

ISO-7503 EFFICIENCY (ϵ) WORKSHEET (Rev. 0)

INSTRUMENT/TECHNICIAN DETAILS

Instrument		Detector	2pi efficiency data	
Make	Ludlum	Ludlum	Technician (First, Last)	A. Jacobs
Model	2224-1	43-93	Validation (First, Last)	N. Berliner
Unique ID#	227246	PR244549	2 Pi Test Date, YYYY-MM-DD	2017-02-22
Cal. Due, YYYY-MM-DD	2018-01-06		Test Site	UNC
t_b - Bkgd. Count Time, min	1.0			
Bkgd. Total Counts (beta)	210.0			
Detector Active Area, cm ²	100			
Window Areal Density, mg/cm ²	1.2			

SOURCE DETAILS

Source	Th-230	H-3	C-14	Tc-99	Cl-36	SrY-90
Emission Type	α	β^-	β^-	β^-	β^-	β^-
Unique ID#	AC-2446	OR-256	AC-2447	AC-2448	AC-2449	AC-2450
Cert. Date, YYYY-MM-DD	2013-07-25	2006-11-01	2013-04-25	2013-04-25	2013-04-25	2013-05-22
Source Active Area, cm ²	150	100	150	150	150	150
Radioactive Half-life, yrs	75,380	12.3	5,700	211,100	301,000	28.8
Cert. Surface Emission Rate (SER), sec ⁻¹	1,080	1,110	1,260	1,830	2,480	4,500
Decay Corrected (SER), sec ⁻¹	1,080	621	1,259	1,830	2,480	4,111
Mean Emission Energy, keV	4,667	5.7	49	85	252	565
End-Point Emission Energy, keV	4,684	18.6	156	294	710	2,280
ϵ_s - Source Efficiency	0.25	0.25	0.25	0.25	0.50	0.50
t_s - Source Count Time, min	2			1		

TEST DATA (enter gross counts - target >30000, required >10000 counts)

Contact	38,108			28,198		
+1 cm	12,520			22,768		
+2 cm						

INSTRUMENT EFFICIENCY (ϵ_i)

Contact	0.441			0.382		
+1 cm	0.145			0.308		
+2 cm						

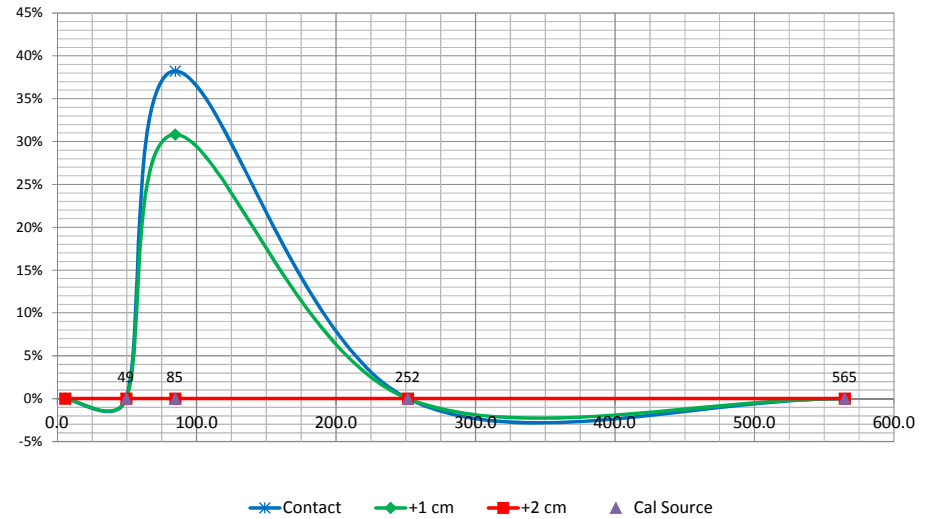
TOTAL EFFICIENCY (ϵ_T)

Contact	0.110			0.096		
+1 cm	0.036			0.077		
+2 cm						

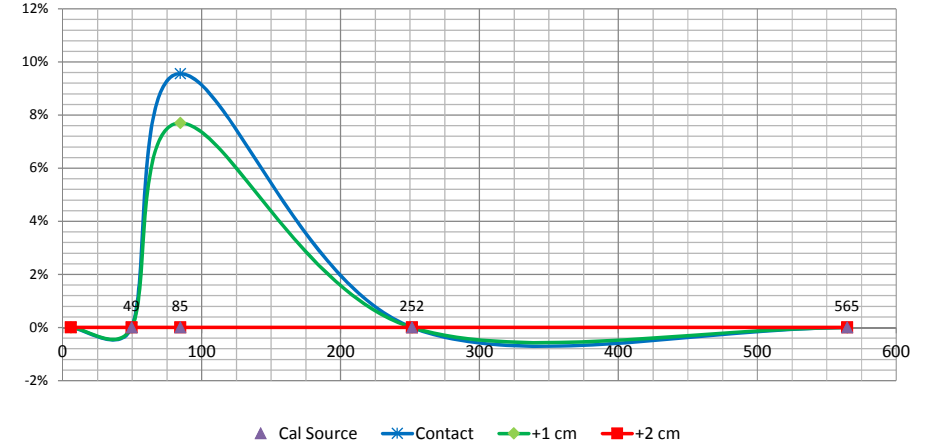
ISO-7503 EFFICIENCY (ϵ) WORKSHEET

EFFICIENCY PLOTS

% Instrument Efficiency vs. Mean Beta Energy, keV



% Total Efficiency vs. Mean Beta Energy, keV



ISO-7503 EFFICIENCY (ϵ) WORKSHEET (Rev. 0)

INSTRUMENT/TECHNICIAN DETAILS

Instrument		Detector		2pi efficiency data	
Make	Ludlum	Ludlum	Technician (First, Last) A. Jacobs		
Model	2360	43-93	Validation (First, Last) N. Berliner		
Unique ID#	184909	PR298426	2 Pi Test Date, YYYY-MM-DD 2017-02-23		
Cal. Due, YYYY-MM-DD	2018-01-16		Test Site UNC		
t_b - Bkgd. Count Time, min	1.0				
Bkgd. Total Counts (beta)	118.0				
Detector Active Area, cm ²	100				
Window Areal Density, mg/cm ²	1.2				

SOURCE DETAILS

Source	Th-230	H-3	C-14	Tc-99	Cl-36	SrY-90
Emission Type	α	β^-	β^-	β^-	β^-	β^-
Unique ID#	AC-2446	OR-256	AC-2447	AC-2448	AC-2449	AC-2450
Cert. Date, YYYY-MM-DD	2013-07-25	2006-11-01	2013-04-25	2013-04-25	2013-04-25	2013-05-22
Source Active Area, cm ²	150	100	150	150	150	150
Radioactive Half-life, yrs	75,380	12.3	5,700	211,100	301,000	28.8
Cert. Surface Emission Rate (SER), sec ⁻¹	1,080	1,110	1,260	1,830	2,480	4,500
Decay Corrected (SER), sec ⁻¹	1,080	621	1,259	1,830	2,480	4,110
Mean Emission Energy, keV	4,667	5.7	49	85	252	565
End-Point Emission Energy, keV	4,684	18.6	156	294	710	2,280
ϵ_s - Source Efficiency	0.25	0.25	0.25	0.25	0.50	0.50
t_s - Source Count Time, min	2			1		

TEST DATA (enter gross counts - target >30000, required >10000 counts)

	Contact	+1 cm	+2 cm
Contact	34,294		18,269
+1 cm	22,211		15,284
+2 cm			

INSTRUMENT EFFICIENCY (ϵ_i)

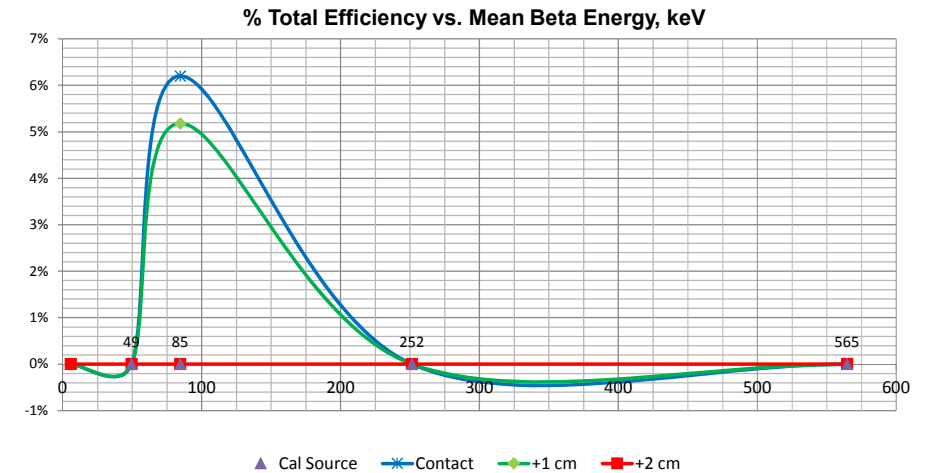
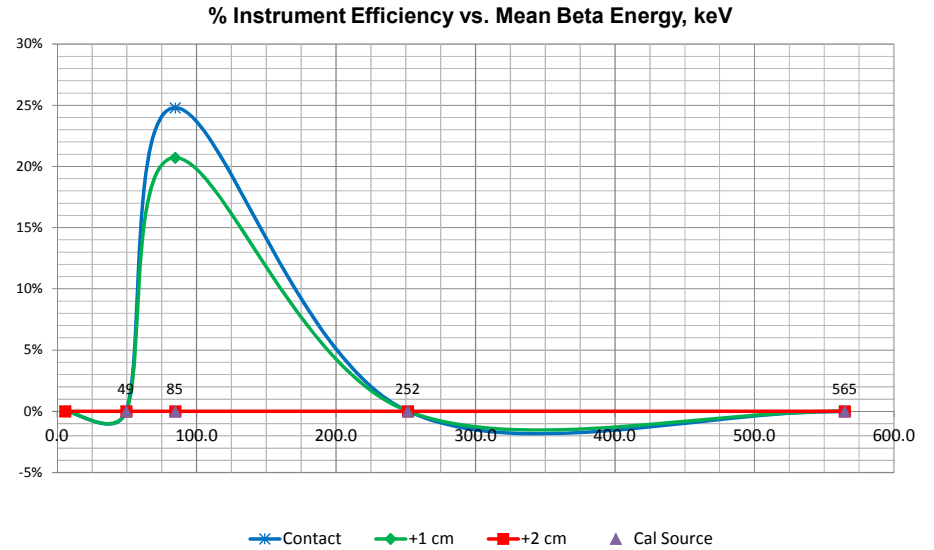
	Contact	+1 cm	+2 cm
Contact	0.397		0.248
+1 cm	0.103		0.207
+2 cm			

TOTAL EFFICIENCY (ϵ_T)

	Contact	+1 cm	+2 cm
Contact	0.099		0.062
+1 cm	0.026		0.052
+2 cm			

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EFFICIENCY PLOTS



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INSTRUMENT/TECHNICIAN DETAILS

Instrument		Detector	2pi efficiency data	
Make	Ludlum	Ludlum	Technician (First, Last)	A. Jacobs
Model	2360	43-93	Validation (First, Last)	N. Berliner
Unique ID#	193638	PR199836	2 Pi Test Date, YYYY-MM-DD	2017-02-24
Cal. Due, YYYY-MM-DD	2018-02-07		Test Site	UNC
t_b - Bkgd. Count Time, min	1.0			
Bkgd. Total Counts (beta)	118.0			
Detector Active Area, cm ²	100			
Window Areal Density, mg/cm ²	1.2			

SOURCE DETAILS

Source	Th-230	H-3	C-14	Tc-99	Cl-36	SrY-90
Emission Type	α	β^-	β^-	β^-	β^-	β^-
Unique ID#	AC-2446	OR-256	AC-2447	AC-2448	AC-2449	AC-2450
Cert. Date, YYYY-MM-DD	2013-07-25	2006-11-01	2013-04-25	2013-04-25	2013-04-25	2013-05-22
Source Active Area, cm ²	150	100	150	150	150	150
Radioactive Half-life, yrs	75,380	12.3	5,700	211,100	301,000	28.8
Cert. Surface Emission Rate (SER), sec ⁻¹	1,080	1,110	1,260	1,830	2,480	4,500
Decay Corrected (SER), sec ⁻¹	1,080	621	1,259	1,830	2,480	4,110
Mean Emission Energy, keV	4,667	5.7	49	85	252	565
End-Point Emission Energy, keV	4,684	18.6	156	294	710	2,280
ϵ_s - Source Efficiency	0.25	0.25	0.25	0.25	0.50	0.50
t_s - Source Count Time, min	2			1		

TEST DATA (enter gross counts - target >30000, required >10000 counts)

Contact	37,853			19,822		
+1 cm	13,738			16,388		
+2 cm						

INSTRUMENT EFFICIENCY (ϵ_i)

