

SHIELDED GAMMA SURVEY DATA SUMMARY REPORT
RIO ALGOM MINING, LLC – AMBROSIA LAKE WEST MILL FACILITY
McKinley County, New Mexico

Prepared for:

Rio Algom Mining LLC
P.O. Box 218
Grants, NM 87020

Prepared by:

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Albuquerque, New Mexico 87109

March 22, 2021

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Acronyms and Abbreviations

ARC	alternate release criteria
CFR	Code of Federal Regulations
cpm	counts per minute
ERG	Environmental Restoration Group, Inc.
FSS	final status survey
GPS	Global Positioning System
H3	H3 Environmental, LLC
LTSM	Long-Term Surveillance and Maintenance
N/A	not applicable
NRC	United States Nuclear Regulatory Commission
pCi g ⁻¹	picocurie(s) per gram
R ²	coefficient of determination
Ra-226	radium-226
RAML	Rio Algom Mining, LLC
RSS	ranked set sampling
SDP	Soil Decommissioning Plan
SGS	shielded gamma survey
SOF	sum of fractions
Th-230	thorium-230
Total U	total uranium as the sum of uranium-234, uranium-235, and uranium-238
UTV	utility task vehicle
WBT	windblown tailings

1 Introduction and Scope

This data summary report was developed by H3 Environmental, LLC (H3) on behalf of Rio Algom Mining, LLC (RAML) and discusses results from shielded gamma surveys (SGSs) performed at RAML's former Ambrosia Lake West Mill facility (the facility) (Figure 1). Work in 2019 was completed by Environmental Restoration Group (ERG) and work in 2020 was completed by H3; this report describes work completed by both companies over the two-year period.

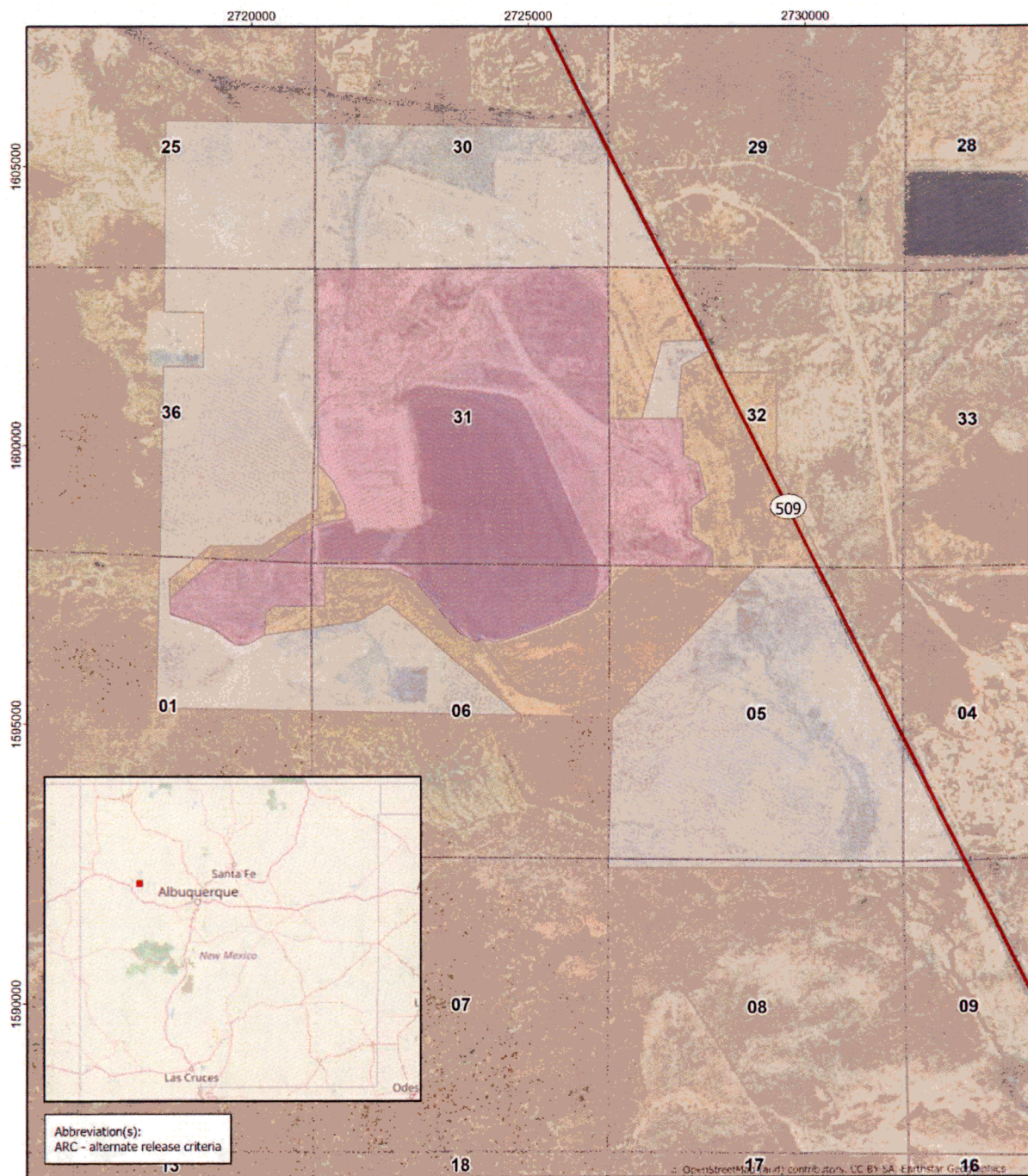
The facility processed uranium ore from 1958 to early 1985. Approximately 33 million tons of uranium ore were processed at the facility during that time. Since the closing of the mill, remediation and decommissioning activities have been ongoing. All mill structures have been razed and disposed of in on-site disposal cells. All disposal cells have been stabilized and capped pursuant to NRC-approved plans. The facility is currently undergoing decommissioning pursuant to a United States Nuclear Regulatory Commission (NRC)-approved *Soil Decommissioning Plan* (SDP) (Komex, 2006).

The SDP identifies two remedies for soil that contains concentrations of licensed radioactive material in excess of the facility's cleanup criteria: (1) excavation and relocation of contaminated soil to a disposal cell for shallow contamination areas (designated as windblown tailings (WBT) affected areas), and (2) placement of no less than one foot of clean soil (and potentially additional erosion protection) on top of areas with the potential for deep contamination (denoted as alternate release criteria (ARC)-designated areas).

On April 1, 2019, RAML submitted to the NRC a *Final Status Survey Work Plan for Windblown Tailings Affected Areas* (the work plan) (ERG, 2019), proposing to supplement the SDP final status survey (FSS) methodology with SGS and ranked set sampling (RSS) as an alternative to unshielded gamma surveys and five-point composite sampling. Within this work plan, RAML committed to providing a summary report of the SGS to NRC in Summer 2019, but additional areas required gamma surveying to completely delineate the spatial extent of soil potentially impacted by licensed radioactive material, which required supplemental SGS work in 2020. SGSs were performed over the course of several months in two different years – March through May 2019 and, after identifying additional areas to completely delineate potentially impacted soil, March through November 2020 (Figure 2). Additionally, this report discusses results from the SGS performed within ARC-designated areas that do not currently have the ARC remedy applied to them.

This 2019 SGS was bounded spatially by the WBT-affected area boundary defined in the SDP (Komex 2006). For the 2020 supplemental SGS, gamma survey data were not collected in areas known to be impacted by mine activities (e.g., the Arroyo del Puerto [arroyo]) or where topographical features limited or prevented further transport of licensed radioactive material (e.g., south and southwest of the mesa-cliff face in the southwest corner of section 5). On the west side of the arroyo, the southern boundary of the SGS area was defined where the talus slope of the mesa (B on Figure 2) approached the arroyo (A on Figure 2). On the eastern side of the arroyo there are two culverts under highway 509 (C on Figure 2). These culverts potentially provide a pathway for transportation of mine related material from the eastern side to the western side of the highway. This area of potential mixed impacts formed the southern gamma survey boundary on the eastern side of the arroyo.

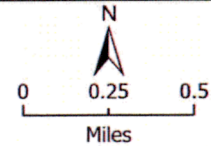
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KOMEX Soil Decommissioning Area classification

- Area of potential deep soil impact (ARC)
- Area of potential surficial windblown impact
- Unaffected or mining affected

- Section line
- State highway



Author: tom.bottomly - Date: 3/18/2021

Map Coordinate System: NAD 1983 StatePlane New Mexico West FIPS 3003 Feet

Document Path: X:\GIS\Rio Algom\Ambrosia Lake\Projects\Shielded Gamma Survey 2020.aprx

Figure 1. Soil Decommissioning Plan area designations. Area of potential surficial windblown impact shown does not include 30 m buffer (Komex, 2006)

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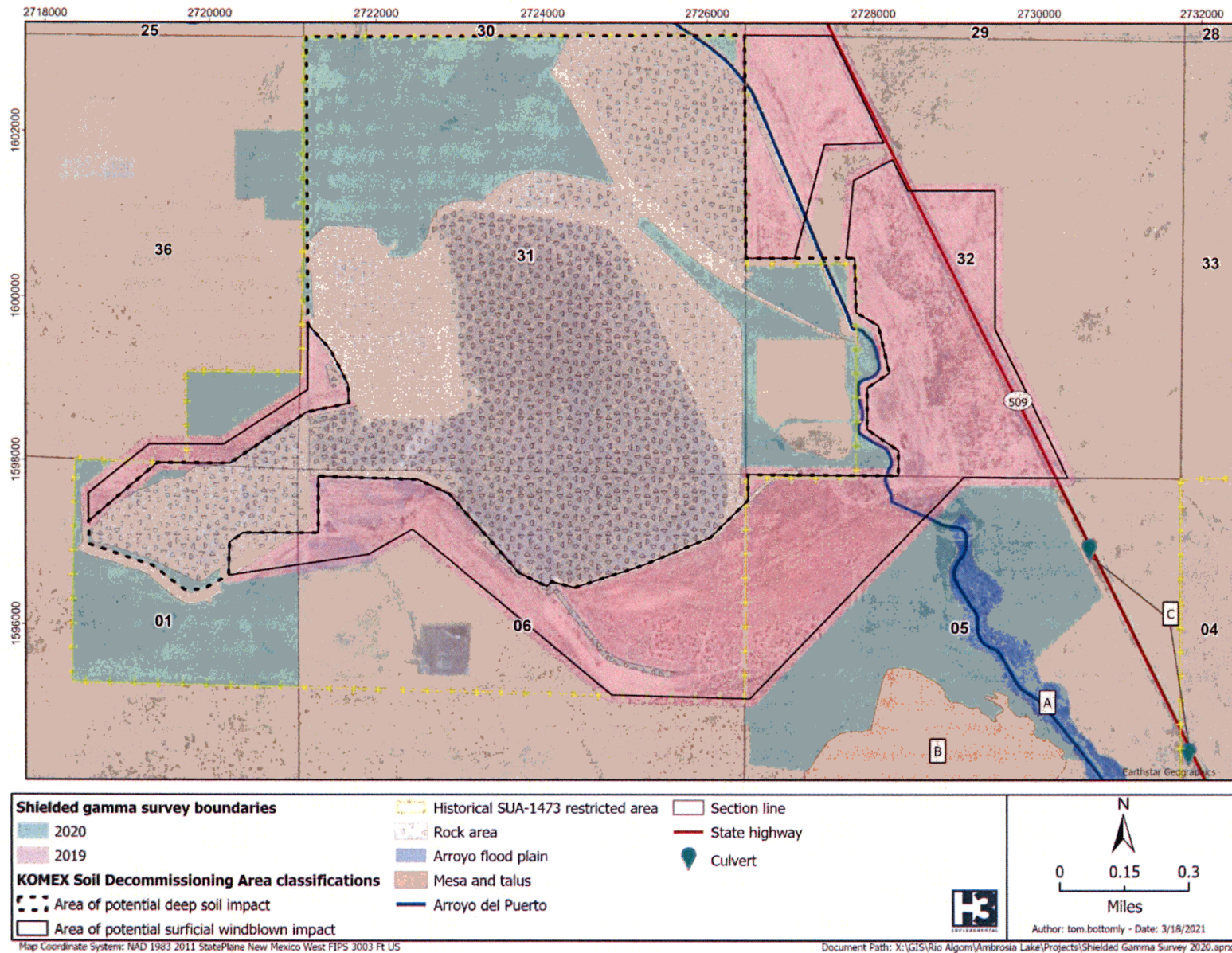


Figure 2. Shielded gamma survey boundaries (2019 and 2020)

2 Previous Investigations

Recent gamma survey and soil investigations took place between 2016 and 2018 in areas potentially impacted by mill-related materials pursuant to the SDP. A summary of these studies is provided in Table 1.

Table 1. Summary of Ambrosia Lake West Mill facility soil investigations 2016-2019

Date	Study Summary	Study Outcomes	References
2016	Unshielded gamma survey of the LTSM area.	RAML was able to calculate grid-mean gamma count rate site-wide, as required by the SDP.	(ERG, 2019)
2016	Pilot soil sampling by 5-point composite in highest 10 grids (based on average gamma) below the 29,000 cpm gamma guideline value.	Results demonstrated that the gamma guideline value of 29,000 cpm was too high to comply with the 95% SOF pass rate required by the SDP. Gamma guideline level reduced to 25,000 cpm.	(ERG, 2019)
2017	FSS soil sampling and correlation study by 5-point composite in top 2% grids (gamma) below the adjusted 25,000 cpm gamma guideline level. Adjusted study design to collect additional 5-point composite samples of grids between 13,000 cpm and 20,000 cpm for correlation.	Demonstrated that the top 2% of grids (as determined by grid-mean gamma count rate) did not pass the FSS ^a (i.e., more than 5% of the top 2% of grids failed SOF ≤ 1). Gamma to Ra-226 correlation study resulted in poor correlation model between Ra-226 and unshielded gamma count rate ($R^2 = 0.24$). Investigation of possible explanations for correlation lack-of-fit.	(RAML, 2019; ERG, 2019)
2018	Pilot soil sampling by ranked set sampling and shielded gamma survey of randomly selected grids	Use of shielded gamma survey and ranked set sampling improves correlation and resilience of method to small scale spatial heterogeneity. Improved gamma to Ra-226 correlation model (adjusted $R^2 = 0.60$).	(RAML, 2019; ERG, 2019)

^a FSS release criteria (pCi g⁻¹): Ra-226 = 7; Th-230 = 17; Total U = 38

cpm – counts per minute

FSS – final status survey

LTSM – Long-Term Surveillance and Maintenance

pCi g⁻¹ – picocurie(s) per gram

R^2 – coefficient of determination

Ra-226 – radium-226

SDP – Soil Decommissioning Plan

SOF – sum of fractions

Th-230 – thorium-230

Total U – sum of uranium-234, uranium-235, and uranium-238

WBT – windblown tailings

3 Purpose and Methods

3.1 Shielded Gamma Survey

SGS work was proposed in the work plan (ERG, 2019). The work plan gamma survey method was consistent with the SDP with two exceptions: detector shielding and transect spacing. The SDP states that walkover gamma surveys will be performed with unshielded gamma detectors on survey transects spaced six feet apart, whereas the work plan proposed to perform walkover gamma surveys with shielded gamma detectors on survey transects spaced three feet apart.

