SAFETY AND ECOLOGY CORP. **CALIBRATION DATA SHEET**

FORM 73-1 REV. 0

CUSTOMER NAME

: SAFETY AND ECOLOGY

INST. MANUFACTURER

PLANT NAME

: SEC LAB

TYPE

: LUDLUM INST. : SCINTILLATION

ADDRESS

: 10512 Lexington Dr.

MODEL NO.

: 19

KNOXVILLE

ΤN

SERIAL NO.

167164

CONTACT PERSON

: JERRY DEGROODT

SOURCE USED

CAL. SOURCE USED CESIUM -137 400 CURIE/130 MILLICURIE S/N 9115

CAL DUE

: 8/22/2010

M&TE

MINIPULSER S/N

: 314

CALIBRATION DUE DATE:

1/23/2010

DVM S/N H.V. PROBE S/N : 82730524 : 82630102

HIGH VOLTAGE

INPUT SENSITIVITY

CALIBRATION DUE DATE:

3/10/2011

CALIBRATION DUE DATE:

3/10/2011

CALIBRATION DATA

AS FOUND

AS LEFT

1063 37

1063 37

VOLTS MILLIVOLTS

SCALE	EXPO:	SURE RATE	INSTRUMEN	T READING	PER CEN	PER CENT ERROR		
· · · · · · · · · · · · · · · · · · ·	uR/HR	(MR/HR)	AS FOUND	AS LEFT	AS FOUND	AS LEFT		
25	5	(PULSED = TO)	6.00	5.00	20.00	0.00		
	12	(PULSED = TO)	14.30	12.00	19.17	0.00		
	20	(PULSED ≃ TO)	24.00	20.00	20.00	0.00		
50	10	(PULSED = TO)	12.0	10.0	20.00	0.00		
	25	(PULSED = TO)	30.0	25.0	20.00	0.00		
· · · · · · · · · · · · · · · · · · ·	40	(PULSED = TO)	48.0	40.0	20.00	0.00		
250	50	(PULSED = TO)	60.0	50.0	20.00	0.00		
	120	(PULSED = TO)	143.0	120.0	19.17	0.00		
	200	(PULSED = TO)	240.0	200.0	20.00	0.00		
500	200	(0.2)	240	200	20.00	0.00		
	250	(0.25)	300	250	20.00	0.00		
	400	(0.4)	480	400	20.00	0.00		
5000	1000	(1.0)	1200	1000	20.00	0.00		
	2500	(2.5)	3000	2500	20.00	0.00		
	4000	(4.0)	4750	3950	18.75	1 25		

PRECISION

SCALE	EXPOSU	RE RATE	AS FOUND	MEAN VALUE	% DEV.
5000			3000		0.00
	2500	(2.5)	3000	3000	0.00
			3000		0.00

COMMENTS/REMARKS:Initial calibration after Ludlum repair.

DOSE RATE CALIBRATION DONE WITH N.I.S.T. TRACEABLE SOURCES AND CALIBRATED TEST EQUIPMENT. PULSE RATE CALIBRATION DONE AS REQUIRED DUE TO BACKGROUND RADIATION AND CORRELATED TO DOSE RATE CALIBRATION ON HIGHER SCALES.

CALIBRATION POINTS ACCEPTANCE CRITERIA +/-10% OF ACTUAL EXPOSURE RATE.

OUT OF TOLERANCE VALUES ARE CIRCLED AND CUSTOMER CONTACT NOTIFIED VERBALLY OF CONDITION. CALIBRATION PERFORMED PER ICAL PROCEDURE NUMBER 73.

CALIBRATED BY

REVIEWED BY

DATE REVIEWED

DATE CALIBRATED:

CALIBRATION DUE DATE

9.17.2010

SAFETY AND ECOLOGY CORP. REPAIR AND SERVICE RECORD

FORM 73-2 REV. 0

CUSTOMER NAME:

SAFETY AND ECOLOGY

MANUFACTURER:

LUDLUM INST.

