

APPENDIX B

FIELD INSTRUMENTATION QC DOCUMENTATION



2800 Solway Road

Knoxville, TN 37931

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Calibration Certificate

11/15/2012

Calibration Certificate for 2929, Serial # 185291, Bar Code #, Property # SEC-5734

Date: 11/15/12

Date Last Cal. Expires: 04/19/13

Technician: Thomas Thompson

Location: 9999.

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 01/26/13

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

AS FOUND

AS LEFT

Beta Channel Window (4-50 mV):

4.2-50.9 mV

4-50 mV

Alpha Channel Threshold (175 mV):

180 mV

175 mV

Alpha Counts w/Pulser @ 10,000 CPM:

10,000 CPM

AF CPM % Error: 0.00%

Beta Counts w/Pulser @ 10,000 CPM:

10,000 CPM

AF CPM % Error: 0.00%

If AS FOUND data in Scaler Function Check is within 10%, the technician may place AF in AS LEFT section and proceed to High Voltage power supply section.

HIGH VOLTAGE POWER SUPPLY CALIBRATION

AS FOUND

AS LEFT

Vernier Setting:

4.29

AF

HV Setpoints:

1050 V

AF V

500 V Reading:

503 V

AF V

1000 V Reading:

1000 V

AF V

1500 V Reading:

1499 V

AF V

Max HV (1500 V +/-):

DIGITAL SCALER

AF 250: 251

% ERR: 0.40%

AL 250: AF

% ERR: 0.40%

AF 2500: 2509

% ERR: 0.36%

AL 2500: AF

% ERR: 0.36%

AF 25K: 25.08 K

% ERR: 0.32%

AL 25K: AF

K % ERR: 0.32%

AF 250K: 250.8 K

% ERR: 0.32%

AL 250K: AF

K % ERR: 0.32%

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

Comments: Married as a set with:

Model: 43-10-1

Serial #: PR194723

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

11/15/13

Performed by:

Reviewed by:

Date: 11/15/12

Printed Name:

Thomas Thompson



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-414 Rev 3

2800 Solway Road, Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

11/15/2012

Calibration Certificate for 43-10-1, Serial # PR194723, Bar Code #, Property # SEC-5735

Date: 11/15/12

Date Last Cal. Expires: 04/19/13

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 2929

SERIAL #: 185291

CAL DUE: 11/15/13

NIST TRACEABLE SOURCES USED

Efficiencies from last calibration

Pu-239: 37.98 %

Tc-99: 23.42 %

Th-230: 35.6 %

SrY-90: 42.02 %

SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
4071-02	Th-230	40300 dpm	20,500 cpm	3/8/2011
4072-02	Tc-99	28300 dpm	17,700 cpm	3/8/2011
4076-02	Sr-90	12100 dpm	8,490 cpm	3/8/2011
4079-02	Pu-239	28300 dpm	14,700 cpm	3/8/2011

AS FOUND DATA AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV: 1050 V Vernier: 4.29

Threshold

Beta: 4 - 50 mV

Alpha: 175 mV

Back	Alpha	Beta	AF Efficiencies
ground:	0 CPM	42 CPM	
Pu-239:	10733 CPM	170 CPM	37.93% A-B XTLK 1.2%
Tc-99:	1 CPM	6008 CPM	21.08% B-A XTLK
Th-230:	14044 CPM	N/A	34.85% 0.0%
SrY-90:	N/A	4994 CPM	40.93%

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust, or Plateau

HV: 1050 V Vernier: 4.29

Back	Alpha	Beta	AL Efficiencies
ground:	1 CPM	43 CPM	
Pu-239:	10673 CPM	210 CPM	37.71% A-B XTLK 1.5%
Tc-99:	0 CPM	6036 CPM	21.18% B-A XTLK
Th-230:	14267 CPM	N/A	35.40% 0.0%
SrY-90:	N/A	4893 CPM	40.08%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☒ Is the As Found Data Within 20% of the efficiency from the last cal.?Reproducibility: Isotope: Sr-90 4841 5019 4869 Average: 4909.7 ☒ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the Plateau Data and go directly to Comments. Geometry = Nal probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU DATA

Source 1: Tc-99

Source 2: Th-230

Net A to B

Net B to A

High Voltage

Response (CPM)

Response (CPM)

Background (CPM)

Xtalk: <10%

Xtalk: <1%

	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	

2 Pi Efficiencies:

Pu-239

Tc-99

Th-230

SrY-90

72.60%

33.86%

69.59%

57.13%

Comments: Married as a set with: Model: 2929

Serial #: 185291

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

11/15/13

Performed by:

Printed Name: Thomas Thompson

Reviewed by: Date: 11/15/12

Form HPM-2-1-1 Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2929	Technician:	J. Hubler
Instrument S/N:	185291	Date:	4/11/2013
Calibration Due:	11/15/2013	Detector Model:	43-10-1
Radiation Detected:	Alpha	Detector S/N:	PR194723
Source Isotope:	Th-230	Detector Type:	Scintillator
Source Serial #:	99TH470-0270	Average BKG CPM:	0.47

Background (10 min)	
Data Point	CPM
1	3
2	6
3	5
4	
5	
6	
7	
8	
9	
10	

Source (1 min)		
Data Point	Gross counts	Net counts
1	1,902	1,902
2	1,944	1,944
3	1,935	1,935
4	1,968	1,968
5	1,977	1,977
6	1,952	1,952
7	1,961	1,961
8	1,988	1,988
9	1,999	1,999
10	1,923	1,923

Average Net Count:	1954
Standard Deviation:	30
20% of Net Count:	390.9
Average minus 2 X standard deviation:	1895
Average plus 2 X standard deviation:	2014
Average minus 20%:	1564
Average plus 20%:	2345

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 4/11/13
Reviewed By:	Date:

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2929	Technician:	J. Hubler
Instrument S/N:	185291	Date:	4/11/2013
Calibration Due:	11/15/2013	Detector Model:	43-10-1
Radiation Detected:	Beta	Detector S/N:	PR240349
Source Isotope:	Tc-99	Detector Type:	Scintillator
Source Serial #:	97TC470-2443	Average BKG CPM:	47

Background (10 min)	
Data Point	CPM
1	461
2	488
3	472
4	
5	
6	
7	
8	
9	
10	

Source (1 min)		
Data Point	Gross counts	Net counts
1	2,108	2,061
2	2,154	2,107
3	2,357	2,310
4	2,205	2,158
5	2,384	2,337
6	2,345	2,298
7	2,231	2,184
8	2,337	2,290
9	2,378	2,331
10	2,268	2,221

Average Net Count:	2229
Standard Deviation:	99
20% of Net Count:	445.9
Average minus 2 X standard deviation:	2032
Average plus 2 X standard deviation:	2426
Average minus 20%:	1783
Average plus 20%:	2675

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 4/11/13
Reviewed By:	Date:



INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL		2929		CALIBRATION Due Date		RADIONUCLIDE		Tl230	
	SERIAL #		185291		11/15/13		ID		99TH470-0270	
DETECTOR	MODEL		43-10-1		CALIBRATION Due Date		RADIONUCLIDE			
	SERIAL #		PR194723		11/15/13		ID			
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	10- MIN. BKGD. READING	SOURCE CHECK		PASS/ FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS	
					GROSS	NET				
4/20/13	NA	S	NA	4	2209	2028.6	P	AG		
4/21/13	NA	S	NA	3	1939	1938.7	P	AG		
4/28/13	NA	S	NA	1	1991	1990.9	P	AG		
4/30/13	NA	S	NA	2	1998	1997.8	P	AG		
5/1/13	NA	S	NA	5	1987	1986.5	P	AG		
5/2/13	NA	S	NA	4	1954	1953.6	P	AG		
5/4/13	NA	S	NA	5	2072	2071.5	P	AG		
5/5/13	NA	S	NA	2	1963	1962.8	P	AG		
5/17/13	NA	S	NA	7	2143	2142.3	P	AG		
5/20/13	NA	S	NA	1	1947	1946.9	P	AG		
5/21/13	NA	S	NA	4	2047	2046.6	P	AG		
7/22/13	NA	S	NA	6	1995	1994.4	P	AG		
7/27/13	NA	S	NA	2	1891	1890.8	P	AG		
7/30/13	NA	S	NA	6	1822	1821.4	P	AG		
8/1/13	NA	S	NA	9	1854	1853.4	P	AG		
8/9/13	NA	S	NA	10	1824	1823.0	P	AG		
8/12/13	NA	S	NA	10	1886	1885.0	P	AG		
8/13/13	NA	S	NA	11	2012	2010.9	P	AG		
9/25/13	NA	S	NA	6	1888	1887.4	P	AG		
10/23/13	NA	S	NA	10	1925	1924.0	P	AG		
								AG		
								AG		

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

1564 cpm to 2345 cpm

Tl230

Data Reviewed By:

Date Reviewed:

10/23/13

	INSTRUMENT SOURCE CHECK FORM
Project Number: _____	Project Name: PADEP _____

CHECK SOURCES

METER	MODEL		2929		CALIBRATION Due Date		RADIONUCLIDE		ID
	SERIAL #		185291		11/15/13		ID		
DETECTOR	MODEL		43-10-1		CALIBRATION Due Date		RADIONUCLIDE		ID
	SERIAL #		PA194723		11/15/13		ID		
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	10- MIN. BKGD. READING	SOURCE CHECK		PASS/ FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS
					GROSS	NET			
4/20/13	NA	S	NA	466	2247	2200	P	AG	
4/21/13	NA	S	NA	430	2283	2240	P	AG	
4/28/13	NA	S	NA	508	2256	2205	P	AG	
4/30/13	NA	S	NA	360	2217	2181	P	AG	
5/1/13	NA	S	NA	615	2288	2227	P	AG	
5/2/13	NA	S	NA	512	2238	2187	P	AG	
5/4/13	NA	S	NA	454	2216	2171	P	AG	
5/5/13	NA	S	NA	423	2258	2226	P	AG	
5/17/13	NA	S	NA	485	2215	2167	P	AG	
5/20/13	NA	S	NA	473	2231	2184	P	AG	
5/21/13	NA	S	NA	475	2306	2259	P	AG	
7/22/13	NA	S	NA	582	2235	2177	P	AG	
7/27/13	NA	S	NA	456	2058	2012	P	AG	
7/30/13	NA	S	NA	395	2097	2058	P	AG	
8/1/13	NA	S	NA	371	2139	2102	P	AG	
8/9/13	NA	S	NA	521	2137	2085	P	AG	
8/12/13	NA	S	NA	454	2184	2139	P	AG	
8/13/13	NA	S	NA	489	2299	2250	P	AG	
9/25/13	NA	S	NA	437	2109	2065	P	AG	
10/23/13	NA	S	NA	771	2361	2284	P	AG	

Go-437 Check Source: AVG +/- 20 % Net Source Response Limits are: TC-99

1783 cpm to 2675 cpm

Data Reviewed By: _____

Date Reviewed: 10/23/13



Calibration Certificate

12/2/2013

Calibration Certificate for 2929, Serial # 143878, Bar Code # ,Property # SEC-5329

Date: 10/24/13

Date Last Cal. Expires: 07/21/12

Technician: Carl Hall

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 132896

CAL DUE: 12/20/13

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

AS FOUND

AS LEFT

Beta Channel Window (4-50 mV):

4.0-50.7 mV

4.0-50.0 mV

Alpha Channel Threshold (175 mV):

185 mV

175 mV

Alpha Counts w/Pulser @ 10,000 CPM:

10,002 CPM

AF CPM % Error: 0.02%

Beta Counts w/Pulser @ 10,000 CPM:

10,002 CPM

AF CPM % Error: 0.02%

If AS FOUND data in Scaler Function Check is within 10%, the technician may place AF in AS LEFT section and proceed to High Voltage power supply section.

HIGH VOLTAGE POWER SUPPLY CALIBRATION

AS FOUND

AS LEFT

Vernier Setting:

3.50

AF

HV Setpoints:

850 V

AF V

500 V Reading:

489 V

AF V

1000 V Reading:

1003 V

AF V

1500 V Reading:

1524 V

AF V

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: 250.2 K

% ERR: 0.08%

AL 250K: AF

K % ERR: 0.08%

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

Comments: Married as a set with: Model: 43-10-1

Serial #: PR147628

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

10/24/14

Performed by:

Reviewed by:

Date: 10-24-13

Printed Name:

Carl Hall

Printed Name: Carl Hall

Form HPM-2-1-1

Performance Check Values

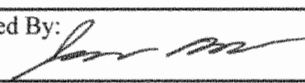
Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2929	Technician:	J. Hubler
Instrument S/N:	143878	Date:	10/30/2013
Calibration Due:	10/24/2014	Detector Model:	43-10-1
Radiation Detected:	Alpha	Detector S/N:	PR147628
Source Isotope:	Th-230	Detector Type:	Scintillator
Source Serial #:	99TH470-0270	Average BKG CPM:	0.93

Background (10 min)	
Data Point	CPM
1	11
2	4
3	13
4	
5	
6	
7	
8	
9	
10	

Source (1 min)		
Data Point	Gross counts	Net counts
1	1,980	1,979
2	1,936	1,935
3	2,000	1,999
4	2,013	2,012
5	1,991	1,990
6	2,025	2,024
7	1,945	1,944
8	2,061	2,060
9	2,037	2,036
10	2,023	2,022

Average Net Count:	2000
Standard Deviation:	39
20% of Net Count:	400.0
Average minus 2 X standard deviation:	1921
Average plus 2 X standard deviation:	2079
Average minus 20%:	1600
Average plus 20%:	2400

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By: 	Date: 10/30/13
Reviewed By:	Date:

Form HPM-2-1-1

Performance Check Values

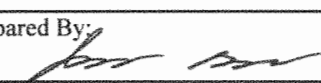
Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2929	Technician:	J. Hubler
Instrument S/N:	143878	Date:	10/30/2013
Calibration Due:	10/24/2014	Detector Model:	43-10-1
Radiation Detected:	Beta	Detector S/N:	PR147628
Source Isotope:	Tc-99	Detector Type:	Scintillator
Source Serial #:	97TC470-2443	Average BKG CPM:	41

Background (10 min)	
Data Point	CPM
1	421
2	407
3	407
4	
5	
6	
7	
8	
9	
10	

Source (1 min)		
Data Point	Gross counts	Net counts
1	2,107	2,066
2	2,237	2,196
3	2,193	2,152
4	2,172	2,131
5	2,167	2,126
6	2,169	2,128
7	2,164	2,123
8	2,072	2,031
9	2,219	2,178
10	2,221	2,180

Average Net Count:	2131
Standard Deviation:	51
20% of Net Count:	426.2
Average minus 2 X standard deviation:	2029
Average plus 2 X standard deviation:	2233
Average minus 20%:	1705
Average plus 20%:	2557

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 10/30/13
Reviewed By:	Date:

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

~~Ge-137~~ Check Source: AVG +/- 20 % Net Source Response Limits are:
Th 232

1600 cpm to 2400 cpm

Data Reviewed By:

Date Reviewed:

2/14/14

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Es-137-Check Source: AVG +/- 20 % Net Source Response Limits are:

1600 to 2400

TC-99

Data Reviewed By:

Date Reviewed:

2/14/14



Calibration Certificate

7/9/2012

Calibration Certificate for 2221, Serial # 262321, Bar Code #, Property # SEC-6972

Date: 07/09/12

Date Last Cal. Expires: 03/06/13

Technician: Thomas Thompson

Location: 9999

Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION

MODEL: SERIAL #: CAL DUE:

MODEL: SERIAL #: CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

New Batteries?

AF Mechanical Zero: 0

(+/- 10% tolerance)

500 V: 504 V

501 V

Threshold ratio: 100=10mV

AL Mechanical Zero: 0

1000 V: 1005 V

1000 V

AF THRESHOLD: 35 mV

AF HV Reading: 1043 V

1500 V: 1505 V

1497 V

AL THRESHOLD: 35 mV

AL HV Reading: 1050 V

RATE METER

DIGITAL SCALER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x1 or	100	100	0.00%	AF	0.00%
x1	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 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%

AF 250: 251	% ERR: 0.40%	AL 250: AF	% ERR: 0.40%
AF 2500: 2508	% ERR: 0.32%	AL 2500: AF	% ERR: 0.32%
AF 25K: 25.08 K	% ERR: 0.32%	AL 25K: AF K	% ERR: 0.32%
AF 250K: 250.7 K	% ERR: 0.28%	AL 250K: AF K	% ERR: 0.28%

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

LOG SCALE

AF 200: 200	% ERR: 0.00%	AL 200: AF	% ERR: 0.00%
AF 2000: 2000	% ERR: 0.00%	AL 2000: AF	% ERR: 0.00%
AF 20K: 20 K	% ERR: 0.00%	AL 20K: AF K	% ERR: 0.00%
AF 200K: 200 K	% ERR: 0.00%	AL 200K: AF K	% ERR: 0.00%

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

REPRODUCIBILITY

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?☒ Fast / Slow Response Function Properly?

Audio Response: SAT

Audio Divide: SAT

Push Buttons: SAT

Lamp: SAT

Scaler/Digital: SAT

Comments: Married as a set with: Model: 44-10

Serial #: PR134981

Bar Code #:

Replaced 2 sec chip 26107N02 with 1 sec chip 26102N07

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 07/09/13

Performed by:

Printed Name: Thomas Thompson

Reviewed by:

Date: 7/12/12



Calibration Certificate

7/9/2012

Calibration Certificate for 44-10, Serial # PR194981, Bar Code #, Property # SEC-7336

Date: 07/09/12

Date Last Cal Expires: 03/06/13

Technician: Thomas Thompson

Location: 9999

Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION

MODEL: 2221

SERIAL #: 262321

CAL DUE: 07/09/13

MODEL:

SERIAL #:

CAL DUE:

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2 π	ASSAY DATE
99-0292	Cs-137	7.03 uCi		1/30/2012

Efficiency from Last Calibration: 0.64 %

HV From Last Calibration: 1050 V

Calibration Threshold: 10 mV

AS FOUND DATA

AS FOUND Instrument Condition: SAT

HV: 1050 V

Center: 113851

Background: 3977

Probe Efficiency: Cs-137 0.70%

1 MINUTE COUNTS (CPM)

AS LEFT DATA after repair of HV adjust

AS LEFT Instrument Condition: SAT

HV: AF V

Center:

Background:

Probe Efficiency: Cs-137

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☒ Is the As Found Efficiency Within 20% of the efficiency from the last cal.?Reproducibility: Isotope: Cs-137 113788 113140 114123 Average: 113664 ☒ Are the individual counts within 10% of the average?