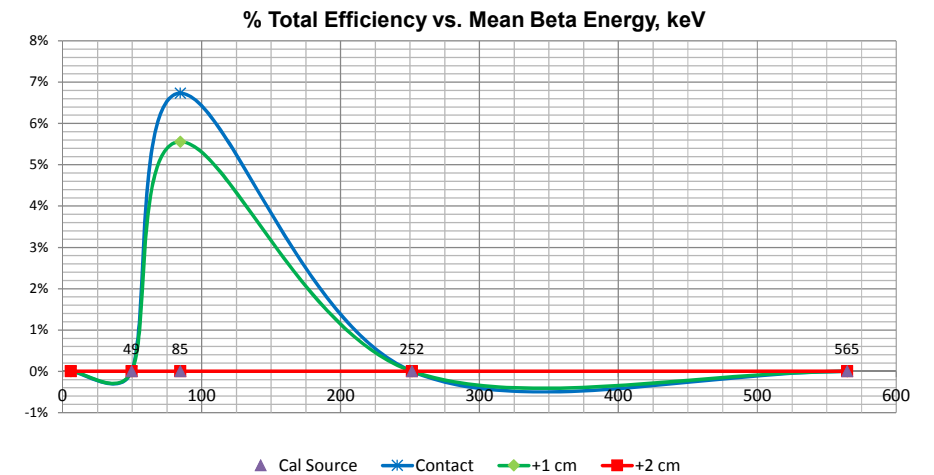
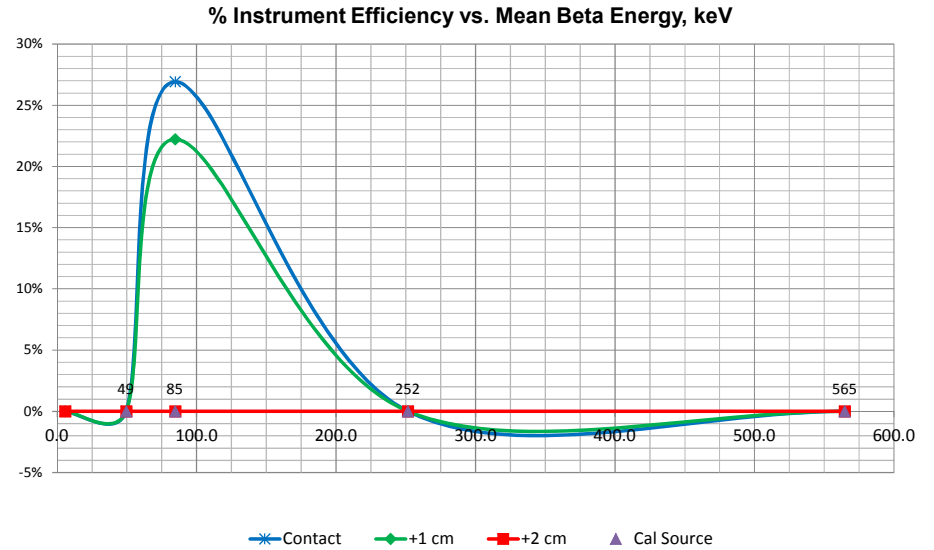
Contact	0.438			0.269		
+1 cm	0.159			0.222		
+2 cm						

TOTAL EFFICIENCY (ϵ_T)

Contact	0.110			0.067		
+1 cm	0.040			0.056		
+2 cm						

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EFFICIENCY PLOTS



ISO-7503 EFFICIENCY (ϵ) WORKSHEET (Rev. 0)

INSTRUMENT/TECHNICIAN DETAILS

Instrument		Detector		2pi efficiency data	
Make	Ludlum	Ludlum	Technician (First, Last) A. Jacobs		
Model	2360	43-37	Validation (First, Last) N. Berliner		
Unique ID#	202408	PR178371	2 Pi Test Date, YYYY-MM-DD 2017-02-24		
Cal. Due, YYYY-MM-DD	2017-11-26		Test Site UNC		
t_b - Bkgd. Count Time, min	2.0				
Bkgd. Total Counts (beta)	357.0				
Detector Active Area, cm ²	582				
Window Areal Density, mg/cm ²	1.2				

SOURCE DETAILS

Source	Th-230	H-3	C-14	Tc-99	Cl-36	SrY-90
Emission Type	α	β^-	β^-	β^-	β^-	β^-
Unique ID#	AC-2446	OR-256	AC-2447	AC-2448	AC-2449	AC-2450
Cert. Date, YYYY-MM-DD	2013-07-25	2006-11-01	2013-04-25	2013-04-25	2013-04-25	2013-05-22
Source Active Area, cm ²	150	100	150	150	150	150
Radioactive Half-life, yrs	75,380	12.3	5,700	211,100	301,000	28.8
Cert. Surface Emission Rate (SER), sec ⁻¹	1,080	1,110	1,260	1,830	2,480	4,500
Decay Corrected (SER), sec ⁻¹	1,080	621	1,259	1,830	2,480	4,110
Mean Emission Energy, keV	4,667	5.7	49	85	252	565
End-Point Emission Energy, keV	4,684	18.6	156	294	710	2,280
ϵ_s - Source Efficiency	0.25	0.25	0.25	0.25	0.50	0.50
t_s - Source Count Time, min	5			5		

TEST DATA (enter gross counts - target >30000, required >10000 counts)

	Contact	+1 cm	+2 cm
Contact	85,141		195,396
+1 cm	28,779		175,189
+2 cm			

INSTRUMENT EFFICIENCY (ϵ_i)

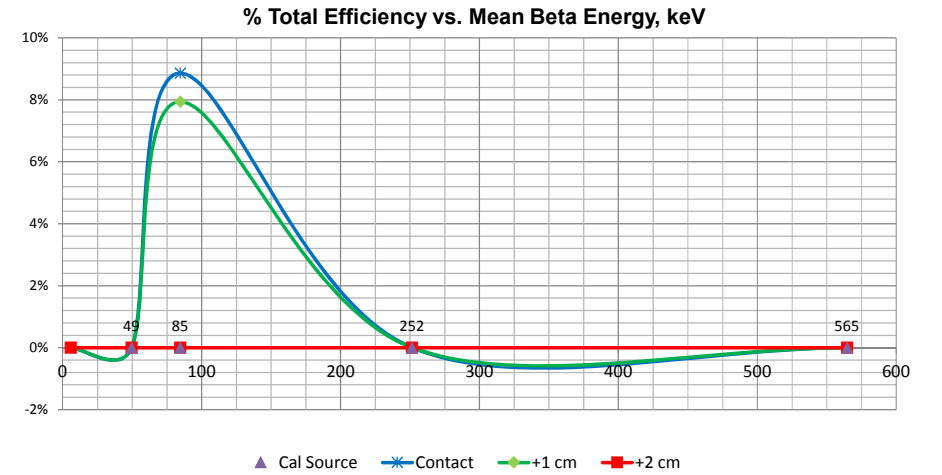
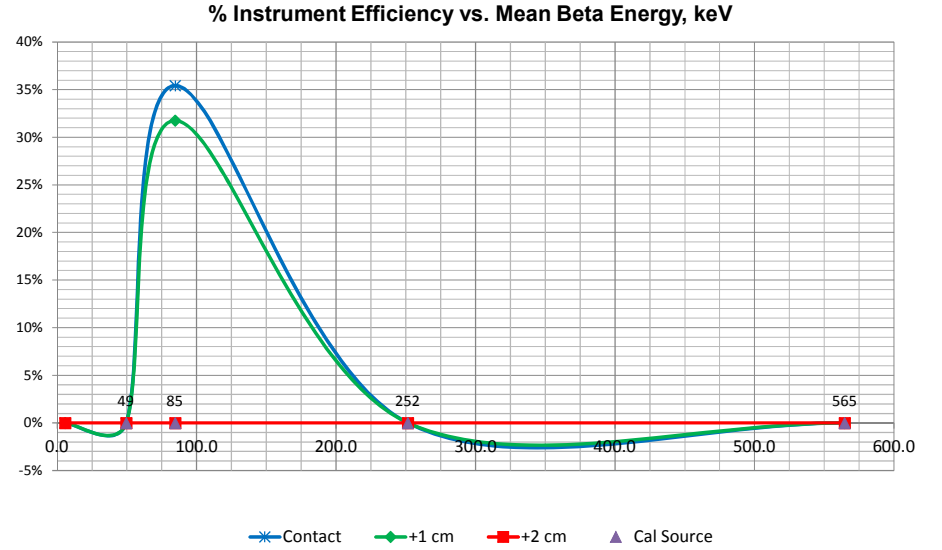
	Contact	+1 cm	+2 cm
Contact	0.263		0.354
+1 cm	0.089		0.317
+2 cm			

TOTAL EFFICIENCY (ϵ_T)

	Contact	+1 cm	+2 cm
Contact	0.066		0.089
+1 cm	0.022		0.079
+2 cm			

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EFFICIENCY PLOTS



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INSTRUMENT/TECHNICIAN DETAILS

Instrument		Detector	2pi efficiency data	
Make	Ludlum	Ludlum	Technician (First, Last)	A. Craig
Model	2360	43-37	Validation (First, Last)	N. Berliner
Unique ID#	278586	PR216982	2 Pi Test Date, YYYY-MM-DD	2017-03-27
Cal. Due, YYYY-MM-DD	2018-03-22		Test Site	UNC
t_b - Bkgd. Count Time, min	1.0			
Bkgd. Total Counts (beta)	745.8			
Detector Active Area, cm ²	584			
Window Areal Density, mg/cm ²	1.2			

SOURCE DETAILS

Source	Th-230	H-3	C-14	Tc-99	Cl-36	SrY-90
Emission Type	α	β^-	β^-	β^-	β^-	β^-
Unique ID#	AC-2446	OR-256	AC-2447	AC-2448	AC-2449	AC-2450
Cert. Date, YYYY-MM-DD	2013-07-25	2006-11-01	2013-04-25	2013-04-25	2013-04-25	2013-05-22
Source Active Area, cm ²	150	100	150	150	150	150
Radioactive Half-life, yrs	75,380	12.3	5,700	211,100	301,000	28.8
Cert. Surface Emission Rate (SER), sec ⁻¹	1,080	1,110	1,260	1,830	2,480	4,500
Decay Corrected (SER), sec ⁻¹	1,080	618	1,259	1,830	2,480	4,102
Mean Emission Energy, keV	4,667	5.7	49	85	252	565
End-Point Emission Energy, keV	4,684	18.6	156	294	710	2,280
ϵ_s - Source Efficiency	0.63	0.50	0.50	0.50	1.00	1.00
t_s - Source Count Time, min	5					5

TEST DATA (enter gross counts - target >30000, required >10000 counts)

	Contact	+1 cm	+2 cm
Contact	88,984		403,588
+1 cm			
+2 cm			

INSTRUMENT EFFICIENCY (ϵ_i)

	Contact	+1 cm	+2 cm
Contact	0.275		0.325
+1 cm			
+2 cm			

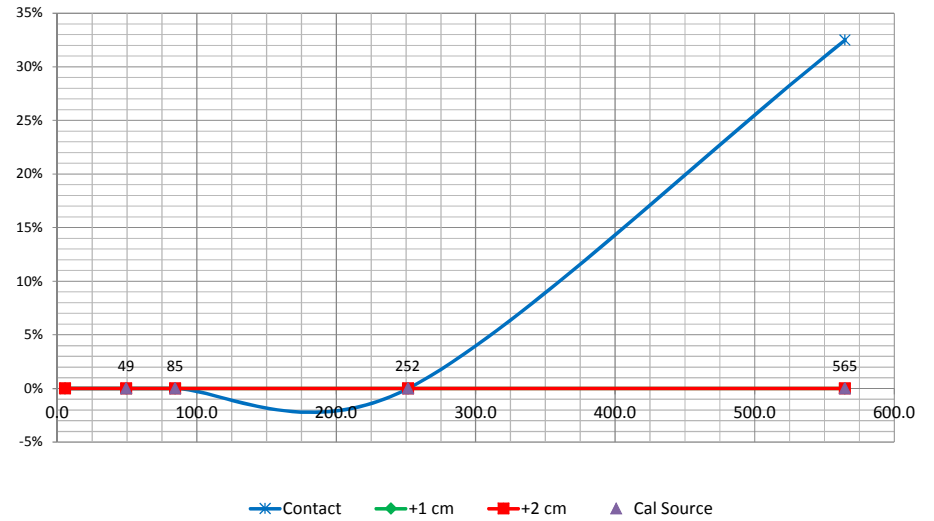
TOTAL EFFICIENCY (ϵ_T)