3.1.1 Purpose of Study

The purpose of this study was to capture the horizontal extent of gamma-emitting licensed radioactive material, especially in areas that exceed the facility cleanup criteria, by collecting facility-wide SGS data. This surface shielded gamma data would be correlated to soil concentrations of gamma-emitting radionuclides, specifically radium-226 (Ra-226). In areas where an adequate correlation exists between gamma count rate and sum of fractions, RAML plans to use gamma count rate as a basis for soil cleanup decisions at the facility.

The scope of the 2019 SGS included all areas designated within the SDP as WBT impacted areas, plus a 30m buffer. Upon completion of the 2019 SGS, it was apparent that the full horizontal extent of WBT impacts were not delineated. The 2020 supplemental SGS was designed to capture the full extent of WBT impacts to soil, as well as to collect shielded gamma data for all ARC-designated areas without the ARC remedy in place.

3.1.2 Shielded Gamma Survey Design

The SGS was performed using two-inch by two-inch Ludlum Model 44-10 thallium doped sodium iodide detectors shielded with 0.5-inch-thick lead collimators, coupled to Ludlum Model 3000 digital survey meters. Where accessible, the SGS was performed using a utility task vehicle (UTV) with detectors mounted to the front. Survey transects were spaced at one meter instead of the three-foot spacing proposed in the work plan. RAML does not expect that a 0.28-foot increase in transect spacing will affect the useability of SGS data, and, for consistency, plans to perform any future gamma surveys at a one meter transect spacing. Detector height while surveying was approximately 18 inches above ground surface. Where UTV access was limited, the survey was performed on foot. Global Positioning System (GPS)-based gamma surveys followed RAML's standard operating procedure ESP-010 – *Radiation Survey Using GPS Unit*.

3.1.3 Shielded Gamma Survey Data Validation

A shield comparison study was conducted by ERG to validate the comparability of the six shields used during the 2019 and 2020 SGSs. H3 and ERG also performed data validation on all gamma data collected during the 2019 and 2020 SGSs. Unusable SGS data were removed from the dataset and the affected areas were resurveyed.

Instrument calibration sheets and function check logs are included in this document as Appendix A.

4 Summary of Field Activities

A summary of completed field activities is presented in Table 2.

Table 2: Gamma survey goals and completed field work

Category	Subcategory	Described in Work Plan	Work Completed	Deviations from Work Plan
2019 Gamma Survey	WBT designated areas 30-meter buffer	576 acres	576 acres	Actual transect spacing 1-meter
2020 Gamma Survey	ARC designated non-ARC remedy areas	344 acres	344 acres	Planned transect spacing 3-feet
	WBT expansion areas	As needed	147 acres	

5 Results

Results for 2019 and 2020 SGSs are presented in the following sections and shown below on Figure 3.

5.1 2019

The results of the 2019 gamma survey demonstrated that the survey did not completely capture the area where future soils remediation may be required. Additionally, the 2019 gamma survey did not include areas within the ARC-designated portion of the facility that do not require the ARC remedy (ARC-designated non-ARC remedy areas), which will require a FSS to demonstrate that soil concentrations of radionuclides are below the limits stipulated in 10 CFR 40 Appendix A.

5.2 2020

The 2020 gamma survey expanded the horizontal extent of SGS data. However, RAML intends to survey a final parcel of land in spring of 2021. The 2021 parcel of land is located in section 6, near the facility's shale pit. With the addition of the planned 2021 data, RAML will have SGS data coverage within the entire historical restricted area associated with the facility, and in the cardinal down-wind directions (e.g., section 5).

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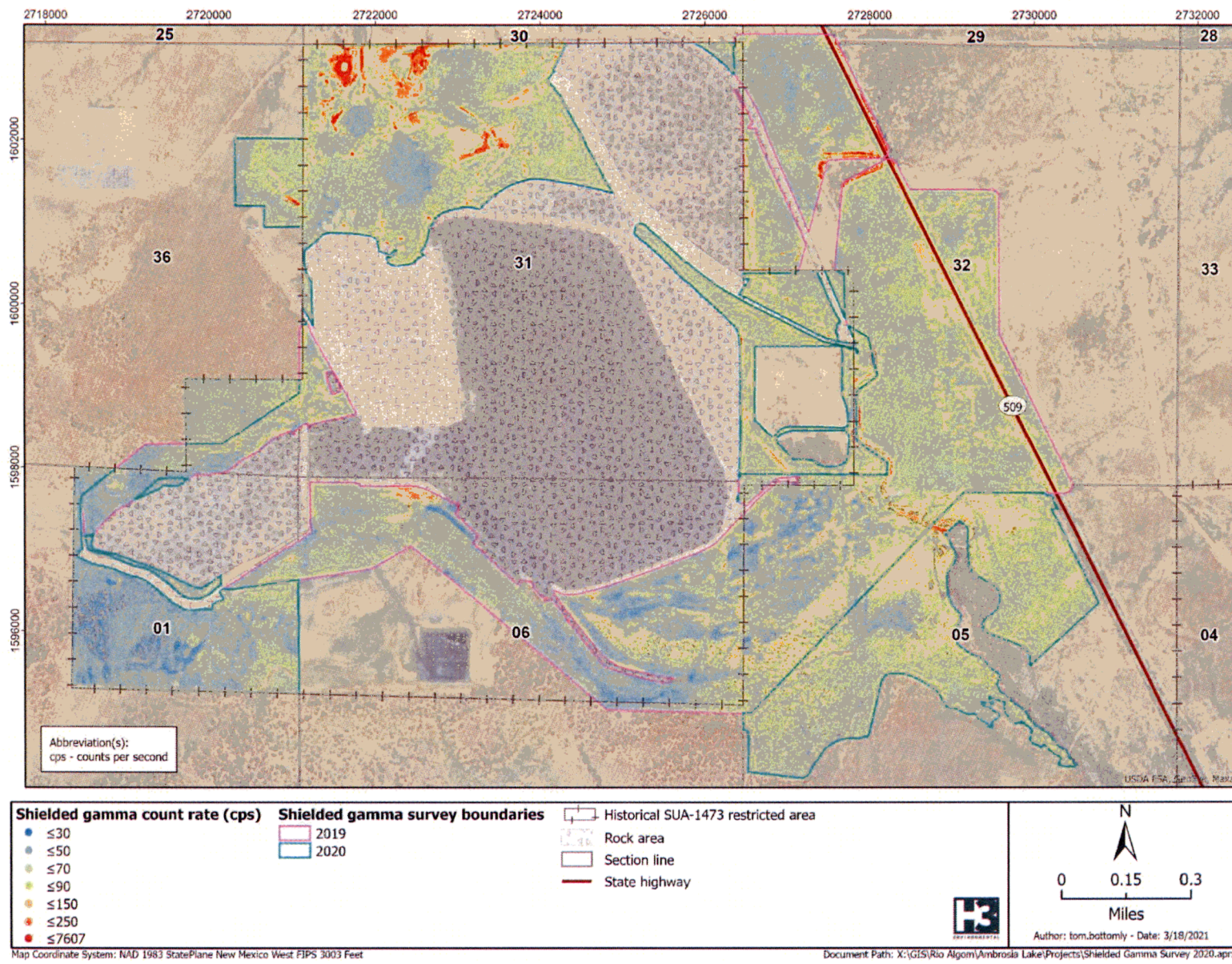


Figure 3. Shielded gamma survey results (2019 and 2020)

6 Discussion and Recommendations

While RAML is still evaluating the magnitude and usefulness of a site-wide gamma guideline value, results of the SGS indicate that remedial soils work will be required at the facility. To reduce the uncertainty associated with this future remedial action, RAML plans to perform surface and subsurface soil sampling in 2021 and 2022. The soil sampling campaign will have two purposes:

1. To identify areas where concentrations of the alpha-emitter thorium-230 preclude remedial decisions on the basis of a gamma guideline alone.
2. To inform remedy selection in ARC-eligible areas of the facility.

RAML is also currently scoping a new on-site disposal option (“cell 4”) for byproduct material. RAML expects that soils remedy selection will be complete in advance of the licensing process for cell 4, and therefore does not expect to initiate a soils remedial campaign until this licensing action is completed.

7 References

- ERG 2019. *Final Status Survey Work Plan for Windblown Tailings Affected Areas*. Supplement to SDP submitted via letter from Sandra L. Ross (RAML) to James Webb (NRC). ADAMS Accession No. ML19099A196: Rio Algom Mining LLC, April 1, 2019.
- Komex 2006. *Soil Decommissioning Plan for Rio Algom Mining LLC’s Ambrosia Lake Facility*. Final Version with all Figures and Attachments submitted by RAML to NRC May 25, 2018. ADAMS Accession No. ML18166A182: Rio Algom Mining LLC, May 1, 2006.
- RAML 2019. *Ranked Set Sampling: A Tool for Estimating Mean Constituent Concentrations in Soil*. NRC Public Meeting, Radioactive Materials License SUA-1473. ADAMS Accession No. ML19015A084: Rio Algom Mining, LLC, January 23, 2019.

Appendix A: Calibration Sheets and Function Check Logs

1



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.



Customer ERG ORDER NO. 20350945/475495

Mfg Ludlum Measurements, Inc. Model 3000 Serial No 25016951

Mfg Ludlum Measurements, Inc. Model 44-10 Serial No PR355773

Cal Date 5-Mar-19 Cal Due Date 5-Mar-20 Cal Interval 1 Year Meterface 44-10 Ra

Check mark ☒ applies to applicable instr. and/or detector IAW mfg spec. T. 73 °F RH 20 % Alt 715.0 mm Hg

☐ New Instrument ☐ Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 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) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 1000 V Input Sens 10 mV Det Oper 1000 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref /Inst 600 / 600 V Ref /Inst 1300 / 1308 V

COMMENTS:

Additional: 8 uSer Unable to take as found readings with 44-10 due to new setup.
Calibration Constant: 534 eph Calibrated using coiled C-cable.
Primary Units Alarm: 5 mR/hr Overload checked but not set.
Secondary Units Alarm: 5 kcpm Over calibration "RATEMETER READOUT" performed without deadtime.
Alarms: 4 uSer Over calibration "SCALER READOUT" reflects 6 second count.

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

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL POINT	RECEIVED	METER READING*	MULTIPLIER	CAL POINT	RECEIVED	METER READING*
Digital	4 mR/hr	N/A	3.99 mR/hr				
Digital	2 mR/hr		2.12				
	1 mR/hr		1.05				
	500 uR/hr		518 uR/hr				
	200 uR/hr		200				
	100 uR/hr		100				

*Uncertainty within $\pm 10\%$ C.F. within $\pm 20\%$

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL POINT	RECEIVED	METER READING*	CAL POINT	RECEIVED	METER READING*
Digital Readout	800K cpm	801 kcpm	Scaler	800K cpm	80.1K
	200K cpm	201		200K cpm	20.1K
	80K cpm	80.1		80K cpm	8.01K
	20K cpm	20.1		20K cpm	2.00K
	8K cpm	8.01		8K cpm	801
	2K cpm	2.00		2K cpm	200
	800 cpm	800 cpm		800 cpm	80
	200 cpm	202		200 cpm	20

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 Standard 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 ISO/IE 17025 2005(E) State of Texas Calibration License No. LO-1983

Reference instruments and/or Sources: Cs 137 S/N 059 2171CP 2201CP 720 734 781 1131 1616 1696 1909 1916CP 2324/2521

5717LO 5719LO 6064C 70897 73410 E652 G112 2168CP S-394 S-1054 T10281 T10282 Neutron Am241 Be T-034 Ra-226 ☒ Y982

Alpha S/N Beta S/N ☒ Other Am241 (0.66uCi)

☒ m 500 S/N 251106 Oscilloscope S/N ☒ Multimeter S/N 15060230

Calibrator James McBeth *James McBeth* Title Calibrator Date 5 MAR 19

QC'd By *[Signature]* Title Final QC Date 5 MAR 19

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25016951
3/5/2019 8:47:09 AM

Device

Device Firmware	49835-N30.3842
Device Model	Model 3000
Device Serial Number	25016951
Device Real Time Clock Day	5
Device Real Time Clock Hour	8
Device Real Time Clock Minutes	47
Device Real Time Clock Month	3
Device Real Time Clock Seconds	5
Device Real Time Clock Year	2019
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sx Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	40
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	160
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	0
Device Auxiliary Mode	0
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0

Device Calibration

Device Calibration High Voltage Slope	29
Device Calibration High Voltage Offset	-50
Device Calibration Channel [1] Pulse Threshold Offset	7

Detector 1

Detector [1] Serial Number	PR355773
Detector [1] Model	44-10
Detector [1] High Voltage	1000
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0

Detector [1] Auto-Response Rate	0
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit 1 Rate Unit Type	9
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	7
Detector [1] Unit 1 Rate Max Range	1
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	50
Detector [1] Unit 1 Rate Alarm Range	1
Detector [1] Unit 1 Rate Alarm Decimal Point	-1
Detector [1] Unit 1 Scaler Unit Type	3
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	1
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit 2 Rate Unit Type	5
Detector [1] Unit 2 Rate Min Range	0
Detector [1] Unit 2 Rate Min Decimal Point	0
Detector [1] Unit 2 Rate Max Value	999
Detector [1] Unit 2 Rate Max Range	1
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Detector [1] Unit 2 Rate Alarm Value	5
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Detector [1] Unit 2 Scaler Min Decimal Point	0
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Detector [1] Unit 2 Scaler Alarm Range	0
Detector [1] Unit 2 Scaler Alarm Decimal Point	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	8
Detector [1] Channel [1] Dead Time Correction-2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	534
Detector [1] Channel [2] Calibration Constant Exponent	8
Detector [1] Channel [1] Efficiency 4pi	15

Order #: 20350945/475495

Customer: ERG

Detector: 44-10

Serial No.: PR355773

Instrument: Model 3000

Serial No.: 25016951

BKG Time: 6

Distance: Surface

Selected HV: 1000

Date: Tuesday, March 05, 2019

Notes: Performed with coiled C-cable.