* If As Found Efficiency (even after repair) is within 10% of the last calibration and uniformity is <10%, the technician may N/A the Plateau Data and proceed to Comments. Geometry = Nai probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU AND SET POINT DATA (CPM)

High Voltage	Source Response	Background	HV	CENTER	Background	Efficiency
N/A			V			Cs-137

Comments: Married as a set with:

Model: 2221

Serial #: 262321

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

07/09/13

Performed by:

Reviewed by:

Date: 7/12/13

Printed Name:

Thomas Thompson

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	Model 2221	Technician:	J. Hubler
Instrument S/N:	262321	Date:	4/11/2013
Calibration Due:	7/9/2013	Detector Model:	44-10
Radiation Detected:	Gamma	Detector S/N:	PR194981
Source Isotope:	Cs-137	Detector Type:	Scintillator
Source Serial #:	314	Average BKG CPM:	7184

Background (1 min)	
Data Point	CPM
1	7,250
2	6,931
3	7,131
4	7,190
5	7,265
6	7,230
7	7,236
8	7,229
9	7,229
10	7,148

Source (1 min)		
Data Point	Gross counts	Net counts
1	30,441	23,257
2	30,393	23,209
3	30,607	23,423
4	30,608	23,424
5	30,266	23,082
6	30,794	23,610
7	30,575	23,391
8	30,748	23,564
9	30,668	23,484
10	30,206	23,022

Average Net Count:	23347
Standard Deviation:	198
20% of Net Count:	4669
Average minus 2 X standard deviation:	22951
Average plus 2 X standard deviation:	23742
Average minus 20%:	18677
Average plus 20%:	28016

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By: 	Date: 4/11/13
Reviewed By:	Date:

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

18677 cpm to 28016 cpm

Data Reviewed By:

Date Reviewed:

6-20-13



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-403 Rev 3

2800 Solway Road, Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

8/10/2012

Calibration Certificate for 2221, Serial # 172029, Bar Code # , Property # SEC-5533

Date: 08/10/12

Date Last Cal. Expires: 07/18/12

Technician: Carl Hall

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 132896

CAL DUE: 01/26/13

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

☒ New Batteries?

AF Mechanical Zero: 0

(+/- 10% tolerance)

500 V: 502 V

AF V

Threshold ratio: 100=10mV

AL Mechanical Zero: 0

1000 V: 1003 V

AF V

AF THRESHOLD: 10.3 mV

AF HV Reading: 1000 V

1500 V: 1503 V

AF V

AL THRESHOLD: 10.0 mV

AL HV Reading: 1000 V

RATE METER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

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

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:	250.2 K	% ERR:	0.08%	AL 250K:	AF K	% ERR:	0.08%

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

LOG SCALE

AF 200:	200	% ERR:	0.00%	AL 200:	AF	% ERR:	0.00%
AF 2000:	2000	% ERR:	0.00%	AL 2000:	AF	% ERR:	0.00%
AF 20K:	20 K	% ERR:	0.00%	AL 20K:	AF K	% ERR:	0.00%
AF 200K:	200 K	% ERR:	0.00%	AL 200K:	AF K	% ERR:	0.00%

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

REPRODUCIBILITY

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

Audio Divide: SAT

Push Buttons: SAT

Lamp: SAT

Scaler/Digital: SAT

☒ Fast / Slow Response Function Properly?

Comments: Married as a set with: Model: 44-10

Serial #: PR276591

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

08/10/13

Performed by:

Printed Name:

Carl Hall

Reviewed by:

Date:

8-10-12

Form HPM-2-1-1

Performance Check Values

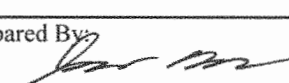
Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	Model 2221	Technician:	J. Hubler
Instrument S/N:	172029	Date:	4/11/2013
Calibration Due:	8/10/2013	Detector Model:	44-10
Radiation Detected:	Gamma	Detector S/N:	PR276591
Source Isotope:	Cs-137	Detector Type:	Scintillator
Source Serial #:	314	Average BKG CPM:	7720

Background (1 min)	
Data Point	CPM
1	7,481
2	7,827
3	7,771
4	7,824
5	7,964
6	7,599
7	7,831
8	7,499
9	7,751
10	7,654

Source (1 min)		
Data Point	Gross counts	Net counts
1	33,313	25,593
2	33,612	25,892
3	33,825	26,105
4	33,583	25,863
5	33,397	25,677
6	33,829	26,109
7	33,457	25,737
8	33,411	25,691
9	33,418	25,698
10	33,570	25,850

Average Net Count:	25821
Standard Deviation:	177
20% of Net Count:	5164.3
Average minus 2 X standard deviation:	25467
Average plus 2 X standard deviation:	26176
Average minus 20%:	20657
Average plus 20%:	30986

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 4/11/13
Reviewed By:	Date:



INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL		2221		CALIBRATION		RADIONUCLIDE		Cs-137
	SERIAL #		172029		DUE DATE: 8/10/13		ID		
DETECTOR	MODEL		44-10		CALIBRATION		RADIONUCLIDE		314
	SERIAL #		276591		DUE DATE: 8/10/13		ID		
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	1- MIN. BKGD. READING	SOURCE CHECK		PASS / FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS
					GROSS	NET			
4/15/13	S	S	F	10041	31466	21425	P	JmH	
4/16/13	S	S	F	11085	34311	23226	P	JmH	
4/17/13	S	S	F	8300	34611	26311	P	JmH	
4/18/13	S	S	F	5422	31765	26343	P	JmH	
4/19/13	S	S	F	9784	31897	22113	P	JmH	
4/26/13	S	S	F	3724	27059	23335	P	JmH	
4/30/13	S	S	F	3666	26450	22784	P	JmH	
5/1/13	S	S	F	4538	27308	22770	P	JmH	
5/3/13	S	S	F	13405	35743	22338	P	JmH	
5/13/13	S	S	F	4744	27952	23208	P	JmH	
5/14/13	S	S	F	5556	26654	21098	P	JmH	
5/15/13	S	S	F	5586	28116	22530	P	JmH	
5/16/13	S	S	F	5694	31654	25960	P	JmH	
6/5/13	S	S	F	4657	27216	22559	P	JmH	
6/6/13	S	S	F	4589	27355	22766	P	JmH	
6/7/13	S	S	F	5361	28116	22755	P	JmH	
6/10/13	S	S	F	6602	28460	21858	P	JmH	
6/17/13	S	S	F	12929	34327	21448	P	JmH	
6/18/13	S	S	F	13190	34748	21558	P	JmH	
6/19/13	S	S	F	3894	25795	21901	P	JmH	
6/20/13	S	S	F	9379	32544	23165	P	JmH	
6/28/13	S	S	F	4971	32779	27808	P	JmH	
7/1/13	S	S	F	4949	33683	28734	P	JmH	
7/16/13	S	S	F	4391	33489	24098	P	JmH	
7/18/13	S	S	F	6100	32243	26143	P	JmH	
7/22/13	S	S	F	5096	34063	28967	P	JmH	
7/25/13	S	S	F	5276	28364	23058	P	JmH	
7/26/13	S	S	F	4740	26956	22216	P	JmH	
7/29/13	S	S	F	7304	29641	22337	P	JmH	
7/30/13	S	S	P	3723	25788	22065	A	JmH	
7/31/13	S	S	F	4130	26839	22709	P	JmH	

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

20657 cpm to 30986 cpm

Data Reviewed By:

Date Reviewed:

7-31-13

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

20657 to 30986

Data Reviewed By:

Date Reviewed:

8-6-13



Safety and Ecology Corporation SEC PROCEDURE # SEC-IS-403 Rev 3
2800 Solway Road, Knoxville, TN 37931
Calibration Certificate

Page 1 of 1
6/25/2013

Calibration Certificate for 2221, Serial # 262321, Bar Code # , Property # SEC-6972

Date: 06/25/13 Date Last Cal. Expires: 07/09/13 Technician: Thomas Thompson
Location: 9999 Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2 SERIAL #: 190580 CAL DUE: 07/28/13
MODEL: SERIAL #: CAL DUE:

AS FOUND DATA

Geotropism: SAT AS FOUND Instrument Condition: SAT AS LEFT Instrument Condition: SAT
HIGH VOLTAGE **AS FOUND HV** **AS LEFT HV** ☐ New Batteries? AF Mechanical Zero: 0
(+/- 10% tolerance) 500 V: 497 V 502 V Threshold ratio: 100=10mV AL Mechanical Zero: 0
1000 V: 993 V 1000 V AF THRESHOLD: 10 mV AF HV Reading: 1038 V
1500 V: 1487 V 1499 V AL THRESHOLD: 10 mV AL HV Reading: 1050 V

RATE METER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

DIGITAL SCALER

AF 250: 250 % ERR: 0.00% AL 250: AF % ERR: 0.00%
AF 2500: 2497 % ERR: 0.12% AL 2500: AF % ERR: 0.12%
AF 25K: 24.97 K % ERR: 0.12% AL 25K: AF K % ERR: 0.12%
AF 250K: 249.7 K % ERR: 0.12% AL 250K: AF K % ERR: 0.12%

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

LOG SCALE

AF 200: 200 % ERR: 0.00% AL 200: AF % ERR: 0.00%
AF 2000: 2000 % ERR: 0.00% AL 2000: AF % ERR: 0.00%
AF 20K: 20 K % ERR: 0.00% AL 20K: AF K % ERR: 0.00%
AF 200K: 200 K % ERR: 0.00% AL 200K: AF K % ERR: 0.00%

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

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

REPRODUCIBILITY

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

Audio Response: SAT

Audio Divide: SAT

Push Buttons: SAT

Lamp: SAT

Scaler/Digital: SAT

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

☒ Fast / Slow Response Function Properly?

Comments: Married as a set with: Model: 44-10 Serial #: PR194981 Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?

☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

06/25/14

Performed by:
Printed Name: Thomas Thompson

Reviewed by:
Date: 6/26/13



Safety and Ecology Corporation SEC PROCEDURE # SEC-IS-415 Rev 3
2800 Solway Road, Knoxville, TN 37931
Calibration Certificate

Page 1 of 1

6/25/2013

Calibration Certificate for 44-10, Serial # PR194981, Bar Code # , Property # SEC-7336

Date: 06/25/13

Date Last Cal. Expires: 07/09/13

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 2221

SERIAL #: 262321

CAL DUE: 06/25/14

MODEL:

SERIAL #:

CAL DUE:

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2 π	ASSAY DATE
99-0292	Cs-137	7.03 μ Ci		1/30/2012

Efficiency from Last Calibration: 0.70 %

HV From Last Calibration: 1050 V

Calibration Threshold: 10 mV

AS FOUND DATA

AS FOUND Instrument Condition: SAT

HV: 1050 V

Center: 111537

Background: 3814

Probe Efficiency: Cs-137 0.69%

1 MINUTE COUNTS (CPM)

AS LEFT DATA after repair of HV adjust

AS LEFT Instrument Condition: SAT

HV: 1050 V

Center: 111592

Background: 4082

Probe Efficiency: Cs-137 0.69%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☒ Is the As Found Efficiency Within 20% of the efficiency from the last cal.?

Reproducibility: Isotope: Cs-137 111481 110348 112126

Average: 111318

☒ Are the individual counts within 10% of the average?

* If As Found Efficiency after repair, is within 10% of the last calibration and uniformity $\pm 10\%$, the technician may N/A the Plateau Data and proceed to Comments. Geometry = Nal probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU AND SET POINT DATA (CPM)

High Voltage	Source Response	Background	HV	CENTER	Background	Efficiency
N/A			V			Cs-137

Comments: Married as a set with:

Model: 2221

Serial #: 262321

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?

☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

06/25/14

Performed by:

Reviewed by:

Date: 6/26/13

Printed Name: Thomas Thompson

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	Model 2221	Technician:	J. Hubler
Instrument S/N:	262321	Date:	4/11/2013
Calibration Due:	6/25/2014	Detector Model:	44-10
Radiation Detected:	Gamma	Detector S/N:	PR194981
Source Isotope:	Cs-137	Detector Type:	Scintillator
Source Serial #:	314	Average BKG CPM:	7795

Background (1 min)	
Data Point	CPM
1	7,959
2	7,143
3	7,608
4	8,091
5	7,959
6	8,054
7	7,868
8	7,882
9	7,817
10	7,570

Source (1 min)		
Data Point	Gross counts	Net counts
1	30,592	22,797
2	30,695	22,900
3	30,957	23,162
4	30,729	22,934
5	30,368	22,573
6	30,944	23,149
7	31,001	23,206
8	31,166	23,371
9	30,827	23,032
10	30,322	22,527

Average Net Count:	22965
Standard Deviation:	275
20% of Net Count:	4593
Average minus 2 X standard deviation:	22416
Average plus 2 X standard deviation:	23514
Average minus 20%:	18372
Average plus 20%:	27558

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 4/11/13
Reviewed By:	Date:



INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL	3221		CALIBRATION		RADIONUCLIDE		Cs-137	
	SERIAL #	262321		DUE DATE: 6/25/14		ID		314	
DETECTOR	MODEL	44-10		CALIBRATION		RADIONUCLIDE			
	SERIAL #	194981		DUE DATE: 6/25/14		ID			
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	1-MIN. BKGD. READING	SOURCE CHECK GROSS NET		PASS / FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS
7/1/13	S	S	F	5367	31411	26044	P	JmH	
7/8/13	S	S	F	5890	30629	24739	P	JmH	
7/15/13	S	S	F	4396	30707	26311	P	JmH	
7/16/13	S	S	F	6135	32554	26419	P	JmH	
7/18/13	S	S	F	6818	29879	23061	P	JmH	
7/22/13	S	S	F	5064	31848	26784	P	JmH	
7/23/13	S	S	F	4393	30620	26227	P	JmH	
7/24/13	S	S	F	3467	29259	25792	P	JmH	
7/25/13	S	S	F	4544	30595	26051	P	JmH	
7/26/13	S	S	F	4582	31403	26841	P	JmH	
7/29/13	S	S	F	7703	33460	25757	P	JmH	
7/30/13	S	S	F	3730	30082	26352	P	JmH	
7/31/13	S	S	F	5370	30946	25576	P	JmH	
8/1/13	S	S	F	5100	31688	20588	P	JmH	
8/5/13	S	S	F	4634	30369	25735	P	JmH	
8/6/13	S	S	F	6502	32251	25749	P	JmH	
8/8/13	S	S	F	5782	31642	25860	P	JmH	
8/26/13	S	S	F	8080	35514	27434	P	JmH	
8/27/13	S	S	F	8811	35595	26784	P	JmH	
8/28/13	S	S	F	9321	34825	25504	P	JmH	
9/4/13	S	S	F	11464	37435	25971	P	JmH	
9/5/13	S	S	F	6922	33570	26648	P	JmH	
9/6/13	S	S	F	9229	34810	25581	P	JmH	
9/11/13	S	S	F	7001	32817	25816	P	JmH	
9/13/13	S	S	F	3878	30010	26132	P	JmH	
9/20/13	S	S	F	8637	28321	19684	P	JmH	
10/7/13	S	S	F	6967	32510	25543	P	JmH	
10/8/13	S	S	F	4017	30819	26802	P	JmH	
10/9/13	S	S	F	8821	36008	27187	P	JmH	
10/14/13	S	S	F	4929	30557	25628	P	JmH	
10/15/13	S	S	F	4924	30530	25606	P	JmH	

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

18372 cpm to 27558 cpm

Data Reviewed By:

Date Reviewed:

10-15-13



Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

18372 cpm to 27558 cpm

Data Reviewed By:

Date Reviewed:

1-7-14



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-403 Rev 3

2800 Solway Road, Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

10/14/2013

Calibration Certificate for 2221, Serial # 262318, Bar Code # ,Property # SEC-6971

Date: 10/14/13

Date Last Cal. Expires: 08/19/14

Technician: Jeffrey Knight

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 153622

CAL DUE: 12/20/13

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

☐ New Batteries?

AF Mechanical Zero: 0

(+/- 10% tolerance)

500 V: 510 V

507 V

Threshold ratio: 100=10mV

AL Mechanical Zero: 0

1000 V: 1009 V

1000 V

AF THRESHOLD: 9.8 mV

AF HV Reading: 925 V

1500 V: 1503 V

1490 V

AL THRESHOLD: 10.0 mV

AL HV Reading: 1050 V

RATE METER

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%
x1 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%

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

DIGITAL SCALER

AF 250:	251	% ERR:	0.40%	AL 250:	AF	% ERR:	0.40%
AF 2500:	2505	% ERR:	0.20%	AL 2500:	AF	% ERR:	0.20%
AF 25K:	25.04 K	% ERR:	0.16%	AL 25K:	AF K	% ERR:	0.16%
AF 250K:	250.4 K	% ERR:	0.16%	AL 250K:	AF K	% ERR:	0.16%

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

LOG SCALE

AF 200:	200	% ERR:	0.00%	AL 200:	AF	% ERR:	0.00%
AF 2000:	2000	% ERR:	0.00%	AL 2000:	AF	% ERR:	0.00%
AF 20K:	20 K	% ERR:	0.00%	AL 20K:	AF K	% ERR:	0.00%
AF 200K:	200 K	% ERR:	0.00%	AL 200K:	AF K	% ERR:	0.00%

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

REPRODUCIBILITY

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

Audio Divide: SAT

Push Buttons: SAT

Lamp: SAT

Scaler/Digital: SAT

☒ Fast / Slow Response Function Properly?