PLANT NAME: ADDRESS:

SEC LAB

ΤN

TYPE:

SCINTILLATION

DDRESS: 10512 LEXINGTON Dr. KNOXVILLE

MODEL NO. : SERIAL NO. : 19 **167164**

CONTACT PERSON:

JERRY DEGROODT

DATE	PROBLEM DESCRIPTION	WORK PERFORMED
9/17/2009	ROUTINE SERVICE: CHECK BATTERIES CHECK METER ZERO CHECK GEOTROPISM CHECK F/S RESPONSE CHECK AUDIO CHECK LIGHT CHECK HIGH VOLTAGE CHECK INPUT SENSITIVITY PERFORMED OVER RANGE TEST DOSE AND/OR PULSE RATE CALIBRATED	PERFORMED PER PROCEDURE 73 ALL SATISFACTORY UNLESS DENOTED BELOW.
		LABOR: 1.0 MAN-HOURS

WORK PERFORMED BY:



SEC PROCEDURE # SEC-IS-418

2800 Solway Road Knoxville, TN 37931 Calibration Certificate

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9/18/2009

Calibration Certificate for 2360, Serial # 145474, Bar Code # , Property # SEC-5742

Date: 09/18/09

Date Last Cal. Expires: 03/10/10

Technician:

Thomas Thompson

Location: 9999,

Reason For Calibration:

Other (See Comments)

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 01/23/10

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA	Geot	ropism: SAT	Γ AS F	OUND Instrumer	nt Condition: SAT AS	LEFT Instrument	Condition: SAT	
■ New Batteries?	Battery	Check: SAT	г	AS FOUND Mech	nanical Zero: 0	AS LEFT Mechanical Zero: 0		
HIGH VOLTAGE	AS F	OUND HV	A	S LEFT HV	WINDOW SETTINGS	AS FOUND	ACIET	
(+/- 10% tolerance)	500 V:	512 V		AF V		4 mV	AS LEFT AF mV	
	1000 V:	1004 V		AF _V	BT (4 mV +/4 mV):			
	1500 V:	1497 V		AF V	BW (40 mV +/- 4 mV):	40 mV	AF mV	
AF H	√ Setting:	1675 V	AL HV Setting:	1700 V	AT (120 mV +/- 10 mV);	120 mV	AF mV	

		RAMEN	ETER		
SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or	100	100	0.00%	AF	0.00%
x1	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
11 or	1000	1000	0.00%	AF	0.00%
/x10	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or	10K	10	0.00%	AF	0.00%
x100	25K	25	0.00%	AF	0.00%
	40K	40	0.00%	AF	0.00%
x100 or	100K	100	0.00%	AF	0.00%
x1000	250K	250	0.00%	AF	0.00%
	400K	400	0.00%	AF	0.00%

		DOTALS	SCALE	7	
AF 250:	250	% ERR: 0.00%	AL 250:	AF	% ERR: 0.00%

AF 2500: 2501 % ERR: 0.04% AL 2500: % ERR: 0.04% AF 25K: 25.01 K % ERR: 0.04% AL 25K: AF K % ERR: 0.04% AF 250K; 250.1 K % ERR; 0.04% AL 250K; AF K % ERR: 0.04%

Is the As Found Data Within 20% of the Set Point?

의로	१००।			
x.1 or x1 Scale:	250	250	250	
x1 or x10 Scale:	2500	2500	2500	
x10 or x100 Scale:	25	K 25	K 25	K
x100 or x1000 Scale:	250	K 250	K 250	K

✓ Are the Individual Counts Within 10% of the Average?

☑ Is the As Found Data Within 20% of the Set Point?

Audio Response:

Overload Light: SAT

Low Battery (2.2V): SAT

Comments: Married as a set with:

Model:

Serial #: PR066273

Bar Code #:

✓ Does Instrument Meet Final Acceptance Criteria?

✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

09/18/10

Performed by: Printed Name: /

Thomas Thompson

Reviewed by:



Performed by:

Printed Name:

Thomas Thompson

Entered in Computer Inventory By:

Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931

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Calibration Certificate 9/18/2009 Calibration Certificate for 43-37, Serial # PR066273, Bar Code # .Property # SEC-5173 Date: 09/18/09 Date Last Cal. Expires: 03/10/10 Technician: Thomas Thompson Location: 9999. Reason For Calibration: Other (See Comments) CAL DUE 09/18/10 **EQUIPMENT USED DURING CALIBRATION** MODEL: 2360 SERIAL #: 145474 **CAL DUE** MODEL: SERIAL #: **NIST TRACEABLE SOURCES USED SOURCE** ISOTOPE **ACTIVITY** 2π **ASSAY DATE** 4071-02 Th-230 40600 dpm 20,600 cpm 1/10/2008 4072-02 27700 dpm 1/10/2008 Tc-99 17,300 cpm 4076-02 13300 dpm 1/10/2008 Sr-90 9,300 cpm 4079-02 Pu-239 28700 dpm 14,600 cpm 1/10/2008 AS FOUND DATA AS FOUND Instrument Condition: SAT AS LEFT Instrument Condition: SAT Calibration Setpoints AS LEFT DATA after repair or HV adjust HV: 1700 V HV: Threshold Beta: ٧ m۷ <u>Alpha</u> <u>Beta</u> Alpha **Beta** Back Back Efficiencies from ground: 9 **CPM** 549 CPM A-B XTLK **CPM** CPM A-B XTLK ground: last calibration Pu-239: 5484 **CPM** 892 CPM 6.3% Pu-239: CPM CPM 17.60 % Pu: Tc-99: 13 CPM 6806 CPM СРМ CPM Tc-99: Tc: 19.63 % Th-230: 6696 **CPM** N/A Th-230: CPM N/A SrY-90: Th: 15.36 % N/A 4290 CPM SrY-90: CPM N/A SrY: 30.07 % Pu-239: 19.08% Tc-99: 22.59% Tc-99: Pu-239: AS FOUND AS LEFT Efficiencies: Th-230: 16.47% SrY-90: 28:13% Efficiencies: Is the As Found Data Within 20% of the efficiency from the last cal.? Reproducibility: Isotope: Sr-90 4318 4263 4296 4292.3 ✓ Are the individual counts within 10% of the average? Average: 1/8" from surface unles Source 1: Tc-99 Source 2: Th-230 PLATEAU DATA Response (CPM) Response (CPM) Background (CPM) Net A to B High Voltage A ch. B ch. Net Eff. A ch. B ch. Net Eff. A ch. B ch. Xtalk: <10% N/A N/A N/A N/A N/A N/A N/A <u>Alpha</u> Beta <u>HV</u> Pu-239 Th-230 SrY-90 Tc-99 Background: CPM CPM CPM **CPM** AL Efficiencies: Comments: Married as a set with: Model: 2360 Serial #: 145474 Bar Code #: Threshold a 120 ß 4-40. **✓** Does Instrument Meet Final Acceptance Criteria? ✓ Calibration Sticker Attached? Date Instrument is Due For Next Calibration: 09/18/10

Reviewed by:



SEC PROCEDURE # SEC-IS-406

2800 Solway Road Knoxville, TN 37931 Calibration Certificate

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9/18/2009

Calibration Certificate for 2929,Serial # 152275, Bar Code # ,Property # SEC-5261

Date: 09/18/09

Date Last Cal. Expires: 12/01/07

Technician:

Thomas Thompson

Location: 9999,

Reason For Calibration:

Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL#: 190580

CAL DUE: 01/23/10

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

AS FOUND Mechanical Zero: 0

AS LEFT Mechanical Zero: 0

Scaler Function Check

Beta Channel Window (4-50 mV):

AS FOUND 4-50

ASILEET

m۷ 175

AF mV AF m۷

Alpha Channel Threshold (175 mV):

mV

AF **CPM**

% Error: 0.00%

Alpha Counts w/Pulser @ 10,000 CPM: Beta Counts w/Pulser @ 10,000 CPM:

CPM 10,000 **CPM**

10,000

AF **CPM**

% Еггог: 0.00%

HIGH VOLTAGE POWER SUPPLY CALIBRATION

Vernier Setting: **HV Setpoints:**

500 V Reading:

AS FOUND 1000 3.97 1000 V AF 506 V AF ٧ 998

1000 V Reading: 1500 V Reading:

Max HV (1500 V +):

DIGITAL SCALER

AF 250: 250

% ERR: 0.00%

AL 250: AF

% ERR: 0.00%

AF 2500: 2502

% ERR: 0.08%

AL 2500: AF

% ERR: 0.08%

AF 25K: 25.02 K % ERR: 0.08%

AL 25K: AF

K % ERR: 0.08%

AF 250K: 250.1 K % ERR: 0.04% AL 250K: AF K % ERR: 0.04% ☑ Is the As Found Data Within 20% of the Set Point?

Comments: Married as a set with:

Model: 43-10-1

Serial #: PR155350

1493 V

Bar Code #:

☑ Does Instrument Meet Final Acceptance Criteria?

✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

Performed by: Printed Name/

Thomas Thompson

Reviewed by:



Performed by:

Printed Name: /

Thomas Thompson

Entered in Computer Inventory By:

Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931

SEC PROCEDURE #

Date: 9.18.09

SEC-IS-414

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Calibration Certificate 9/18/2009 Calibration Certificate for 43-10-1, Serial # PR155350, Bar Code # , Property # SEC-5262 Date: 09/18/09 Date Last Cal. Expires: 12/01/07 Technician: Thomas Thompson Location: 9999, Reason For Calibration: Due for Calibration MODEL: 2929 SERIAL #: 152275 CAL DUE: 09/18/10 **EQUIPMENT USED DURING CALIBRATION** CAL DUE: MODEL: SERIAL #: **NIST TRACEABLE SOURCES USE** SOURCE ISOTOPE **ACTIVITY** ASSAY DATE 211 4071-02 Th-230 40600 dpm 20,600 cpm 1/10/2008 4072-02 Tc-99 17,300 cpm 1/10/2008 27700 dpm 4076-02 Sr-90 13300 dpm 9,300 cpm 1/10/2008 4079-02 Pu-239 28700 dpm 14,600 cpm 1/10/2008 AS LEFT Instrument Condition: SAT AS FOUND Instrument Condition: SAT AS FOUND DATA Calibration Setpoints Threshold AS LEFT DATA after repair or HV adjust HV: 1000 V Vernier: 3.97 Beta: 4 - 50 mV HV: 1000 V Vernier: 3.97 Alpha: 175 mV Efficiencies from <u>Alpha</u> Beta Alpha Beta last calibration Back Back CPM A-B XTLK CPM CPM 30 0 n n CPM A-B XTLK ground: ground: 38.16 % Pu: Pu-239: 0 **CPM** 0 CPM Pu-239: 10368 CPM 247 **CPM** 2.1% #Div/0! Tc: 19.42 % Tc-99: n CPM 0 CPM Tc-99: 0 CPM 5626 CPM **B-A XTLK B-AXTLK** Th: 35.65 % Th-230: 0 CPM Th-230: 14071 N/A **CPM** 0.0% N/A #Div/0! SrY: 45.28 % SrY-90: 0 **CPM** SrY-90: 5456 **CPM** N/A Pu-239: 0:00% Tc-99: 0:00% Tc-99: 20.20% Pu-239: 36:13% AS FOUND **AS LEFT** Th-230: 0.00% SrY-90: 0.00% Th-230: 34.66% SrY-90: 40:80% Efficiencies: Efficiencies: Is the As Found Data Within 20% of the efficiency from the last cal.? Reproducibility: Isotope: Sr-90 5335 5313 5463 Average: 5370.3 🗹 Are the individual counts within 10% of the average? PLATEAU DATA Source 1: Tc-99 Source 2: Th-230 Net A to B Net B to A Xtalk: <10% Xtalk: <1% High Voltage Response (CPM) Response (CPM) Background (CPM) A ch. B ch. Net Eff. A ch. B ch. Net Eff. A ch. B ch. N/A N/A N/A N/A N/A N/A N/A <u>Alpha</u> HV/Vernier <u>Beta</u> Pu-239 Tc-99 Th-230 SrY-90 Background: **CPM** CPM **CPM CPM** AL Efficiencies: 1869 April de la Comments: Married as a set with: Model: 2929 Serial #: 152275 Bar Code #: Replaced mylar. Does Instrument Meet Final Acceptance Criteria? ✓ Calibration Sticker Attached? Date Instrument is Due For Next Calibration: 09/18/10

Reviewed by:



2800 Solway Road Knoxville, TN 37931 Calibration Certificate

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9/18/2009

Calibration Certificate for 2360, Serial # 184906, Bar Code # , Property # SEC-5495

Date: 09/18/09

Date Last Cal. Expires: 09/12/09

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration:

Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 01/23/10

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA	Geot	ropism: SAT	AS F	OUND Instrumer	S LEFT Instrument Condition: SAT				
Mew Batteries?		Check: SAT		AS FOUND Meci	-	AS LEFT Mechanical Zero: 0			
	•				ianical Zero.	AO EEI THICCHA	incar Ecro.		
		OUND HV	A	S LEFT HV	WINDOW SETTINGS	AS FOUND	AS LEFT		
(+/- 10% tolerance)	500 V:	504 V		AF V	BT (4 mV +/4 mV):	3.5 mV	4 mV		
	1000 V:	1003 V		AF V	BW (40 mV +/- 4 mV):	40.8 mV	40 mV		
	1500 V:	150 V		AF V	544 (40 mV +/- 4 mV):				
AF HV	/ Setting:	802 V	AL HV Setting:	1650 V	AT (120 mV +/- 10 mV):	120 mV	AF mV		