Signature: *James M. B. B.*

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background		Am241
	Reading		Reading
750		515	7,166
800		529	10,591
850		571	12,339
900		571	12,537
950		565	12,697
1,000		515	12,550
1,050		518	12,649
1,100		550	12,514
1,150		570	12,445
1,200		607	13,141
1,250		888	13,417
1,300		1,603	15,126



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CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street

325-235-5494

Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer ERG ORDER NO 20351031/475495A

Mfg Ludlum Measurements, Inc. Model 3000 Serial No 25017006

Mfg Ludlum Measurements, Inc. Model 44-10 Serial No PR357755

Cal. Date 11-Mar-19 Cal Due Date 11-Mar-20 Cal Interval 1 Year Meterface 44-10 Ra

Check mark ☒ Applies to applicable instr and/or detector IAW mfg spec T 73 °F RH 27 % Alt 710.0 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) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 900 V Input Sens 10 mV Det. Oper 900 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 600 599 V Ref/Inst 1300 1314 V

COMMENTS:

Deadtime: 1.8 µSec Unable to take as found readings with 44-10 due to new setup.
 Calibration Constant: 559 ± 6 Calibrated using coiled C-cable.
 Battery Status Alarm: 5 mSec Overload checked but not set.
 Accuracy Status Alarm: 5 mSec Filter calibration "RATEMETER READOUT" performed without deadtime.
 Accuracy Status Alarm: 5 mSec Filter calibration "SCALER READOUT" reflects 6 second point.

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

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL POINT	RECEIVED	METER READING*	MULTIPLIER	CAL POINT	RECEIVED	METER READING*
Digital	4 mR/hr	N/A	4.00 mR/hr				
Digital	2 mR/hr		2.02				
	1 mR/hr		1.05				
	500 µR/hr		514 µR/hr				
	200 µR/hr		203				
	100 µR/hr		99				

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

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL POINT	RECEIVED	METER READING*	CAL POINT	RECEIVED	METER READING*
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	199		200K cpm	19.9K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	19.9		20K cpm	1.99K
	8K cpm	8.00		8K cpm	801
	2K cpm	1.99		2K cpm	200
	800 cpm	799 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

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.

This calibration system conforms to the requirements of ANSI/NCSL Z540-1:1994 and ANSI N323-1978

ISO/IEC 17025:2005(E)

State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs 137 S/N 059 2171CP 2261CP 720 734 781 1131 1615 1696 1909 1916CP 2324/2521
 Co-60 5719CP Co-60 70997 73410 Co-60 G112 2168CP S-384 S-1054 T10081 T10082 Neutron Am-241 Be T-304 Ra-226 Y992

Alpha S/N

Beta S/N

☒ Other

Am241 (0.66µCi)

☒ m 500 S/N

251106

Oscilloscope S/N

☒ Multimeter S/N

15060230

Calibrator

James McBeth

Title Calibrator

Date

11 MAR 19

QC'd By

Donnie Micko

Title Final QC

Date

11 MAR 19

Order #: 20351031/475495A

Customer: ERG

Detector: 44-10

Serial No.: PR357755

Instrument: Model 3000

Serial No.: 25017006

BKG Time: 6

Distance: Surface

Selected HV: 900

Date: Monday, March 11, 2019

Notes: Performed using coiled C-cable.

Signature: *[Handwritten Signature]*

Channel(s)

Name:

Threshold

Channel 1

10 mV

Source(s)

Name	ID	Activity	Time	Type
Am241		0.66 μ Ci	6	γ

High Voltage	Background	Am241
	Reading	Reading
700	474	10,144
750	485	12,028
800	441	12,209
850	447	12,320
900	477	12,114
950	462	12,173
1,000	494	12,283
1,050	506	12,240
1,100	670	12,689
1,150	1,483	14,168

Ludlum Device Parameters

Product: Model 3000
 Serial Number: 25017006
 3/11/2019 2:49:00 PM

Device

Device Firmware	49835-N30.3842
Device Model	Model 3000
Device Serial Number	25017006
Device Real Time Clock Day	11
Device Real Time Clock Hour	14
Device Real Time Clock Minutes	48
Device Real Time Clock Month	3
Device Real Time Clock Seconds	56
Device Real Time Clock Year	2019
Device Real Time Clock Day of the Week	5
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	40
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	0
Device Auxiliary Mode	0
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0

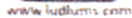
Device Calibration

Device Calibration High Voltage Slope	41
Device Calibration High Voltage Offset	-58
Device Calibration Channel [1] Pulse Threshold Offset	3

Detector 1

Detector [1] Serial Number	PR357755
Detector [1] Model	44-10
Detector [1] High Voltage	900
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0

Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit 1 Rate Unit Type	9
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	7
Detector [1] Unit 1 Rate Max Range	1
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	5
Detector [1] Unit 1 Rate Alarm Range	1
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	3
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	1
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit 2 Rate Unit Type	5
Detector [1] Unit 2 Rate Min Range	0
Detector [1] Unit 2 Rate Min Decimal Point	0
Detector [1] Unit 2 Rate Max Value	999
Detector [1] Unit 2 Rate Max Range	1
Detector [1] Unit 2 Rate Max Decimal Point	0
Detector [1] Unit 2 Rate Alarm Value	5
Detector [1] Unit 2 Rate Alarm Range	1
Detector [1] Unit 2 Rate Alarm Decimal Point	0
Detector [1] Unit 2 Scaler Unit Type	1
Detector [1] Unit 2 Scaler Min Range	0
Detector [1] Unit 2 Scaler Min Decimal Point	0
Detector [1] Unit 2 Scaler Alarm Value	0
Detector [1] Unit 2 Scaler Alarm Range	0
Detector [1] Unit 2 Scaler Alarm Decimal Point	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	7.9
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	539
Detector [1] Channel [1] Calibration Constant Exponent	8
Detector [1] Channel [1] Efficiency 4pi	15



CERTIFICATE OF CALIBRATION

501 Oak Street
325-235-5454
Sweetwater, TX 79556, U.S.A.



100% Passed Written Theory and Computer Test

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25016921
3/5/2019 10:36:05 AM

Device

Device Firmware	49835C-N30.3838
Device Model	Model 3000
Device Serial Number	25016921
Device Real Time Clock Day	5
Device Real Time Clock Hour	10
Device Real Time Clock Minutes	36
Device Real Time Clock Month	3
Device Real Time Clock Seconds	0
Device Real Time Clock Year	2019
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	40
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	0
Device Auxiliary Auto Power Down	1
Device Auxiliary Write Protect	1
Device Auxiliary Encryption Enabled	1
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375 Ethernet Mode Port	0

Device Calibration

Device Calibration High Voltage Slope	24
Device Calibration High Voltage Offset	-43
Device Calibration Channel [1] Pulse Threshold Offset	5

Detector 1

Detector [1] Serial Number	PR355767
Detector [1] Model	44-10
Detector [1] High Voltage	850
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0

Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit 1 Rate Unit Type	9
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	700
Detector [1] Unit 1 Rate Max Range	1
Detector [1] Unit 1 Rate Max Decimal Point	2
Detector [1] Unit 1 Rate Alarm Value	30
Detector [1] Unit 1 Rate Alarm Range	1
Detector [1] Unit 1 Rate Alarm Decimal Point	1
Detector [1] Unit 1 Scaler Unit Type	3
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	1
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit 2 Rate Unit Type	5
Detector [1] Unit 2 Rate Min Range	0
Detector [1] Unit 2 Rate Min Decimal Point	0
Detector [1] Unit 2 Rate Max Value	999
Detector [1] Unit 2 Rate Max Range	1
Detector [1] Unit 2 Rate Max Decimal Point	0
Detector [1] Unit 2 Rate Alarm Value	5
Detector [1] Unit 2 Rate Alarm Range	1
Detector [1] Unit 2 Rate Alarm Decimal Point	0
Detector [1] Unit 2 Scaler Unit Type	1
Detector [1] Unit 2 Scaler Min Range	0
Detector [1] Unit 2 Scaler Min Decimal Point	0
Detector [1] Unit 2 Scaler Alarm Value	0
Detector [1] Unit 2 Scaler Alarm Range	0
Detector [1] Unit 2 Scaler Alarm Decimal Point	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	7.4
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	537
Detector [1] Channel [1] Calibration Constant Exponent	8
Detector [1] Channel [1] Efficiency 4pi	15

Order #: 20350945/475495

Customer: ERG

Detector: 44-10

Serial No.: PR355767

Instrument: Model 3000

Serial No.: 25016921

BKG Time: 6

Distance: Surface

Selected HV: 850

Date: Tuesday, March 05, 2019

Notes: Performed with coiled C-cable.

Signature: *James M. B. R.*

Channel(s)

Name Threshold

Channel 1 10 mV

Source(s)

Name ID Activity Time Type

Am241 0.66 μ Ci 6 7

High Voltage	Background	Am241
	Reading	Reading
650	502	2,450
700	562	10,829
750	542	12,361
800	568	12,392
850	540	12,483
900	550	12,500
950	517	12,550
1,000	814	12,816
1,050	9,052	16,866

4



www.ludlum.com

Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater TX 79556 U.S.A.


CERT # 4084.01

Customer **ERG** ORDER NO **20350945/475495**

Mfg **Ludlum Measurements, Inc.** Model **3000** Serial No **25016973**

Mfg **Ludlum Measurements, Inc.** Model **44-10** Serial No **PR375295**

Cal Date **5-Mar-19** Cal Due Date **5-Mar-20** Cal Interval **1 Year** Meterface **44-10 Ra**

Check mark ☒ Applies to applicable instr and/or detector IAW mfg spec **T** **73** °F **RH** **20** % **Alt** **715.0 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) **4.4** VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set **800** V Input Sens **10** mV Det Oper **800** V at **10** mV Threshold **=** mV

☒ HV Readout (2 points) Ref/Inst. **600** / **603** V Ref/Inst. **1300** / **1312** V

COMMENTS:

Replaced the probe cable as it could not take in field readings with 44-10 due to new setup.
 Replaced the probe cable as it could not take in field readings with 44-10 due to new setup.
 Replaced the probe cable as it could not take in field readings with 44-10 due to new setup.
 Replaced the probe cable as it could not take in field readings with 44-10 due to new setup.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-10 in which the front of probe faces source

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL POINT	RECEIVED	METER READING*	MULTIPLIER	CAL POINT	RECEIVED	METER READING*
Digital	4 mR/hr	N/A	4.00 mR/hr				
Digital	2 mR/hr		1.91				
	1 mR/hr		990 mR/hr				
	500 µR/hr		503				
	200 µR/hr		200				
	100 µR/hr		101				

*Uncertainty within ± 1.0% C.F. within ± 2.0%

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL POINT	RECEIVED	METER READING*	CAL POINT	RECEIVED	METER READING*
Digital			Scaler		
Readout	800K cpm	799 kcpm	800K cpm	79.9K	79.9K
	200K cpm	199	200K cpm	19.9K	19.9K
	80K cpm	79.9	80K cpm	7.99K	7.99K
	20K cpm	19.9	20K cpm	1.99K	1.99K
	8K cpm	7.99	8K cpm	799	799
	2K cpm	2.00	2K cpm	199	199
	800 cpm	798 cpm	800 cpm	80	80
	200 cpm	201	200 cpm	20	20

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/NIST Z39.1-1994 and ANSI N329-1976. ISO/IE 17025:2005(E) State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs 137 S/N 069 217CP 226CP 720 11734 721 11734 1616 1696 1402 1416CP 23242521
 Sr 90 S/N 41901 60446 10897 13410 1551 1112 2168CP S394 11054 11061 11062 Neutron Am241 Be 134 Ra-226 ✓ Y90

Alpha S/N **251106** Beta S/N **15060230** Other **Am241 (0.66µCi)**
☒ m 500 S/N **251106** Oscilloscope S/N **15060230** Multimeter S/N **15060230**

Calibrator **James McBeth** Title **Calibrator** Date **5 MAR 19**
 QC'd By **James McBeth** Title **Final QC** Date **5 MAR 19**

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25016973
3/5/2019 9:44:30 AM

Device

Device Firmware	49835C-N30.3838
Device Model	Model 3000
Device Serial Number	25016973
Device Real Time Clock Day	5
Device Real Time Clock Hour	9
Device Real Time Clock Minutes	44
Device Real Time Clock Month	3
Device Real Time Clock Seconds	25
Device Real Time Clock Year	2019
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to SV Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	40
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	0
Device Auxiliary Auto Power Down	1
Device Auxiliary Write Protect	1
Device Auxiliary Encryption Enabled	1
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375 Ethernet Mode Port	0

Device Calibration

Device Calibration High Voltage Slope	34
Device Calibration High Voltage Offset	-48
Device Calibration Channel [1] Pulse Threshold Offset	3

Detector 1

Detector [1] Serial Number	PR375295
Detector [1] Model	44-10
Detector [1] High Voltage	800
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0

Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit 1 Rate Unit Type	9
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	700
Detector [1] Unit 1 Rate Max Range	1
Detector [1] Unit 1 Rate Max Decimal Point	2
Detector [1] Unit 1 Rate Alarm Value	50
Detector [1] Unit 1 Rate Alarm Range	1
Detector [1] Unit 1 Rate Alarm Decimal Point	1
Detector [1] Unit 1 Scaler Unit Type	3
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	1
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit 2 Rate Unit Type	5
Detector [1] Unit 2 Rate Min Range	0
Detector [1] Unit 2 Rate Min Decimal Point	0
Detector [1] Unit 2 Rate Max Value	999
Detector [1] Unit 2 Rate Max Range	1
Detector [1] Unit 2 Rate Max Decimal Point	0
Detector [1] Unit 2 Rate Alarm Value	5
Detector [1] Unit 2 Rate Alarm Range	1
Detector [1] Unit 2 Rate Alarm Decimal Point	0
Detector [1] Unit 2 Scaler Unit Type	1
Detector [1] Unit 2 Scaler Min Range	0
Detector [1] Unit 2 Scaler Min Decimal Point	0
Detector [1] Unit 2 Scaler Alarm Value	0
Detector [1] Unit 2 Scaler Alarm Range	0
Detector [1] Unit 2 Scaler Alarm Decimal Point	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	8.2
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	533
Detector [1] Channel [1] Calibration Constant Exponent	8
Detector [1] Channel [1] Efficiency 4pi	15

Order #: 20350945/475495

Customer: ERG

Detector: 44-10

Serial No.: PR375295

Instrument: Model 3000

Serial No.: 25016973

BKG Time: 6

Distance: Surface

Selected HV: 800

Date: Tuesday, March 05, 2019

Notes: Performed with coiled C-cable.

