APPENDIX E

Instrument Calibration Reports

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 PIKA INTERNATIONAL ORDER NO 20134551/338474

Mfg Ludlum Measurements, Inc Model 2350-1 Serial No 221027

Cal Date 29-May-09 Cal Due Date 29-May-10 Cal. Interval 1 Year Meterface N/A

Check mark ✓applies to applicable instr. and/or detector IAW mfg spec T. 76 °F RH 41 % Alt 703.8 mm Hg

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

✓ Mechanical check ✓ Input Sens. Linearity
✓ F/S Resp. check ✓ Reset check ✓ Window Operation
✓ Audio check ✓ Alarm Setting check ✓ Battery check (Min Volt) 4.4 VDC
✓ Ratemeter Linearity check ✓ Integrated Dose check ✓ Recycle Mode check
✓ Data Log check ✓ Overload check ✓ Scaler Readout check Threshold Dial Ratio 100 = 4 mV
✓ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89 Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

✓ HV Readout (2 points) Ref./Inst 500 / 498 V Ref./Inst 2000 / 1999 V

COMMENTS: *Firmware 37122N28*

[illegible]

[illegible]

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

	Probe Model	Serial #	High Voltage	Threshold	Units/ Time Base	Dead Time Correction Factor	Calibration Constant	Linearity ±10%*
Detector #	43-37 A	PR216878	1250	100	7 / 1	1.823569E-05	1.000000E+00	
Detector #	43-37 B	PR216878	1700	100	7 / 1	2.314757E-05	1.000000E+00	
Detector #	43-68 A	PR216846	1200	100	7 / 1	1.669870E-05	1.000000E+00	
Detector #	43-68 B	PR216846	1650	100	7 / 1	2.089564E-05	1.000000E+00	
Detector #								
Detector #								
Detector #								
Detector #								
Detector #								
Detector #								

Units: 0 -- rad 1 -- Gray 2 -- rem 3 -- Sv 4 -- R 5 -- C/Kg 6 -- Disintegrations 7 -- Counts 8 -- Ci/cm sq 9 -- Bq/cm sq
Time Base: 0 -- Seconds 1 -- Minutes 2 -- Hours

* See attached detector documentation, if app

Digital Readout	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	400kcpm	40056(0)	40056(0)	400cpm	40(0)	40(0)
	40kcpm	4005	4005	40cpm	4	4
	4kcpm	400	400			

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: Cs-137 Gamma S/N S-394/1122 1131 781 059 280 60646
1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304

✓ Alpha S/N Pu239 s/n 5283 ✓ Beta S/N Tc99 s/n 5296 Other

✓ m 500 S/N 114520 ✓ Multimeter S/N 78401030

Calibrated By Sebastian Ceballos Date 29-May-09
Reviewed By Rhonda Hein Date 3 Jun 09

FORM C44C 10/15/2008 This certificate shall not be reproduced except in full without the written approval of Ludlum Measurements, Inc.

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

Detector 43-37 A Serial No. PR216878 Order #. 20134551/338474

Customer PIKA INTERNATIONAL

Counter 2350-1 Serial No 221027 Counter Input Sensitivity 4.00 mV

Count Time 1 min. Distance Source to Detector Surface

Other Cal Constant = 1.000000E+00 Dead Time = 1.823569E-05

High Voltage	Background	Isotope Size Pu239 24,600 dpm	Isotope Size	Isotope Size	Isotope Size
1150V	5	5,665			
1200	1	5,805			
*1250	3	5,913			
1300	3	5,929			
1350	4	5,974			

✓ Gas proportional detector count rate decreased 5-10% after 15 hour static test using 39" cable.

Signature Sebastian Ceballos Date 29-May-09

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

FORM C4D 04/09/2003

• *Serving The Nuclear Industry Since 1962* •

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

Detector 43-37 B Serial No. PR216878 Order #. 20134551/338474

Customer PIKA INTERNATIONAL

Counter 2350-1 Serial No. 221027 Counter Input Sensitivity 4.00 mV

Count Time 1 min. Distance Source to Detector Surface

Other Cal Constant = 1 000000E+00 Dead Time = 2.314757E-05

High Voltage	Background	Isotope Size Tc 99 33,200 dpm	Isotope Size	Isotope Size	Isotope Size
1650V	539	10,177			
1675	703	11,174			
* 1700	995	12,164			
1725	1 197	12,856			

✓ Gas proportional detector count rate decreased < 10% after 15 hour static test using 39" cable.