	Contact	+1 cm	+2 cm
Contact	0.172		0.325
+1 cm			
+2 cm			

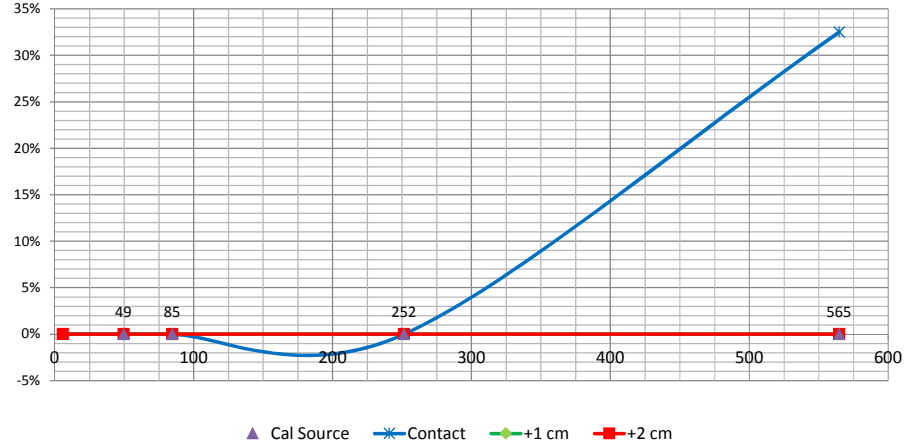
ISO-7503 EFFICIENCY (ϵ) WORKSHEET

EFFICIENCY PLOTS

% Instrument Efficiency vs. Mean Beta Energy, keV



% Total Efficiency vs. Mean Beta Energy, keV

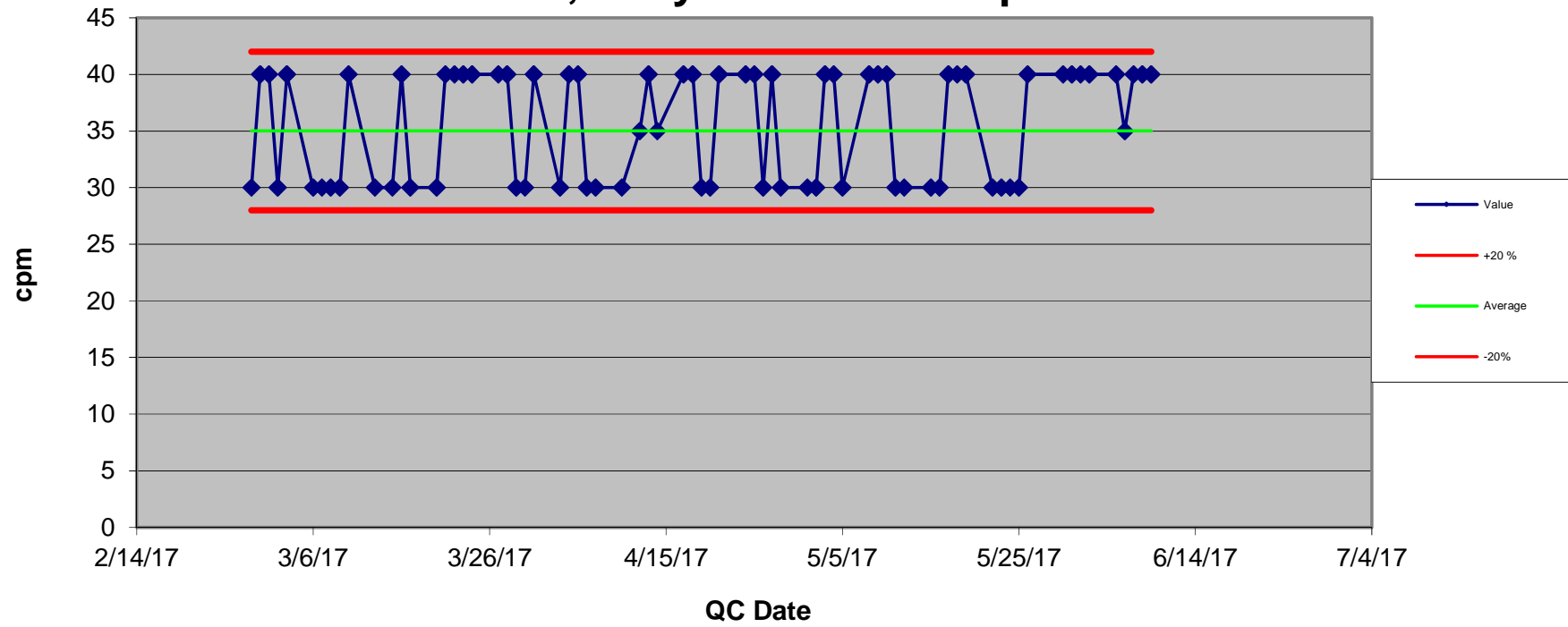


Instrument QA/QC Ludlum 2221/44-9

PR251740/SN262322		
QC Daily Source		
Date	Result (cpm)	P/F
2/27/2017	30	Pass
2/28/2017	40	Pass
3/1/2017	40	Pass
3/2/2017	30	Pass
3/3/2017	40	Pass
3/6/2017	30	Pass
3/7/2017	30	Pass
3/8/2017	30	Pass
3/9/2017	30	Pass
3/10/2017	40	Pass
3/13/2017	30	Pass
3/15/2017	30	Pass
3/16/2017	40	Pass
3/17/2017	30	Pass
3/20/2017	30	Pass
3/21/2017	40	Pass
3/22/2017	40	Pass
3/23/2017	40	Pass
3/24/2017	40	Pass
3/27/2017	40	Pass
3/28/2017	40	Pass
3/29/2017	30	Pass
3/30/2017	30	Pass
3/31/2017	40	Pass
4/3/2017	30	Pass
4/4/2017	40	Pass
4/5/2017	40	Pass
4/6/2017	30	Pass
4/7/2017	30	Pass
4/10/2017	30	Pass
4/12/2017	35	Pass
4/13/2017	40	Pass
4/14/2017	35	Pass
4/17/2017	40	Pass
4/18/2017	40	Pass
4/19/2017	30	Pass
4/20/2017	30	Pass
4/21/2017	40	Pass
4/24/2017	40	Pass
4/25/2017	40	Pass
4/26/2017	30	Pass
4/27/2017	40	Pass
4/28/2017	30	Pass
5/1/2017	30	Pass
5/2/2017	30	Pass
5/3/2017	40	Pass
5/4/2017	40	Pass
5/5/2017	30	Pass
5/8/2017	40	Pass
5/9/2017	40	Pass
5/10/2017	40	Pass
5/11/2017	30	Pass
5/12/2017	30	Pass
5/15/2017	30	Pass
5/16/2017	30	Pass
5/17/2017	40	Pass
5/18/2017	40	Pass
5/19/2017	40	Pass
5/22/2017	30	Pass
5/23/2017	30	Pass
5/24/2017	30	Pass
5/25/2017	30	Pass
5/26/2017	40	Pass
5/30/2017	40	Pass
5/31/2017	40	Pass
6/1/2017	40	Pass
6/2/2017	40	Pass
6/5/2017	40	Pass
6/6/2017	35	Pass
6/7/2017	40	Pass
6/8/2017	40	Pass
6/9/2017	40	Pass

PR251740/SN262322		Source Ser. #	NA
Initial Source Readings		Nuclide	Bkg
Date	Result (cpm)		
2/27/2017	30		
2/27/2017	40		
2/27/2017	30		
2/27/2017	30		
2/27/2017	40		
2/27/2017	40		
2/27/2017	30		
2/27/2017	30		
2/27/2017	40		
2/27/2017	40		
2/27/2017	40		
	Average		
	35		

PR251740/SN262322, Daily QC Trend Graph

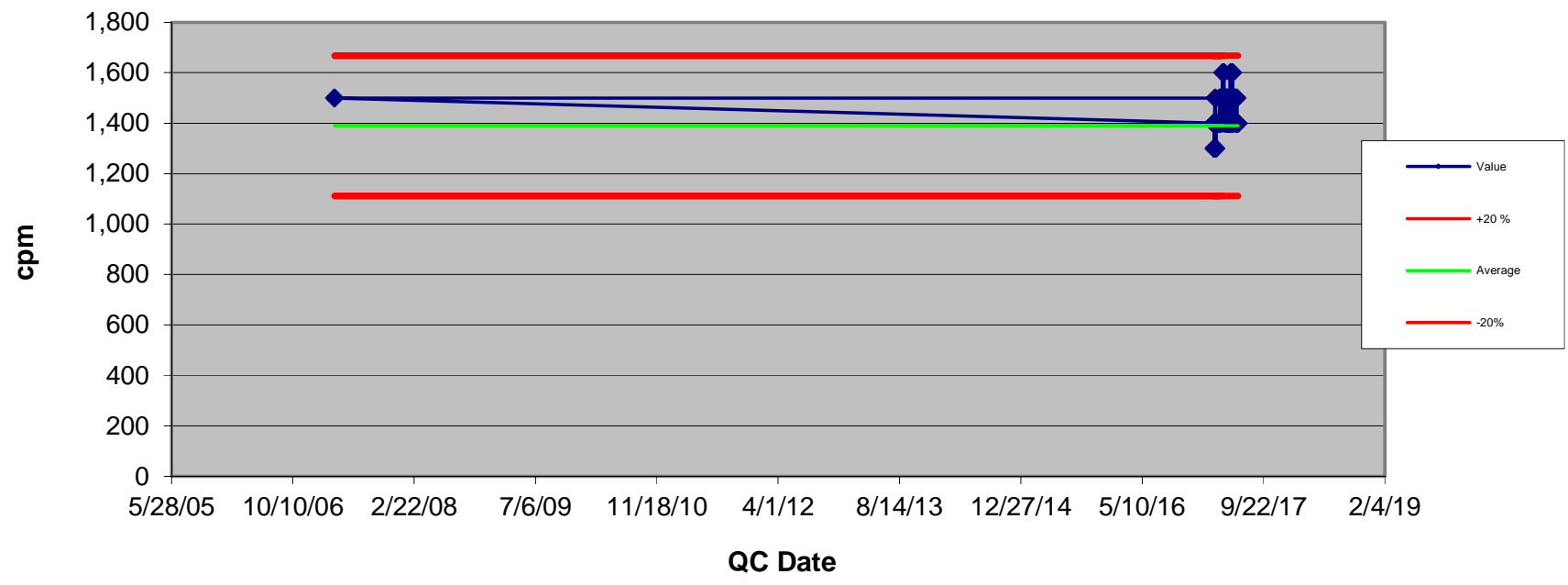


Instrument QA/QC Ludlum 2221/44-9

Inst.#PR251740/SN262322		
QC Daily Source		
Date	Result (cpm)	P/F
2/27/2017	1,400	Pass
2/28/2017	1,400	Pass
3/1/2017	1,400	Pass
3/2/2017	1,300	Pass
3/3/2017	1,400	Pass
3/6/2017	1,500	Pass
3/7/2017	1,400	Pass
3/8/2017	1,400	Pass
3/9/2017	1,300	Pass
3/10/2017	1,400	Pass
3/13/2017	1,400	Pass
3/15/2017	1,400	Pass
3/16/2017	1,400	Pass
3/17/2017	1,400	Pass
3/20/2017	1,400	Pass
3/21/2017	1,400	Pass
3/22/2017	1,400	Pass
3/23/2017	1,400	Pass
3/24/2017	1,500	Pass
3/27/2017	1,500	Pass
3/28/2017	1,400	Pass
3/29/2017	1,400	Pass
3/30/2017	1,500	Pass
3/31/2007	1,500	Pass
4/3/2017	1,400	Pass
4/4/2017	1,500	Pass
4/5/2017	1,500	Pass
4/6/2017	1,600	Pass
4/7/2017	1,500	Pass
4/10/2017	1,600	Pass
4/12/2017	1,600	Pass
4/13/2017	1,400	Pass
4/14/2017	1,500	Pass
4/17/2017	1,500	Pass
4/18/2017	1,500	Pass
4/19/2017	1,400	Pass
4/20/2017	1,400	Pass
4/21/2017	1,500	Pass
4/24/2017	1,500	Pass
4/25/2017	1,400	Pass
4/26/2017	1,500	Pass
4/27/2017	1,400	Pass
4/28/2017	1,400	Pass
5/1/2017	1,500	Pass
5/2/2017	1,500	Pass
5/3/2017	1,400	Pass
5/4/2017	1,400	Pass
5/5/2017	1,400	Pass
5/8/2017	1,600	Pass
5/9/2017	1,400	Pass
5/10/2017	1,400	Pass
5/11/2017	1,600	Pass
5/12/2017	1,600	Pass
5/15/2017	1,400	Pass
5/16/2017	1,600	Pass
5/17/2017	1,600	Pass
5/18/2017	1,400	Pass
5/19/2017	1,400	Pass
5/22/2017	1,400	Pass
5/23/2017	1,500	Pass
5/24/2017	1,500	Pass
5/25/2017	1,500	Pass
5/26/2017	1,500	Pass
5/30/2017	1,400	Pass
5/31/2017	1,400	Pass
6/1/2017	1,400	Pass
6/2/2017	1,500	Pass
6/5/2017	1,500	Pass
6/6/2017	1,400	Pass
6/7/2017	1,400	Pass
6/8/2017	1,400	Pass
6/9/2017	1,400	Pass

Inst.#PR251740/SN262322		Source Ser. #	5634-05
Initial Source Readings		Nuclide	Tc-99
Date	Result (cpm)		
2/27/2017	1,400		
2/27/2017	1,300		
2/27/2017	1,400		
2/27/2017	1,500		
2/27/2017	1,400		
2/27/2017	1,400		
2/27/2017	1,500		
2/27/2017	1,300		
2/27/2017	1,400		
2/27/2017	1,500		
2/27/2017	1,300		
2/27/2017	1,400		
2/27/2017	1,300		
	Average		
	1390		

Inst.#PR251740/SN262322, Daily QC Trend Graph

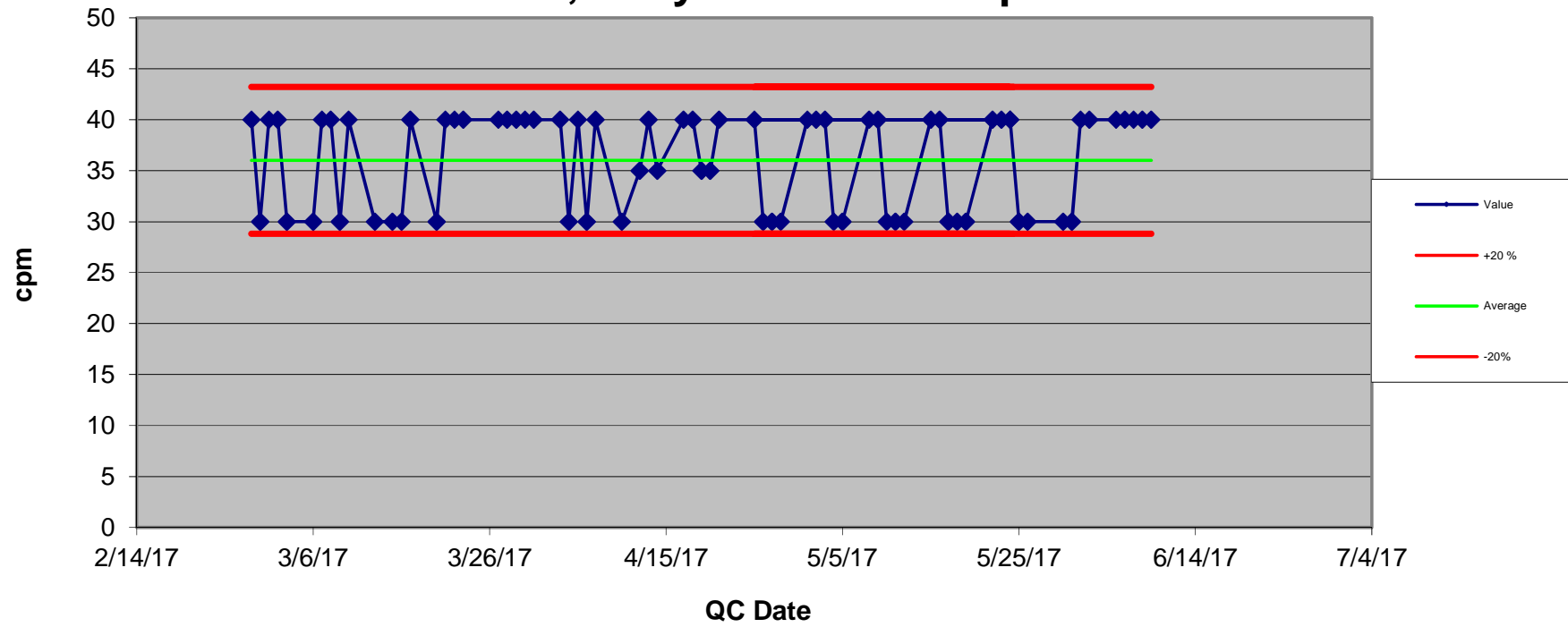


Instrument QA/QC Ludlum 2221/44-9

PR147787/SN276863		
QC Daily Source		
Date	Result (cpm)	P/F
2/27/2017	40	Pass
2/28/2017	30	Pass
3/1/2017	40	Pass
3/2/2017	40	Pass
3/3/2017	30	Pass
3/6/2017	30	Pass
3/7/2017	40	Pass
3/8/2017	40	Pass
3/9/2017	30	Pass
3/10/2017	40	Pass
3/13/2017	30	Pass
3/15/2017	30	Pass
3/16/2017	30	Pass
3/17/2017	40	Pass
3/20/2017	30	Pass
3/21/2017	40	Pass
3/22/2017	40	Pass
3/23/2017	40	Pass
3/27/2017	40	Pass
3/28/2017	40	Pass
3/29/2017	40	Pass
3/30/2017	40	Pass
3/31/2017	40	Pass
4/3/2017	40	Pass
4/4/2017	30	Pass
4/5/2017	40	Pass
4/6/2017	30	Pass
4/7/2017	40	Pass
4/10/2017	30	Pass
4/12/2017	35	Pass
4/13/2017	40	Pass
4/14/2017	35	Pass
4/17/2017	40	Pass
4/18/2017	40	Pass
4/19/2017	35	Pass
4/20/2017	35	Pass
4/21/2017	40	Pass
5/24/2017	40	Pass
4/25/2017	40	Pass
4/26/2017	30	Pass
4/27/2017	30	Pass
4/28/2017	30	Pass
5/1/2017	40	Pass
5/2/2017	40	Pass
5/3/2017	40	Pass
5/4/2017	30	Pass
5/5/2017	30	Pass
5/8/2017	40	Pass
5/9/2017	40	Pass
5/10/2017	30	Pass
5/11/2017	30	Pass
5/12/2017	30	Pass
5/15/2017	40	Pass
5/16/2017	40	Pass
5/17/2017	30	Pass
5/18/2017	30	Pass
5/19/2017	30	Pass
5/22/2017	40	Pass
5/23/2017	40	Pass
5/24/2017	40	Pass
5/25/2017	30	Pass
5/26/2017	30	Pass
5/30/2017	30	Pass
5/31/2017	30	Pass
6/1/2017	40	Pass
6/2/2017	40	Pass
6/5/2017	40	Pass
6/6/2017	40	Pass
6/7/2017	40	Pass
6/8/2017	40	Pass
6/9/2017	40	Pass

