

# CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:			Ludlum 2360		Detector:		Ludlum 43-93		Calibration Date:		2/7/2011							
Serial #:			276935		Serial #:		PR295818		12 month calibration:		OK							
Detector Active Area or Area Covered by Smear (cm <sup>2</sup> ):							100											
	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	T <sub>1/2</sub> (yr)	Source Decayed Activity	Required MDA (DPM/100cm <sup>2</sup> )	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	0.0693	Th-230	7104-10	-	-	-	#VALUE!	500	1	1	0.50	0.71	2452.8	68.48				
Beta	0.0894	Tc-99	7102-10	-	-	-	#VALUE!	1000	1	1	89.50	8.91	1388.0	62.98				
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						
9/13/2011	0	106	2417	1560	0.0	106.0	2417.0	1454.0	PASS	PASS	PASS	PASS	43.29	569	Yes	Yes	B. Gardner	B.G.
9/14/2011	1	106	2476	1539	1.0	106.0	2475.0	1433.0	PASS	PASS	PASS	PASS	110.43	569	Yes	Yes	B. Gardner	B.G.
9/15/2011	1	102	2432	1540	1.0	102.0	2431.0	1438.0	PASS	PASS	PASS	PASS	110.43	559	Yes	Yes	B. Gardner	B.G.
9/16/2011	0	88	2449	1441	0.0	88.0	2449.0	1353.0	PASS	PASS	PASS	PASS	43.29	522	Yes	Yes	B. Gardner	B.G.
9/19/2011	1	100	2280	1449	1.0	100.0	2279.0	1349.0	PASS	PASS	QUESTION	PASS	110.43	554	Yes	Yes	B. Gardner	B.G.
9/20/2011	1	89	2330	1432	1.0	89.0	2329.0	1343.0	PASS	PASS	PASS	PASS	110.43	525	Yes	Yes	B. Gardner	B.G.
9/21/2011	1	88	2390	1412	1.0	88.0	2389.0	1324.0	PASS	PASS	PASS	PASS	110.43	522	Yes	Yes	PR	PR
9/22/2011	2	101	2344	1505	2.0	101.0	2342.0	1404.0	QUESTION	PASS	PASS	PASS	138.24	557	Yes	Yes	PR	PR
9/23/2011	1	93	2318	1511	1.0	93.0	2317.0	1418.0	PASS	PASS	PASS	PASS	110.43	535	Yes	Yes	B. Gardner	B.G.
9/27/2011	0	90	2329	1541	0.0	90.0	2329.0	1451.0	PASS	PASS	PASS	PASS	43.29	527	Yes	Yes	PR	PR
9/28/2011	1	83	2405	1458	1.0	83.0	2404.0	1375.0	PASS	PASS	PASS	PASS	110.43	508	Yes	Yes	PR	PR
9/29/2011	1	101	2329	1501	1.0	101.0	2328.0	1400.0	PASS	PASS	PASS	PASS	110.43	557	Yes	Yes	PR	PR
9/30/2011	1	93	2462	1432	1.0	93.0	2461.0	1339.0	PASS	PASS	PASS	PASS	110.43	535	Yes	Yes	PR	PR
10/3/2011	1	91	2522	1518	1.0	91.0	2521.0	1427.0	PASS	PASS	PASS	PASS	110.43	530	Yes	Yes	PR	PR
10/4/2011	1	103	2335	1447	1.0	103.0	2334.0	1344.0	PASS	PASS	PASS	PASS	110.43	562	Yes	Yes	PR	PR
10/5/2011	1	89	2360	1445	1.0	89.0	2359.0	1356.0	PASS	PASS	PASS	PASS	110.43	525	Yes	Yes	PR	PR
10/6/2011	0	92	2322	1493	0.0	92.0	2322.0	1401.0	PASS	PASS	PASS	PASS	43.29	533	Yes	Yes	PR	PR
10/27/2011	0	91	2327	1528	0.0	91.0	2327.0	1437.0	PASS	PASS	PASS	PASS	43.29	530	Yes	Yes	PR	PR
10/28/2011	1	94	2297	1570	1.0	94.0	2296.0	1476.0	PASS	PASS	QUESTION	PASS	110.43	538	Yes	Yes	PR	PR
11/1/2011	1	98	2318	1550	1.0	98.0	2317.0	1452.0	PASS	PASS	PASS	PASS	110.43	549	Yes	Yes	PR	PR
11/2/2011	1	95	2318	1571	1.0	95.0	2317.0	1476.0	PASS	PASS	PASS	PASS	110.43	541	Yes	Yes	N. Berliner	NMB
11/3/2011	0	101	2468	1456	0.0	101.0	2468.0	1355.0	PASS	PASS	PASS	PASS	43.29	557	Yes	Yes	N. Berliner	NMB
11/4/2011	1	90	2369	1510	1.0	90.0	2368.0	1420.0	PASS	PASS	PASS	PASS	110.43	527	Yes	Yes	N. Berliner	NMB
11/7/2011	1	86	2279	1445	1.0	86.0	2278.0	1359.0	PASS	PASS	QUESTION	PASS	110.43	516	Yes	Yes	N. Berliner	NMB
11/8/2011	0	99	2356	1479	0.0	99.0	2356.0	1380.0	PASS	PASS	PASS	PASS	43.29	551	Yes	Yes	Gbright	GB
11/9/2011	0	91	2476	1579	0.0	91.0	2476.0	1488.0	PASS	PASS	PASS	PASS	43.29	530	Yes	Yes	Gbright	GB
11/10/2011	0	85	2325	1523	0.0	85.0	2325.0	1438.0	PASS	PASS	PASS	PASS	43.29	513	Yes	Yes	Gbright	GB
11/11/2011	0	99	2408	1464	0.0	99.0	2408.0	1365.0	PASS	PASS	PASS	PASS	43.29	551	Yes	Yes	Gbright	GB
11/14/2011	0	88	2470	1497	0.0	88.0	2470.0	1409.0	PASS	PASS	PASS	PASS	43.29	522	Yes	Yes	Gbright	GB
11/15/2011	0	98	2385	1388	0.0	98.0	2385.0	1290.0	PASS	PASS	PASS	PASS	43.29	549	Yes	Yes	Gbright	GB
11/16/2011	0	83	2321	1456	0.0	83.0	2321.0	1373.0	PASS	PASS	PASS	PASS	43.29	508	Yes	Yes	Gbright	GB
11/17/2011	1	97	2398	1508	1.0	97.0	2397.0	1411.0	PASS	PASS	PASS	PASS	110.43	546	Yes	Yes	Gbright	GB
11/18/2011	1	107	2556	1500	1.0	107.0	2555.0	1393.0	PASS	PASS	PASS	PASS	110.43	572	Yes	Yes	S.Devlin	SD
11/21/2011	0	96	2291	1514	0.0	96.0	2291.0	1418.0	PASS	PASS	QUESTION	PASS	43.29	543	Yes	Yes	Gbright	GB
11/22/2011	1	98	2338	1528	1.0	98.0	2337.0	1430.0	PASS	PASS	PASS	PASS	110.43	549	Yes	Yes	Gbright	GB
11/23/2011	2	96	2416	1530	2.0	96.0	2414.0	1434.0	QUESTION	PASS	PASS	PASS	138.24	543	Yes	Yes	Gbright	GB
11/28/2011	1	98	2356	1510	1.0	98.0	2355.0	1412.0	PASS	PASS	PASS	PASS	110.43	549	Yes	Yes	Gbright	GB
11/29/2011	0	102	2391	1489	0.0	102.0	2391.0	1387.0	PASS	PASS	PASS	PASS	43.29	559	Yes	Yes	Gbright	GB