Signature Sebastian Ceballos Date 29-May-09

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

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501 OAK STREET FAX NO 325-235-4672
SWEETWATER, TEXAS 79556 U S A

Bench Test Data

Detector 43-68 A Serial No. PR216846 Order #. 20134551/338474

Customer PIKA INTERNATIONAL

Counter 2350-1 Serial No. 221027 Counter Input Sensitivity 4.00 mV

Count Time 1 min. Distance Source to Detector Surface

Other Cal Constant = 1.000000E+00 Dead Time = 1.669870E-05

High Voltage	Background	Isotope Size Pu239 24,600 dpm	Isotope Size	Isotope Size	Isotope Size
1100V	0	5,864			
1150	0	6,027			
*1200	3	6,159			
1250	1	6,114			
1300	1	6,065			

✓ Gas proportional detector count rate decreased < 10% after 15 hour static test using 39" cable.

Signature Sebastian Cebaclos Date 29-May-09

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

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SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data

Detector 43-68 B Serial No. PR216846 Order #. 20134551/338474

Customer PIKA INTERNATIONAL

Counter 2350-1 Serial No. 221027 Counter Input Sensitivity 4.00 mV

Count Time 1 min. Distance Source to Detector Surface

Other Cal Constant = 1.000000E+00 Dead Time = 2.089564E-05

High Voltage	Background	Isotope Size Tc99 33,200dpm	Isotope Size	Isotope Size	Isotope Size
1600	217	11,266			
1625	261	12,155			
* 1650	311	12,083			
1675	357	12,098			

✓ Gas proportional detector count rate decreased 5-10% after 15 hour static test using 39" cable.

Signature Sebastian Ceballos Date 29-May-09

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

FORM C4D 04/09/2003

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 PIKA INTERNATIONAL ORDER NO. 20119667/331787

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 193654

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR198509

Cal. Date 11-Nov-08 Cal Due Date 11-Nov-09 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 42 % 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 725 V

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

Firmware Version: 39010-20
Alpha Threshold 120 mv
Beta Threshold: 3.5 mv
Beta Window: 30 mv
Overload Set To Simulate light leak
Instrument calibrated with a 39" 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: 11/11/2008
Calibration Date Due: 11/11/2009

COMMENTS:

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*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39861 (0)	39861 (0)	Log Scale			
	40kcpm	3996	3996				
	4kcpm	400	400				
	400cpm	40	40				
	40cpm	4	4				

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: ☐ S-394/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ 1879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu239 SN: 5282 ☑ Beta S/N Tc99 SN: 5296 ☑ Other Sr/90 SN: 5281

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

Calibrated By: Jason Flo Date 11-Nov-08

Reviewed By: Rhonda Hain Date 11 Nov 08

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.
FORM C225 10/15/2008

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. PR198509 Order # 20119667/331787

Customer PIKA INTERNATIONAL Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 193654 Beta Input Sensitivity 3.5 mV

Count Time 1 Minute Beta Window 30 mV

Other Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu 239 Size 35515dpm Alpha	Isotope Pu 239 Size 35515dpm Beta	Isotope Tc 99 Size 33077dpm Alpha	Isotope Tc 99 Size 33077dpm Beta	Isotope Sr Y90 Size 107687dpm Alpha	Isotope Sr Y90 Size 107687dpm Beta
700	0	164	8790	578	8	3845	3	26104
725	0	226	9260	777	13	5506	1	33004
750	4	407	9449	1218	15	6862	0	37089

☐ 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 Flan Date 11-nov-08

FORM C48 04/09/2003

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.

USTOMER PIKA INTERNATIONAL ORDER NO. 20134288/338292

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 275173

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR237000

Cal. Date 29-May-09 Cal Due Date 29-May-10 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 43 % Alt 700.8 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 850 V

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2000 / 2000 V

Firmware Version: 39010n24
Alpha Threshold: 140 mV
Beta Threshold: 38 mV
Beta Window: 37 mV
Overload set to simulate light leak
Instrument calibrated with a 15' cable.
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 29.May.09
Calibration Date Due: 29.May10

COMMENTS:

na 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*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	39999 (0)	39999 (0)	Log Scale			
	40kcpm	3999	3999				
	4kcpm	400	400				
	400cpm	40	40				
	40cpm	4	4				

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: ☐ S-394/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
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 Pu239 2928-01 ☑ Beta S/N Tc99 NI-EV SrY90 4016 ☐ Other