PR147787/SN276863		Source Ser. #	NA
Initial Source Readings		Nuclide	Bkg
Date	Result (cpm)		
2/27/2017	40		
2/27/2017	30		
2/27/2017	30		
2/27/2017	40		
2/27/2017	30		
2/27/2017	40		
2/27/2017	40		
2/27/2017	40		
2/27/2017	30		
2/27/2017	40		
Average			
36			

PR251740/SN262322, Daily QC Trend Graph

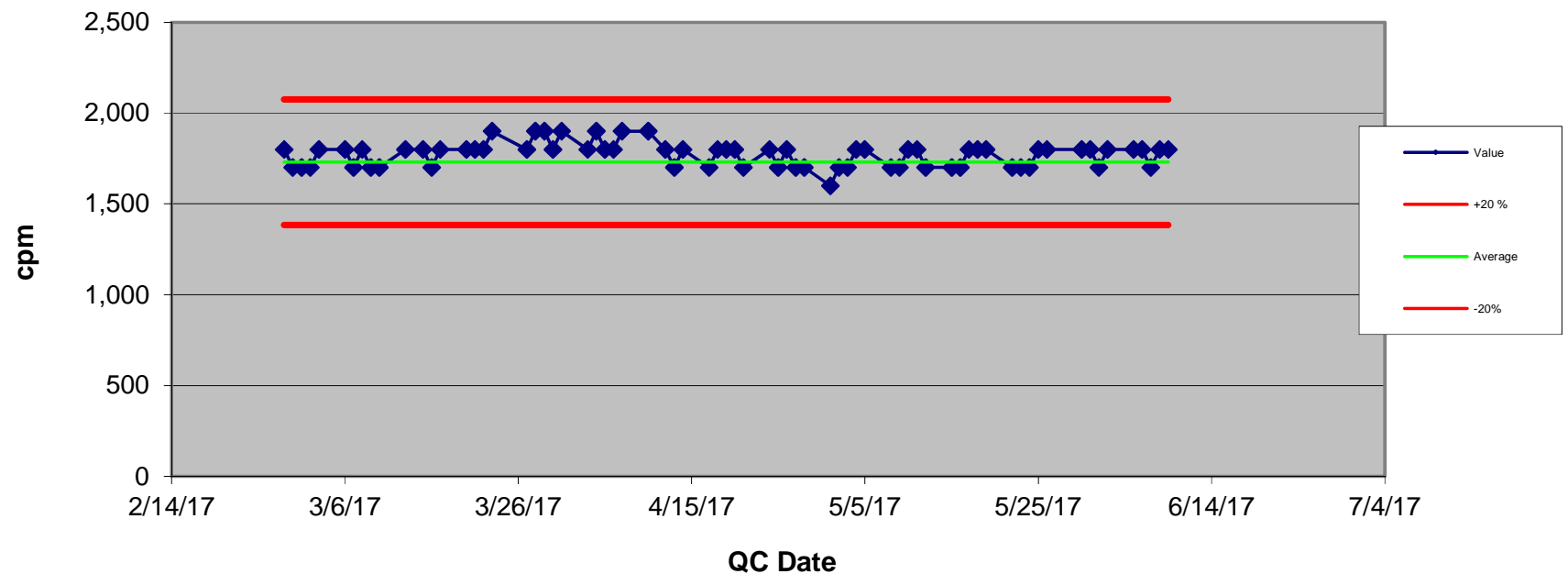


Instrument QA/QC Ludlum 2221/44-9

PR147787/SN276863		
QC Daily Source		
Date	Result (cpm)	P/F
2/27/2017	1,800	Pass
2/28/2017	1,700	Pass
3/1/2017	1,700	Pass
3/2/2017	1,700	Pass
3/3/2017	1,800	Pass
3/6/2017	1,800	Pass
3/7/2017	1,700	Pass
3/8/2017	1,800	Pass
3/9/2017	1,700	Pass
3/10/2017	1,700	Pass
3/13/2017	1,800	Pass
3/15/2017	1,800	Pass
3/16/2017	1,700	Pass
3/17/2017	1,800	Pass
3/20/2017	1,800	Pass
3/21/2017	1,800	Pass
3/22/2017	1,800	Pass
3/23/2017	1,900	Pass
3/27/2017	1,800	Pass
3/28/2017	1,900	Pass
3/29/2017	1,900	Pass
3/30/2017	1,800	Pass
3/31/2017	1,900	Pass
4/3/2017	1,800	Pass
4/4/2017	1,900	Pass
4/5/2017	1,800	Pass
4/6/2017	1,800	Pass
4/7/2017	1,900	Pass
4/10/2017	1,900	Pass
4/12/2017	1,800	Pass
4/13/2017	1,700	Pass
4/14/2017	1,800	Pass
4/17/2017	1,700	Pass
4/18/2017	1,800	Pass
4/19/2017	1,800	Pass
4/20/2017	1,800	Pass
4/21/2017	1,700	Pass
4/24/2017	1,800	Pass
4/25/2017	1,700	Pass
4/26/2017	1,800	Pass
4/27/2017	1,700	Pass
4/28/2017	1,700	Pass
5/1/2017	1,600	Pass
5/2/2017	1,700	Pass
5/3/2017	1,700	Pass
5/4/2017	1,800	Pass
5/5/2017	1,800	Pass
5/8/2017	1,700	Pass
5/9/2017	1,700	Pass
5/10/2017	1,800	Pass
5/11/2017	1,800	Pass
5/12/2017	1,700	Pass
5/15/2017	1,700	Pass
5/16/2017	1,700	Pass
5/17/2017	1,800	Pass
5/18/2017	1,800	Pass
5/19/2017	1,800	Pass
5/22/2017	1,700	Pass
5/23/2017	1,700	Pass
5/24/2017	1,700	Pass
5/25/2017	1,800	Pass
5/26/2017	1,800	Pass
5/30/2017	1,800	Pass
5/31/2017	1,800	Pass
6/1/2017	1,700	Pass
6/2/2017	1,800	Pass
6/5/2017	1,800	Pass
6/6/2017	1,800	Pass
6/7/2017	1,700	Pass
6/8/2017	1,800	Pass
6/9/2017	1,800	Pass

PR147787/SN276863		Source Ser. #	5634-05
Initial Source Readings		Nuclide	Tc-99
Date	Result (cpm)		
2/27/2017	1,700		
2/27/2017	1,800		
2/27/2017	1,800		
2/27/2017	1,700		
2/27/2017	1,700		
2/27/2017	1,700		
2/27/2017	1,600		
2/27/2017	1,700		
2/27/2017	1,800		
2/27/2017	1,700		
2/27/2017	1,800		
Average			
1730			

Inst.#PR251740/SN262322, Daily QC Trend Graph



CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:	2360	Detector:	43-37	Calibration Date:	3/22/2017
Serial #:	278586	Serial #:	PR216982	12 month calibration:	OK

Detector Active Area or Area Covered by Smear (cm²): 584

	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	0.0660	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	100	1	1	2.80	1.40	2343.8	48.71
Beta	0.0890	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	1000	1	1	563.90	17.18	2037.2	48.06

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	Reviewed By
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta						
8/22/2017	3	552	2439	2640	3.0	552.0	2436.0	2088.0	PASS	PASS	PASS	PASS	28.69	216	Yes	Yes	M. Plonski	MSP
8/23/2017	3	547	2443	2617	3.0	547.0	2440.0	2070.0	PASS	PASS	PASS	PASS	28.69	215	Yes	Yes	M. Plonski	MSP
8/24/2017	3	537	2368	2544	3.0	537.0	2365.0	2007.0	PASS	PASS	PASS	PASS	28.69	213	Yes	Yes	M. Plonski	MSP
8/26/2017	3	562	2417	2538	3.0	562.0	2414.0	1976.0	PASS	PASS	PASS	PASS	28.69	218	Yes	Yes		
8/28/2017	1	575	2,302	2,610	1.0	575.0	2301.0	2035.0	PASS	PASS	PASS	PASS	19.85	220	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	4	4	576	576	2263	2263	2660	2660
2	3	3	578	578	2375	2375	2551	2551
3	2	2	583	583	2317	2317	2599	2599
4	2	2	570	570	2375	2375	2591	2591
5	2	2	551	551	2390	2390	2632	2632
6	1	1	562	562	2356	2356	2669	2669
7	3	3	527	527	2398	2398	2544	2544
8	6	6	561	561	2292	2292	2582	2582
9	3	3	579	579	2393	2393	2660	2660
10	2	2	552	552	2307	2307	2523	2523
Mean		2.80		563.9		2346.6		2601.1
S _(n-1)		1.40		17.18		48.07		52.54
-3 sigma		-1.40		512.35		2202.40		2443.48
+3 sigma		7.00		615.45		2490.80		2758.72
-2 sigma		0.00		529.54		2250.46		2496.02
+2 sigma		5.60		598.26		2442.74		2706.18
					Mean-bkg	2343.8		2037.2
					S _(n-1)	48.71		48.06
				Mean-bkg	-3 sigma	2197.68		1893.03
				Mean-bkg	+3 sigma	2489.92		2181.37
				Mean-bkg	-2 sigma	2246.39		1941.09
				Mean-bkg	+2 sigma	2441.21		2133.31

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	0.3678	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	1,000	1	1	0.30	0.48	6448.5	120.90				
Beta	0.2011	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	1,000	1	1	37.40	5.38	2065.4	66.10				
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						
8/21/2017	0	38	6,428	2,009	0.0	38.0	6428.0	1971.0	PASS	PASS	PASS	PASS	8.16	158	Yes	Yes	Mplonski	MP
8/22/2017	0	37	6,441	2,107	0.0	37.0	6441.0	2070.0	PASS	PASS	PASS	PASS	8.16	156	Yes	Yes	Mplonski	MP
8/23/2017	0	30	6,213	2,073	0.0	30.0	6213.0	2043.0	PASS	PASS	PASS	PASS	8.16	142	Yes	Yes	Mplonski	MP
8/24/2017	0	34	6,284	2,048	0.0	34.0	6284.0	2014.0	PASS	PASS	PASS	PASS	8.16	150	Yes	Yes	Mplonski	MP
8/28/2017	1	35	6,300	2,012	1.0	35.0	6299.0	1977.0	PASS	PASS	PASS	PASS	20.81	152	Yes	Yes	Mplonski	MP

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	37	37	6,261	6,261	1,992	1,992
2	1	1	37	37	6,480	6,480	2,091	2,091
3	1	1	30	30	6,496	6,496	2,255	2,255
4	0	0	29	29	6,346	6,346	2,112	2,112
5	0	0	39	39	6,496	6,496	2,094	2,094
6	0	0	35	35	6,424	6,424	2,085	2,085
7	0	0	47	47	6,323	6,323	2,108	2,108
8	1	1	38	38	6,557	6,557	2,113	2,113
9	0	0	39	39	6,428	6,428	2,096	2,096
10	0	0	43	43	6,677	6,677	2,082	2,082
Mean		0.30		37.4		6448.8		2102.8
S _(n-1)		0.48		5.38		121.07		63.83
-3 sigma		-1.15		21.26		6085.59		1911.31
+3 sigma		1.75		53.54		6812.01		2294.29
-2 sigma		-0.67		26.64		6206.66		1975.14
+2 sigma		1.27		48.16		6690.94		2230.46
					Mean-bkg	6448.5		2065.4
					S _(n-1)	120.90		66.10
				Mean-bkg	-3 sigma	6085.80		1867.10
				Mean-bkg	+3 sigma	6811.20		2263.70
				Mean-bkg	-2 sigma	6206.70		1933.20
				Mean-bkg	+2 sigma	6690.30		2197.60

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	5	5	645	645	2762	2762	2612	2612
2	4	4	653	653	2834	2834	2594	2594
3	2	2	661	661	2482	2482	2751	2751
4	1	1	631	631	2592	2592	2783	2783
5	5	5	642	642	2745	2745	2644	2644
6	1	1	692	692	2715	2715	2446	2446
7	3	3	605	605	2748	2748	2248	2248
8	2	2	640	640	2107	2107	2708	2708
9	2	2	645	645	2414	2414	2622	2622
10	2	2	612	612	2706	2706	2244	2244
Mean		2.70		642.6		2610.5		2565.2
S _(n-1)		1.49		24.47		220.84		192.30
-3 sigma		-1.78		569.18		1947.99		1988.31
+3 sigma		7.18		716.02		3273.01		3142.09
-2 sigma		-0.29		593.65		2168.83		2180.61
+2 sigma		5.69		691.55		3052.17		2949.79
					Mean-bkg	2607.8		1922.6
					S _(n-1)	220.16		183.91
				Mean-bkg	-3 sigma	1947.32		1370.86
				Mean-bkg	+3 sigma	3268.28		2474.34
				Mean-bkg	-2 sigma	2167.48		1554.78
				Mean-bkg	+2 sigma	3048.12		2290.42