Comments: Married as a set with: Model: 44-10

Serial #: PR240330

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

10/14/14

Performed by:

Printed Name: Jeffrey Knight

Reviewed by:

Date: 10-14-13

Form HPM-2-1-1
Performance Check Values

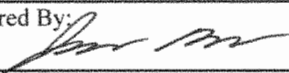
Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	Model 2221	Technician:	J. Hubler
Instrument S/N:	262318	Date:	10/15/2013
Calibration Due:	10/14/2014	Detector Model:	44-10
Radiation Detected:	Gamma	Detector S/N:	PR240330
Source Isotope:	Cs-137	Detector Type:	Scintillator
Source Serial #:	314	Average BKG CPM:	8212

Background (1 min)	
Data Point	CPM
1	8,271
2	7,972
3	8,136
4	8,391
5	8,279
6	8,258
7	8,350
8	8,256
9	8,249
10	7,953

Source (1 min)		
Data Point	Gross counts	Net counts
1	31,920	23,709
2	31,699	23,488
3	31,924	23,713
4	31,713	23,502
5	32,089	23,878
6	31,817	23,606
7	31,840	23,629
8	31,526	23,315
9	31,504	23,293
10	31,660	23,449

Average Net Count:	23558
Standard Deviation:	184
20% of Net Count:	4711.5
Average minus 2 X standard deviation:	23189
Average plus 2 X standard deviation:	23926
Average minus 20%:	18846
Average plus 20%:	28269

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By: 	Date: 10/15/13
Reviewed By:	Date:

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20% Net Source Response Limits are:

18846

to

28269

Data Reviewed By:

Date Reviewed:

7-18-14



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-403 Rev 3

2800 Solway Road, Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

6/28/2014

Calibration Certificate for 2221, Serial # 178106, Bar Code # ,Property # SEC-5541

Date: 06/28/14

Date Last Cal. Expires: 02/03/15

Technician: Jeffrey Knight

Location: 999999,

Reason For Calibration: Other (See Comments)

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 153622

CAL DUE: 12/13/14

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

☒ New Batteries?

AF Mechanical Zero: 0

(+/- 10% tolerance)

500 V: 510 V

507 V

Threshold ratio: 100=10mV

AL Mechanical Zero: 0

1000 V: 1006 V

1000 V

AF THRESHOLD: 8.9 mV

AF HV Reading: 1100 V

1500 V: 1507 V

1496 V

AL THRESHOLD: 10.0 mV

AL HV Reading: 1150 V

RATE METER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

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

DIGITAL SCALER

AF 250:	251	% ERR:	0.40%	AL 250:	AF	% ERR:	0.40%
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 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?

LOG SCALE

AF 200:	200	% ERR:	0.00%	AL 200:	AF	% ERR:	0.00%
AF 2000:	2000	% ERR:	0.00%	AL 2000:	AF	% ERR:	0.00%
AF 20K:	20 K	% ERR:	0.00%	AL 20K:	AF K	% ERR:	0.00%
AF 200K:	200 K	% ERR:	0.00%	AL 200K:	AF K	% ERR:	0.00%

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

REPRODUCIBILITY

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

Audio Divide: SAT

Push Buttons: SAT

Lamp: SAT

Scaler/Digital: SAT

☒ Fast / Slow Response Function Properly?

Comments: Married as a set with: Model: 44-10

Serial #: PR276591

Bar Code #:

Calibrated for new customer. Cleaned Circuit Boards.

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

06/28/15

Performed by:

Printed Name: Jeffrey Knight

Reviewed by:

Date: 6/30/14



Calibration Certificate for 44-10, Serial # PR276591, Bar Code # ,Property # SEC-6853

Date: 06/28/14 Date Last Cal. Expires: 08/10/13 Technician: Jeffrey Knight
Location: 999999, Reason For Calibration: Other (See Comments)

EQUIPMENT USED DURING CALIBRATION

MODEL: 2221 SERIAL #: 178106 CAL DUE: 06/28/15
MODEL: SERIAL #: CAL DUE:

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2 π	ASSAY DATE
99CS250-0288	Cs-137	6.655 uCi		12/26/2012

Efficiency from Last Calibration: 0.65 % HV From Last Calibration: 1000 V Calibration Threshold: 10 mV

AS FOUND DATA

AS FOUND Instrument Condition: SAT
HV: 1000 V
Center: 90328
Background: 3549
Probe Efficiency: Cs-137 0.59%

1 MINUTE COUNTS (CPM)

AS LEFT DATA after repair of HV adjust

AS LEFT Instrument Condition: SAT
HV: AF V
Center:
Background:
Probe Efficiency: Cs-137

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☒ Is the As Found Efficiency Within 20% of the efficiency from the last cal.?

Reproducibility: Isotope: Cs-137 95171 96176 95916 Average: 95754 ☒ Are the individual counts within 10% of the average?

* If As Found Efficiency (even after repair) is within 10% of the last calibration and uniformity is <10%, the technician may N/A the Plateau Data and proceed to Comments. Geometry = Nal probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU AND SET POINT DATA (CPM)

High Voltage	Source Response	Background	HV	CENTER	Background	Efficiency
1050	92152	3762	1150 V	95416	3828	Cs-137 0.62%
1100	93759	3814				
1150	95287	3882				
1200	96669	3972				

Comments: Married as a set with: Model: 2221 Serial #: 178106 Bar Code #:
Calibrated for new customer. New plateau to verify HV setting.

☒ Does Instrument Meet Final Acceptance Criteria?

☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/28/15

Performed by: Jeffrey Knight

Reviewed by: Date: 6/30/14

Printed Name: Jeffrey Knight

Form HPM-2-1-1

Performance Check Values

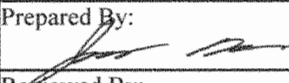
Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	Model 2221	Technician:	J. Hubler
Instrument S/N:	178106	Date:	7/8/2014
Calibration Due:	6/28/2015	Detector Model:	44-10
Radiation Detected:	Gamma	Detector S/N:	PR276591
Source Isotope:	Cs-137	Detector Type:	Scintillator
Source Serial #:	314	Average BKG CPM:	7848

Background (1 min)	
Data Point	CPM
1	7,821
2	7,920
3	7,923
4	7,870
5	7,735
6	8,011
7	7,898
8	7,754
9	7,729
10	7,814

Source (1 min)		
Data Point	Gross counts	Net counts
1	29,870	22,023
2	30,181	22,334
3	29,744	21,897
4	29,860	22,013
5	29,776	21,929
6	29,351	21,504
7	29,397	21,550
8	29,960	22,113
9	29,924	22,077
10	30,034	22,187

Average Net Count:	21962
Standard Deviation:	262
20% of Net Count:	4392.4
Average minus 2 X standard deviation:	21439
Average plus 2 X standard deviation:	22486
Average minus 20%:	17570
Average plus 20%:	26355

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By:	Date
	7/8/14
Reviewed By:	Date:

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20% Net Source Response Limits are:

17570

to

26355

Data Reviewed By:

Date Reviewed:

7-18-14



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-418 Rev 2

2800 Solway Road

Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

4/8/2013

Calibration Certificate for 2360, Serial # 227415, Bar Code #, Property # SEC-6124

Date: 04/08/13

Date Last Cal. Expires: 10/06/12

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 07/28/13

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

☒ New Batteries?

Battery Check: SAT

AS FOUND Mechanical Zero: 0

AS LEFT Mechanical Zero: 0

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

WINDOW SETTINGS

AS FOUND

AS LEFT

(+/- 10% tolerance)

500 V: 503 V

AF V

BT (4 mV +/- .4 mV):

3.1 mV

4 mV

1000 V: 1000 V

AF V

BW (40 mV +/- 4 mV):

40.7 mV

40 mV

1500 V: 1499 V

AF V

AT (120 mV +/- 10 mV):

120 mV

AF mV

AF HV Setting: 874 V

AL HV Setting: 540 V

RATE METER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

DIGITAL SCALER

AF 250: 250 % ERR: 0.00% AL 250: AF % ERR: 0.00%
AF 2500: 2495 % ERR: 0.20% AL 2500: AF % ERR: 0.20%
AF 25K: 24.95 K % ERR: 0.20% AL 25K: AF K % ERR: 0.20%
AF 250K: 249.5 K % ERR: 0.20% AL 250K: AF K % ERR: 0.20%

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

REPRODUCIBILITY

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: SAT

Overload Light: SAT

Low Battery (2.2V): SAT

Comments: Married as a set with: Model: 43-89

Serial #: PR240349

Bar Code #:

Repaired bent handle.