Signature: *James M. [Signature]*

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
600	577	9,272
650	701	10,965
700	574	11,505
750	660	11,472
800	492	11,527
850	561	11,424
900	553	11,513
950	743	11,612
1,000	1,588	21,642



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

6

Meter: Manufacturer: Ludlum Model Number: 3000 Serial Number: 25017006
Detector: Manufacturer: Ludlum Model Number: 44-10 Serial Number: PR355771

☒ Mechanical Check ☒ THR/WIN Operation
☒ F/S Response Check ☒ Reset Check
☐ Geotropism ☒ Audio Check
☒ Meter Zeroed ☒ Battery Check (Min 4.4 VDC)
Source Distance: ☐ Contact ☒ 6 inches ☐ Other:
Source Geometry: ☒ Side ☐ Below ☐ Other:

HV Check (+/- 2.5%): ☒ 500 V ☒ 1000 V ☒ 1500 V
Cable Length: ☐ 39-inch ☒ 72-inch ☐ Other: -ft coil cabl

Barometric Pressure: 24.3 inches Hg
Temperature: 72 °F
Relative Humidity: 20 %
Threshold: 10 mV
Window: 1/4

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	422	400	400000	
x 1000	100	101	101		
x 100	400	40.2	40.2	40200	
x 100	100	100	100		
x 10	400	4.02	4.02	4000	
x 10	100	100	100		
x 1	400	400	400	401	
x 1	100	101	101		

High Voltage

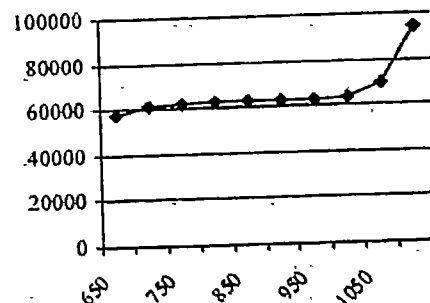
Source Counts

Background

650	57683
700	61028
750	62096
800	62876
850	62771
900	62784
950	62905
1000	63977
1050	69432
1100	94273

9367

Voltage Plateau



Comments: Firmware = 5LC-N30.4364, Units 1 = R/hr, Units 2 cpm, HV Plateau Scaler Count Time = 1-min. Recommended HV = 850 volts

Reference Instruments and/or Sources:

Ludlum pulser serial number: ☐ 97743 ☒ 201932

Fluke multimeter serial number: ☐ 87490128

☐ Alpha Source: Th-230 sn: 4098-03@12,800dpm/6,520 cpm (1/4/12)

☒ Gamma Source Cs-137 @ 5.2 uCi (1/4/12) sn: 4097-03

☐ Beta Source: Tc-99 sn: 4099-03@17,700dpm/11,100cpm(1/4/12)

☐ Other Source:

Calibrated By:

Calibration Date: 5/28/19

Calibration Due: 5/28/20

Reviewed By:

Date: 5/28/19

ERG Form ITC.101.A

This calibration conforms to the requirements and acceptable calibration conditions of ANSI N323A - 1997

Order #:

Channel(s)

Customer:

Name

Threshold

Detector: 44-10

Serial No.: PR355771

Channel: 1

10 mV

Instrument: Model 3000

Serial No.: 25017006

BKG Count 60 seconds

Source(s)

Time:

Name

ID

Activity

Count Time (Sec.)

Distance:

Cs-137

4097-03

5.2 uCi

60

Date: Tuesday, May 28, 2019

010412

Notes:

Signature:

High Voltage	Background	Cs-137 (5.2 uCi 010412)
500	983	16021
550	2513	33261
600	5729	50757
650	8301	57683
700	9056	61028
750	9289	62096
800	9084	62876
850	9367	62771
900	9168	62784
950	9332	62905
1000	9510	63977
1050	10453	69432
1100	14047	94273
1150	23212	155016
1200	35878	289945

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25017006
5/28/2019 2:08:38 PM

Device

Device Firmware	5LC-N30.4364
Device Model	Model 3000
Device Serial Number	25017006
Device Real Time Clock Day	28
Device Real Time Clock Hour	14
Device Real Time Clock Minutes	7
Device Real Time Clock Month	5
Device Real Time Clock Seconds	27
Device Real Time Clock Year	2019
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Setup Prtct	Normal
Device Count DisplayMode	0
Device Count AudioMode	0
Device Back Light Threshold Low LightTurnOn	0
Device Back Light Threshold Low LightTurnOff	120
Device Back Light Threshold High LightTurnOn	0
Device Back Light Threshold High LightTurnOff	100
Device AuxCom En	1
Device AuxCom Mode	5
Device AuxCom Pwr Mode	0
Device AuxCom Pwr AutoOffTm	0
Device AuxCom WritePrtct	0
Device AuxCom Crypto En	0
Device AuxCom AutoMode Interval	1
Device RateResetBtn	0
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	41
Device Calibration High Voltage Offset	-58
Device Calibration Channel [1] Pulse Threshold Offset	3

Detector 1

Detector [1] Serial Number	PR355771
Detector [1] Model	44-10

Detector [1] High Voltage	850
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	0
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	7.9
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	100
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 CPSOffset	0
Detector 1 Channel 1 Dead Time Correction 2	0
Detector 1 Unit 1 Rate Unit	R/h
Detector 1 Unit 2 Rate Unit	cpm
Detector 1 Unit 1 Rate Min Display Value	-6
Detector 1 Unit 2 Rate Min Display Value	0
Detector 1 Unit 1 Rate Max Display Value	999
Detector 1 Unit 2 Rate Max Display Value	999000
Detector 1 Unit 1 Rate Alarm 1	999
Detector 1 Unit 1 Rate Alarm 2	999
Detector 1 Unit 2 Rate Alarm 1	999000
Detector 1 Unit 2 Rate Alarm 2	999000
Detector 1 Unit 1 Scaler Unit	R
Detector 1 Unit 2 Scaler Unit	counts
Detector 1 Unit 1 Scaler Min Display Value	-6
Detector 1 Unit 2 Scaler Min Display Value	0
Detector 1 Unit 1 Scaler Alarm 1	0
Detector 1 Unit 1 Scaler Alarm 2	0
Detector 1 Unit 2 Scaler Alarm 1	0
Detector 1 Unit 2 Scaler Alarm 2	0



Designer and Manufacturer
of
Scientific and Industrial
Instruments

www.ludlum.com

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A



CER

20348366/473835

Customer ENVIRONMENTAL RESTORATION GRP

Mfg. Ludlum Measurements, Inc. Model 2360

Serial No. 177166

Mfg. Ludlum Measurements, Inc. Model 43-93

Serial No. 299623

Cal. Date 28-Jan-19 Cal Due Date 28-Jan-20 Cal. Interval 1 Year Meterface 202-855

Check mark ☒ Applies to applicable instr. and/or detector IAW mfg. spec.

T. 73 °F RH 48 % Alt 688.0 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. ☐ RS-232 Port OK
- ☒ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 850 V

☒ HV Readout (2 points) Ref./Inst. 500 / 502 V Ref./Inst. 1500 / 1500 V

Firmware Version: 39010-29

(EEPROM Settings)

Alpha Threshold: 12.0 mV

User Time: 1.0

Beta Threshold: 3.5 mV

Alpha Alarm: 999999

Beta Window: 30 mV

Beta Alarm: 999999

Overload SET TO SIMULATE LIGHT LEAK.

A/B Alarm: 999999

Instrument calibrated with a 39" cable.

Model 2360 Date: 1/28/2019

High voltage set with detector NOT CONNECTED

Calibration Date Due: 1/28/2020

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	39954(0)	400kcpm	39954(0)	
	40kcpm	3995	40kcpm	3995	
	4kcpm	399	4kcpm	399	
	400cpm	40	400cpm	40	
	40cpm	4	40cpm	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 ISO/IE 17025:2005(E) State of Texas Calibration License No. LO-1963

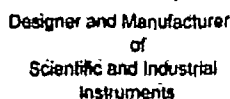
Reference Instruments and/or Sources: Cs-137 S/N 059 2171CP 2261CP 720 734 781 1131 1616 1696 1909 1916CP 2324/2521 5717CO 5719CO 60646 70897 73410 E552 G112 2168CP S-394 S-1054 T10081 T10082 Neutron Am-241 Be T-304 Ra-226 Y96

☒ Alpha S/N Pu239 SN:7053 ☒ Beta S/N Tc99SN:5280, SrY90SN:5281 ☐ Other

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

Calibrator Jason Flores Title Calibrator Date 28-Jan-19

QC'd By Title Final QC Date 28 Jan 19



501 Oak Street
325-235-5484
Sweetwater, TX 79556, U.S.A.



Customer ENVIRONMENTAL RESTORATION GRP

ORDER NO. 20348366/473835

Detector 43-93 Serial No. PR299623

Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 177166

Beta Input Sensitivity 3.5 mV

Count Time 1 Minute

Beta Window 30 mV

Other _____

Distance Source to Detector Surface[illegible]

- ☐ Gas Proportional detector count rate decreased $\leq 10\%$ after 15 hour static test using 39" cable.
- ☐ Gas proportional detector count rate decreased $\leq 10\%$ after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jason Flores

Date 28-Jan-19



Designer and Manufacturer
of
Scientific and Industrial
Instruments

www.ludlum.com

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC

501 Oak Street

325-235-5494

Sweetwater, TX 79556 U.S.A



CERT. NO. 1

Customer ENVIRONMENTAL RESTORATION GRP ORDER NO. 20348366/473835

Mfg Ludlum Measurements, Inc. Model 2360 Serial No. 127184

Mfg Ludlum Measurements, Inc. Model 43-93 Serial No. PN 299676

Cal Date 28-Jan-19 Cal Due Date 28-Jan-20 Cal. Interval 1 Year Meterface 202-855

Check mark ☒ Applies to applicable instr and/or detector IAW mfg. spec. T 73 °F RH 48 % Alt 688.0 mm Hg

☐ New Instrument ☐ Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 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. ☐ RS-232 Port OK

☐ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 800 V

☒ HV Readout (2 points) Ref./Inst 500 1501 V Ref./Inst. 1500 1502 V

Firmware Version 39010-20 (EEPROM Settings)

Alpha Threshold: 120 mV User Time: 1.0

Beta Threshold: 3.5 mV Alpha Alarm: 99999

Beta Window: 30 mV Beta Alarm: 99999

Overload Set to simulate light leak. A/B Alarm: 99999

Instrument calibrated with a 39" cable. Model 2360 Date: 1/28/2019

High voltage set with detector not connected Calibration Date Due: 1/28/2020

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 $\pm 10\%$ C.F. within $\pm 20\%$

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	40032(0)			
	40kcpm	4003			
	4kcpm	400			
	400cpm	40			
	40cpm	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/NCCL Z540-1:1994 and ANSI N323-1978 ISO/IE 17025:2005(E) State of Texas Calibration License No. LO-1963

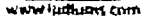
Reference Instruments and/or Sources: Cs-137 S/N 1059 2171CP 2261CP 720 734 781 1131 1616 1696 1909 1916CP 2324/2521 5717CO 5719CO 60646 70897 73410 E552 G112 2168CP S-394 S-1054 T10081 T10082 Neutron Am-241 Be T-304 Ra-226 Y96

☒ Alpha S/N Pu239 SN:7053 ☒ Beta S/N Tc99SN:5280 SrY90SN:5281 Other _____

☒ m 500 S/N 190566 Oscilloscope S/N _____ ☒ Multimeter S/N 86250390

Calibrator Jason Flores Title Calibrator Date 28-Jan-19

QC'd By [Signature] Title Final QC Date 28 Jan 19



2LA
ACCREDITED
RT # 4084.0



of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5404
Sweetwater, TX 79556, U.S.A.



Customer **ERG**

Mfg. Ludlum Measurements, Inc. Model 2928 ORDER NO. 20348368473836

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. 157320

Cal. Date 29-Jan-19 Cal Due Date 29-Jan-20 Serial No. PR 157821

Check mark ☒ Applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F Cal. Interval 1 Year Meterface 202-014

☐ New Instrument Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 10-20% ☐ Out of Tol. RH 20 % Alt 713.0 mm Hg

☒ Mechanical ck. ☒ Window Operation ☒ Requiring Repair ☐ Other-See comments

☒ Audio ck. ☒ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☒ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 750 V = 4.18 on High Voltage dial. High Voltage set with detector connected.

☒ HV Readout (2 points) Ref./Inst. 500 1 495 V Ref./Inst. 2000 1 1996 V

COMMENTS:

CAL WITH A 39" CABLE

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

Alpha Channel
Digital Readout

REFERENCE CAL POINT

INSTRUMENT RECEIVED

INSTRUMENT METER READING*

400K cpm
40K cpm
4K cpm
400 cpm
40 cpm

40056
4006
401
40
4

40056
4006
401
40
4

Beta/Gamma Channel
Digital Readout

REFERENCE CAL POINT

INSTRUMENT RECEIVED

INSTRUMENT METER READING*

400K cpm
40K cpm
4K cpm
400 cpm
40 cpm

40057
4006
401
40
4

40057
4006
401
40
4

*Accuracy within $\pm 10\%$ C.F. within $\pm 20\%$

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 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 technique.

ISO/IE 17025:2005(E)

State of Texas Calibration License No. LO-1983

Reference Instruments and/or Sources: Cs-137 S/N ☐ 058 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1908 ☐ 1818CP ☐ 23242521
☐ Sr-90 ☐ Sr-90CU ☐ 60645 ☐ 70897 ☐ 73310 ☐ E552 ☐ Q112 ☐ 2189CP ☐ 3-294 ☐ 5-1054 ☐ T10081 ☐ T10082 Ndutron Am-241 Be ☐ T-304 Pa-228 ☐ Y562

☒ Alpha S/N PU-239: 2928 ☒ Beta S/N TC-99: 5279 C14: 1867 ☐ Other

☒ m 500 S/N 238275 ☐ Oscilloscope S/N ☒ Multimeter S/N 70602489

Calibrator Dwayne Jackson Title Calibrator Date 29 Jan 19

C'd By [Signature] Title Final QC Date 30 Jan 19

as certificate shall not be reproduced except in full without the written approval of Ludlum Measurements, Inc.

JRM-C25 10/05/2012

Page 1 of 2

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



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Instruments

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.



ACCREDITED
CERT # 4084.01

Bench Test Data For Detector

Customer ERG

ORDER NO. 20348368/473836

Detector 43-10-1 Serial No. PR 157821

Counter 2929 Serial No. 157320

Count Time 1 Minute

Other _____

Alpha Input Sensitivity 175 mV

Beta Input Sensitivity 0.4 mV

Beta Window 50 mV

Distance Source to Detector Surface

High Voltage	Background		Isotope <u>Pu-239</u> Size <u>25.2 Kdpm</u>		Isotope <u>Tc-99</u> Size <u>28.8 Kdpm</u>		Isotope <u>C14</u> Size <u>22,710 dpm</u>	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
<u>725</u>	<u>0</u>	<u>41</u>	<u>9486</u>	<u>398</u>	<u>5</u>	<u>9573</u>	<u>0</u>	<u>18167</u>
<u>750</u>	<u>0</u>	<u>59</u>	<u>9897</u>	<u>445</u>	<u>10</u>	<u>12194</u>	<u>0</u>	<u>21358</u>
<u>775</u>	<u>0</u>	<u>55</u>	<u>9831</u>	<u>487</u>	<u>10</u>	<u>12709</u>	<u>1</u>	<u>24040</u>
<u>800</u>	<u>1</u>	<u>92</u>	<u>9885</u>	<u>874</u>	<u>12</u>	<u>12887</u>	<u>0</u>	<u>28133</u>

- ☐ Gas Proportional detector count rate decreased \leq 10% after 15 hour static test using 39" cable.
- ☐ Gas proportional detector count rate decreased \leq 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Duaine Jackson

Date 29-JAN-19



Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer ERG

Mfg. Ludlum Measurements, Inc.