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	0.1095	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	5,000	1	1	1.00	1.56	3928.9	200.11				
Beta	0.0673	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	5,000	1	1	124.30	10.06	1445.8	139.76				
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						
8/30/2017	0	115	3,823	1,492	0.0	115.0	3823.0	1377.0	PASS	PASS	PASS	PASS	27.39	786	Yes	Yes	M. Plonski	MSP

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	5	5	135	135	4,108	4,108	1,617	1,617
2	1	1	137	137	3,856	3,856	1,598	1,598
3	2	2	131	131	3,857	3,857	1,339	1,339
4	1	1	136	136	3,737	3,737	1,425	1,425
5	1	1	127	127	3,960	3,960	1,764	1,764
6	0	0	115	115	3,995	3,995	1,674	1,674
7	0	0	118	118	4,046	4,046	1,435	1,435
8	0	0	110	110	3,946	3,946	1,542	1,542
9	0	0	119	119	3,536	3,536	1,583	1,583
10	0	0	115	115	4,258	4,258	1,724	1,724
Mean		1.00		124.3		3929.9		1570.1
S _(n-1)		1.56		10.06		200.39		136.92
-3 sigma		-3.69		94.13		3328.74		1159.34
+3 sigma		5.69		154.47		4531.06		1980.86
-2 sigma		-2.13		104.19		3529.13		1296.26
+2 sigma		4.13		144.41		4330.67		1843.94
					Mean-bkg	3928.9		1445.8
					S _(n-1)	200.11		139.76
				Mean-bkg	-3 sigma	3328.57		1026.52
				Mean-bkg	+3 sigma	4529.23		1865.08
				Mean-bkg	-2 sigma	3528.68		1166.28
				Mean-bkg	+2 sigma	4329.12		1725.32

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:		Ludlum 2224-1		Detector:		Ludlum 43-93		Calibration Date:		1/6/2017								
Serial #:		227246		Serial #:		PR244549		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	0.1103	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	5,000	1	1	2.40	1.90	3835.1	323.47				
Beta	0.0620	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	5,000	1	1	232.30	20.67	2008.4	100.81				
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						
2/21/2017	2	235	4,037	2,351	2.0	235.0	4035.0	2116.0	PASS	PASS	PASS	PASS	86.88	1199	Yes	Yes	N. Berliner	N. Berliner
2/22/2017	1	210	4,068	2,234	1.0	210.0	4067.0	2024.0	PASS	PASS	PASS	PASS	69.40	1136	Yes	Yes	A. Craig	A. Craig
2/23/2017	1	266	4,138	2,235	1.0	266.0	4137.0	1969.0	PASS	PASS	PASS	PASS	69.40	1272	Yes	Yes	N. Berliner	N. Berliner
2/24/2017	4	222	3,956	2,316	4.0	222.0	3952.0	2094.0	PASS	PASS	PASS	PASS	111.60	1167	Yes	Yes	A.Jacobs	AJ
2/27/2017	2	199	4,046	2,193	2.0	199.0	4044.0	1994.0	PASS	PASS	PASS	PASS	86.88	1107	Yes	Yes	N. Berliner	N. Berliner
2/28/2017	2	215	3,962	2,267	2.0	215.0	3960.0	2052.0	PASS	PASS	PASS	PASS	86.88	1149	Yes	Yes	N. Berliner	N. Berliner

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	3	3	216	216	4,045	4,045	2,244	2,244
2	0	0	245	245	4,055	4,055	2,391	2,391
3	2	2	216	216	3,939	3,939	2,179	2,179
4	5	5	201	201	3,933	3,933	2,054	2,054
5	0	0	225	225	3,654	3,654	2,372	2,372
6	3	3	237	237	3,911	3,911	2,261	2,261
7	1	1	264	264	4,177	4,177	2,136	2,136
8	1	1	232	232	4,089	4,089	2,302	2,302
9	4	4	264	264	3,298	3,298	2,213	2,213
10	5	5	223	223	3,274	3,274	2,255	2,255
Mean		2.40		232.3		3837.5		2240.7
S _(n-1)		1.90		20.67		322.48		102.53
-3 sigma		-3.29		170.30		2870.05		1933.12
+3 sigma		8.09		294.30		4804.95		2548.28
-2 sigma		-1.39		190.97		3192.53		2035.64
+2 sigma		6.19		273.63		4482.47		2445.76
					Mean-bkg	3835.1		2008.4
					S _(n-1)	323.47		100.81
				Mean-bkg	-3 sigma	2864.68		1705.97
				Mean-bkg	+3 sigma	4805.52		2310.83
				Mean-bkg	-2 sigma	3188.15		1806.78
				Mean-bkg	+2 sigma	4482.05		2210.02

CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

Counting Instrument:		Ludlum 2360		Detector:		Ludlum 43-93		Calibration Date:		1/16/2017								
Serial #:		184909		Serial #:		PR298426		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	0.0992	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	5,000	1	1	0.30	0.48	3605.9	288.96				
Beta	0.0620	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	5,000	1	1	110.70	10.51	1232.5	145.26				
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						
2/21/2017	0	91	3,800	1,442	0.0	91.0	3800.0	1351.0	PASS	PASS	PASS	PASS	30.23	764	Yes	Yes	N. Berliner	N. Berliner
2/22/2017	1	117	3,821	1,445	1.0	117.0	3820.0	1328.0	PASS	PASS	PASS	PASS	77.12	860	Yes	Yes	A. Craig	A. Craig
2/23/2017	0	118	3,569	1,392	0.0	118.0	3569.0	1274.0	PASS	PASS	PASS	PASS	30.23	863	Yes	Yes	A. Craig	A. Craig
2/24/2017	1	113	3,854	1,465	1.0	113.0	3853.0	1352.0	PASS	PASS	PASS	PASS	77.12	846	Yes	Yes	A. Jacobs	AJ
2/27/2017	0	123	3,783	1,456	0.0	123.0	3783.0	1333.0	PASS	PASS	PASS	PASS	30.23	880	Yes	Yes	N. Berliner	N. Berliner
2/28/2017	0	107	3,827	1,459	0.0	107.0	3827.0	1352.0	PASS	PASS	PASS	PASS	30.23	824	Yes	Yes	N. Berliner	N. Berliner
3/10/2017	1	116	3,790	1,420	1.0	116.0	3789.0	1304.0	PASS	PASS	PASS	PASS	77.12	856	Yes	Yes	S. Owe	S. Owe
3/17/2017	0	126	3,730	1,330	0.0	126.0	3730.0	1204.0	PASS	PASS	PASS	PASS	30.23	891	Yes	Yes	S. Owe	S. Owe
3/20/2017	0	119	3,637	1,409	0.0	119.0	3637.0	1290.0	PASS	PASS	PASS	PASS	30.23	867	Yes	Yes	S. Owe	S. Owe
3/21/2017	0	126	3,840	1,573	0.0	126.0	3840.0	1447.0	PASS	PASS	PASS	PASS	30.23	891	Yes	Yes	S. Owe	S. Owe
3/22/2017	1	127	3,700	1,405	1.0	127.0	3699.0	1278.0	PASS	PASS	PASS	PASS	77.12	894	Yes	Yes	S. Owe	S. Owe
3/23/2017	0	103	3,596	1,309	0.0	103.0	3596.0	1206.0	PASS	PASS	PASS	PASS	30.23	810	Yes	Yes	S. Owe	S. Owe
3/24/2017	0	93	3,621	1,388	0.0	93.0	3621.0	1295.0	PASS	PASS	PASS	PASS	30.23	772	Yes	Yes	A. Jacobs	AJ
3/27/2017	0	106	3,681	1,336	0.0	106.0	3681.0	1230.0	PASS	PASS	PASS	PASS	30.23	821	Yes	Yes	Mplonski	MP
3/28/2017	0	114	3,690	1,440	0.0	114.0	3690.0	1326.0	PASS	PASS	PASS	PASS	30.23	849	Yes	Yes	A. Jacobs	AJ
3/29/2017	0	115	3,759	1,443	0.0	115.0	3759.0	1328.0	PASS	PASS	PASS	PASS	30.23	853	Yes	Yes	A. Jacobs	AJ
3/30/2017	0	118	3,623	1,397	0.0	118.0	3623.0	1279.0	PASS	PASS	PASS	PASS	30.23	863	Yes	Yes	A. Jacobs	AJ
3/31/2017	0	119	3,868	1,387	0.0	119.0	3868.0	1268.0	PASS	PASS	PASS	PASS	30.23	867	Yes	Yes	A. Jacobs	AJ
4/3/2017	0	117	3,908	1,539	0.0	117.0	3908.0	1422.0	PASS	PASS	PASS	PASS	30.23	860	Yes	Yes	M. Plonski	MP
4/4/2017	1	113	3,517	1,428	1.0	113.0	3516.0	1315.0	PASS	PASS	PASS	PASS	77.12	846	Yes	Yes	M. Plonski	MP
4/5/2017	1	106	3,701	1,307	1.0	106.0	3700.0	1201.0	PASS	PASS	PASS	PASS	77.12	821	Yes	Yes	M. Plonski	MP
4/6/2017	1	116	4,060	1,417	1.0	116.0	4059.0	1301.0	PASS	PASS	PASS	PASS	77.12	856	Yes	Yes	M. Plonski	MP
4/7/2017	1	109	3,700	1,510	1.0	109.0	3699.0	1401.0	PASS	PASS	PASS	PASS	77.12	832	Yes	Yes	M. Plonski	MP
4/10/2017	0	112	3,928	1,462	0.0	112.0	3928.0	1350.0	PASS	PASS	PASS	PASS	30.23	842	Yes	Yes	M. Plonski	MP
4/12/2017	1	127	3,790	1,373	1.0	127.0	3789.0	1246.0	PASS	PASS	PASS	PASS	77.12	894	Yes	Yes	J.Cote	JAC
4/13/2017	1	120	3,692	1,399	1.0	120.0	3691.0	1279.0	PASS	PASS	PASS	PASS	77.12	870	Yes	Yes	J.Cote	JAC
4/14/2017	1	114	3,766	1,446	1.0	114.0	3765.0	1332.0	PASS	PASS	PASS	PASS	77.12	849	Yes	Yes	J.Cote	JAC
4/17/2017	1	124	3,831	1,509	1.0	124.0	3830.0	1385.0	PASS	PASS	PASS	PASS	77.12	884	Yes	Yes	J.Cote	JAC
4/18/2017	1	122	3,827	1,485	1.0	122.0	3826.0	1363.0	PASS	PASS	PASS	PASS	77.12	877	Yes	Yes	J.Cote	JAC
4/19/2017	0	121	3,830	1,481	0.0	121.0	3830.0	1360.0	PASS	PASS	PASS	PASS	30.23	874	Yes	Yes	J.Cote	JAC
4/20/2017	0	120	3,764	1,453	0.0	120.0	3764.0	1333.0	PASS	PASS	PASS	PASS	30.23	870	Yes	Yes	J.Cote	JAC
4/21/2017	1	113	3,973	1,622	1.0	113.0	3972.0	1509.0	PASS	PASS	PASS	PASS	77.12	846	Yes	Yes	J.Cote	JAC
4/24/2017	0	126	3,868	1,409	0.0	126.0	3868.0	1283.0	PASS	PASS	PASS	PASS	30.23	891	Yes	Yes	J.Cote	JAC
4/25/2017	1	130	3,772	1,351	1.0	130.0	3771.0	1221.0	PASS	PASS	PASS	PASS	77.12	904	Yes	Yes	J.Cote	JAC
4/26/2017	1	115	4,167	1,469	1.0	115.0	4166.0	1354.0	PASS	PASS	PASS	PASS	77.12	853	Yes	Yes	J.Cote	JAC
4/27/2017	1	108	3,815	1,487	1.0	108.0	3814.0	1379.0	PASS	PASS	PASS	PASS	77.12	828	Yes	Yes	J.Cote	JAC
4/28/2017	0	124	3,799	1,516	0.0	124.0	3799.0	1392.0	PASS	PASS	PASS	PASS	30.23	884	Yes	Yes	J.Cote	JAC
5/1/2017	1	115	3,776	1,503	1.0	115.0	3775.0	1388.0	PASS	PASS	PASS	PASS	77.12	853	Yes	Yes	J.Cote	JAC

