

REPORT DOCUMENTATION PAGE				<i>Form Approved</i> <i>OMB No. 0704-0188</i>	
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				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) SSgt Emily Arceo				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USAF School of Aerospace Medicine Occupational & Environmental Health Dept Consultative Services Division 2510 Fifth St. Wright-Patterson AFB, OH 45433-7913				8. PERFORMING ORGANIZATION REPORT NUMBER AFRL-SA-WP-CL-2015-0010	
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14. ABSTRACT At the request of the U.S. Air Force Radioisotope Committee Secretariat, the U.S. Air Force School of Aerospace Medicine, Consultative Services Division (USAFSAM/OEC), Radiation Health Consulting Branch performed an independent radiological verification survey of five areas, consisting of 25 survey units within AOC 314, located on the former McClellan AFB, California, from 14-17 October 2014. USAFSAM/OEC personnel performed a gamma walkover survey of the five areas to assess the feasibility of unrestricted release and ensure the potential health risk to future inhabitants is minimized. USAFSAM/OEC personnel also collected 22 soil samples from within AOC 314. Laboratory analysis revealed that the concentration of radium-226 (Ra-226) in 10 of the soil samples exceeded the cleanup goal of 2.0 pCi/g agreed upon between the USAF and the State of California. Four of the five areas within AOC 314 yielded at least one sample that exceeded 2.0 pCi/g. The highest concentration of Ra-226 found in any of the soil samples was 25.8 pCi/g. Based on these findings, the cleanup goal was not met, and further remediation should be accomplished to ensure that the potential health risk to future inhabitants is minimized and cleanup levels are within current guidelines.					
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a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			Col Krystal L. Murphy
			SAR	55	19b. TELEPHONE NUMBER (include area code)



DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
WRIGHT-PATTERSON AFB OH

31 March 2015

MEMORANDUM FOR AFMSA/SG3PB
ATTN: MAJ DANIEL SHAW
7700 ARLINGTON BLVD STE 5158
FALLS CHURCH VA 22042

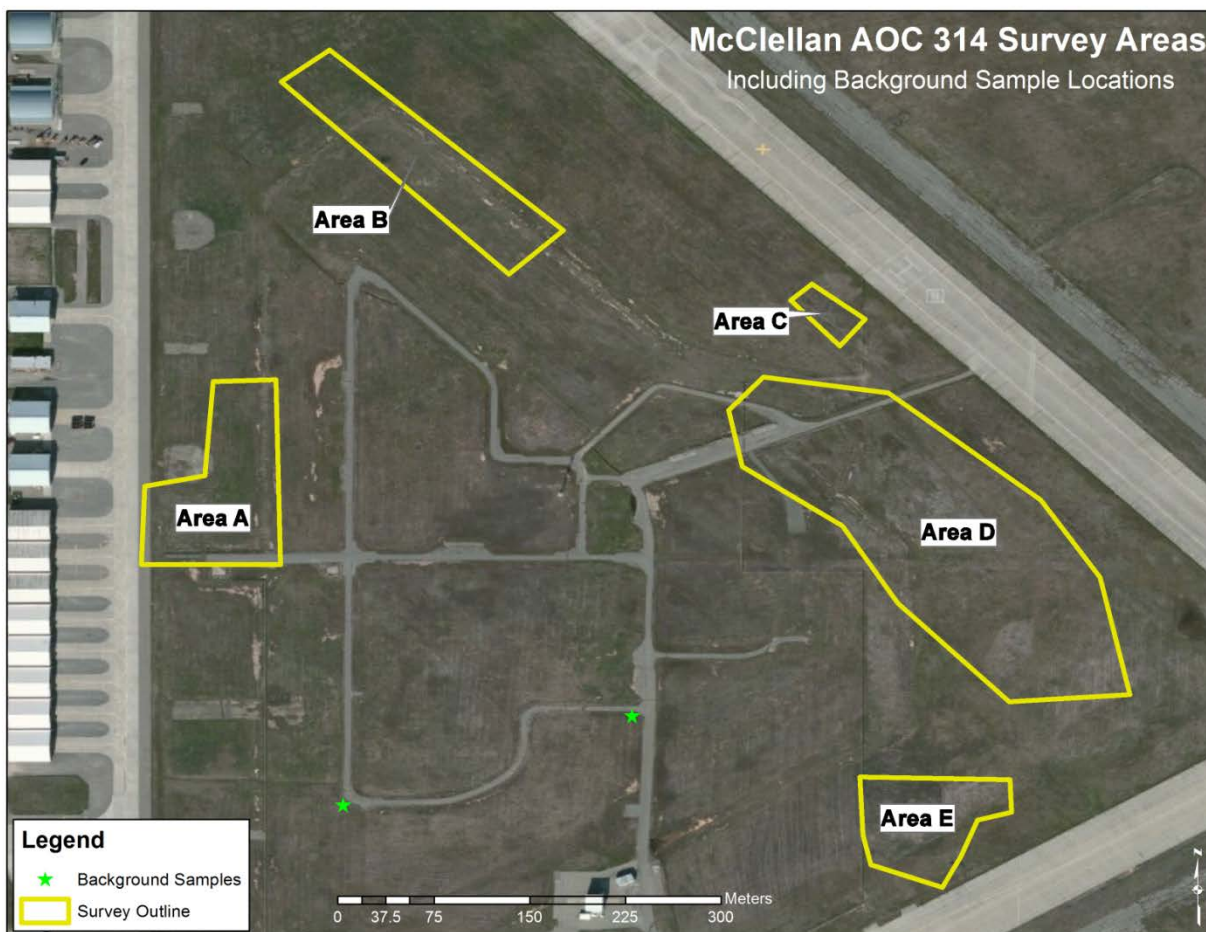
FROM: USAFSAM/OEC
2510 Fifth Street
Wright-Patterson AFB OH 45433