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

alibrated By: Jeremy Thompson Date 29.May.09

Reviewed By: [illegible] Date 31 May 09

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.
FORM C22S 10/15/2008

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. PR237000 Order #. 20134288/338292

Customer PIKA INTERNATIONAL Alpha Input Sensitivity 140 mV

Counter 2360 Serial No. 225173 Beta Input Sensitivity 3.8 mV

Count Time 1Minute Beta Window 37 mV

Other Plateau done with 15' cable Distance Source to Detector Surface

High Voltage	Background		Isotope Pu 239 Size ≈ 25,200 dpm		Isotope Tc 99 Size ≈ 22,600 dpm		Isotope Sr 90 Size ≈ 55,100 dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
825	1	165	5208	571	5	2973	2	9809
* 850	1	209	5359	709	3	3847	5	12410
875	0	339	5642	1006	2	4871	5	14093

☐ 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 Jeremy Thompson Date 29-May-09

FORM C48 04/09/2003

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.

'USTOMER PIKA INTERNATIONAL ORDER NO. 20137527/340279

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 193682

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR236970

Cal. Date 23-Jul-09 Cal Due Date 23-Jul-10 Cal. Interval 1 Year Meterface 202-855

Check mark [✓] applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 45 % Alt 703.8 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 800 V

[✓] HV Readout (2 points) Ref./Inst. 500 / 504 V Ref./Inst. 1500 / 1486 V

Firmware Version: 34010n24
Alpha Threshold: 120mV
Beta Threshold: 3.5mV
Beta Window: 30mV
Overload set to simulate a light leak
Instrument calibrated with a 39" C- cable.
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0 minutes
Alpha Alarm: 50000
Beta Alarm: 50000
A/B Alarm: 50000
Model 2360 Date: 07/23/2009
Calibration Date Due: 07/23/2010

COMMENTS:

ma 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*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	40098(0)	40098(0)	Log Scale			
	40kcpm	4010	4010				
	4kcpm	401	401				
	400cpm	40	40				
	40cpm	4	4				

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: [ ] S-394/1122 [ ] 1131 [ ] 781 [ ] 059 [ ] 280 [ ] 60646
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 Pu239#5283 [✓] Beta S/N Tc99#5280;Sr90Y90#5281 [ ] Other

[✓] m 500 S/N 238275 [ ] Oscilloscope S/N [✓] Multimeter S/N 83750210

alibrated By: James K. Mills Date 23-JUL-09

Reviewed By: [signature] Date 24 Jul 09

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.
FORM C22S 10/15/2008

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. PR236970 Order #. 20137527/340279

Customer PIKA INTERNATIONAL Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 193682 Beta Input Sensitivity 3.5 mV

Count Time 1Minute Beta Window 30 mV

Other Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu239 Size 24640.45 dpm Alpha	Isotope Pu239 Size 24640.45 dpm Beta	Isotope Tc99 Size 93239.85 dpm Alpha	Isotope Tc99 Size 93239.85 dpm Beta	Isotope Sr90Y90 Size 105874.21 dpm Alpha	Isotope Sr90Y90 Size 105874.21 dpm Beta
775	0	125	5415	312	36	10587	0	27246
800	0	159	5629	414	26	14535	1	33430
825	0	250	5679	565	31	18384	0	37571

☐ 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 James K. Nubb Date 23-JUL-09

FORM C4B 04/09/2003

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 PIKA INTERNATIONAL ORDER NO. 20143814/344064

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 225237

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR237000

Cal. Date 23-Nov-09 Cal Due Date 23-Nov-10 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 70 °F RH 25 % 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 800 V

☑ HV Readout (2 points) Ref./Inst. 500 / 505 V Ref./Inst. 1500 / 1511 V Replaced fuse

Firmware Version: 3010N24
Alpha Threshold: 120 mV
Beta Threshold: 3.5 mV
Beta Window: 20 mV
Overload set to simulate a light leak
Instrument calibrated with a 39" cable.
High voltage set with detector not connected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 11/23/2009
Calibration Date Due: 11/23/2010

COMMENTS:

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	400 Kcpm	400	400
X1000	100 Kcpm	100	100
X100	40 Kcpm	400	400
X100	10 Kcpm	100	100
X10	4 Kcpm	400	400
X10	1 Kcpm	100	100
X1	400 cpm	400	400
X1	100 cpm	100	100