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	0.0992	Th-230	5648-06	15,900	9/24/2012	7.54E+04	15,899	5,000	1	1	0.30	0.48	3605.9	288.96				
Beta	0.0620	Tc-99	5634-05	9,860	2/25/2013	2.11E+05	9,860	5,000	1	1	110.70	10.51	1232.5	145.26				
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						
5/2/2017	0	121	3,932	1,502	0.0	121.0	3932.0	1381.0	PASS	PASS	PASS	PASS	30.23	874	Yes	Yes	J.Cote	JAC
5/3/2017	1	114	3,770	1,394	1.0	114.0	3769.0	1280.0	PASS	PASS	PASS	PASS	77.12	849	Yes	Yes	J.Cote	JAC
5/4/2017	1	123	3,695	1,434	1.0	123.0	3694.0	1311.0	PASS	PASS	PASS	PASS	77.12	880	Yes	Yes	J.Cote	JAC
5/5/2017	1	128	3,681	1,330	1.0	128.0	3680.0	1202.0	PASS	PASS	PASS	PASS	77.12	897	Yes	Yes	J.Cote	JAC
5/8/2017	0	113	3,756	1,415	0.0	113.0	3756.0	1302.0	PASS	PASS	PASS	PASS	30.23	846	Yes	Yes	MPlonski	MP
5/9/2017	1	123	3,829	1,407	1.0	123.0	3828.0	1284.0	PASS	PASS	PASS	PASS	77.12	880	Yes	Yes	J.Cote	JAC
5/10/2017	0	126	3,739	1,462	0.0	126.0	3739.0	1336.0	PASS	PASS	PASS	PASS	30.23	891	Yes	Yes	J.Cote	JAC
5/11/2017	0	110	3,615	1,367	0.0	110.0	3615.0	1257.0	PASS	PASS	PASS	PASS	30.23	835	Yes	Yes	J.Cote	JAC
5/12/2017	1	97	3,627	1,412	1.0	97.0	3626.0	1315.0	PASS	PASS	PASS	PASS	77.12	787	Yes	Yes	J.Cote	JAC
5/15/2017	0	129	3,725	1,421	0.0	129.0	3725.0	1292.0	PASS	PASS	PASS	PASS	30.23	900	Yes	Yes	J.Cote	JAC
5/16/2017	1	122	3,839	1,454	1.0	122.0	3838.0	1332.0	PASS	PASS	PASS	PASS	77.12	877	Yes	Yes	J.Cote	JAC
5/17/2017	1	115	3,586	1,438	1.0	115.0	3585.0	1323.0	PASS	PASS	PASS	PASS	77.12	853	Yes	Yes	J.Cote	JAC
5/18/2017	0	102	3,572	1,414	0.0	102.0	3572.0	1312.0	PASS	PASS	PASS	PASS	30.23	806	Yes	Yes	J.Cote	JAC
5/19/2017	1	93	3,779	1,443	1.0	93.0	3778.0	1350.0	PASS	PASS	PASS	PASS	77.12	772	Yes	Yes	J.Cote	JAC
5/22/2017	0	110	3,779	1,456	0.0	110.0	3779.0	1346.0	PASS	PASS	PASS	PASS	30.23	835	Yes	Yes	J.Cote	JAC
5/23/2017	0	112	3,641	1,401	0.0	112.0	3641.0	1289.0	PASS	PASS	PASS	PASS	30.23	842	Yes	Yes	J.Cote	JAC
5/24/2017	1	120	3,666	1,437	1.0	120.0	3665.0	1317.0	PASS	PASS	PASS	PASS	77.12	870	Yes	Yes	J.Cote	JAC
5/25/2017	0	98	3,545	1,422	0.0	98.0	3545.0	1324.0	PASS	PASS	PASS	PASS	30.23	791	Yes	Yes	J.Cote	JAC
5/26/2017	1	101	3,757	1,319	1.0	101.0	3756.0	1218.0	PASS	PASS	PASS	PASS	77.12	802	Yes	Yes	J.Cote	JAC
5/30/2017	1	104	3,706	1,404	1.0	104.0	3705.0	1300.0	PASS	PASS	PASS	PASS	77.12	813	Yes	Yes	J.Cote	JAC
5/31/2017	1	116	3,701	1,460	1.0	116.0	3700.0	1344.0	PASS	PASS	PASS	PASS	77.12	856	Yes	Yes	J.Cote	JAC
6/1/2017	1	119	3,704	1,458	1.0	119.0	3703.0	1339.0	PASS	PASS	PASS	PASS	77.12	867	Yes	Yes	J.Cote	JAC
6/2/2017	1	113	3,713	1,406	1.0	113.0	3712.0	1293.0	PASS	PASS	PASS	PASS	77.12	846	Yes	Yes	J.Cote	JAC
6/5/2017	0	119	3,703	1,412	0.0	119.0	3703.0	1293.0	PASS	PASS	PASS	PASS	30.23	867	Yes	Yes	J.Cote	JAC
6/6/2017	0	114	3,619	1,471	0.0	114.0	3619.0	1357.0	PASS	PASS	PASS	PASS	30.23	849	Yes	Yes	J.Cote	JAC
6/7/2017	1	115	3,722	1,556	1.0	115.0	3721.0	1441.0	PASS	PASS	PASS	PASS	77.12	853	Yes	Yes	J.Cote	JAC
6/8/2017	1	118	3,758	1,419	1.0	118.0	3757.0	1301.0	PASS	PASS	PASS	PASS	77.12	863	Yes	Yes	J.Cote	JAC
6/9/2017	1	119	3,675	1,449	1.0	119.0	3674.0	1330.0	PASS	PASS	PASS	PASS	77.12	867	Yes	Yes	J.Cote	JAC
8/14/2017	1	108	4,088	1,418	1.0	108.0	4087.0	1310.0	PASS	PASS	PASS	PASS	77.12	828	Yes	Yes	MPlonski	MP
8/15/2017	0	120	3,503	1,307	0.0	120.0	3503.0	1187.0	PASS	PASS	PASS	PASS	30.23	870	Yes	Yes	MPlonski	MP
8/16/2017	0	115	3,663	1,343	0.0	115.0	3663.0	1228.0	PASS	PASS	PASS	PASS	30.23	853	Yes	Yes	MPlonski	MP
8/17/2017	1	113	3,421	1,380	1.0	113.0	3420.0	1267.0	PASS	PASS	PASS	PASS	77.12	846	Yes	Yes	MPlonski	MP
8/18/2017	0	121	3,430	1,353	0.0	121.0	3430.0	1232.0	PASS	PASS	PASS	PASS	30.23	874	Yes	Yes	MPlonski	MP
8/21/2017	0	119	3,313	1,329	0.0	119.0	3313.0	1210.0	PASS	PASS	PASS	PASS	30.23	867	Yes	Yes	MPlonski	MP
8/22/2017	0	122	3,029	1,256	0.0	122.0	3029.0	1134.0	PASS	PASS	PASS	PASS	30.23	877	Yes	Yes	MPlonski	MP
8/23/2017	1	105	3,574	1,218	1.0	105.0	3573.0	1113.0	PASS	PASS	PASS	PASS	77.12	817	Yes	Yes	MPlonski	MP
8/24/2017	0	107	3,272	1,303	0.0	107.0	3272.0	1196.0	PASS	PASS	PASS	PASS	30.23	824	Yes	Yes	MPlonski	MP
8/25/2017	0	118	3,717	1,438	0.0	118.0	3717.0	1320.0	PASS	PASS	PASS	PASS	30.23	863	Yes	Yes	MPlonski	MP
8/28/2017	1	116	3,756	1,439	1.0	116.0	3755.0	1323.0	PASS	PASS	PASS	PASS	77.12	856	Yes	Yes	MPlonski	MP
8/29/2017	1	129	3,570	1,452	1.0	129.0	3569.0	1323.0	PASS	PASS	PASS	PASS	77.12	900	Yes	Yes	MPlonski	MP
8/30/2017	0	109	3,746	1,440	0.0	109.0	3746.0	1331.0	PASS	PASS	PASS	PASS	30.23	832	Yes	Yes	MPlonski	MP

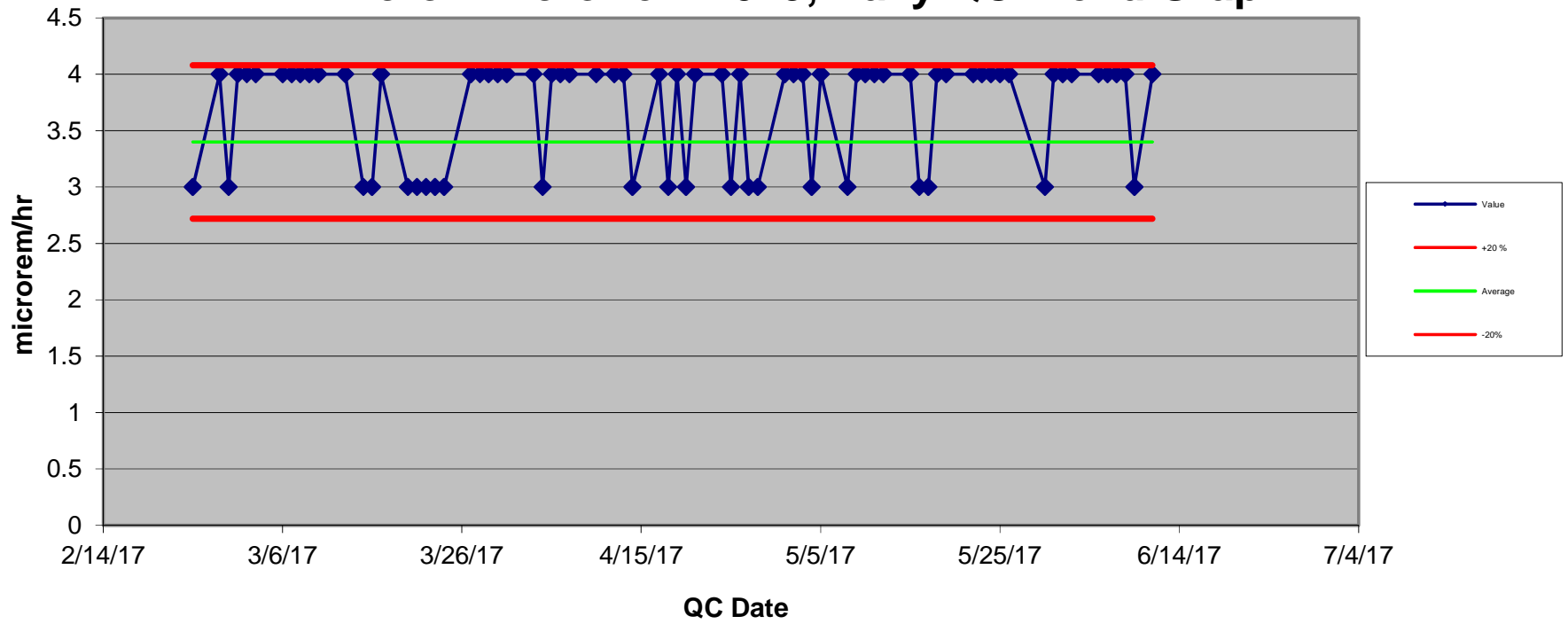
CABRERA ALPHA-BETA COUNTING INSTRUMENT (Rev 6)

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	103	103	3,729	3,729	1,439	1,439
2	0	0	109	109	3,753	3,753	1,369	1,369
3	0	0	112	112	3,651	3,651	1,391	1,391
4	0	0	112	112	3,074	3,074	1,431	1,431
5	1	1	121	121	3,877	3,877	1,416	1,416
6	1	1	102	102	3,905	3,905	1,562	1,562
7	0	0	109	109	3,376	3,376	1,291	1,291
8	0	0	93	93	3,192	3,192	1,082	1,082
9	0	0	115	115	3,730	3,730	1,124	1,124
10	0	0	131	131	3,775	3,775	1,327	1,327
Mean		0.30		110.7		3606.2		1343.2
S _(n-1)		0.48		10.51		289.23		146.16
-3 sigma		-1.15		79.17		2738.52		904.71
+3 sigma		1.75		142.23		4473.88		1781.69
-2 sigma		-0.67		89.68		3027.75		1050.87
+2 sigma		1.27		131.72		4184.65		1635.53
					Mean-bkg	3605.9		1232.5
					S _(n-1)	288.96		145.26
				Mean-bkg	-3 sigma	2739.02		796.72
				Mean-bkg	+3 sigma	4472.78		1668.28
				Mean-bkg	-2 sigma	3027.98		941.98
				Mean-bkg	+2 sigma	4183.82		1523.02

Bicron MicroRem 2079		
QC Daily Source		
Date	Result (µrem/hr)	P/F
2/24/2017	3	Pass
2/27/2017	4	Pass
2/28/2017	3	Pass
3/1/2017	4	Pass
3/2/2017	4	Pass
3/3/2017	4	Pass
3/6/2017	4	Pass
3/7/2017	4	Pass
3/8/2017	4	Pass
3/9/2017	4	Pass
3/10/2017	4	Pass
3/13/2017	4	Pass
3/15/2017	3	Pass
3/16/2017	3	Pass
3/17/2017	4	Pass
3/20/2017	3	Pass
3/21/2017	3	Pass
3/22/2017	3	Pass
3/23/2017	3	Pass
3/24/2017	3	Pass
3/27/2017	4	Pass
3/28/2017	4	Pass
3/29/2017	4	Pass
3/30/2017	4	Pass
3/31/2017	4	Pass
4/3/2017	4	Pass
4/4/2017	3	Pass
4/5/2017	4	Pass
4/6/2017	4	Pass
4/7/2017	4	Pass
4/10/2017	4	Pass
4/12/2017	4	Pass
4/13/2017	4	Pass
4/14/2017	3	Pass
4/17/2017	4	Pass
4/18/2017	3	Pass
4/19/2017	4	Pass
4/20/2017	3	Pass
4/21/2017	4	Pass
4/24/2017	4	Pass
4/25/2017	3	Pass
4/26/2017	4	Pass
4/27/2017	3	Pass
4/28/2017	3	Pass
5/1/2017	4	Pass
5/2/2017	4	Pass
5/3/2017	4	Pass
5/4/2017	3	Pass
5/5/2017	4	Pass
5/8/2017	3	Pass
5/9/2017	4	Pass
5/10/2017	4	Pass
5/11/2017	4	Pass
5/12/2017	4	Pass
5/15/2017	4	Pass
5/16/2017	3	Pass
5/17/2017	3	Pass
5/18/2017	4	Pass
5/19/2017	4	Pass
5/22/2017	4	Pass
5/23/2017	4	Pass
5/24/2017	4	Pass
5/25/2017	4	Pass
5/26/2017	4	Pass
5/30/2017	3	Pass
5/31/2017	4	Pass
6/1/2017	4	Pass
6/2/2017	4	Pass
6/5/2017	4	Pass
6/6/2017	4	Pass
6/7/2017	4	Pass
6/8/2017	4	Pass
6/9/2017	3	Pass
6/11/2017	4	Pass

Bicron MicroRem 2079		Source Ser. #	N/A
Initial Source Readings		Nuclide	Bkgd
Date	Result (µrem/hr)		
2/24/2017	2		
2/24/2017	3		
2/24/2017	3		
2/24/2017	4		
2/24/2017	5		
2/24/2017	4		
2/24/2017	3		
2/24/2017	3		
2/24/2017	4		
2/24/2017	3		
	Average		
	3		