1	. 4 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		KANEN			900
	SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
	x.1 or	100	100	0.00%	AF	0.00%
	x1	250	250	0.00%	AF	0.00%
		400	400	0.00%	AF	0.00%
اسم	्र्1 or	1000	1000	0.00%	AF	0.00%
•	_/x10	2500	2500	0.00%	AF	0.00%
		4000	4000	0.00%	AF	0.00%
	x10 or	10K	10	0.00%	AF	0.00%
	×100	25K	25	0.00%	AF	0.00%
		40K	40	0.00%	AF	0.00%
	x100 or	100K	100	0.00%	AF	0.00%
:	x1000	250K	250	0.00%	AF	0.00%
	<u></u>	400K	400	0.00%	AF	0.00%

✓ Is the As Found Data Within 20% of the Set Point?

EDIGITAL SCALER AF 250: 250 % ERR: 0.00% AL 250: % ERR: 0.00% AF 2500: 2501 % ERR: 0.04% AL 2500: % ERR: 0.04% AF K % ERR: 0.04% AF 25K: 25.01 K % ERR: 0.04% AL 25K: AF 250K: 250.1 K % ERR: 0.04% AL 250K: AF K % ERR: 0.04%

Is the As Found Data Within 20% of the Set Point?

(트라이스 - MEP)	KODUGI	SILIN		
x.1 or x1 Scale:	250	250	250	
x1 or x10 Scale:	2500	2500	2500	
x10 or x100 Scale:	25 K	25 K	25 K	
x100 or x1000 Scale:	250 K	250 K	250 K	

✓ Are the Individual Counts Within 10% of the Average?

Audio Response: SAT

> Overload Light: SAT

Low Battery (2.2V): SAT

Comments: Married as a set with:

Serial #: PR116721

Bar Code #:

✓ Does Instrument Meet Final Acceptance Criteria?

Model:

✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

43-68

Performed by: Printed Name:

Thomas Thompson

Reviewed by:

Entered in Computer Inventory By:

Date: 9-18-09



Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931 Calibration Certificate

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Calibratio	n Cert	ificate for	<i>43-68,</i> S	erial #	PR116	721, Ba	r Code	Pro,	perty#	SEC-5	386			
Date:	09/18/0	09	Date L	ast Cal. E	Expires:	06/09/09	3	Te	echnician	: Thom	nas Thor	mpson		
Location:	9999,						Reason	For Ca	libration	: Due f	or Calib	ration		
EQUIPME	NT US	ED DURII	NG CAL	IBRATI	ON M	ODEL: 2	2360	SE	ERIAL #:	184906		CAL	DUE 09/1	8/10
					М	ODEL:		SI	ERIAL #:			CAL [UE	
NIST TRACE	ABLE S	OURCES US	SED SOU	RCE		ISOTOP	E	ACT	IVITY			2π	ASSAY	DATE
			4071	-02		Th-230		4060	00 dpm		2	0,600 cpm	1/10/2	800
			4072	-02		Tc-99		2770	00 dpm		1	7,300 cpm	1/10/2	800
			4076	-02		Sr-90		1330	00 dpm		9	,300 cpm	1/10/2	800
			4079	-02		Pu-239		2870	00 dpm		1	4,600 cpm	1/10/2	800
AS FOUN	ND DA	TA	AS FOUN	D instrur	nent Co	ndition:	SAT		AS	LEFT Ins	strumen	t Conditio	n: SAT	
	•			Calibr	ation Se	tpoints			<u>A</u> :	S LEFT [DATA af	ter repair	<u>or HV adj</u>	<u>ust</u>
				H	V : 1650	٧								
	Thresh	old Beta:		-	mV			1			HV:	\	<i>(</i>	
Efficiencies	from	Back	<u>Alpha</u>		<u>Beta</u>				ack	<u>Alpha</u>		<u>Beta</u>		
last calibra		ground: Pu-239:	0 5969	CPM CPM	168	CPM			round:		CPM		CPM	A-B XTI
Pu: 21.7	78 %	Tc-99:	12	CPM	524 5837	CPM CPM		0 1	Pu-239: Tc-99:		CPM CPM		CPM CPM	
Tc: 22.0	01 %	Th-230:	7666	CPM	N/A	. 01 111			Th-230:		CPM	N/A	0	
Th: 20.	51 %	SrY-90:	N/A		4314	CPM			SrY-90:	N/A			CPM	
SrY: 33.8	87 %	, AS E	OUND	Pu-239	20.80%	Tc-9	9: 20.47%	Ž.	AS LEF	_r P	u-239:	No. of Con-	Tc-99:	
			iencies:		18:889		0: 31:17%	77	Efficien		h-230:	100	SrY-90:	
✓ Is the A	As Foun	d Data Withi	n 20% of		22200000	-T:J	500-00-00-000				12.		ion.	
Reproducibi				6 4292	•	Averag		6.0☑ A	Are the in	dividual	counts	within 109	% of the a	verage?
-	-	njerter (repair)is jsovice,≘jilusijiu				-								_
Connectation	eomain.e	scorce ∋llush to							wise specifie					
PLATE	<u> AU C</u>	<u>ATA</u>		e 1: Tc-!			e 2: Th-2							
	1	ligh Voltage		ponse (C			ponse (CF			round (C		Net A to Xtalk: <10		
	<u>-</u>	N/A	A CII.	B ch.	Net Eff.	A Cit.	. Bch. I	Net Ell.	A ch.		ch.	N/A	776	
	-	****			 							N/A	\dashv	
												N/A		
												N/A		
	-		ļ <u>.</u>		ļ				<u> </u>	<u> </u>		N/A		
	-				1	Į			B.	- 1	1	N/A	l	