Model 19

ORDER NO. 20349475/474567

Mfg. Model

Serial No. 186841

Serial No.

Cal. Date 12-Feb-19

Cal Due Date 12-Feb-20

Cal. Interval 1 Year Meterface 202-016

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec.

T. 72 °F

RH 28 % Alt 710.0 mm Hg

☐ New Instrument ☐ Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 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

☒ Geotrolism

☒ Audio ck.

☐ Alarm Setting ck.

☒ Batt. ck.

☐ Calibrated in accordance with LMI SOP 14.8

☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 750 V Input Sens. 34 mV Det. Oper. V at mV Threshold = mV

☐ HV Readout (2 points) Ref./Inst. / V Ref./Inst. / V

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*
5000	4000µR/hr	3800	4000
5000	1000µR/hr	950	1000
500	400µR/hr = 72000 cpm	385	400
500	100µR/hr	95	100
250	200µR/hr = 34800 cpm	190	200
250	100µR/hr	95	100
50	7200 cpm	38.5	40
50	1800 cpm	9.5	10
25	3480 cpm	19	20
25	870 cpm	4.8	5

*Uncertainty within $\pm 10\%$ C.F. within $\pm 20\%$.

50.25 Range(s) Calibrated Electronically

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

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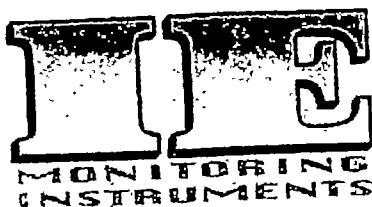
Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1916CP ☐ 2324/2521
☐ 5717CO ☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☒ 2168CP ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y982

☐ Alpha S/N ☐ Beta S/N ☐ Other

☒ m 500 S/N 247891 ☐ Oscilloscope S/N ☒ Multimeter S/N 17500076

Calibrator Scott VanAllen Title Calibrator Date 12 FEB 19

QC'd By Title Final QC Date 14 Feb 19



Industrial Environmental Monitoring Instruments, Inc.

7410 Worthington-Galea Road
Worthington, Ohio 43085
Phone: (614) 436-4933
Fax: (614) 436-9144

Website: www.iereents.com

Certificate of Calibration and Operational Check

Instrument: MSA Escort ELF
Serial #: A2-29427

Date: 4/23/2019
Technician: Rob Rayner

MSA Flow Range

3000 ml/min
2500 ml/min
2000 ml/min
1000 ml/min

Back Pressure Applied

10" H2O
20" H2O
30" H2O
30" H2O

Magnehelic Reading

10" H2O
20" H2O
30" H2O
30" H2O

Standard: Gilian Universal Pump Calibrator sn.3989
Calibration Due: 3/1/2020
Accuracy: $\pm 2\%$

The calibration standards used are NIST traceable
Instrument must be calibrated and operated according to manufacturers specifications



Designer and Manufacturer
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www.ludlums.com

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494

Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer ERG

ORDER NO. 20335160/465186

Mfg. Ludlum Measurements, Inc. Model 2000 Serial No. 97722

Mfg. Ludlum Measurements, Inc. Model 43-1 Serial No. PR 097432

Cal. Date 21-Jun-18 Cal Due Date 21-Jun-19 Cal. Interval 1 Year Meterface 202-013

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec. T. 70 °F RH 55 % Alt 704.0 mm Hg

☐ New Instrument Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 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 ☐ Geotrolism

☐ Audio ck. ☐ Alarm Setting ck. ☒ Batt. ck.

☒ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 650 V Input Sens. 10 mV Det. Oper. 650 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 500 / 503 V Ref./Inst. 2000 / 2001 V

COMMENTS:

HV dial: 2.46

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

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*

*Uncertainty within $\pm 10\%$ C.F. within $\pm 20\%$

Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout			Log Scale		
400 K cpm	<u>39951</u>	<u>39951</u>			
40 K cpm	<u>3997</u>	<u>3997</u>			
4 K cpm	<u>400</u>	<u>400</u>			
400 cpm	<u>40</u>	<u>40</u>			
40 cpm	<u>4</u>	<u>4</u>			

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The calibration system conforms to the requirements of ANSI/NCCL Z540-1-1994 and ANSI N323-1978

ISO/IEC 17025:2005(E)

State of Texas Calibration License No. LO-1963

Reference instruments and/or Sources: Cs-137 S/N ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1666 ☐ 1909 ☐ 1916CP ☐ 2324/2521
☐ 5717CO ☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☐ 2165CP ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y962

☒ Alpha S/N PU-239: 7053 24.9Kdpm ☐ Beta S/N ☐ Other

☒ m 500 S/N 238275 ☐ Oscilloscope S/N ☒ Multimeter S/N 70602489

Calibrator Duane Jackson Title Calibrator Date 21-Jun-18

QC'd By Title Final QC Date 21-Jun-18



LUDLUM MEASUREMENTS, INC.

325-235-5494



CERT # 4084.01

Detector 43-1 Serial No. PK 097432

Customer	ERG	ORDER NO.	20335160/465186
----------	-----	-----------	-----------------

Counter 2000 Serial No. 97722 Counter Input Sensitivity 10 mV

Count Time 1 m. n Bq, 6 sec sound Distance Source to Detector Surface

Other _____

Signature Dwayne Jackson

Date 21-June-8



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A



CERT # 4084.01

Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20372953/489946

Mfg. Ludlum Measurements, Inc. Model 3000

Serial No. 25018667

Mfg. Ludlum Measurements, Inc. Model 44-10

Serial No. PR320678

Cal. Date 14-Feb-20 Cal Due Date 14-Feb-21 Cal. Interval 1 Year Meterface 44-10 R

Check mark ☒ Applies to applicable Instr. and/or detector IAW mfg spec. T. 71 °F RH 20 % Alt 713.0 mm Hg

☐ New Instrument ☐ Instrument Received ☐ Within Toler. $\pm 10\%$ ☐ 10-20% ☒ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☒ Mechanical ok. ☐ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity

☒ F/S Resp. ck ☒ Reset ok. ☐ Window Operation ☐ Geotoplasm

☒ Audio ck. ☒ Alarm Setting ck. ☒ Batt. ck. (Min. Volt) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 900 V Input Sens. 10 mV Del. Oper. 900 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 600 / 599 V Ref./Inst. 1300 / 1307 V

COMMENTS:

Deadtime: 9.1 μ Sec Overload checked but not set.

Calibration Constant: 543 e+8 Pulser calibration RATEMETER READOUT performed without deadtime.

Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 6 second count.

Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.

Firmware: 5LC-N30

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-8 in which the front of probe faces source.

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL POINT	RECEIVED	METER READING	MULTIPLIER	CAL POINT	RECEIVED	METER READING
Digital	5 mR/hr	3.87 mR/hr	4.92 mR/hr				
Digital	1 mR/hr	990 μ R/hr	1.02				
	800 μ R/hr	802	817 μ R/hr				
	200 μ R/hr	196	195				

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL POINT	RECEIVED	METER READING	CAL POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	200		200K cpm	20.0K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	20.0		20K cpm	2.00K
	8K cpm	8.00		8K cpm	801
	2K cpm	2.00		2K cpm	200
	800 cpm	799 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

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ISO/IEC 17025:2017 (M)
State of Texas Calibration License No. LO-1983

Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2251CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1888 ☐ 1900 ☐ 1916CP ☐ 2324/2521
☐ 5717CO ☐ 5718CO ☐ 60645 ☐ 70867 ☐ 73410 ☐ E552 ☐ G112 ☒ 2158CP ☐ 8-394 ☐ 8-1064 ☐ T10081 ☐ T10082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y962
☐ E561 ☐ 5106 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☒ Other Am241 (0.86 μ CI)
☒ m 500 S/N 251106 ☐ Oscilloscope S/N ☒ Multimeter S/N 15080230

Calibrator James McBeth James McBeth Title Calibrator Date 14 FEB 20

QC'd By [Signature] Title Final QC Date 14 FEB 20

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FORM C3000 01/22/2020

Page 1 of 2

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

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25018567
2/14/2020 8:33:06 AM

Device

Device Firmware	5LC-N30-4364
Device Model	Model 3000
Device Serial Number	25018567
Device Real Time Clock Day	14
Device Real Time Clock Hour	8
Device Real Time Clock Minutes	32
Device Real Time Clock Month	2
Device Real Time Clock Seconds	58
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	3
Device Backlight Threshold	0
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	0
Device Backlight Threshold Low Turn Off	0
Device Backlight Threshold High Turn On	0
Device Backlight Threshold High Turn Off	0
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	35
Device Calibration High Voltage Offset	-54
Device Calibration Channel [1] Pulse Threshold Offset	4

Detector 1

Detector [1] Serial Number	PR320678
Detector [1] Model	44-10
Detector [1] High Voltage	900
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	5000
Detector [1] Unit [1] Scaler Alarm [1]	0
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	-6
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	9.1
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	5.43E+10
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 CPSOffset	0

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR320678

Instrument: Model 3000

Serial No.: 25018567

BKG Time: 6

Distance: Surface

Selected HV: 900

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: James M. B. B.

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
700	318	10,167
750	287	11,461
800	344	12,372
850	303	12,341
- 900	359	12,325
950	387	12,341
1000	344	12,392
1050	399	12,313
1100	2,419	14,058



Designer and Manufacturer
of
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CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494

Sweetwater, TX 78586, U.S.A.



CERT # 4084.01

Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20372953/489946

Mfg. Ludlum Measurements, Inc.

Model 3000

Serial No. 25018543

Mfg. Ludlum Measurements, Inc.

Model 44-10

Serial No. PR321872

Cal. Date 14-Feb-20

Cal Due Date 14-Feb-21

Cal. Interval 1 Year

Meterface 44-10 R

Check mark ☒ Applies to applicable Instr. and/or detector IAW mfg. spec.

T. 71 °F

RH 20 %

Alt 713.0 mm Hg

☐ New Instrument

☐ Instrument Received

☐ Within Toler. $\pm 10\%$

☒ 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

☐ Geotriplem

☒ Audio ck.

☒ Alarm Setting ck.

☒ Batt. ck. (Min. Vol) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8

☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 1000

V Input Sens. 10

mV

Det. Oper. 1000

V at 10

mV

Threshold Dial Ratio =

mV

☒ HV Readout (2 points)

Ref./Inst. 600

601

V

Ref./Inst. 1300

1319

V

COMMENTS:

Deadtime: 8.8 μ sec Overload checked but not set.

Calibration Constant: 531 ± 8 Pulsor calibration RATEMETER READOUT performed without deadtime.

Primary Units Alarm: 5 kcpm Pulsor calibration SCALER READOUT reflects 6 second count.

Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.

Firmware: 5LC-N30

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-10 in which the front of probe faces source.

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL. POINT	RECEIVED	METER READING	MULTIPLIER	CAL. POINT	RECEIVED	METER READING
Digital	5 mR/hr	4.00 mR/hr	5.20 mR/hr				
Digital	1 mR/hr	957 μ R/hr	1.01				
	800 μ R/hr	773	809 μ R/hr				
	200 μ R/hr	195	197				

Range(s) Calibrated Electronically

Multimeter uncertainty within 1.5% of reading, Gamma uncertainty within 5.0% of reading, Neutron uncertainty within 7.0% of reading, Count rate uncertainty within 5.4% of reading

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL. POINT	RECEIVED	METER READING	CAL. POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	800K cpm	80.0K	80.0K
	200K cpm	200	200K cpm	20.0K	20.0K
	80K cpm	80.0	80K cpm	8.00K	8.00K
	20K cpm	20.0	20K cpm	2.00K	2.00K
	8K cpm	8.00	8K cpm	801	801
	2K cpm	2.01	2K cpm	201	201
	800 cpm	799 cpm	800 cpm	80	80
	200 cpm	201	200 cpm	20	20

Ludlum Measurements, Inc. certifies that no above instrument has been calibrated by supplier according to its National Institute of Standards and Technology, or to the calibration (series) of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the same type of calibration technique. All physical measurements are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent calculated uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/NCSL Z39-1-1994 and ANSI M1734M-2013.