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

04/08/14

Performed by:

Reviewed by:

Date: 4/11/13

Printed Name:

Thomas Thompson



Calibration Certificate

Calibration Certificate for 43-89, Serial # PR240349, Bar Code #, Property # SEC-6140

Date: 04/08/13

Date Last Cal. Expires: 11/08/13

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due and Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2360 SERIAL #: 227415 CAL DUE 04/08/14

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2 π	ASSAY DATE
Efficiencies from last calibration					
Pu: 20.03 %	4071-02	Th-230	40300 dpm	20,500 cpm	3/8/2011
Tc: 12.21 %	4072-02	Tc-99	28300 dpm	17,700 cpm	3/8/2011
Th: 16.54 %	4076-02	Sr-90	12100 dpm	8,490 cpm	3/8/2011
SrY: 24.03 %	4079-02	Pu-239	28300 dpm	14,700 cpm	3/8/2011

AS FOUND DATA

AS FOUND Instrument Condition: UNSAT

Calibration Setpoints

HV: 540 V

Threshold Beta:	4	-	40	mV Alpha:	120 mV
Back	Alpha	Beta	AF Efficiencies	A-B XTLK	
ground:	0	CPM	0	CPM	0.00%
Pu-239:	0	CPM	0	CPM	0.00%
Tc-99:	0	CPM	0	CPM	0.00%
Th-230:	0	CPM	N/A	CPM	0.00%
SrY-90:	N/A	0	CPM	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV: 540 V

Back	Alpha	Beta	AL Efficiencies	A-B XTLK
ground:	1	CPM	264	CPM
Pu-239:	5241	CPM	774	CPM
Tc-99:	2	CPM	3552	CPM
Th-230:	6382	CPM	N/A	CPM
SrY-90:	N/A	3448	CPM	CPM

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility: Isotope: Sr-90 3694 3598 3502 Average: 3598.0 ☒ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Source 1: Tc-99

Source 2: Th-230

High Voltage	Response (CPM)			Response (CPM)			Background (CPM)		Net A to B
	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

2 Pi Efficiencies: Pu-239 35.65% Tc-99 18.58% Th-230 31.13% SrY-90 37.50%**Comments:** Married as a set with: Model: 2360 Serial #: 227415 Bar Code #: Replaced mylar.☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 04/08/14

Performed by:

Reviewed by:

Date: 4/11/13

Printed Name: Thomas Thompson

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	227415	Date:	4/11/2013
Calibration Due:	4/8/2014	Detector Model:	43-89
Radiation Detected:	Beta	Detector S/N:	PR240349
Source Isotope:	Tc-99	Detector Type:	Scintillator
Source Serial #:	97TC470-2443	Average BKG CPM:	326

Background (1 min)	
Data Point	CPM
1	319
2	309
3	320
4	335
5	312
6	334
7	339
8	328
9	330
10	335

Source (1 min)		
Data Point	Gross counts	Net counts
1	1,507	1,181
2	1,478	1,152
3	1,533	1,207
4	1,524	1,198
5	1,505	1,179
6	1,555	1,229
7	1,604	1,278
8	1,533	1,207
9	1,546	1,220
10	1,560	1,234

Average Net Count:	1208
Standard Deviation:	35
20% of Net Count:	241.7
Average minus 2 X standard deviation:	1139
Average plus 2 X standard deviation:	1278
Average minus 20%:	967
Average plus 20%:	1450

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By:	Date:
Reviewed By:	Date:

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	227415	Date:	4/11/2013
Calibration Due:	4/8/2014	Detector Model:	43-89
Radiation Detected:	Alpha	Detector S/N:	PR240349
Source Isotope:	Th-230	Detector Type:	Scintillator
Source Serial #:	99TH470-0270	Average BKG CPM:	2

Background (1 min)	
Data Point	CPM
1	1
2	4
3	1
4	3
5	3
6	2
7	2
8	3
9	1
10	2

Source (1 min)		
Data Point	Gross counts	Net counts
1	995	993
2	978	976
3	934	932
4	994	992
5	954	952
6	999	997
7	926	924
8	987	985
9	996	994
10	968	966

Average Net Count:	971
Standard Deviation:	27
20% of Net Count:	194.2
Average minus 2 X standard deviation:	917
Average plus 2 X standard deviation:	1025
Average minus 20%:	777
Average plus 20%:	1165

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By:	Date:
Reviewed By:	Date:



INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL		2360		CALIBRATION Due Date		RADIONUCLIDE		Th230	
	SERIAL #		227415		4/8/14		ID		99TH4700270	
DETECTOR	MODEL		43-89		CALIBRATION Due Date		RADIONUCLIDE			
	SERIAL #		PR240349		4/8/14		ID			
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	170 MIN. BKGD. READING	SOURCE CHECK		PASS/ FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS	
					GROSS	NET				
4/15/13	S	S	NA	1	878	877	P	JmH		
4/16/13	S	S	NA	0	863	863	P	JmH		
4/17/13	S	S	NA	0	861	861	P	JmH		
5/1/13	S	S	NA	1	834	833	P	JmH		
5/3/13	S	S	NA	0	822	822	P	JmH		
5/13/13	S	S	NA	1	901	900	P	JmH		
5/14/13	S	S	NA	0	895	895	P	JmH		
5/15/13	S	S	NA	0	893	893	P	JmH		
5/16/13	S	S	NA	0	905	905	P	JmH		
6/5/13	S	S	NA	0	891	891	P	JmH		
6/6/13	S	S	NA	1	855	854	P	JmH		
6/7/13	S	S	NA	0	856	856	P	JmH		
6/8/13	S	S	NA	0	866	866	P	JmH		
6/9/13	S	S	NA	0	847	847	P	JmH		
6/10/13	S	S	NA	0	823	823	P	JmH		
6/17/13	S	S	NA	0	917	917	P	JmH		
6/18/13	S	S	NA	1	895	894	P	JmH		
6/19/13	S	S	NA	0	936	936	P	JmH		
6/20/13	S	S	NA	0	869	869	P	JmH		
6/28/13	S	S	NA	0	827	827	P	JmH		
7/8/13	S	S	NA	0	830	830	P	JmH		
9/11/13	S	S	NA	1	906	906	P	JmH		

Check Source: AVG +/- 20 % Net Source Response Limits are:

Th230

777 cpm to 1.165 cpm

Data Reviewed By:

Date Reviewed:

9-11-13



Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

CS-137 Check Source: AVG +/- 20 % Net Source Response Limits are:
TC99

967 cm to 1450 cm

Data Reviewed By: [Signature]

Date Reviewed: 9-11-13



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-418 Rev 2

2800 Solway Road

Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

4/8/2013

Calibration Certificate for 2360, Serial # 164675, Bar Code # , Property # SEC-5431

Date: 04/08/13

Date Last Cal. Expires: 02/11/14

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 07/28/13

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

☒ New Batteries?

Battery Check: SAT

AS FOUND Mechanical Zero: <0

AS LEFT Mechanical Zero: 0

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

WINDOW SETTINGS

AS FOUND

AS LEFT

(+/- 10% tolerance)

500 V: 504 V

AF V

BT (4 mV +/- .4 mV):

3.9 mV

4 mV

1000 V: 1000 V

AF V

BW (40 mV +/- 4 mV):

40.6 mV

40 mV

1500 V: 1494 V

AF V

AT (120 mV +/- 10 mV):

120 mV

AF mV

AF HV Setting: 700 V

AL HV Setting: 670 V

RATE METER

SCALE	RATE CPM	AS FOUND	% ERROR	AS LEFT	% ERROR
x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

DIGITAL SCALER

AF 250:	250	% ERR: 0.00%	AL 250:	AF	% ERR: 0.00%
AF 2500:	2496	% ERR: 0.16%	AL 2500:	AF	% ERR: 0.16%
AF 25K:	24.95 K	% ERR: 0.20%	AL 25K:	AF K	% ERR: 0.20%
AF 250K:	249.5 K	% ERR: 0.20%	AL 250K:	AF K	% ERR: 0.20%

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

REPRODUCIBILITY

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: SAT

Overload Light: SAT

Low Battery (2.2V): SAT

Comments: Married as a set with: Model: 43-89 Serial #: PR176413 Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

04/08/14

Performed by:

Reviewed by:

Date: 4/11/13

Printed Name:

Thomas Thompson



Calibration Certificate

4/8/2013

Calibration Certificate for 43-89, Serial # PR176413, Bar Code #, Property # SEC-5340

Date: 04/08/13

Date Last Cal. Expires: 02/11/14

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION MODEL: 2360 SERIAL #: 164675 CAL DUE 04/08/14

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2 π	ASSAY DATE
Efficiencies from last calibration	4071-02	Th-230	40300 dpm	20,500 cpm	3/8/2011
Pu: 19.96 %	4072-02	Tc-99	28300 dpm	17,700 cpm	3/8/2011
Tc: 10.03 %	4076-02	Sr-90	12100 dpm	8,490 cpm	3/8/2011
Th: 17.48 %	4079-02	Pu-239	28300 dpm	14,700 cpm	3/8/2011
SrY: 25.26 %					