<u>Alpha</u> Pu-239 Th-230 <u>Beta</u> ΗV Tc-99 SrY-90 Background: **CPM** CPM **CPM CPM** ٧ AL Efficiencies: Comments: Married as a set with: Model: 2360 Serial #: 184906 Bar Code #:

Threshold a 120 ß 4-40.

Printed Name:

☑ Does Instrument Meet Final Acceptance Criteria?

Thomas Thompson

✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

09/18/10

Performed by:

Reviewed by:_



Performed by:

Printed Name:

Thomas Thompson

Entered in Computer Inventory By:

Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931

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Calibration Certificate 9/18/2009 Calibration Certificate for 43-68, Serial # PR160790, Bar Code # , Property # SEC-6340 Date: 09/18/09 Date Last Cal. Expires: 05/21/10 Technician: Thomas Thompson Location: 9999, Reason For Calibration: Due for Calibration MODEL: 2360 SERIAL #: 225241 CAL DUE 09/17/10 EQUIPMENT USED DURING CALIBRATION **CAL DUE** MODEL: SERIAL #: **ASSAY DATE** ISOTOPE **ACTIVITY** 2π **NIST TRACEABLE SOURCES USED SOURCE** 1/10/2008 4071-02 Th-230 40600 dpm 20,600 cpm 4072-02 Tc-99 27700 dpm 17,300 cpm 1/10/2008 1/10/2008 4076-02 Sr-90 9,300 cpm 13300 dpm 4079-02 Pu-239 28700 dpm 14,600 cpm 1/10/2008 AS FOUND Instrument Condition: AS LEFT Instrument Condition: SAT **AS FOUND DATA** Calibration Setpoints AS LEFT DATA after repair or HV adjust HV: 1650 V HV: [650 Threshold Beta: mV <u>Alpha</u> Beta <u>Alpha</u> Back Back Efficiencies from ground: **CPM** 0 0 CPM A-B XTLK 1 **CPM** 155 CPM A-B XTLK ground: last calibration Pu-239: 0 **CPM** 0 #Div/0! 6092 CPM 556 **CPM** 6.2% CPM Pu-239: 20.31 % Pu: Tc-99: 0 **CPM** 0 CPM Tc-99: 44 CPM 5671 CPM Tc: 19.86 % Th-230: 0 **CPM** N/A Th-230: 8240 CPM N/A Th: SrY-90: 19.66 % N/A CPM **CPM** SrY-90: 4515 N/A SrY: 30.92 % Pu-239: 0.00% Tc-99: 0.00% Pu-239: 21-22% Tc-99: 19:9126 AS FOUND AS LEFT Efficiencies: Th-230: 0.00% SrY-90: 0.00% Efficiencies: SrY-90: 32 Th-230: 20:29% Is the As Found Data Within 20% of the efficiency from the last cal.? Reproducibility: Isotope: Sr-90 4409 4440 Average: 4422.3 ✓ Are the individual counts within 10% of the average? Source 1: Tc-99 Source 2: Th-230 PLATEAU DATA Response (CPM) Response (CPM) Background (CPM) Net A to B **High Voltage** A ch. B ch. Net Eff. A ch. B ch. Net Eff. A ch. B ch. Xtalk: <10% N/A N/A N/A N/A N/A N/A N/A <u>Alpha</u> <u>Beta</u> HV Pu-239 Tc-99 Th-230 SrY-90 Background: **CPM CPM CPM CPM** ٧ AL Efficiencies: Comments: Married as a set with: Model: 2360 Serial #: 225241 Bar Code #: Replaced mylar. Threshold a 120 ß 4-40. ✓ Does Instrument Meet Final Acceptance Criteria? ✓ Calibration Sticker Attached? Date Instrument is Due For Next Calibration: 09/18/10