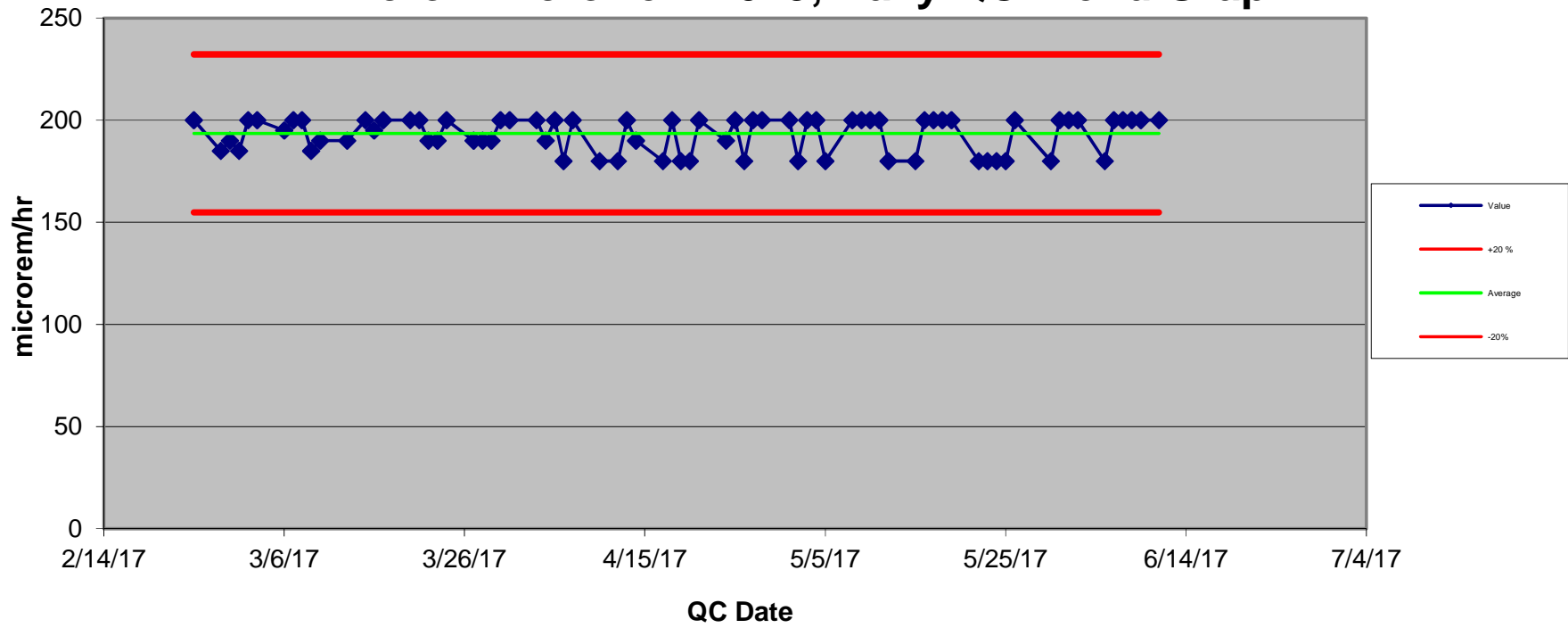
Bicron MicroRem 2079, Daily QC Trend Graph



Bicron MicroRem 2079		
QC Daily Source		
Date	Result (µrem/hr)	P/F
2/24/2017	200	Pass
2/27/2017	185	Pass
2/28/2017	190	Pass
3/1/2017	185	Pass
3/2/2017	200	Pass
3/3/2017	200	Pass
3/6/2017	195	Pass
3/7/2017	200	Pass
3/8/2017	200	Pass
3/9/2017	185	Pass
3/10/2017	190	Pass
3/13/2017	190	Pass
3/15/2017	200	Pass
3/16/2017	195	Pass
3/17/2017	200	Pass
3/20/2017	200	Pass
3/21/2017	200	Pass
3/22/2017	190	Pass
3/23/2017	190	Pass
3/24/2017	200	Pass
3/27/2017	190	Pass
3/28/2017	190	Pass
3/29/2017	190	Pass
3/30/2017	200	Pass
3/31/2017	200	Pass
4/3/2017	200	Pass
4/4/2017	190	Pass
4/5/2017	200	Pass
4/6/2017	180	Pass
4/7/2017	200	Pass
4/10/2017	180	Pass
4/12/2017	180	Pass
4/13/2017	200	Pass
4/14/2017	190	Pass
4/17/2017	180	Pass
4/18/2017	200	Pass
4/19/2017	180	Pass
4/20/2017	180	Pass
4/21/2017	200	Pass
4/24/2017	190	Pass
4/25/2017	200	Pass
4/26/2017	180	Pass
4/27/2017	200	Pass
4/28/2017	200	Pass
5/1/2017	200	Pass
5/2/2017	180	Pass
5/3/2017	200	Pass
5/4/2017	200	Pass
5/5/2017	180	Pass
5/8/2017	200	Pass
5/9/2017	200	Pass
5/10/2017	200	Pass
5/11/2017	200	Pass
5/12/2017	180	Pass
5/15/2017	180	Pass
5/16/2017	200	Pass
5/17/2017	200	Pass
5/18/2017	200	Pass
5/19/2017	200	Pass
5/22/2017	180	Pass
5/23/2017	180	Pass
5/24/2017	180	Pass
5/25/2017	180	Pass
5/26/2017	200	Pass
5/30/2017	180	Pass
5/31/2017	200	Pass
6/1/2017	200	Pass
6/2/2017	200	Pass
6/5/2017	180	Pass
6/6/2017	200	Pass
6/7/2017	200	Pass
6/8/2017	200	Pass
6/9/2017	200	Pass
6/11/2017	200	Pass

Bicron MicroRem 2079		Source Ser. #	N/A
Initial Source Readings		Nuclide	Co-60
Date	Result (µrem/hr)		
2/24/2017	185		
2/24/2017	190		
2/24/2017	200		
2/24/2017	190		
2/24/2017	200		
2/24/2017	185		
2/24/2017	200		
2/24/2017	190		
2/24/2017	195		
2/24/2017	200		
	Average		
	194		

Bicron MicroRem 2079, Daily QC Trend Graph

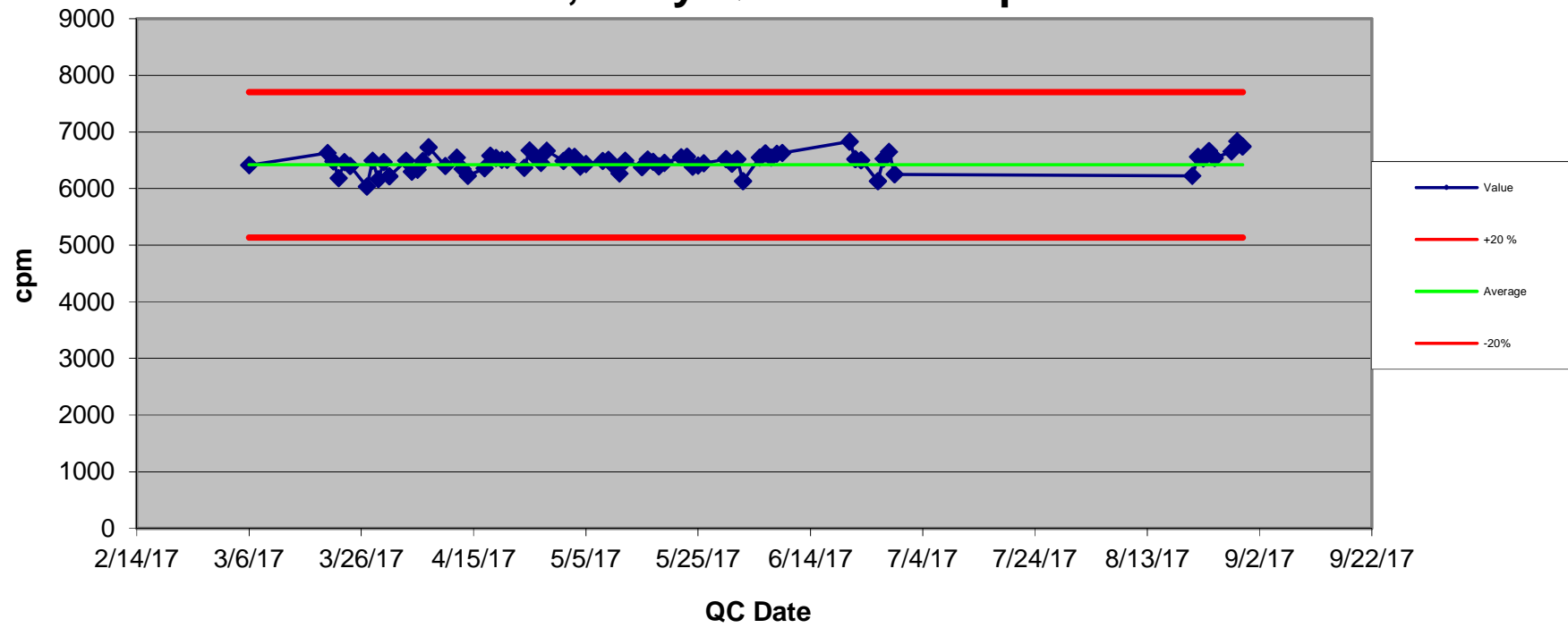


Instrument QA/QC Ludlum 2221/44-9

PR251740/SN262322		
QC Daily Source		
Date	Result (cpm)	P/F
3/6/2017	6413	Pass
3/20/2017	6627	Pass
3/21/2017	6476	Pass
3/22/2017	6185	Pass
3/23/2017	6463	Pass
3/24/2017	6397	Pass
3/27/2017	6033	Pass
3/28/2017	6490	Pass
3/29/2017	6160	Pass
3/30/2017	6463	Pass
3/31/2017	6220	Pass
4/3/2017	6495	Pass
4/4/2017	6301	Pass
4/5/2017	6334	Pass
4/6/2017	6486	Pass
4/7/2017	6730	Pass
4/10/2017	6400	Pass
4/12/2017	6548	Pass
4/13/2017	6346	Pass
4/14/2017	6221	Pass
4/17/2017	6358	Pass
4/18/2017	6581	Pass
4/19/2017	6537	Pass
4/20/2017	6503	Pass
4/21/2017	6504	Pass
4/24/2017	6365	Pass
4/25/2017	6672	Pass
4/26/2017	6557	Pass
4/27/2017	6454	Pass
4/28/2017	6665	Pass
5/1/2017	6487	Pass
5/2/2017	6570	Pass
5/3/2017	6562	Pass
5/4/2017	6388	Pass
5/5/2017	6430	Pass
5/8/2017	6485	Pass
5/9/2017	6507	Pass
5/10/2017	6398	Pass
5/11/2017	6265	Pass
5/12/2017	6491	Pass
5/15/2017	6380	Pass
5/16/2017	6512	Pass
5/17/2017	6472	Pass
5/18/2017	6390	Pass
5/19/2017	6452	Pass
5/22/2017	6551	Pass
5/23/2017	6558	Pass
5/24/2017	6387	Pass
5/25/2017	6405	Pass
5/26/2017	6447	Pass
5/30/2017	6521	Pass
5/31/2017	6438	Pass
6/1/2017	6522	Pass
6/2/2017	6130	Pass
6/5/2017	6548	Pass
6/6/2017	6620	Pass
6/7/2017	6544	Pass
6/8/2017	6615	Pass
6/9/2017	6627	Pass
6/21/2017	6832	Pass
6/22/2017	6517	Pass
6/23/2017	6497	Pass
6/26/2017	6133	Pass
6/27/2017	6524	Pass
6/28/2017	6647	Pass
6/29/2017	6254	Pass
8/21/2017	6223	Pass
8/22/2017	6563	Pass
8/23/2017	6535	Pass
8/24/2017	6662	Pass
8/25/2017	6541	Pass
8/28/2017	6656	Pass
8/29/2017	6837	Pass
8/30/2017	6744	Pass

PR251740/SN262322		Source Ser. #	NA
Initial Source Readings		Nuclide	Bkg
Date	Result (cpm)		
3/6/2017	6426		
3/6/2017	6398		
3/6/2017	6458		
3/6/2017	6374		
3/6/2017	6439		
3/6/2017	6407		
3/6/2017	6359		
3/6/2017	6424		
3/6/2017	6400		
3/6/2017	6504		
	Average		
	6419		

PR251740/SN262322, Daily QC Trend Graph



Instrument QA/QC
Ludlum 2221/44-9

Inst.#PR251740/SN262322		
QC Daily Source		
Date	Result (cpm)	P/F
3/6/2017	10,128	Pass
3/20/2017	10,692	Pass
3/21/2017	11,262	Pass
3/22/2017	11,257	Pass
3/23/2017	11,033	Pass
3/24/2017	11,197	Pass
3/27/2017	10,411	Pass
3/28/2017	10,447	Pass
3/29/2017	10,260	Pass
3/30/2017	10,443	Pass
3/31/2017	10,263	Pass
4/3/2017	11,039	Pass
4/4/2017	10,508	Pass
4/5/2017	10,273	Pass
4/6/2017	10,428	Pass
4/7/2017	10,789	Pass
4/10/2017	10,884	Pass
4/12/2013	10,400	Pass
4/13/2017	10,813	Pass
4/14/2017	10,666	Pass
4/17/2017	10,732	Pass
4/18/2017	10,715	Pass
4/19/2017	10,989	Pass
4/20/2017	10,972	Pass
4/21/2017	10,882	Pass
4/24/2017	10,939	Pass
4/25/2017	10,909	Pass
4/26/2017	10,594	Pass
4/27/2017	10,940	Pass
4/28/2017	10,315	Pass
5/1/2017	10,661	Pass
5/2/2017	10,672	Pass
5/3/2017	10,803	Pass
5/4/2017	10,636	Pass
5/5/2017	10,481	Pass
5/8/2017	10,703	Pass
5/9/2017	10,956	Pass
5/10/2017	10,463	Pass
5/11/2017	10,308	Pass
5/12/2017	10,527	Pass
5/15/2017	10,597	Pass
5/16/2017	10,415	Pass
5/17/2017	10,390	Pass
5/18/2017	10,449	Pass
5/19/2017	10,441	Pass
5/22/2017	10,888	Pass
5/23/2017	10,556	Pass
5/24/2017	10,384	Pass
5/25/2017	10,736	Pass
5/26/2017	10,646	Pass
5/30/2017	10,425	Pass
5/31/2017	10,060	Pass
6/1/2017	10,495	Pass
6/2/2017	10,323	Pass
6/5/2017	10,164	Pass
6/6/2017	9,928	Pass
6/7/2017	10,552	Pass
6/8/2017	10,826	Pass
6/9/2017	10,873	Pass
6/21/2017	9,896	Pass
6/22/2017	9,821	Pass
6/23/2017	10,140	Pass
6/26/2017	10,009	Pass
6/27/2017	9,803	Pass
6/28/2017	9,997	Pass
6/29/2017	10,298	Pass
8/21/2017	9,722	Pass
8/22/2017	9,918	Pass
8/23/2017	10,146	Pass
8/24/2017	9,926	Pass
8/25/2017	10,142	Pass
8/28/2017	9,628	Pass
8/29/2017	9,737	Pass
8/30/2017	10,096	Pass