AS FOUND Instrument Condition: UNSAT
Calibration Setpoints
HV: 670 V

Threshold Beta:	4	-	40	mV Alpha:	120 mV
Back	Alpha	Beta	AF Efficiencies	A-B XTLK	
ground:	0	CPM	0	CPM	0.00% #Div/0!
Pu-239:	0	CPM	0	CPM	0.00%
Tc-99:	0	CPM	0	CPM	0.00%
Th-230:	0	CPM	N/A	CPM	0.00%
SrY-90:	N/A	0	CPM	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT
AS LEFT DATA after repair, HV adjust or Plateau

Back	Alpha	Beta	AL Efficiencies	A-B XTLK	
ground:	0	CPM	171	CPM	9.74%
Pu-239:	5440	CPM	701	CPM	19.22%
Tc-99:	1	CPM	3233	CPM	10.82%
Th-230:	6528	CPM	N/A	CPM	16.20%
SrY-90:	N/A	3134	CPM	CPM	24.49%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility: Isotope: Sr-90 3033 3135 3188 Average: 3118.7 ☒ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Source 1: Tc-99	Source 2: Th-230				
Response (CPM)	Response (CPM)	Background (CPM)	Net A to B		
High Voltage	A ch.	B ch.	Net Eff.	A ch.	B ch.
N/A					

2 Pi Efficiencies: Pu-239 37.01% Tc-99 17.30% Th-230 31.84% SrY-90 34.90%

Comments: Married as a set with: Model: 2360 Serial #: 164675 Bar Code #: Replaced mylar.

☒ Does Instrument Meet Final Acceptance Criteria?

☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 04/08/14

Performed by:

Reviewed by:

Date: 4/11/13

Printed Name: Thomas Thompson

Form HPM-2-1-1
Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	164675	Date:	4/11/2013
Calibration Due:	4/8/2014	Detector Model:	43-89
Radiation Detected:	Alpha	Detector S/N:	PR176413
Source Isotope:	Th-230	Detector Type:	Scintillator
Source Serial #:	99TH470-0270	Average BKG CPM:	2

Background (1 min)	
Data Point	CPM
1	2
2	4
3	1
4	1
5	1
6	2
7	2
8	2
9	3
10	4

Source (1 min)		
Data Point	Gross counts	Net counts
1	844	842
2	889	887
3	887	885
4	886	884
5	913	911
6	837	835
7	904	902
8	888	886
9	872	870
10	853	851

Average Net Count:	875
Standard Deviation:	25
20% of Net Count:	175.0
Average minus 2 X standard deviation:	825
Average plus 2 X standard deviation:	926
Average minus 20%:	700
Average plus 20%:	1050

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By:	Date:
Reviewed By:	Date:

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	164675	Date:	4/11/2013
Calibration Due:	4/8/2014	Detector Model:	43-89
Radiation Detected:	Beta	Detector S/N:	PR176413
Source Isotope:	Tc-99	Detector Type:	Scintillator
Source Serial #:	97TC470-2443	Average BKG CPM:	218

Background (1 min)	
Data Point	CPM
1	233
2	205
3	222
4	228
5	227
6	224
7	237
8	221
9	196
10	185

Source (1 min)		
Data Point	Gross counts	Net counts
1	1,382	1,164
2	1,358	1,140
3	1,335	1,117
4	1,315	1,097
5	1,329	1,111
6	1,361	1,143
7	1,348	1,130
8	1,314	1,096
9	1,366	1,148
10	1,300	1,082

Average Net Count:	1123
Standard Deviation:	26
20% of Net Count:	224.6
Average minus 2 X standard deviation:	1070
Average plus 2 X standard deviation:	1176
Average minus 20%:	898
Average plus 20%:	1348

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By:	Date:
Reviewed By:	Date:

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Cs-137 Check Source: AVG +/- 20 % Net Source-Response Limits are:

898 cpm to 1348 cpm

Data Reviewed By:

Date Reviewed:

4-30-13



Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

05-157 Check Source: AVG +/- 20 % Net Source Response Limits are:

Tn230

700 cpm to 1050 cpm

Data Reviewed By:

Date Reviewed:

4-30-13



Safety and Ecology Corporation

SEC PROCEDURE # SEC-IS-418 Rev 2

2800 Solway Road

Knoxville, TN 37931

Calibration Certificate

Page 1 of 1

6/25/2013

Calibration Certificate for 2360, Serial # 227389, Bar Code # ,Property # SEC-6117

Date: 06/25/13

Date Last Cal. Expires: 02/28/13

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2

SERIAL #: 190580

CAL DUE: 07/28/13

MODEL:

SERIAL #:

CAL DUE:

AS FOUND DATA

Geotropism: SAT

AS FOUND Instrument Condition: SAT

AS LEFT Instrument Condition: SAT

☐ New Batteries?

Battery Check: SAT

AS FOUND Mechanical Zero: 0

AS LEFT Mechanical Zero: 0

HIGH VOLTAGE

AS FOUND HV

AS LEFT HV

WINDOW SETTINGS

AS FOUND

AS LEFT

(+/- 10% tolerance)

500 V: 508 V

AF V

BT (4 mV +/- .4 mV):

4 mV

AF mV

1000 V: 1000 V

AF V

BW (40 mV +/- 4 mV):

38.2 mV

40 mV

1500 V: 1507 V

AF V

AT (120 mV +/- 10 mV):

120 mV

AF mV

AF HV Setting: 704 V

AL HV Setting: 660 V

RATE METER

SCALE RATE CPM AS FOUND % ERROR AS LEFT % ERROR

x.1 or x1	100	100	0.00%	AF	0.00%
	250	250	0.00%	AF	0.00%
	400	400	0.00%	AF	0.00%
x1 or x10	1000	1000	0.00%	AF	0.00%
	2500	2500	0.00%	AF	0.00%
	4000	4000	0.00%	AF	0.00%
x10 or x100	10K	10	0.00%	AF	0.00%
	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%
	400K	400	0.00%	AF	0.00%

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

DIGITAL SCALER

AF 250: 250 % ERR: 0.00% AL 250: AF % ERR: 0.00%
AF 2500: 2499 % ERR: 0.04% AL 2500: AF % ERR: 0.04%
AF 25K: 24.98 K % ERR: 0.08% AL 25K: AF K % ERR: 0.08%
AF 250K: 249.8 K % ERR: 0.08% AL 250K: AF K % ERR: 0.08%

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

REPRODUCIBILITY

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: Model: 43-89

Serial #: PR240337

Bar Code #:

☒ Does Instrument Meet Final Acceptance Criteria?☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration:

06/25/14

Performed by:

Reviewed by:

Date: 6/26/13

Printed Name:

Thomas Thompson



Calibration Certificate

6/25/2013

Calibration Certificate for 43-89, Serial # PR240337, Bar Code #, Property # SEC-6141

Date: 06/25/13

Date Last Cal. Expires: 02/28/13

Technician: Thomas Thompson

Location: 9999,

Reason For Calibration: Due and Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2360 SERIAL #: 227389 CAL DUE 06/25/14

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
Efficiencies from last calibration					
Pu: 18.03 %	4071-02	Th-230	40300 dpm	20,500 cpm	3/8/2011
Tc: 10.34 %	4072-02	Tc-99	28300 dpm	17,700 cpm	3/8/2011
Th: 15.38 %	4076-02	Sr-90	12100 dpm	8,490 cpm	3/8/2011
SrY: 26.23 %	4079-02	Pu-239	29000 dpm	14,700 cpm	3/8/2011

AS FOUND DATA

AS FOUND Instrument Condition: UNSAT
Calibration Setpoints

HV: 660 V

Threshold Beta: 4 - 40 mV Alpha: 120 mV

Back	Alpha	Beta	AF Efficiencies	A-B XTLK
ground: 0 CPM	368 CPM	CPM	17.82%	5.61%
Pu-239: 5169 CPM	658 CPM	CPM	9.37%	
Tc-99: 0 CPM	3021 CPM	CPM	15.47%	
Th-230: 6233 CPM	N/A	CPM	23.26%	
SrY-90: N/A	3182 CPM	CPM		

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV: 660 V

Back	Alpha	Beta	AL Efficiencies	A-B XTLK
ground: 0 CPM	242 CPM	CPM	18.38%	7.90%
Pu-239: 5330 CPM	663 CPM	CPM	10.60%	
Tc-99: 2 CPM	3241 CPM	CPM	15.88%	
Th-230: 6401 CPM	N/A	CPM	26.36%	
SrY-90: N/A	3432 CPM	CPM		

☒ Is the As Found Data within 20% of the efficiency from the last cal.?

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility: Isotope: Sr-90 3403 3525 3323 Average: 3417.0 ☒ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration and the A-B XTLK is <1% and the A-B XTLK is <10% then the technician may N/A the Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Source 1: Tc-99 Source 2: Th-230

High Voltage	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	Background (CPM)	Net A to B Xtalk: <10%
N/A								N/A
								N/A
								N/A
								N/A
								N/A
								N/A
								N/A

2 Pi Efficiencies: Pu-239 36.26% Tc-99 16.94% Th-230 31.22% SrY-90 37.57%

Comments: Married as a set with: Model: 2360 Serial #: 227389 Bar Code #: Replaced mylar.