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

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400 K cpm	40049 cpm	40049 cpm	Log Scale			
	40 K cpm	4005	4005				
	4 K cpm	400	400				
	400 cpm	40	40				
	40 cpm	4	4				

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: ☐ S-394/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1006 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N PU-239#2928 ☑ Beta S/N TC-99#5279 Sr90y90#5281 ☐ Other

☑ m 500 S/N 189606 ☐ Oscilloscope S/N ☑ Multimeter S/N 93870637

Calibrated By: Duane Jackson Date 23-Nov-09

Reviewed By: Rhonda Heim Date 23 Nov 09

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.
FORM C223 10/15/2008

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. PR236961 Order #. 20143814/344064

Customer PIKA INTERNATIONAL Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 193651 Beta Input Sensitivity 3.5 mV

Count Time 1Minute Beta Window 80 mV

Other Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu-239 Size 25,240dpm Alpha	Isotope Pu-239 Beta	Isotope Tc-99 Size 28,800dpm Alpha	Isotope Tc-99 Beta	Isotope Sr90/Y90 Size 105,000dpm Alpha	Isotope Sr90/Y90 Beta
775	0	140	5231	388	8	4635	2	28665
* 800	1	218	5800	461	10	5785	3	34906
825	0	267	5907	548	8	6768	0	39371
850	1	352	5932	700	8	7855	0	41264

☐ 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 Timothy Acklom Date 23-NOV-09

FORM C4B 04/09/2003

• *Serving The Nuclear Industry Since 1962* •

Certificate of Calibration

Calibration and Voltage Plateau

Environmental Restoration Group, Inc
8809 Washington St NE, Suite 150
Albuquerque, NM 87113
(505) 298-4224
www.ERGoffice.com

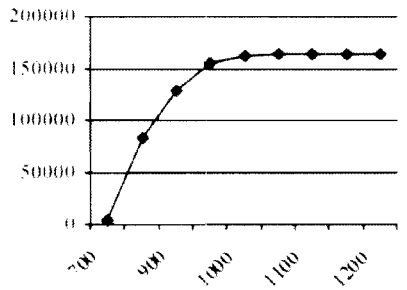
Meter:	Manufacturer:	Ludlum	Model Number:	2221	Serial Number:	108878
Detector:	Manufacturer:	Ludlum	Model Number:	FIDLER	Serial Number:	010807G

✔ Mechanical Check ✔ Geotropism ✔ THR/WIN Operation ✔ Audio Check ✔ Battery Check (Min 4.4 VDC)
✔ F S Response Check ✔ Meter Zeroed ✔ Reset Check HV Check (+ - 2.5%): ✔ 500 V ✔ 1000 V ✔ 1500 V
Source Distance: Contact 6 inches ✔ Other: 3/4" Cable Length: 39-inch ✔ 72-inch Other:
Source Geometry: Side ✔ Below Other: Temperature: 73 F Relative Humidity 20 %
Threshold: 10 mV Window: Barometric Pressure: 24.6 inches Hg
Instrument found within tolerance: ✔ Yes No

Range Multiplier	Reference Setting	"As Found Reading"	Meter Reading	Integrated 1-min count	Log Scale Count
x 1000	400	400	400	399028	400
x 1000	100	100	100		100
x 100	40	400	400	39899	400
x 100	10	100	100		100
x 10	4	400	400	3989	400
x 10	1	100	100		100
x 1	400	400	400	398	400
x 1	100	100	100		100

High Voltage	Source Counts	Background
700	4264	
800	83088	
900	127837	
950	153639	
1000	161439	
1050	163814	
1100	163157	5507
1150	163243	
1200	163279	

Voltage Plateau



Comments: Recommended HV 1100 * COUNT TIME = 30 SECONDS

Reference Instruments and/or Sources:

Ludlum pulser serial number: 97743 ✔ 201932 Fluke multimeter serial number: 87490128
Alpha Source: Th-230 @ 12,900 dpm (2/18/09) sn: 4098-03 Gamma Source Cs-137 @ 5.32 uCi (2/18/09) sn: 4097-03
Beta Source: Tc-99 @ 17,300 dpm (2/18/09) sn: 4099-03 ✔ Other Source: Am-241

Calibrated By: [signature] Calibration Date: 10-6-09 Calibration Due: 10-6-10

Reviewed By: [signature] Review Date: 10/6/09

This calibration conforms to the requirements and acceptable calibration conditions of ANSI N323A - 1997.
NMRCB Registration No 481-3 • Calibration of Radiation Detection Instrument Devices

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 6065
P.O.# 789945

Description of Standard:

Model No. DNS-16S Serial No. 5282-04 Isotope Pu-239

Electroplated on polished Ni 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 4001-02.