ISO/IEC 17025:2017(2017)
Date of Next Calibration: License No. LO-1983

Reference Instruments and/or Sources: Ce-137 S/N ☐ 059 ☐ 2171CP ☐ 2251CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1615 ☐ 1690 ☐ 1908 ☐ 1B16CP ☐ 2324/2521
☐ 5717CO ☐ 5719CO ☐ 5084B ☐ 70897 ☐ 73410 ☐ 5662 ☐ G112 ☒ 2158CP ☐ 5394 ☐ S-1054 ☐ 710081 ☐ 710082 Neutron Am-241 Bo ☐ T-304 Rn-226 ☐ Y982
☐ 5581 ☐ 5105 ☐ CSV280

☐ Alpha S/N

☐ Beta S/N

☒ Other

Am241 (0.66 μ Ci)

☒ m 500 S/N

251106

☐ Oscilloscope S/N

☒ Multimeter S/N

15080230

Calibrator James McBeth

Title Calibrator

Date 14 FEB 20

QC'd By James McBeth

Title Final QC

Date 14 Feb 20

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FORM Q3000 01/22/2020

Page 1 of 2

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

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR321872

Instrument: Model 3000

Serial No.: 25018543

BKG Time: 6

Distance: Surface

Selected HV: 1000

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: *Jamie M. R.*

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
700	435	10,115
750	513	11,302
800	490	12,405
850	475	12,425
900	474	12,614
950	509	12,837
— 1000	483	12,669
1050	503	12,700
1100	501	12,532
1150	606	12,997
1200	791	13,774
1,250	1,443	15,285

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25018543
2/14/2020 1:12:45 PM

Device

Device Firmware	5LC-N30.4364
Device Model	Model 3000
Device Serial Number	25018543
Device Real Time Clock Day	14
Device Real Time Clock Hour	13
Device Real Time Clock Minutes	12
Device Real Time Clock Month	2
Device Real Time Clock Seconds	39
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	2
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	0
Device Backlight Threshold Low Turn Off	0
Device Backlight Threshold High Turn On	0
Device Backlight Threshold High Turn Off	0
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	45
Device Calibration High Voltage Offset	-57
Device Calibration Channel [1] Pulse Threshold Offset	6

Detector 1

Detector [1] Serial Number		PR321872
Detector [1] Model		44-10
Detector [1] High Voltage		1000
Detector [1] Overload		100
Detector [1] Count Time		60
Detector [1] Operation Mode		0
Detector [1] Auto Response Rate		1
Detector [1] Response Time		0
Detector [1] Audio Sigma		0
Detector [1] Enabled		0
Detector [1] Unit [1] Rate Unit Type		cpm
Detector [1] Unit [1] Rate Min Exponent		0
Detector [1] Unit [1] Rate Max Value		999000
Detector [1] Unit [1] Scaler Unit Type		counts
Detector [1] Unit [1] Scaler Min Exponent		0
Detector [1] Unit [1] Rate Alarm [1]		0
Detector [1] Unit [1] Rate Alarm [2]		5000
Detector [1] Unit [1] Scaler Alarm [1]		0
Detector [1] Unit [1] Scaler Alarm [2]		0
Detector [1] Unit 1 Rate Unit Type		0
Detector [1] Unit 1 Rate Min Range		0
Detector [1] Unit 1 Rate Min Decimal Point		0
Detector [1] Unit 1 Rate Max Value		0
Detector [1] Unit 1 Rate Max Range		0
Detector [1] Unit 1 Rate Max Decimal Point		0
Detector [1] Unit 1 Rate Alarm Value		0
Detector [1] Unit 1 Rate Alarm Range		0
Detector [1] Unit 1 Rate Alarm Decimal Point		0
Detector [1] Unit 1 Scaler Unit Type		0
Detector [1] Unit 1 Scaler Min Range		0
Detector [1] Unit 1 Scaler Min Decimal Point		0
Detector [1] Unit 1 Scaler Alarm Value		0
Detector [1] Unit 1 Scaler Alarm Range		0
Detector [1] Unit 1 Scaler Alarm Decimal Point		0
Detector [1] Unit [2] Rate Unit Type		R/h
Detector [1] Unit [2] Rate Min Exponent		-6
Detector [1] Unit [2] Rate Max Value		0.007
Detector [1] Unit [2] Scaler Unit Type		R
Detector [1] Unit [2] Scaler Min Exponent		-6
Detector [1] Unit [2] Rate Alarm [1]		0
Detector [1] Unit [2] Rate Alarm [2]		0.005
Detector [1] Unit [2] Scaler Alarm [1]		0
Detector [1] Unit [2] Scaler Alarm [2]		0
Detector [1] Channel [1] Pulse Threshold		10
Detector [1] Channel [1] Dead Time Correction		8.9
Detector [1] Channel [1] Dead Time Correction 2		0
Detector [1] Channel [1] Loss of Count Time		60
Detector [1] Channel [1] Calibration Constant		5.31E+10
Detector [1] Channel [1] Calibration Constant Exponent		0
Detector [1] Channel [1] Efficiency 4pi		15
Detector 1 Channel 1 CPSOffset		0



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LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-8484
Sewebwater, TX 79608, U.S.A.



Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20372953/489946

Mfg. Ludlum Measurements, Inc. Model 3000

Serial No. 25018596

Mfg. Ludlum Measurements, Inc. Model 44-10

Serial No. PR355769

Cal. Date 14-Feb-20 Cal Due Date 14-Feb-21 Cal. Interval 1 Year Meterface 44-10 R

Check mark ☒ Applies to applicable instr. and/or detector IAW mfg. spec. T. 71 °F RH 20 % Alt 713.0 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 ☐ Geotripism
☒ Audio ck. ☒ Alarm Setting ck. ☒ Batt. ck. (Min. Volt) 4.4 VDC
☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 800 V Input Sens. 10 mV Det. Oper. 800 V at 10 mV Threshold Dial Ratio 1302 mV
☒ HV Readout (2 points) Ref./Inst. 600 / 599 V Ref./Inst. 1300 / 1302 V

COMMENTS:

Deadtime: 8.5 µSec Overload checked but not set.
 Calibration Constant: 535 e+8 Pulser calibration RATEMETER READOUT performed without deadtime.
 Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 5 second count.
 Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.
 Firmware: 5LC-N30

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

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL. POINT	RECEIVED	METER READING	MULTIPLIER	CAL. POINT	RECEIVED	METER READING
Digital	6 mR/hr	4.04 mR/hr	5.09 mR/hr				
Digital	1 mR/hr	964 µR/hr	1.01				
	800 µR/hr	784	799 µR/hr				
	200 µR/hr	194	197				

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL. POINT	RECEIVED	METER READING	CAL. POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	200		200K cpm	20.0K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	20.0		20K cpm	2.00K
	8K cpm	8.00		8K cpm	801
	2K cpm	2.00		2K cpm	200
	800 cpm	802 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

Ludlum Measurements, Inc. certifies that the above calibration has been performed by technicians (in accordance with the National Institute of Standards and Technology) at the calibration facilities of other operational Standards Organizations, or have been derived from accepted values of national physical constants or have been derived by the ratio type of calibration techniques. All (zero) adjustments are based on the manufacturer's specifications without compensating uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/ISO 9001-1:1984 and ANSI/ISO 9001:2015.

ISO/IEC 17025:2017 (2)
 State of Texas Calibration License No. LC-1003

Reference Instruments and/or Sources: Cs-137 S/N ☐ 050 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1618 ☐ 1696 ☐ 1809 ☐ 1918CP ☐ 2324/2321
☐ 5717CO ☐ 5719CO ☐ 6064S ☐ 70897 ☐ 73410 ☐ E562 ☐ G112 ☒ 2188CP ☐ 8-394 ☐ 8-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Ba ☐ T-304 Ra-226 ☐ Y082
☐ E561 ☐ 5105 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☒ Other Am241 (0.66µCi)
☒ m 500 S/N 251106 ☐ Oscilloscope S/N ☒ Multimeter S/N 15060230

Calibrator James McBeth Title Calibrator Date 14 FEB 20
 QC'd By James McBeth Title Final QC Date 14 Feb 20

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FORM C3000 01/22/2020

Page 1 of 2

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

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR355769

Instrument: Model 3000

Serial No.: 25018596

BKG Time: 6

Distance: Surface

Selected HV: 800

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: James M. Burt

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
600	498	9,553
650	466	11,668
700	507	12,293
750	528	12,203
~ 800	517	12,391
850	550	12,395
900	598	12,486
950	739	13,027
1000	1,318	14,022

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25018596
2/14/2020 9:59:09 AM

Device

Device Firmware	5LC-N30.4364
Device Model	Model 3000
Device Serial Number	25018596
Device Real Time Clock Day	14
Device Real Time Clock Hour	9
Device Real Time Clock Minutes	59
Device Real Time Clock Month	2
Device Real Time Clock Seconds	2
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	1
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	0
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	0
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	35
Device Calibration High Voltage Offset	-49
Device Calibration Channel [1] Pulse Threshold Offset	5

Detector 1

Detector [1] Serial Number	PR355769
Detector [1] Model	44-10
Detector [1] High Voltage	800
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	0
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	5000
Detector [1] Unit [1] Scaler Alarm [1]	0
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	-6
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	10
Detector [1] Channel [1] Pulse Threshold	8.5
Detector [1] Channel [1] Dead Time Correction	0
Detector [1] Channel [1] Dead Time Correction 2	60
Detector [1] Channel [1] Loss of Count Time	5.35E+10
Detector [1] Channel [1] Calibration Constant	0
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 CPSOffset	0



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501 Oak Street
325-235-5484

Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20372953/489946

Mfg. Ludlum Measurements, Inc. Model 3000 Serial No. 25018042

Mfg. Ludlum Measurements, Inc. Model 44-10 Serial No. PR355782

Cal. Date 14-Feb-20 Cal Due Date 14-Feb-21 Cal. Interval 1 Year Meterface 44-10 R

Check mark ☒ Applies to applicable instr. and/or detector IAW mfg. spec. T. 71 °F RH 20 % Alt 713.0 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) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 900 V Input Sens. 10 mV Det. Oper. 900 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 600 / 599 V Ref./Inst. 1300 / 1311 V

COMMENTS:

Deadtime: 8.7 µSec Overload checked but not set.

Calibration Constant: 530 e+8 Pulser calibration RATEMETER READOUT performed without deadtime.

Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 5 second count.

Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.

Firmware: 5LC-N30

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-0 in which the front of probe faces source.

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL. POINT	RECEIVED	METER READING	MULTIPLIER	CAL. POINT	RECEIVED	METER READING
Digital	5 mR/hr	5.29 mR/hr	5.29 mR/hr				
Digital	1 mR/hr	1.06	1.06				
	800 µR/hr	837 µR/hr	837 µR/hr				
	200 µR/hr	205	205				

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL. POINT	RECEIVED	METER READING	CAL. POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	200		200K cpm	20.0K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	20.0		20K cpm	2.00K
	8K cpm	8.00		8K cpm	800
	2K cpm	2.00		2K cpm	201
	800 cpm	799 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

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 technique.

All parallel determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/ISO 17025:2005 and ANSI N323AD-2013.

Reference Instruments and/or Sources: Cs-137 S/N: 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☒ 781 ☐ 1131 ☐ 1616 ☐ 1806 ☐ 1909 ☐ 1916CP ☐ 2324/2521 ☐ 5717CO ☐ 5719CO ☐ 60846 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☐ 2168CP ☐ B-394 ☐ S-1054 ☐ T100B1 ☐ T10092 Neutron Am-241 Be ☐ T-304 Re-226 ☐ Y862 ☐ E551 ☐ 5105 ☐ C6V280

☐ Alpha S/N ☐ Beta S/N ☒ Other Am241 (0.66µCi) ☒ m 500 S/N 251106 ☐ Oscilloscope S/N ☒ Multimeter S/N 15060230

Calibrator James McBeth James McBeth Title Calibrator Date 14 Feb 20

QC'd By [Signature] Title Final QC Date 14 Feb 20

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FORM C3000 01/22/2020

Page 1 of 2

AC Inst ☐ Passed Dielectric (H-Pot) and Continuity Test
Only ☐ Failed

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR355782

Instrument: Model 3000

Serial No.: 25018042

BKG Time: 6

Distance: Surface

Selected HV: 900

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: James M. M. M.

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
700	472	10,766
750	518	12,236
800	535	12,669
850	515	12,420
- 900	504	12,664
950	502	12,434
1000	515	12,717
1050	533	12,815
1100	776	13,424

Lidlum Device Parameters

Product: Model 3000
Serial Number: 25018042
2/14/2020 11:48:01 AM

Device

Device Firmware	SLC-N30.4364
Device Model	Model 3000
Device Serial Number	25018042
Device Real Time Clock Day	14
Device Real Time Clock Hour	11
Device Real Time Clock Minutes	47
Device Real Time Clock Month	2
Device Real Time Clock Seconds	54
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	3
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to S Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	0
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	0
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	31
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	41
Device Calibration High Voltage Offset	-58
Device Calibration Channel [1] Pulse Threshold Offset	6

Detector 1

Detector [1] Serial Number	PR355782
Detector [1] Model	44-101
Detector [1] High Voltage	900
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	5000
Detector [1] Unit [1] Scaler Alarm [1]	0
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	0
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	8.7
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	5.3E+10
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 CPSSet	0



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494

Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer **ENVIRONMENTAL RESTORATION GROUP**

ORDER NO. **20372953/489946**

Mfg. **Ludlum Measurements, Inc.**

Model **3000**

Serial No. **25018572**

Mfg. **Ludlum Measurements, Inc.**

Model **44-10**

Serial No. **PR373531**

Cal. Date **14-Feb-20**

Cal Due Date **14-Feb-21**

Cal. Interval **1 Year** Meterface **44-10 R**

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec.

T. **71** °F RH **20** % Alt **713.0** mm Hg

☐ New Instrument ☐ Instrument Received ☐ Within Toler. $\pm 10\%$ ☐ 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) **4.4** VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set **900** V Input Sens. **10** mV Det. Oper. **900** V at **10** mV Threshold Dial Ratio **=** mV

☒ HV Readout (2 points) Ref./Inst. **600** **1597** V Ref./Inst. **1300** **1297** V

COMMENTS:

Deadtime: 9.2 μ Sec Overload checked but not set.

Calibration Constant: 528 e+8 Pulser calibration RATEMETER READOUT performed without deadtime.

Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 6 second count.

Secondary Units Alarm: 5 mR/hr Calibrated using 9' C-cable.

Firmware: SLC-N30

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

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL. POINT	RECEIVED	METER READING	MULTIPLIER	CAL. POINT	RECEIVED	METER READING
Digital	5 mR/hr	3.98 mR/hr	5.29 mR/hr				
Digital	1 mR/hr	940 μ R/hr	998 μ R/hr				
	800 μ R/hr	764	802				
	200 μ R/hr	196	197				

Range(s) Calibrated Electronically

Multimeter uncertainty within 1.3% of reading, Gamma uncertainty within 6.0% of reading, Neutron uncertainty within 7.0% of reading, Count rate uncertainty within 5.4% of reading							
Digital Readout	REFERENCE	INSTRUMENT	INSTRUMENT	Scaler	REFERENCE	INSTRUMENT	INSTRUMENT
	CAL. POINT	RECEIVED	METER READING		CAL. POINT	RECEIVED	METER READING
	800K cpm	800 kcpm	800 kcpm		800K cpm	80.0K	80.0K
	200K cpm	200	200		200K cpm	20.0K	20.0K
	80K cpm	80.0	80.0		80K cpm	8.00K	8.00K
	20K cpm	19.9	19.9		20K cpm	2.00K	2.00K
	8K cpm	8.00	8.00		8K cpm	801	801
	2K cpm	2.00	2.00		2K cpm	200	200
	800 cpm	800 cpm	800 cpm		800 cpm	80	80
	200 cpm	201	201		200 cpm	20	20

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. All partial determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/NCSL Z540-1:1994 and ANSI N325A3-2013.