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	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	T <sub>1/2</sub> (yr)	Source Decayed Activity	Required MDA (DPM/100cm <sup>2</sup> )	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	0.0693	Th-230	7104-10	-	-	-	#VALUE!	500	1	1	0.50	0.71	2452.8	68.48				
Beta	0.0894	Tc-99	7102-10	-	-	-	#VALUE!	1000	1	1	89.50	8.91	1388.0	62.98				
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						
11/30/2011	1	94	2369	1452	1.0	94.0	2368.0	1358.0	PASS	PASS	PASS	PASS	110.43	538	Yes	Yes	Gbright	GB
12/1/2011	0	85	2361	1614	0.0	85.0	2361.0	1529.0	PASS	PASS	PASS	QUESTION	43.29	513	Yes	Yes	Gbright	GB
12/2/2011	1	102	2365	1514	1.0	102.0	2364.0	1412.0	PASS	PASS	PASS	PASS	110.43	559	Yes	Yes	Gbright	GB
12/5/2011	1	97	2555	1553	1.0	97.0	2554.0	1456.0	PASS	PASS	PASS	PASS	110.43	546	Yes	Yes	Gbright	GB
12/6/2011	1	95	2507	1513	1.0	95.0	2506.0	1418.0	PASS	PASS	PASS	PASS	110.43	541	Yes	Yes	PR	PR
12/7/2011	1	87	2441	1589	1.0	87.0	2440.0	1502.0	PASS	PASS	PASS	PASS	110.43	519	Yes	Yes	Gbright	GB
12/8/2011	0	85	2342	1546	0.0	85.0	2342.0	1461.0	PASS	PASS	PASS	PASS	43.29	513	Yes	Yes	Gbright	GB
12/9/2011	1	99	2358	1537	1.0	99.0	2357.0	1438.0	PASS	PASS	PASS	PASS	110.43	551	Yes	Yes	Gbright	GB
12/12/2011	1	86	2307	1575	1.0	86.0	2306.0	1489.0	PASS	PASS	QUESTION	PASS	110.43	516	Yes	Yes	Gbright	GB
12/13/2011	0	102	2348	1527	0.0	102.0	2348.0	1425.0	PASS	PASS	PASS	PASS	43.29	559	Yes	Yes	Gbright	GB
12/14/2011	0	103	2354	1422	0.0	103.0	2354.0	1319.0	PASS	PASS	PASS	PASS	43.29	562	Yes	Yes	Gbright	GB
12/15/2011	1	104	2324	1448	1.0	104.0	2323.0	1344.0	PASS	PASS	PASS	PASS	110.43	564	Yes	Yes	Gbright	GB