Reviewed by:



2800 Solway Road Knoxville, TN 37931 Calibration Certificate

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9/18/2009

Calibration Certificate for 2360, Serial # 225241, Bar Code # , Property # SEC-6210

Date: 09/18/09

Date Last Cal. Expires: 09/17/09

Technician:

Thomas Thompson

Location: 9999,

Reason For Calibration:

Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 01/23/10

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA	Geoti	ropism: SAT	AS FO	OUND Instrument	Condition: SAT AS	AS LEFT Instrument Condition: SAT			
New Batteries?	Battery	Check: SAT		AS FOUND Mecha	anical Zero: >0	AS LEFT Mechanical Zero: 0			
HIGH VOLTAGE	AS F	OUND HV	<u>A</u>	S LEFT HV	WINDOW SETTINGS	AS FOUND	AS LEFT		
(+/- 10% tolerance)	500 V:	507 V		AF V	BT (4 mV +/4 mV):	3.6 mV	4 mV		
	1000 V:	1005 V		AF V	•				
	1500 V:	1511 V		AF V	BW (40 mV +/- 4 mV):	35.4 mV	40 mV		
AF HV	Setting:	1682 V	Al HV Setting:	1650 V	AT (120 mV +/- 10 mV):	87 mV	120 mV		

		RATEIN			
SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or	100	100	0.00%	AF	0.00%
x1	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
्र1 or	1000	1000	0.00%	AF	0.00%
)x10	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or	10K	10	0.00%	AF	0.00%
x100	25K	25	0.00%	AF	0.00%
	40K	40	0.00%	AF	0.00%
x100 or x1000	100K	100	0.00%	AF	0.00%
	250K	250	0.00%	AF	0.00%
İ	400K	400	0.00%	AF	0.00%

				Same Francisco, pa	化自然性的 (1000)
AF 250:	250	% ERR: 0.00%	AL 250:	AF	% ERR: 0.00%
AF 2500:	2500	% ERR: 0.00%	AL 2500:	AF	% ERR: 0.00%
AF 25K:	25 K	% ERR: 0.00%	AL 25K:	AF K	% ERR: 0.00%
AF 250K:	250 K	% ERR: 0.00%	AL 250K:	AF K	% ERR: 0.00%

Is the As Found Data Within 20% of the Set Point?

REA	RODUGII	BILITY &		
x.1 or x1 Scale:	250	250	250	e for land
x1 or x10 Scale:	2500	2500	2500	
x10 or x100 Scale:	25 K	25 K	25 K	
x100 or x1000 Scale:	250 K	250 K	250 K	

✓ Are the Individual Counts Within 10% of the Average?

✓ Is the As Found Data Within 20% of the Set Point?

Audio Response: SAT Overload Light: SAT

Low Battery (2.2V): SAT

Comments: Married as a set with:

Model:

43-68

Serial #: PR160790

Bar Code #:

✓ Does Instrument Meet Final Acceptance Criteria?

✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

Performed by: Printed Name: -

Thomas Thompson



Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931 Calibration Certificate

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Calibration Certificate for 3,Serial # 187558	Bar Code # Property # SEC-6447
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Date: 09/18/09

Date Last Cal. Expires: 11/10/09

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 01/23/10

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism:

SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

HIGH VOLTAGE

■ New Batteries?