ISO/IEC 17025:2017(F)

State of Texas Calibration License No. LQ-1963

Reference Instruments and/or Sources: Cs-137 S/N ☐ 059 ☐ 2171CP ☐ 2281CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1816 ☐ 1896 ☐ 1909 ☐ 1916CP ☐ 2324/2521
☐ 5717CO ☐ 5719CO ☐ 60846 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☒ 2168CP ☐ S-394 ☐ S-1054 ☐ T1D081 ☐ T1D062 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y962
☐ E551 ☐ 5105 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☒ Other **Am241(0.66 μ Ci)**

☒ m 500 S/N **251106** ☐ Oscilloscope S/N ☒ Multimeter S/N **15060230**

Calibrator **James McBeth**

Title **Calibrator** Date **14 FEB 20**

QC'd By **John V.**

Title **Final QC** Date **14 Feb 20**

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

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: Ludlum Serial No.: PR373531
44-10

Instrument: Model 3000 Serial No.: 25018572

BKG Time: 6

Distance: Surface

Selected HV: 900

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: James M. B. ID

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
650	453	10,213
700	484	11,690
750	455	11,980
800	479	12,071
850	478	12,299
- 900	445	12,247
950	544	12,315
1000	547	12,306
1050	672	12,631
1100	924	13,285
1150	1,673	15,422

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25018572
2/14/2020 7:56:04 AM

Device

Device Firmware	5LC-N30.4382
Device Model	Model 3000
Device Serial Number	25018572
Device Real Time Clock Day	14
Device Real Time Clock Hour	7
Device Real Time Clock Minutes	55
Device Real Time Clock Month	2
Device Real Time Clock Seconds	58
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	0
Device Backlight Threshold Low Turn Off	0
Device Backlight Threshold High Turn On	0
Device Backlight Threshold High Turn Off	0
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31
Device Battery Voltage	4.894
Device 1 Channel 1 RawCnt	5107509

Device Calibration

Device Calibration High Voltage Slope	24
Device Calibration High Voltage Offset	-46
Device Calibration Channel [1] Pulse Threshold Offset	7

Detector 1

Detector [1] Serial Number	PR373531
Detector [1] Model	Ludlum 44-10
Detector [1] High Voltage	900
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	0
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	5000
Detector [1] Unit [1] Scaler Alarm [1]	0
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	-6
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	9.2
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	5.28E+10
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 CPSOffset	0



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LUDLUM MEASUREMENTS, INC.

501 Oak Street

325-235-5494

Sweetwater, TX 79556, U.S.A.



CERT # 4084.01

Customer ENVIRONMENTAL RESTORATION GROUP

Mfg. Ludlum Measurements, Inc.

Model 3000

ORDER NO. 20372954/489947

Serial No. 25018576

Mfg. Ludlum Measurements, Inc.

Model 44-10

Serial No. PR357747

Cal. Date 14-Feb-20

Cal Due Date 14-Feb-21

Cal Interval 1 Year Meterface 44-10 R

Check mark ☒ Applies to applicable Instr. and/or detector IAW mfg. spec

T 71 °F RH 20 % Alt 713.0 mm Hg

☐ New Instrument ☐ Instrument Received ☐ Within Toler. $\pm 10\%$ ☒ 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 ☐ Geotopism

☒ Audio ck. ☒ Alarm Setting ck. ☒ Batt. ck. (Min. Volt) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 750 V Input Sens. 10 mV Det. Oper. 750 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 600 / 601 V Ref./Inst. 1300 / 1315 V

COMMENTS:

Deadtime: 8.9 μ Sec Overload checked but not set.

Calibration Constant: 542 ± 8 Pulser calibration RATEMETER READOUT performed without deadtime.

Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 6 second count.

Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.

Firmware: 5LC-N30

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-10 in which the front of probe faces source

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER	CAL. POINT	RECEIVED	METER READING	MULTIPLIER	CAL. POINT	RECEIVED	METER READING
Digital	5 mR/hr	4.06 mR/hr	5.19 mR/hr				
Digital	1 mR/hr	994 μ R/hr	1.03				
	800 μ R/hr	796	818 μ R/hr				
	200 μ R/hr	198	195				

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL. POINT	RECEIVED	METER READING	CAL. POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	200		200K cpm	20.0K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	20.0		20K cpm	2.00K
	8K cpm	8.00		8K cpm	800
	2K cpm	1.99		2K cpm	200
	800 cpm	799 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

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. All partial determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of $k=2$. The calibration system conforms to the requirements of ANSI/NCSL Z540-1:1994 and ANSI N329A-2013.

ISO/IEC 17025:2017(E)

State of Texas Calibration License No. LO-1983

Reference Instruments and/or Sources: Ca-137 S/N ☐ 059 ☐ 2171CP ☐ 2251CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1918CP ☐ 2324/2521 ☐ 5717CO ☐ 5718CO ☐ 60640 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☒ 2188CP ☐ S-394 ☐ S-105 ☐ T10081 ☐ T40082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y982 ☐ E551 ☐ 5105 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☒ Other Am241(0.66 μ Ci)
☒ m 500 S/N 251106 ☐ Oscilloscope S/N ☒ Multimeter S/N 15060230

Calibrator James McBeth James McBeth

Title Calibrator

Date 14 FEB 20

QC'd By James McBeth

Title Final QC

Date 14 FEB 20

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FORM C3000 01/22/2020

Page 1 of 2

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

Ludlum Device Parameters

Product: Model 3000
 Serial Number: 25018576
 2/14/2020 2:35:49 PM

Device

Device Firmware	5LC-N30.4364
Device Model	Model 3000
Device Serial Number	25018576
Device Real Time Clock Day	14
Device Real Time Clock Hour	14
Device Real Time Clock Minutes	35
Device Real Time Clock Month	2
Device Real Time Clock Seconds	42
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	3
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	40
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	46
Device Calibration High Voltage Offset	-62
Device Calibration Channel [1] Pulse Threshold Offset	5

Detector 1

Detector [1] Serial Number	PR357747
Detector [1] Model	44-10
Detector [1] High Voltage	750
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Signal	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	5000
Detector [1] Unit [1] Scaler Alarm [1]	0
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	-6
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	0
Detector [1] Channel [1] Pulse Threshold	10
Detector [1] Channel [1] Dead Time Correction	8.9
Detector [1] Channel [1] Dead Time Correction 2	0
Detector [1] Channel [1] Loss of Count Time	60
Detector [1] Channel [1] Calibration Constant	5.42E+10
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector [1] Channel [1] CPS Offset	0

Order #: 20372954/489947

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR357747

Instrument: Model 3000

Serial No.: 25018576

BKG Time: 6

Distance: Surface

Selected HV: 750

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: *James M. Burt*

Channel(s)

Name	Threshold
Channel 1	10 mV

Source(s)

Name	ID	Activity	Time	Type
Am241		0.66 μ Ci	6	γ

High Voltage	Background	Am241
	Reading	Reading
600	489	10,590
650	523	12,196
700	521	12,529
750	461	12,340
800	528	12,424
850	530	12,631
900	609	12,572
950	988	13,037



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.



CERT # 406401

Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20372953/489946

Mfg. Ludlum Measurements, Inc. Model 3000

Serial No. 250183 25018638

Mfg. Ludlum Measurements, Inc. Model 44-10

Serial No. PR375290

Cal. Date 14-Feb-20 Cal Due Date 14-Feb-21 Cal. Interval 1 Year Meterface 44-10 R

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec.

T. 71 °F RH 20 % Alt 713.0 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) 4.4 VDC

☒ Calibrated in accordance with LMI SOP 14.8

☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 800 V Input Sens. 10 mV Det. Oper. 800 V at 10 mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 600 / 599 V Ref./Inst. 1300 / 1310 V

COMMENTS:

Deadtime: 8.8 µSec Overload checked but not set.
Calibration Constant: 522 e+8 Pulser calibration RATEMETER READOUT performed without deadtime.
Primary Units Alarm: 5 kcpm Pulser calibration SCALER READOUT reflects 6 second count.
Secondary Units Alarm: 5 mR/hr Calibrated using 5' C-cable.
Firmware: 51C-N30

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

RANGE	REFERENCE	INSTRUMENT	INSTRUMENT	RANGE	REFERENCE	INSTRUMENT	INSTRUMENT
MULTIPLIER CAL. POINT		RECEIVED	METER READING	MULTIPLIER CAL. POINT		RECEIVED	METER READING
Digital	5 mR/hr	3.96 mR/hr	5.14 mR/hr				
Digital	1 mR/hr	936 µR/hr	992 µR/hr				
	800 µR/hr	759	806				
	200 µR/hr	191	198				

Range(s) Calibrated Electronically

REFERENCE	INSTRUMENT	INSTRUMENT	REFERENCE	INSTRUMENT	INSTRUMENT
CAL. POINT	RECEIVED	METER READING	CAL. POINT	RECEIVED	METER READING
Digital Readout	800K cpm	800 kcpm	Scaler	800K cpm	80.0K
	200K cpm	200		200K cpm	20.0K
	80K cpm	80.0		80K cpm	8.00K
	20K cpm	20.0		20K cpm	2.00K
	8K cpm	7.99		8K cpm	800
	2K cpm	2.00		2K cpm	201
	800 cpm	799 cpm		800 cpm	80
	200 cpm	201		200 cpm	20

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 systems 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. All pass/fail determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/NCSL Z540-1:1994 and ANSI N323AB-2013.

ISO/IEC 17025:2017(E)
State of Texas Calibration License No. LC-11681

Reference Instruments and/or Sources: Cs-137 S/N: 059 2171CP 8281CP 720 734 781 1131 1816 1696 1609 1916CP 2324/2621
☐ 5717CO ☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☒ 2168CP ☐ S-394 ☐ S-1054 ☐ T10061 ☐ T10082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y982
☐ E551 ☐ 5105 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☒ Other Am241(0.66µCi)
☒ m 500 S/N 251106 ☐ Oscilloscope S/N ☒ Multimeter S/N 15060230

Calibrator James McBeth James McBeth Title Calibrator Date 14 FEB 20
QC'd By [Signature] Title Final QC Date 14 Feb 20

AC Inst Only	<input type="checkbox"/> Passed Dielectric (Hi-Pot) and Continuity Test
	<input type="checkbox"/> Failed

Order #: 20372953/489946

Customer: ENVIRONMENTAL RESTORATION
GROUP

Detector: 44-10

Serial No.: PR375290

Instrument: Model 3000

Serial No.: 25018638

BKG Time: 6

Distance: Surface

Selected HV: 800

Date: Friday, February 14, 2020

Notes: Performed using 5' C-cable.

Signature: *[Signature]*

Channel(s)

Name

Threshold

Channel 1

10 mV

Source(s)

Name

ID

Activity

Time

Type

Am241

0.66 μ Ci

6

γ

High Voltage	Background	Am241
	Reading	Reading
600	467	9,514
650	481	11,172
700	547	11,497
750	499	11,498
- 800	529	11,396
850	504	11,523
900	523	11,426
950	617	12,008
1000	1,273	12,635

Ludlum Device Parameters

Product: Model 3000
Serial Number: 25018638
2/14/2020 9:30:47 AM

Device

Device Firmware	SLC-N30.4364
Device Model	Model 3000
Device Serial Number	25018638
Device Real Time Clock Day	14
Device Real Time Clock Hour	9
Device Real Time Clock Minutes	39
Device Real Time Clock Month	2
Device Real Time Clock Seconds	39
Device Real Time Clock Year	2020
Device Real Time Clock Day of the Week	6
Device Backlight Threshold	2
Device Sleep	0
Device Dual Level Audio Setting	0
Device R to Sv Ratio	0.0106
Device Log Button	0
Device Backlight Threshold Low Turn On	140
Device Backlight Threshold Low Turn Off	120
Device Backlight Threshold High Turn On	17
Device Backlight Threshold High Turn Off	100
Device Backlight On	0
Device Count Display Mode	0
Device Count Audio Mode	0
Device Rate Reset Button	0
Device Setup Protect	Normal
Device Auxiliary Enabled	1
Device Auxiliary Mode	5
Device Auxiliary Auto Power Down	0
Device Auxiliary Write Protect	0
Device Auxiliary Encryption Enabled	0
Device Area Monitor enabled	0
Device Auxiliary Enabled	0
Device Auxiliary 375-Ethernet-Mode Port	0
Device Auxiliary AutoMode Interval	1
Device Button Handle RateMap 1	1
Device Button Handle RateMap 2	31
Device Button Handle RateMap 3	31
Device Button Handle CntMap 1	1
Device Button Handle CntMap 2	31
Device Button Handle CntMap 3	31

Device Calibration

Device Calibration High Voltage Slope	38
Device Calibration High Voltage Offset	-60
Device Calibration Channel [1] Pulse Threshold Offset	2

Detector 1

Detector [1] Serial Number	PR375290
Detector [1] Model	44-10
Detector [1] High Voltage	800
Detector [1] Overload	100
Detector [1] Count Time	60
Detector [1] Operation Mode	0
Detector [1] Auto Response Rate	1
Detector [1] Response Time	0
Detector [1] Audio Sigma	0
Detector [1] Enabled	0
Detector [1] Unit [1] Rate Unit Type	cpm
Detector [1] Unit [1] Rate Min Exponent	0
Detector [1] Unit [1] Rate Max Value	999000
Detector [1] Unit [1] Scaler Unit Type	counts
Detector [1] Unit [1] Scaler Min Exponent	0
Detector [1] Unit [1] Rate Alarm [1]	0
Detector [1] Unit [1] Rate Alarm [2]	0
Detector [1] Unit [1] Scaler Alarm [1]	5000
Detector [1] Unit [1] Scaler Alarm [2]	0
Detector [1] Unit 1 Rate Unit Type	0
Detector [1] Unit 1 Rate Min Range	0
Detector [1] Unit 1 Rate Min Decimal Point	0
Detector [1] Unit 1 Rate Max Value	0
Detector [1] Unit 1 Rate Max Range	0
Detector [1] Unit 1 Rate Max Decimal Point	0
Detector [1] Unit 1 Rate Alarm Value	0
Detector [1] Unit 1 Rate Alarm Range	0
Detector [1] Unit 1 Rate Alarm Decimal Point	0
Detector [1] Unit 1 Scaler Unit Type	0
Detector [1] Unit 1 Scaler Min Range	0
Detector [1] Unit 1 Scaler Min Decimal Point	0
Detector [1] Unit 1 Scaler Alarm Value	0
Detector [1] Unit 1 Scaler Alarm Range	0
Detector [1] Unit 1 Scaler Alarm Decimal Point	0
Detector [1] Unit [2] Rate Unit Type	R/h
Detector [1] Unit [2] Rate Min Exponent	-6
Detector [1] Unit [2] Rate Max Value	0.007
Detector [1] Unit [2] Scaler Unit Type	R
Detector [1] Unit [2] Scaler Min Exponent	-8
Detector [1] Unit [2] Rate Alarm [1]	0
Detector [1] Unit [2] Rate Alarm [2]	0.005
Detector [1] Unit [2] Scaler Alarm [1]	0
Detector [1] Unit [2] Scaler Alarm [2]	10
Detector [1] Channel [1] Pulse Threshold	8.8
Detector [1] Channel [1] Dead Time Correction	0
Detector [1] Channel [1] Dead Time Correction 2	60
Detector [1] Channel [1] Loss of Count Time	5.22E+10
Detector [1] Channel [1] Calibration Constant	0
Detector [1] Channel [1] Calibration Constant Exponent	0
Detector [1] Channel [1] Efficiency 4pi	15
Detector 1 Channel 1 GPSOffset	0



Durridge Company

900 Technology Park Drive
Billerica, MA 01821
Tel: (978) 667-9556, Fax: (978) 667-9557
www.durridge.com

Certificate of Calibration

RAD7 PROFESSIONAL RADON DETECTOR (NRSB Device Code - 31810 CR)

Calibration Date:	January 29, 2020	Date of Previous Calibration:	October 28, 2019
Serial Number:	0333	Previous Sensitivity, Normal mode:	0.454 cpm/(pCi/L)
Model Number:	RAD7-710	Previous Sensitivity, Sniff mode:	0.217 cpm/(pCi/L)
Firmware Version:	3.1a 151208	Previous CB Spill Factor:	0.017
RADLINK Version:	311		
Dates of Calibration Run:	January 26, 2020 to January 29, 2020		
Reference Unit Number(s):	504, 961, 1277, 4232		
Mean Temperature:	23.3 °C		
Mean Radon Concentration:	61.0 pCi/L, 2260 Bq/m ³		
Sensitivity, Normal Mode:	0.460 cpm/(pCi/L), 0.0124 cpm/(Bq/m ³)		
Sensitivity, Sniff Mode:	0.220 cpm/(pCi/L), 0.00595 cpm/(Bq/m ³)		
CB Spill Factor:	0.016		
Calibration Uncertainty:	2% 2-Sigma (See Notes 1, 2)		
Conversion Factor, Normal:	2.17 (pCi/L)/cpm, 80.4 (Bq/m ³)/cpm		
Conversion Factor, Sniff:	4.55 (pCi/L)/cpm, 168 (Bq/m ³)/cpm		

Note 1) Based on counting statistics of the reference and this unit.