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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	81	81	2376	2376	1491	1491
2	0	0	100	100	2415	2415	1548	1548
3	1	1	85	85	2358	2358	1449	1449
4	0	0	105	105	2520	2520	1548	1548
5	1	1	83	83	2452	2452	1448	1448
6	0	0	100	100	2565	2565	1369	1369
7	0	0	84	84	2426	2426	1395	1395
8	0	0	91	91	2433	2433	1547	1547
9	1	1	82	82	2540	2540	1521	1521
10	2	2	84	84	2448	2448	1459	1459
Mean		0.50		89.5		2453.3		1477.5
S <sub>(n-1)</sub>		0.71		8.91		68.44		64.51
-3 sigma		-1.62		62.77		2247.99		1283.98
+3 sigma		2.62		116.23		2658.61		1671.02
-2 sigma		-0.91		71.68		2316.42		1348.49
+2 sigma		1.91		107.32		2590.18		1606.51
					Mean-bkg	2452.8		1388.0
					S <sub>(n-1)</sub>	68.48		62.98
				Mean-bkg	-3 sigma	2247.37		1199.06
				Mean-bkg	+3 sigma	2658.23		1576.94
				Mean-bkg	-2 sigma	2315.85		1262.04
				Mean-bkg	+2 sigma	2589.75		1513.96
						2376		1410
						2415		1448
						2357		1364
						2520		1443
						2451		1365
						2565		1269
						2426		1311
						2433		1456
						2539		1439
						2446		1375

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Counting Instrument:			Ludlum 2360		Detector:		Ludlum 43-93		Calibration Date:		2/7/2011							
Serial #:			276935		Serial #:		PR295818		12 month calibration:		OK							
Detector Active Area or Area Covered by Smear (cm <sup>2</sup> ):							100											
	Efficiency (fraction)	Source Nuclide	Source Number	Original Source Activity (DPM)	Source Creation Date	T <sub>1/2</sub> (yr)	Source Decayed Activity	Required MDA (DPM/100cm <sup>2</sup> )	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	0.0693	Th-230	7104-10	-	-	-	#VALUE!	500	1	1	1.50	1.35	2296.3	87.42				
Beta	0.0894	Tc-99	7102-10	-	-	-	#VALUE!	1000	1	1	128.60	10.02	1391.3	98.42				
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	141	2390	1540	0.0	141.0	2390.0	1399.0	PASS	PASS	PASS	PASS	43.29	652	Yes	Yes	Gbright	GB

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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	2	2	130	130	2236	2236	1493	1493
2	2	2	135	135	2226	2226	1407	1407
3	3	3	130	130	2334	2334	1384	1384
4	0	0	150	150	2173	2173	1632	1632
5	0	0	130	130	2240	2240	1465	1465
6	0	0	125	125	2445	2445	1597	1597
7	1	1	122	122	2383	2383	1460	1460
8	2	2	123	123	2283	2283	1507	1507
9	1	1	130	130	2262	2262	1582	1582
10	4	4	111	111	2396	2396	1672	1672
Mean		1.50		128.6		2297.8		1519.9
S <sub>(n-1)</sub>		1.35		10.02		87.73		96.73
-3 sigma		-2.56		98.53		2034.61		1229.71
+3 sigma		5.56		158.67		2560.99		1810.09
-2 sigma		-1.21		108.55		2122.34		1326.44
+2 sigma		4.21		148.65		2473.26		1713.36
					Mean-bkg	2296.3		1391.3
					S <sub>(n-1)</sub>	87.42		98.42
				Mean-bkg	-3 sigma	2034.04		1096.05
				Mean-bkg	+3 sigma	2558.56		1686.55
				Mean-bkg	-2 sigma	2121.46		1194.47
				Mean-bkg	+2 sigma	2471.14		1588.13
						2234		1363
						2224		1272
						2331		1254
						2173		1482
						2240		1335
						2445		1472
						2382		1338
						2281		1384
						2261		1452
						2392		1561