Battery Check: SAT

Alarm: N/A

(+/- 10% tolerance)

AS LEFT HV AS FOUND HV

500 V: 1000 V: N/A

AS FOUND Mechanical Zero: 0

AS LEFT Mechanical Zero:

AS LEFT THRESHOLD: 37.3 mV

1500 V:

N/A N/A N/A N/A

N/A

AS FOUND THRESHOLD: 37.3 mV AS FOUND HV Reading: 573 V

AS LEFT HV Reading:

900 V

HV Range 400-1500V: SAT

is desired.	in a	irayê M	EIIER =		
SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or	100	110	10.00%	100	0.00%
x1	250	260	4.00%	250	0.00%
.!_	400	410	2.50%	400	0.00%
x1 or	1000	1100	10.00%	1000	0.00%
x10	2500	2600	4.00%	2500	0.00%
	4000	4100	2.50%	4000	0.00%
x10 or	10K	10	0.00%	AF	0.00%
x100	25K	25	0.00%	AF	0.00%
	40K	40	0.00%	AF	0.00%
x100 or	100K	100	0.00%	AF	0.00%
x1000	. 250K	250	0.00%	AF	0.00%
	400K	400	0.00%	AF	0.00%

V	ls	the .	As	Found	Data	Within	20%	of	the	Set	Po	int?
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DIGITAL SCALER

250 % ERR: 0.00% AL 250: AF % ERR: 0.00% AF 250: AF 2500: 2502 % ERR: 0.08% AL 2500: AF % ERR: 0.08%

AF 25K: 25.01 K % ERR: 0.04% AL 25K: AF K % ERR: 0.04%

AF 100K: 100.0 K % ERR: 0.00% AL 100K: AF K % ERR: 0.00%

✓ Is the As Found Data Within 20% of the Set Point?

EPRODU	CIBILITY:		
250	250	250	
2500	2500	2500	
25 K	25 K	25 K	
250 K	250 K	250 K	
	2500 25 K	2500 2500 25 K 25 K	2500 2500 2500 25 K 25 K 25 K

- Are the Individual Counts Within 10% of the Average?
- Fast / Slow Response Switch Functions Properly?

Audio Response: SAT

Audio Divide: N/A

Push Buttons: SAT

Lamp: N/A

Scaler/Digital: SAT

Comments: Married as a set with:

Model:

Serial #: PR193572

Bar Code #:

⊻	Does	Instrumen	t Meet	Final	Accept	tance	Criteria?
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✓ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

Reviewed by:

Date: 10/13/09

Performed by: Printed Name:

Thomas Thompson



Safety and Ecology Corporation 2800 Solway Road, Knoxville, TN 37931 **Calibration Certificate**

SEC PROCEDURE # SEC-IS-407

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Calibration Certificate for 44-9,Serial # PR193572, Bar C	ode # ,Property # SEC-5357
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Date: 09/18/09

Date Last Cal. Expires: 02/04/10

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 3

SERIAL # 187558

CAL DUE: 09/18/10

MODEL:

SERIAL#

CAL DUE:

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
4072-02	Tc-99	27700 dpm	17,300 cpm	1/10/2008
4076-02	Sr-90	13300 dpm	9,300 cpm	1/10/2008

Geometry = in contact with surface unless otherwise specified

AS FOUND DATA

1 MINUTE COUNTS (CPM)

PREVIOUS Tc-99 EFFICIENCY: 13.99 %

Calibration Voltage: 900 V

Calibration Threshold: 37.3 mV

AS FOUND Instrument Condition:

SAT

AS LEFT Instrument Condition: SAT

AS LEFT DATA

1 MINUTE COUNTS (CPM)

4178

AF Background:

AVERAGE

Tc-99 Count:

0

0.0

Sr-90 Count:

Tc-99 EFF: 0.00%

Efficiencies :

AL Background:

Tc-99 Count:

4146

36

4037

<u>AVERAGE</u> 4120.3

Sr-90 Count: 3515

Efficiencies (Tc-99 EFF:

100000	THE RESERVE THE
	(6%)
20.	I D Zoss
344 FEB.	Service April 1

☐ Is the AS FOUND efficiency within 20% of efficiency from last calibration?

Reproducibility: Are the individual counts within 10% of the average?

✓ Does the probe meet final acceptance criteria?

✓ Calibration sticker attached?

0

Comments: Married as a set with:

Model: 3

Serial #: 187558

Bar Code #:

Replaced GMT.

Date Instrument is Due For Next Calibration:

Performed by: **Printed Name:**

Thomas Thompson

Reviewed by:

Entered in Computer Inventory By:

_Date: 9.18.04