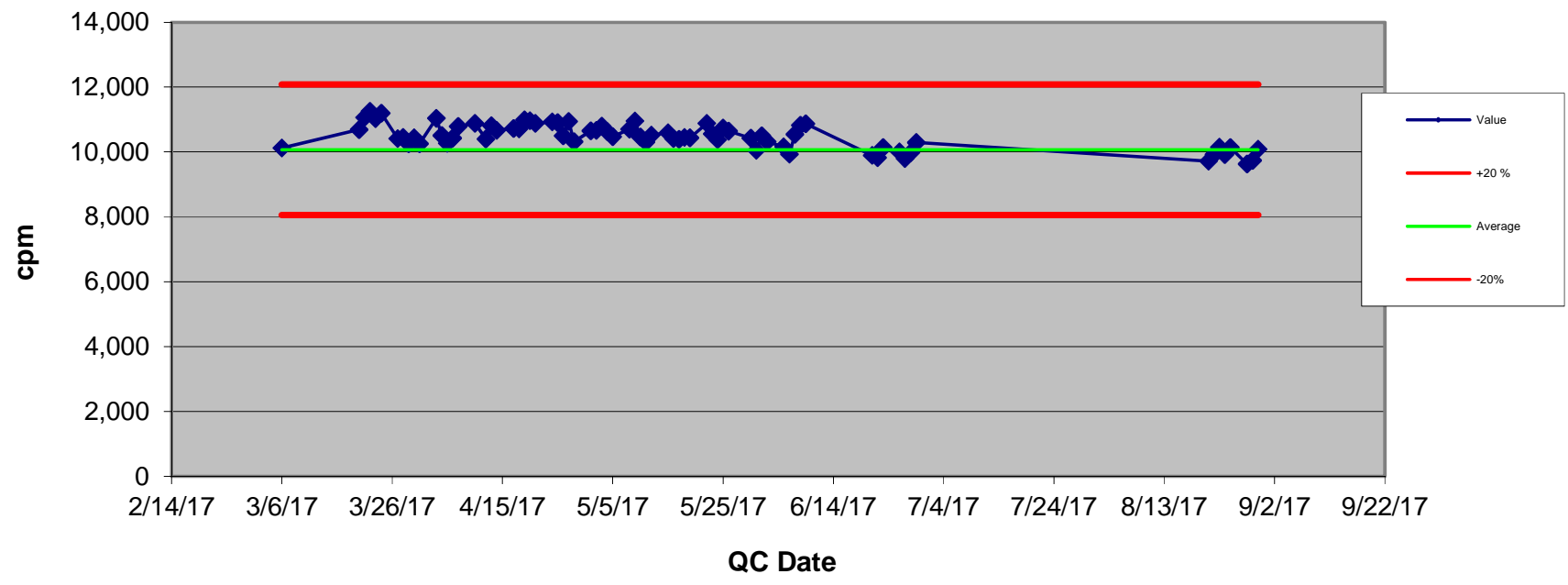
Inst.#PR251740/SN262322		Source Ser. #	3974-02
Initial Source Readings		Nuclide	Co-60
Date	Result (cpm)		
3/6/2017	10,184		
3/6/2017	10,107		
3/6/2017	10,165		
3/6/2017	9,933		
3/6/2017	10,114		
3/6/2017	10,031		
3/6/2017	10,082		
3/6/2017	9,921		
3/6/2017	9,959		
3/6/2017	10,210		
	Average		
	10071		

Instrument QA/QC Ludlum 2221/44-9

Inst.#PR251740/SN262322		
QC Daily Source		
Date	Result (cpm)	P/F
3/6/2017	10,128	Pass
3/20/2017	10,692	Pass
3/21/2017	11,062	Pass
3/22/2017	11,257	Pass
3/23/2017	11,033	Pass
3/24/2017	11,197	Pass
3/27/2017	10,411	Pass
3/28/2017	10,447	Pass
3/29/2017	10,260	Pass
3/30/2017	10,443	Pass
3/31/2017	10,263	Pass
4/3/2017	11,039	Pass
4/4/2017	10,508	Pass
4/5/2017	10,273	Pass
4/6/2017	10,428	Pass
4/7/2017	10,789	Pass
4/10/2017	10,884	Pass
4/12/2017	10,400	Pass
4/13/2017	10,813	Pass
4/14/2017	10,666	Pass
4/17/2017	10,732	Pass
4/18/2017	10,715	Pass
4/19/2017	10,989	Pass
4/20/2017	10,972	Pass
4/21/2017	10,882	Pass
4/24/2017	10,939	Pass
4/25/2017	10,909	Pass
4/26/2017	10,504	Pass
4/27/2017	10,940	Pass
4/28/2017	10,315	Pass
5/1/2017	10,661	Pass
5/2/2017	10,672	Pass
5/3/2017	10,803	Pass
5/4/2017	10,636	Pass
5/5/2017	10,481	Pass
5/8/2017	10,703	Pass
5/9/2017	10,956	Pass
5/10/2017	10,463	Pass
5/11/2017	10,308	Pass
5/12/2017	10,527	Pass
5/15/2017	10,597	Pass
5/16/2017	10,415	Pass
5/17/2017	10,390	Pass
5/18/2017	10,449	Pass
5/19/2017	10,441	Pass
5/22/2017	10,888	Pass
5/23/2017	10,556	Pass
5/24/2017	10,384	Pass
5/25/2017	10,736	Pass
5/26/2017	10,646	Pass
5/30/2017	10,425	Pass
5/31/2017	10,060	Pass
6/1/2017	10,495	Pass
6/2/2017	10,323	Pass
6/5/2017	10,164	Pass
6/6/2017	9,928	Pass
6/7/2017	10,552	Pass
6/8/2017	10,826	Pass
6/9/2017	10,873	Pass
6/21/2017	9,896	Pass
6/22/2017	9,821	Pass
6/23/2017	10,140	Pass
6/26/2017	10,009	Pass
6/27/2017	9,803	Pass
6/28/2017	9,987	Pass
6/29/2017	10,298	Pass
8/21/2017	9,722	Pass
8/22/2017	9,918	Pass
8/23/2017	10,146	Pass
8/24/2017	9,926	Pass
8/25/2017	10,142	Pass
8/28/2017	9,628	Pass
8/29/2017	9,737	Pass
8/30/2017	10,096	Pass

Inst.#PR251740/SN262322		Source Ser. #	3974-02
Initial Source Readings		Nuclide	Co-60
Date	Result (cpm)		
3/6/2017	10,184		
3/6/2017	10,107		
3/6/2017	10,165		
3/6/2017	9,933		
3/6/2017	10,114		
3/6/2017	10,031		
3/6/2017	10,082		
3/6/2017	9,921		
3/6/2017	9,959		
3/6/2017	10,210		
	Average		
	10071		

Inst.#PR251740/SN262322, Daily QC Trend Graph



Ludlum 2929 200051 with 43-10-1 PR215948 Alpha

0.3 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.368 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

8.0 MDC = minimum detectable concentration in DPM / 100 cm^2

Ludlum 2929 200051 with 43-10-1 PR215948 Beta

37.4 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.201 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

33.9 MDC = minimum detectable concentration in DPM / 100 cm^2

Scan MDC

$$i = \frac{w}{s}$$

$$\text{MDCR} = d' \sqrt{b * \left(\frac{i}{60}\right) * \left(\frac{60}{i}\right)}$$

$$\text{Scan MDC} = \frac{\text{MDCR}}{\left(\sqrt{p}\right)\left(\epsilon_i\right)\left(\frac{\text{Probe Area}}{100}\right)}$$

Probe area	100 cm ²		
w	9.14 cm		
s	2 cm/s		
d'	1.4 unitless		
p	0.5 unitless		
b	2.40 cpm	b	232.30 cpm

i= 4.57 s

a MDCR= 7.858709 b MDCR= 77.31614

a Scan MDC= 100.8063 b Scan MDC= 1144.938

Ludlum 2224-1 227246 43-93 PR244549 Alpha

2.4 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.441 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.110 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

115 MDC = minimum detectable concentration in DPM / 100 cm^2

[Index](#) Ludlum 2224-1 227246 43-93 PR244549 Beta

232 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.382 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.096 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

799 MDC = minimum detectable concentration in DPM / 100 cm^2

Scan MDC

$$i = \frac{w}{s}$$

$$\text{MDCR} = d' \sqrt{b * \left(\frac{i}{60}\right) * \left(\frac{60}{i}\right)}$$

$$\text{Scan MDC} = \frac{\text{MDCR}}{\left(\sqrt{p}\right)\left(\epsilon_i\right)\left(\frac{\text{Probe Area}}{100}\right)}$$

Probe area	100 cm ²		
w	9.14 cm		
s	2 cm/s		
d'	1.4 unitless		
p	0.5 unitless		
b	0.30 cpm	b	110.70 cpm
i=	4.57 s		
a MDCR=	2.778473	b MDCR=	53.37272
a Scan MDC=	39.59047	b Scan MDC=	1217.426

Ludlum 2360 184909 43-93 PR298426 Alpha

0.3 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.397 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.099 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

80 MDC = minimum detectable concentration in DPM / 100 cm^2

[Index](#) Ludlum 2360 184909 43-93 PR298426 Beta

- 111 N_B = number of background counts during interval TB
- 1 T_B = background counting time in minutes
- 1 T_S = sample counting time in minutes
- 0.248 ϵ_i = instrument efficiency in counts per alpha decay
- 0.25 ϵ_s = contaminated surface efficiency in particles per disintegration
- 0.062 ϵ = total instrument efficiency in counts per particle
- 100 W_A = active area of the detector window in cm^2
- 877 MDC = minimum detectable concentration in DPM / 100 cm^2

Scan MDC

$$i = \frac{w}{s}$$

$$\text{MDCR} = d' \sqrt{b * \left(\frac{i}{60}\right) * \left(\frac{60}{i}\right)}$$

$$\text{Scan MDC} = \frac{\text{MDCR}}{\left(\sqrt{p}\right)\left(\epsilon_i\right)\left(\frac{\text{Probe Area}}{100}\right)}$$

Probe area	100 cm ²		
w	9.14 cm		
s	2 cm/s		
d'	1.4 unitless		
p	0.5 unitless		
b	1.00 cpm	b	124.30 cpm
i=	4.57 s		
a MDCR=	5.072775	b MDCR=	56.55632
a Scan MDC=	65.51586	b Scan MDC=	1189.334

Ludlum 2360 193638 43-93 PR199836 Alpha

1 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.438 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.110 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

92 MDC = minimum detectable concentration in DPM / 100 cm^2

Ludlum 2360 193638 43-93 PR199836 Beta

124 N_B = number of background counts during interval TB

1 T_B = background counting time in minutes

1 T_S = sample counting time in minutes

0.269 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.067 ϵ = total instrument efficiency in counts per particle

100 W_A = active area of the detector window in cm^2

852 MDC = minimum detectable concentration in DPM / 100 cm^2

Scan MDC

$$i = \frac{w}{s}$$

$$\text{MDCR} = d' \sqrt{b * \left(\frac{i}{60}\right) * \left(\frac{60}{i}\right)}$$

$$\text{Scan MDC} = \frac{\text{MDCR}}{\left(\sqrt{p}\right)\left(\epsilon_i\right)\left(\frac{\text{Probe Area}}{100}\right)}$$

Probe area	584 cm ²		
w	15.24 cm		
s	5 cm/s		
d'	1.4 unitless		
p	0.5 unitless		
b	2.70 cpm	b	642.60 cpm

i=	3.048 s		
a MDCR=	10.20653	b MDCR=	157.4587
a Scan MDC=	37.59105	b Scan MDC=	430.8493

Ludlum 2360 202403 43-37 PR178371 Alpha

2.7 N_b = number of background counts during interval TB

1 T_b = background counting time in minutes

1 T_s = sample counting time in minutes

0.263 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.066 ϵ = total instrument efficiency in counts per particle

584 W_A = active area of the detector window in cm^2

34 MDC = minimum detectable concentration in DPM / 100 cm^2

Ludlum 2360 202403 43-37 PR178371 Alpha

642.6 N_b = number of background counts during interval TB

1 T_b = background counting time in minutes

1 T_s = sample counting time in minutes

0.354 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.089 ϵ = total instrument efficiency in counts per particle

584 W_A = active area of the detector window in cm^2

239 MDC = minimum detectable concentration in DPM / 100 cm^2

Scan MDC

$$i = \frac{w}{s}$$

$$\text{MDCR} = d' \sqrt{b * \left(\frac{i}{60}\right) * \left(\frac{60}{i}\right)}$$

$$\text{Scan MDC} = \frac{\text{MDCR}}{\left(\sqrt{p}\right)\left(\epsilon_i\right)\left(\frac{\text{Probe Area}}{100}\right)}$$

Probe area	584 cm ²		
w	15.24 cm		
s	5 cm/s		
d'	1.4 unitless		
p	0.5 unitless		
b	2.80 cpm	b	563.90 cpm
i=	3.048 s		
a MDCR=	10.39382	b MDCR=	147.5018
a Scan MDC=	36.61041	b Scan MDC=	403.6046

Ludlum 2360 278586 43-37 PR216982 Alpha

2.8 N_b = number of background counts during interval TB

1 T_b = background counting time in minutes

1 T_s = sample counting time in minutes

0.275 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.069 ϵ = total instrument efficiency in counts per particle

584 W_A = active area of the detector window in cm^2

33 MDC = minimum detectable concentration in DPM / 100 cm^2

Ludlum 2360 278586 43-37 PR216982 Alpha

563.9 N_b = number of background counts during interval TB

1 T_b = background counting time in minutes

1 T_s = sample counting time in minutes

0.354 ϵ_i = instrument efficiency in counts per alpha decay

0.25 ϵ_s = contaminated surface efficiency in particles per disintegration

0.089 ϵ = total instrument efficiency in counts per particle

584 W_A = active area of the detector window in cm^2

224 MDC = minimum detectable concentration in DPM / 100 cm^2