☒ Does Instrument Meet Final Acceptance Criteria?

☒ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/25/14

Performed by: Thomas Thompson

Reviewed by: Date: 6/26/13

Printed Name: Thomas Thompson

Form HPM-2-1-1

Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	227389	Date:	7/1/2013
Calibration Due:	6/25/2014	Detector Model:	43-89
Radiation Detected:	Alpha	Detector S/N:	PR240337
Source Isotope:	Th-230	Detector Type:	Scintillator
Source Serial #:	99TH470-0270	Average BKG CPM:	1

Background (1 min)	
Data Point	CPM
1	0
2	1
3	0
4	1
5	0
6	0
7	2
8	0
9	2
10	1

Source (1 min)		
Data Point	Gross counts	Net counts
1	882	881
2	846	845
3	821	820
4	891	890
5	901	900
6	816	815
7	872	871
8	888	887
9	844	843
10	823	822

Average Net Count:	858
Standard Deviation:	32
20% of Net Count:	171.5
Average minus 2 X standard deviation:	793
Average plus 2 X standard deviation:	922
Average minus 20%:	686
Average plus 20%:	1029

Formulas	
Where: n = number of counts (20)	
$\bar{x}$ = average of counts	
x_i = each count result	
$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	

Comments	
Prepared By: 	Date: 7/1/13
Reviewed By:	Date:



INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL	2360	CALIBRATION	RADIONUCLIDE	Th-230			
	SERIAL #	227389	DUE DATE: 6/25/14	ID	99TH4700270			
DETECTOR	MODEL	43-89	CALIBRATION	RADIONUCLIDE				
	SERIAL #	PA240337	DUE DATE: 6/25/14	ID				
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	1-MIN. BKGD. READING	SOURCE CHECK GROSS NET	PASS / FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS
7/15/13	S	S	NA	0	740 740	P	JmH	
7/16/13	S	S	NA	4	813 809	P	JmH	
7/18/13	S	S	NA	1	796 795	P	JmH	
7/22/13	S	S	NA	6	818 812	P	JmH	
7/23/13	S	S	NA	4	714 710	P	JmH	
7/24/13	S	S	NA	0	775 775	P	JmH	
7/25/13	S	S	NA	0	724 724	P	JmH	
7/26/13	S	S	NA	0	780 780	P	JmH	
7/29/13	S	S	NA	0	764 764	P	JmH	
7/30/13	S	S	NA	3	790 787	P	JmH	
7/31/13	S	S	NA	1	891 890	P	JmH	
8/1/13	S	S	NA	1	890 889	P	JmH	
8/5/13	S	S	NA	0	730 730	P	JmH	
8/6/13	S	S	NA	0	749 749	P	JmH	
8/7/13	S	S	NA	0	702 702	P	JmH	
8/8/13	S	S	NA	0	712 712	P	JmH	
8/26/13	S	S	NA	2	713 711	P	JmH	
8/27/13	S	S	NA	2	881 879	P	JmH	
8/30/13	S	S	NA	0	910 910	P	JmH	
9/4/13	S	S	NA	1	885 884	P	JmH	
9/5/13	S	S	NA	1	835 834	P	JmH	
9/6/13	S	S	NA	1	859 858	P	JmH	
9/13/13	S	S	NA	1	912 911	P	JmH	
9/20/13	S	S	NA	1	878 877	P	JmH	
10/7/13	S	S	NA	0	857 857	P	JmH	
10/8/13	S	S	NA	0	859 859	P	JmH	
10/9/13	S	S	NA	2	915 913	P	JmH	
10/10/13	S	S	NA	1	938 937	P	JmH	
10/14/13	S	S	NA	3	865 862	P	JmH	
10/15/13	S	S	NA	0	954 954	P	JmH	
10/16/13	S	S	NA	6	923 917	P	JmH	

CS-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

Th-230

686 cpm

to

1,029 cpm

Data Reviewed By:

Date Reviewed:

10-16-13

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

~~CS-157~~ Check Source: AVG +/- 20 % Net Source Response Limits are:

Th-230

Data Reviewed By:

686 cpm to 1029 cpm

Date Reviewed: 11-22-13

Form HPM-2-1-1
Performance Check Values

Project Number:	Not Specific	Project Name:	Perma-Fix Beaver
Instrument Model:	2360	Technician:	J. Hubler
Instrument S/N:	227389	Date:	7/1/2013
Calibration Due:	6/25/2014	Detector Model:	43-89
Radiation Detected:	Beta	Detector S/N:	PR240337
Source Isotope:	Tc-99	Detector Type:	Scintillator
Source Serial #:	97TC470-2443	Average BKG CPM:	265

Background (1 min)	
Data Point	CPM
1	280
2	246
3	266
4	274
5	272
6	269
7	284
8	265
9	235
10	257

Source (1 min)		
Data Point	Gross counts	Net counts
1	1,312	1,047
2	1,348	1,083
3	1,298	1,033
4	1,332	1,067
5	1,342	1,077
6	1,356	1,091
7	1,348	1,083
8	1,327	1,062
9	1,353	1,088
10	1,367	1,102

Average Net Count:	1074
Standard Deviation:	21
20% of Net Count:	214.7
Average minus 2 X standard deviation:	1031
Average plus 2 X standard deviation:	1116
Average minus 20%:	859
Average plus 20%:	1288

Formulas	
Where: n = number of counts (20) $\bar{x}$ = average of counts x_i = each count result	$StdDev = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Comments	
Prepared By: 	Date: 7/1/13
Reviewed By:	Date:

Fix

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

METER	MODEL	2360		CALIBRATION		RADIONUCLIDE		Tc-99	
	SERIAL #	227389		DUE DATE: 6/25/14		ID		97TC4702943	
DETECTOR	MODEL	43-89		CALIBRATION		RADIONUCLIDE			
	SERIAL #	PR240337		DUE DATE: 6/25/14		ID			
DATE/TIME OF CHECK	BATT. (S/U)	HIGH VOLTAGE (S/U)	FAST/SLOW RESPONSE	1-MIN. BKGD. READING	SOURCE CHECK		PASS / FAIL	TECH INITIALS	DATA REVIEW TECH INITIALS
					GROSS	NET			
7/15/13	S	S	NA	230	1315	1085	P	JmH	
7/16/13	S	S	NA	264	1214	950	P	JmH	
7/18/13	S	S	NA	222	1368	1146	P	JmH	
7/22/13	S	S	NA	252	1285	1033	P	JmH	
7/23/13	S	S	NA	221	1220	999	P	JmH	
7/24/13	S	S	NA	257	1235	978	P	JmH	
7/25/13	S	S	NA	238	1259	1021	P	JmH	
7/26/13	S	S	NA	218	1380	1162	P	JmH	
7/29/13	S	S	NA	305	1318	1013	P	JmH	
7/30/13	S	S	NA	258	1244	986	P	JmH	
7/31/13	S	S	NA	242	1282	1040	P	JmH	
8/1/13	S	S	NA	291	1314	1023	P	JmH	
8/5/13	S	S	NA	263	1230	967	P	JmH	
8/6/13	S	S	NA	230	1411	1181	P	JmH	
8/7/13	S	S	NA	279	1306	1027	P	JmH	
8/8/13	S	S	NA	251	1345	1094	P	JmH	
8/26/13	S	S	NA	300	1354	1054	P	JmH	
8/27/13	S	S	NA	328	1392	1064	P	JmH	
8/30/13	S	S	NA	295	1433	1137	P	JmH	
9/4/13	S	S	NA	308	1426	1118	P	JmH	
9/5/13	S	S	NA	273	1325	1052	P	JmH	
9/6/13	S	S	NA	297	1334	1037	P	JmH	
9/13/13	S	S	NA	257	1355	1098	P	JmH	
9/20/13	S	S	NA	261	1389	1128	P	JmH	
10/7/13	S	S	NA	405	1633	1228	P	JmH	
10/8/13	S	S	NA	338	1427	1089	P	JmH	
10/9/13	S	S	NA	327	1575	1248	P	JmH	
10/10/13	S	S	NA	360	1570	1210	P	JmH	
10/14/13	S	S	NA	307	1559	1252	P	JmH	
10/15/13	S	S	NA	290	1553	1263	P	JmH	
10/16/13	S	S	NA	410	1443	1033	P	JmH	

CS-137 Check Source: AVG +/- 20 % Net Source Response Limits are:

859 cpm

to

1,288 cpm

Tc-99

Data Reviewed By:

Date Reviewed:

10-16-13

INSTRUMENT SOURCE CHECK FORM

Project Number:

Project Name: PADEP

CHECK SOURCES

[illegible]

Es-137 Check Source: AVG +/- 20 % Net Source/Response Limits are:

$T_c - aC_g$

859 cpm to 1,288 cpm

Data Reviewed By:

Date Reviewed:

11-22-13