200
x10	8k cpm	800	800
x10	2k cpm	200	200
x1	800 cpm	800	800
x1	200 cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	799862	799862
	80kcpm	79988	79988
	8kcpm	7998	7998
	800cpm	800	800
	80cpm	80	80

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: ☐ 73410 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646 ☐ 70897
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ☐ Beta S/N ☐ Other

☑ m 500 S/N 190566 ☐ Oscilloscope S/N ☑ Multimeter S/N 86250390

Calibrated By: [signature] Date 7 Sept-11

Reviewed By: [signature] Date 7 Sep 11

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR193921 Order #. 20183503/367657

Customer CABRERA SERVICES - EH Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162426 Beta Input Sensitivity 3.5 mV

Count Time 1Minute Beta Window 30 mV

Other Distance Source to Detector Surface

High Voltage	Background		Isotope TH230 Size 19800dpm		Isotope Tc99 Size 93200dpm		Isotope Sr/Y90 Size 102085dpm		Isotope Ni 63 Size 280409dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
800	0	210	3741	552	28	1747	5	33807	5	223
825	1	256	4081	676	27	20080	2	38074	1	400
850	3	337	4374	900	25	23047	3	40254	1	611

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jason Date 7 Sept. 11

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Beta Standard

S.O.# 7008
P.O.# 10-0260

Description of Standard:

Model No. DNS-12 Serial No. 7104-10 Isotope Tc-99

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated beta source S/N 75323-201.

Measurement Result:

The observed beta count rate from the surface of the disc per minute (cpm) on the calibration date was:

7,760 ± 388

The total disintegration rate (dpm) assuming 25 % backscatter of beta particles from the surface of the disc, was:

12,400 ± 621 (0.00559 μCi)

The uncertainty of the measurement is 5 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by:

Calibration Technician: Art Reust Q.A. Manager: Charles McCurdy

Calibration Date: 6-21-2010 Reviewed Date: 6/22/10

Source Manufacturing Lab
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 761-5413 Fax (505) 761-5416
areust@eberlineservices.com

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 7008
P.O.# 10-0260

Description of Standard:

Model No. DNS-11 Serial No. 7102-10 Isotope Th-230

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated alpha source S/N 75322-201

Measurement Result:

The observed alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was:

8,850 ± 265

The total disintegration rate (dpm) assuming 1.5% backscatter of alpha particles from the surface of the disc, was:

17,400 ± 523 (0.00785 μCi)

The uncertainty of the measurement is 3 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by:

Calibration Technician: Art Reust Q.A. Manager: Charlotte McCutcheon

Calibration Date: 6-16-2010 Reviewed Date: 6/22/10

Source Manufacturing Lab
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 761-5413 Fax (505) 761-5416
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Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 20177310/364063

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 193635

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR 202583

Cal. Date 7-Jun-11 Cal Due Date 7-Jun-12 Cal. Interval 1 Year Meterface 202-855

Check mark ✓ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 38 % Alt 701.8 mm Hg

☐ New Instrument Instrument Received ✓ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

✓ Mechanical ck. ✓ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ✓ Reset ck. ✓ Window Operation ☐ Geotropism
✓ Audio ck. ✓ Alarm Setting ck. ✓ Batt. ck. (Min. Volt) 2.2 VDC ☐ RS-232 Port OK

✓ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 600 V

✓ HV Readout (2 points) Ref./Inst. 500 / 502 V Ref./Inst. 2000 / 1999 V

Firmware Version: 39010v20
Alpha Threshold: 175 mv
Beta Threshold: 4 mv
Beta Window: 50 mv
Overload Checked BUT not Set.
Instrument calibrated with a 39' cable.
High voltage set with detector not connected.

(EEPROM Settings)
User Time: 30.0
Alpha Alarm: 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 6/07/2011
Calibration Date Due: 6/07/2012

COMMENTS:

Th230 SN:E121495, Size:19800dpm, Counts:7727cpm, Background:1cpm, 4pi Eff:39.02%
Tc99 SN:5280, Size:93200dpm, Counts:27219cpm, Background:63cpm, 4pi Eff:29.13%
SrY90 SN:5281, Size:102085dpm, Counts:48007cpm, Background:63cpm, 4pi Eff:46.96%
Ni63 SN:4017, Size:280894dpm, Counts:4783cpm, Background:63cpm, 4pi Eff:1.68%

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	400k cpm	400	400
x1000	100k cpm	100	100
x100	40k cpm	400	400
x100	10k cpm	100	100
x10	4k cpm	400	400
x10	1k cpm	100	100
x1	400 cpm	400	400
x1	100 cpm	100	100

*Uncertainty within ± 10% C.F. within ± 20% ALL **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39986(0)	39986(0)
	40kcpm	3998	3998
	4kcpm	400	400
	400cpm	40	40
	40cpm	4	4

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: ☐ 73410 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646 ☐ 70897
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ☐ Beta S/N ☐ Other

✓ m 500 S/N 190566 ☐ Oscilloscope S/N ✓ Multimeter S/N 86250390

Calibrated By: [signature] Date 7-Jun-11

Reviewed By: [signature] Date 7 Jun 11

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
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POST OFFICE BOX 810 PH. 325-235-5494
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SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR202583 Order #. 20177310/364063

Customer CABRERA SERVICES Alpha Input Sensitivity 175 mV

Counter 2360 Serial No. 193635 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 50 mV

Other Distance Source to Detector TRAY

High Voltage	Background		Isotope TH230 Size 19800dpm		Isotope Tc99 Size 93200dpm		Isotope SrY90 Size 102085dpm		Isotope Ni63 Size 280894dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
575	1	62	7580	619	42	22571	2	44796	2	1338
600	1	63	7727	942	39	27219	2	48007	5	4783
625	1	51	7561	973	55	30991	3	48499	7	9100

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jason Ze Date 7-Jun-11