Note 2) No account has been made for the calibration uncertainty of the reference unit relative to an absolute standard, which we estimate to be within +/- 5%.

Accredited Radon Chamber Certificate No: NRSB TRC0003

Technician Certification No: 14SS023

Calibration Technician: Linda M. MacDougall

Signature: L.M. MacDougall Date: January 29, 2020

Per EPA recommendation, this RAD7 should be calibrated again on or before January 29, 2021.



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5484

Sweetwater, TX 79558, U.S.A.



CERT # 4084.01

Customer ENVIRONMENTAL RESTORATION GROUP

ORDER NO. 20389948/487897

Mfg. Ludlum Measurements, Inc. Model 19 Serial No. 209722

Mfg. Model Serial No.

Cal. Date 26-Dec-19 Cal Due Date 26-Dec-20 Cal. Interval 1 Year Meterface 202-1070

Check mark ☒ Applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 24 % Alt 706.0 mm Hg

☐ New Instrument ☐ Instrument Received ☒ Within Toler. $\pm 10\%$ ☐ 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.

☐ Calibrated in accordance with LMI SOP 14.8 ☒ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 650 V Input Sens. 30 mV Det. Oper. V at mV Threshold Dial Ratio = mV

☒ HV Readout (2 points) Ref./Inst. 500 500 V Ref./Inst. 1000 984 V

COMMENTS:

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

Multimeter uncertainty within 1.3% of reading, Gamma uncertainty within 5.0% of reading, Neutron uncertainty within 7.0% of reading, Count Rate uncertainty within 5.4% of reading

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING
5000	4000µR/hr	4210	4000
5000	1000µR/hr	1100	1010
500	400µR/hr = 72800 cpm	400	400
500	100µR/hr	100	100
250	200µR/hr = 36900 cpm	200	200
250	100µR/hr	100	100
50	7280 cpm	40	40
50	1820 cpm	10	10
25	3690 cpm	20	20
25	922 cpm	5	5

Range(s) Calibrated Electronically

Digital	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING	Log	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING
Readout				Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Bureau of Standards and Technology, or to the Calibration Services 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. All pass/fail determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/NCCL Z540-1-1994 and ANSI N322AB-2013.

ISO/IEC 17025:2017(2)
State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2281CP ☐ 720 ☐ 734 ☒ 781 ☐ 1131 ☐ 1616 ☐ 1896 ☐ 1809 ☐ 1816CP ☐ 2324/2521
☐ 5717CO ☐ 5718CO ☐ 60846 ☐ 70887 ☐ 73410 ☐ 8562 ☐ G112 ☐ 2188CP ☐ S-394 ☐ S-1064 ☐ T10081 ☐ T10082 Neutron Am-241 Be ☐ T-304 Ra-226 ☐ Y082
☐ E551 ☐ 6106 ☐ CSV280

☐ Alpha S/N ☐ Beta S/N ☐ Other

☒ m 500 S/N 189509 ☐ Oscilloscope S/N ☒ Multimeter S/N 71300492

Calibrator WENDELL WILLIAMS Title Calibrator Date 26 Dec 19

QC'd By Title Final QC Date 26 Dec 19



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Swoodwater, TX 78586, U.S.A



CERT # 4084.01

Customer ERG

ORDER NO. 20372243489481

Mfg. Ludlum Measurements, Inc. Model 2927 Serial No. 111523
Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR114341
Cal. Date 10-Feb-20 Cal Due Date 10-Feb-21 Cal. Interval 1 Year Meterface 202-014

Check mark ☒ applies to applicable instr. and/or detector IAW mfg. spec. 1 73 °F RH 32 % Alt 676.0 mm Hg

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

☐ Mechanical ck. ☒ Window Operation

☒ Audio ck.

☒ Motor Zeroed

Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☒ Calibrated in accordance with LMI SOP 14.8 ☐ Calibrated in accordance with LMI SOP 14.9

Instrument Volt Set 825 V = 3.59 on High Voltage dial. High Voltage set with detector connected.

☒ HV Readout (2 points) Ref./Inst. 500 1 501 V Ref./Inst. 1500 1 1496 V

COMMENTS:

Gamma Calibration: GMA detector positioned perpendicular to source at least for M 44-9 in which the front of probe faces source
Multimeter Uncertainty within 1.3% of reading. Gamma uncertainty within 5.0% of reading. Radiation uncertainty within 7.0% of reading. Count rate uncertainty within 5.0% of reading.

Alpha Channel	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING
Digital Readout	<u>400K cpm</u>	<u>39982(0)</u>	<u>39982(0)</u>
	<u>40K cpm</u>	<u>3998</u>	<u>3998</u>
	<u>4K cpm</u>	<u>400</u>	<u>400</u>
	<u>400 cpm</u>	<u>40</u>	<u>40</u>
	<u>40 cpm</u>	<u>4</u>	<u>4</u>

Beta/Gamma Channel	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING
Digital Readout	<u>400K cpm</u>	<u>39976(0)</u>	<u>39976(0)</u>
	<u>40K cpm</u>	<u>3998</u>	<u>3998</u>
	<u>4K cpm</u>	<u>400</u>	<u>400</u>
	<u>400 cpm</u>	<u>40</u>	<u>40</u>
	<u>40 cpm</u>	<u>4</u>	<u>4</u>

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by methods traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organizations, or have been derived from accepted values of natural physical constants or have been derived by the ratio of two calibrations on the same instrument. As possible, determinations are based on the International System of Units without considering uncertainty factors. Measurements result in stated uncertainties (expressed at approximately the 95% level of confidence) using a coverage factor of 1.96. This calibration is in accordance with the requirements of ANSI N42.42-1994 and ANSI N42.43-2013. State of Texas Calibration License No. 10-1964

Reference Instruments and/or Sources: Cs-137 S/N ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1694 ☐ 1909 ☐ 1916CP ☐ 2324/CS21
☐ 5717CO ☐ 5719CO ☐ 60446 ☐ 70897 ☐ 73410 ☐ 7532 ☐ G112 ☐ 2168CP ☐ S-394 ☐ S-1051 ☐ 110291 ☐ T10082 Neutron Am-241 Ba ☐ 1321 ☐ 1526 ☐ 1982
☐ E551 ☐ S105 ☐ CSV289

☒ Alpha S/N PU239 SN:7053 ☒ Beta S/N TC99 SN:5280, C14 SN:1476 ☐ Other

☒ m.500 S/N 190566 ☐ Oscilloscope S/N ☒ Multimeter S/N 86250390

Calibrator Jason Flores Title Calibrator Date 10-Feb-20

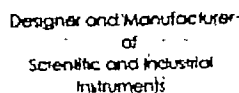
QC'd By John W. Title Final QC Date 12-Feb-20

This certificate shall not be reproduced except in full without the written approval of Ludlum Measurements, Inc.

Form 400-01-001000

Page 1 of 2

Accepted: Jason Flores Posted: 10-Feb-20 Filed: 10-Feb-20



501 Oak Street
325-235-5494
Sweetwater, TX 79558, U.S.A

Customer ERG

ORDER NO. 20372245/489181

Detector 43-10-1 Serial No. PR 114341

Alpha Input Sensitivity 175 mV

Counter 2929 Serial No. 111573

Beta Input Sensitivity 4 mV

Count Time 1 Minute

Beta Window 50 mV

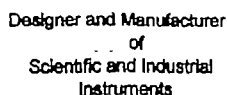
Other _____ Distance Source to Detector 1.25

[illegible]

- ☐ Gas Proportional detector count rate decreased $\leq 10\%$ after 15 hour static test using 39" cable,
☒ Gas proportional detector count rate decreased $\leq 10\%$ after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jason Flores

Date 10 FEB 20



501 Oak Street
325-235-5494
Sweetwater, TX 79558, U.S.A.



ORDER NO. 20369959/487898

Multimeter uncertainty within 1.3% of reading, Gamma uncertainty within 5.0% of reading, Neutron uncertainty within 7.0% of reading, Count rate uncertainty within 5.4% of reading

(0) indicates 0.1 minute count

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. All possible determinations are based on the manufacturer's specifications without considering uncertainty factors. Measurement results represent expanded uncertainties expressed at approximately the 95% level of confidence, using a coverage factor of k=2. The calibration system conforms to the requirements of ANSI/ISO/IEC 17025:2005 and ANSI N323AB-2013.

ISO/IEC 17025:2017(E)
State of Texas Collecting License No. LC-1989

FORM C25-2 03/27/2019

Page 1 of 1

AC Inst ☒ Passed Dielectric (HI-Pot) and Continuity Test
Only ☐ Failed:

Ludlum Measurements, Inc.
Model 3030 Plateau Data

12/30/2019
1:13:40 PM

Header 1: John Q Public
Header 2: Serial#342322
Header 3: Site:Building 1
Header 4: Room 7 EastWall
Header 5: More Comments?
Header 6: More Comments?

Calibration Due Date: 12/30/2020

Model 3030 Date: 12/30/2019
Model 3030 Time: 11:47:19 AM

User PC Time: 1.0

Alpha Isotope: Pu239
Alpha Source Size (dpm): 25200
Alpha Source Size (Bq): 420.0
Alpha Source Size (uCi): 0.011351351

Beta Isotope: Tc99
Beta Source Size (dpm): 33200
Beta Source Size (Bq): 553.33
Beta Source Size (uCi): 0.014954955

Starting High Voltage: 550
Starting High Voltage: 650
High Voltage Increment: 25

Plateau Count Mode: SCALER
Source Count Time (min): 1.0
Background Count Time (min): 1.0

HV	ALPHA				CrossTalk	BETA			
	Source (Beta)	Background	Eff			Source (Alpha)	Background	Eff	Crosstalk
550	8993 (327)	0	35.7%	3.5%		4935 (12)	9	14.8%	0.2%
575	9541 (232)	0	37.9%	2.2%		7063 (10)	19	21.2%	0.1%
600	9545 (208)	1	37.9%	1.9%		8578 (13)	24	25.8%	0.1%
625	9743 (223)	0	38.7%	2.0%		9849 (17)	31	29.6%	0.2%
650	9840 (246)	2	39.0%	2.1%		10945 (15)	44	32.8%	0.1%
675	9835 (224)	3	39.0%	1.3%		11556 (28)	101	34.5%	0.2%

Lydium Measurements, Inc.
Model 3030 Parameters

12/30/2019
1:20:46 PM

Header 1: John Q Public
Header 2: Serial#342322
Header 3: Site:Building 1
Header 4: Room 7 EastWall
Header 5: More Comments?
Header 6: More Comments?

Calibration Due Date: 12/30/2020

Model 3030 Date: 12/30/2019
Model 3030 Time: 1:30:26 PM

Count Time Switch (min): 1.0
User PC Time (min): 1.0

Alpha Alarm: 999999
Beta Alarm: 999999
Alpha + Beta Alarm: 999999

High Voltage (VDC): 625

Loss of Count Time (min): 30.0

Count Mode: SCALER

Alpha Efficiency %: 37.6
Beta Efficiency %: 25.8

Background Subtract: OFF
Alpha Background: 0.0
Beta Background: 25.0

Crosstalk Correction: OFF
Alpha to Beta Crosstalk %: 2.1
Beta to Alpha Crosstalk %: 0.2

Show Parameters during startup: Enabled

Daily QC Check: Automatic and Manual
Update Efficiency/Background Subtract from QC: ON
Override QC Count Time: ON

Last Alpha Efficiency %: 37.6
Last Beta Efficiency %: 25.8

Standard Alpha Efficiency %: 38
Standard Beta Efficiency %: 29

Allowable Alpha QC Efficiency \pm %: 15
Allowable Beta QC Efficiency \pm %: 15

Alpha Source Size (dpm): 25200
Alpha Source Size (Bq): 420.00
Alpha Source Size (μ Ci): 0.01135135135

Beta Source Size (dpm): 33200
Beta Source Size (Bq): 553.33
Beta Source Size (μ Ci): 0.01495495495

Alpha QC Count Time (min): 1.0
Beta QC Count Time (min): 1.0
Background QC Count Time (min): 1.0

Last Alpha QC Background: 0.0
Last Beta QC Background: 25.0

Alpha Background Upper Limit (cpm): 3.1
Alpha Background Lower Limit (cpm): 0.0
Beta Background Upper Limit (cpm): 50.1
Beta Background Lower Limit (cpm): 0.0

Next Sample Number: 0346
User-defined Comment: AAAAAAAAAA
Logging Mode: Log All
Recycle Mode: OFF
Printer Mode: OFF

Ludlum Measurements, Inc.
Model 3030 MDA Calculation Data

12/30/2019
1:20:52 PM

Alpha Background(cpm): 0.0
Beta Background(cpm): 25.0

Alpha Efficiency %: 37.6
Beta Efficiency %: 25.8

Background Count Time: 1.0 minute(s)
Confidence Level: 95% (3.290)

Count Time	Alpha MDA(dpm)	Beta MDA(dpm)
0.1	72.1	316.5
0.5	14.4	131.4
1.0	7.2	100.7
2.0	3.6	83.3
5.0	1.4	71.9
10.0	0.7	67.9
60.0	0.1	64.5
PC (1.0)	7.2	100.7