Measurement Result:

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

18,100 ± 541

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

35,600 ± 1,070 (0.0160 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: [signature]

Calibration Technician: [signature] Q.A. Representative: [signature]

Calibration Date: 6-22-2004 Reviewed Date: 6-23-04

7021 Pan American Freeway NI
Albuquerque, New Mexico 87109-4291
(505) 262-2694 Fax (505) 262-2691

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 6628
P.O.# 705764

Description of Standard:

Model No. DNS-16S Serial No. 5283-04 Isotope Pu-239

Electroplated on polished _____ 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 4001-02.

Measurement Result:

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

12,500 ± 374

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

24,600 ± 738 (0.0111 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: [signature]

Calibration Technician: [signature] Q.A. Manager: Anthony W. Toth

Calibration Date: 5-17-2007 Reviewed Date: 5-17-07

Source Manufacturing Lat
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4231
(505) 761-6413 Fax (505) 761-5411

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 3812
P.O.# 774925

Description of Standard:

Model No. S94-1 Serial No. 2928-01 Isotope Pu-239

Electroplated on polished Ni disc, 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.54 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:

12,600 ± 377

The total disintegration rate (dpm) assuming 0% backscatter of alpha particles from the surface of the disc, was:

25,200 ± 754 (0.0113 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: Q.A. Representative: Kathy Burnham

Calibration Date: 10-24-2001 Reviewed Date: 10-24-01

Analytical Services
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4235
(505) 345-3461 Fax (505) 761-5411

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404·352·8677
Fax 404·352·2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

76595-763

Cs-137 47 mm Diameter Glass Fiber Filter in Auminum Planchet

Customer: PIKA International, Inc.
P.O. No.: 0701151-001, Item 3

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1

ISOTOPE:	Cs-137
ACTIVITY (Bq):	4.949 E1
HALF-LIFE:	3.007 E1 years
CALIBRATION DATE:	January 30, 2008 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Comments:
Impurities: γ-impurities <0.1%

Diameter of active area: 47 mm. Low smooth bottom planchet. Source covering 0.85 mg/cm^2 mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: N Kiesman for
M. I. Taskaeva, Radiochemist

QA Approved: QA MZ
D. M. Montgomery, QA Manager

Date: 1/31/08

End of Certificate

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404·352·8677
Fax 404·352·2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

76593-763

47 mm Diameter Glass Fiber Filter in Aluminum Planchet

Customer: PIKA International, Inc.
P.O. No.: 0701151-001, Item 1

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The Am-241 was calibrated by liquid scintillation counting. All other radionuclides were calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

CALIBRATION DATE: January 29, 2008 12:00 EST

ISOTOPE:	Am-241	Cs-137
ACTIVITY (Bq):	1.688 E2	1.684 E2
HALF LIFE:	4.322 E2 Y	3.007 E1 Y
RELATIVE EXPANDED UNCERTAINTY(k=2):	3.3%	3.3%

Comments
Impurities: γ-impurities <0.1%, α-impurities <0.1%

Diameter active area: 47 mm. Low smooth bottom planchet. Source covering 0.85 mg/cm^2 mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: M Kiamen for
M. I. Taskaeva, Radiochemist

QA Approved: QA ALT
D. M. Montgomery, QA Manager

Date: 1/31/08

End of Certificate

Eckert & Ziegler
Analytics

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Atlanta, Georgia 30318
Tel 404·352·8677
Fax 404·352·2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

76594-763

Am-241 47 mm Diameter Glass Fiber Filter in Aluminum Planchet

Customer: PIKA International Inc.
P. O. No.: 0701151-001, Item 2

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. The calibration was checked by alpha counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Isotope:	Am-241
Activity (Bq):	1.652 E1
Half-Life:	4.322 E2 years
Calibration Date:	January 30, 2008 12:00 EST
Relative Expanded Uncertainty (k=2):	3.3%

Comments:
Impurities: γ-impurities <0.1%, α-impurities <0.1%
Diameter of active area: 47 mm. Low smooth bottom planchet. Source covering 0.85 mg/cm^2 mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: M Kiesman for
M. I. Taskaeva, Radiochemist

QA Approved: QA MM
D. M. Montgmery, QA Manager

Date: 1/31/08

End of Certificate