SUBJECT: Consultative Letter, AFRL-SA-WP-CL-2015-0010, Area of Concern (AOC) 314
Verification Survey at Former McClellan AFB, Sacramento, CA

1. EXECUTIVE SUMMARY: At the request of the U.S. Air Force Radioisotope Committee Secretariat, the U.S. Air Force School of Aerospace Medicine, Consultative Services Division (USAFSAM/OEC), Radiation Health Consulting Branch performed an independent radiological verification survey of five areas, consisting of 25 survey units (SUs) within AOC 314, located on the former McClellan AFB, California, from 14-17 October 2014. USAFSAM/OEC personnel performed a gamma walkover survey of the five areas to assess the feasibility of unrestricted release and ensure the potential health risk to future inhabitants is minimized. USAFSAM/OEC personnel also collected 22 soil samples from within AOC 314. Laboratory analysis revealed that the concentration of radium-226 (Ra-226) in 10 of the soil samples exceeded the cleanup goal of 2.0 pCi/g agreed upon between the USAF and the State of California. Four of the five areas within AOC 314 yielded at least one sample that exceeded 2.0 pCi/g. The highest concentration of Ra-226 found in any of the soil samples was 25.8 pCi/g. Based on these findings, the cleanup goal was not met, and further remediation should be accomplished to ensure that the potential health risk to future inhabitants is minimized and cleanup levels are within current guidelines.

2. INTRODUCTION

a. *Purpose:* The purpose of USAFSAM/OEC's verification survey was to provide an independent evaluation of the final radiological conditions within the site, with Ra-226 as the sole radionuclide of concern. USAFSAM/OEC surveyed the five areas within AOC 314 to determine if surface activity levels complied with the derived concentration guideline level of 2.0 pCi/g agreed upon between the USAF and the State of California for the site (Figure 1). Nuclear Regulatory Guide 1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Rev 1, specifies the techniques and procedures used during this verification survey.



b. *Background:* AOC 314 is the site of a former ammunition storage area on McClellan AFB. The site currently comprises approximately 45 acres of open land that include old asphalt roads and natural vegetation located within a triangle of three taxiways on a Sacramento County Airport controlled area (see Figure 1). Although existing records do not show that radioactive materials were ever stored or released on AOC 314, contractors identified five separate areas where levels of Ra-226 exceeded background levels. Tetra Tech, Inc. excavated these five areas (Areas A-E) between October 2012 and January 2013 to remove potentially contaminated soil. Cabrera Services, Inc. performed a Final Status Survey (FSS) between November 2012 and July 2013. The California Department of Public Health requested the collection of additional confirmatory soil samples in December 2013. The results of these soil samples revealed elevated Ra-226 levels in 17 locations within AOC 314. Tetra Tech performed further excavation in these 17 areas in July 2014, and Cabrera Services reconducted the FSS in its entirety between August and October 2014.

Each of the five areas within AOC 314 is divided into Class 1 and Class 2 SUs. The Class 1 SUs consist of the excavated areas of land. The Class 2 SUs surround the Class 1 SUs, extending 10 feet beyond the outer edges of the Class 1 SUs. The survey areas shown in Figures 1 through 6 include both the Class 1 and Class 2 SUs.

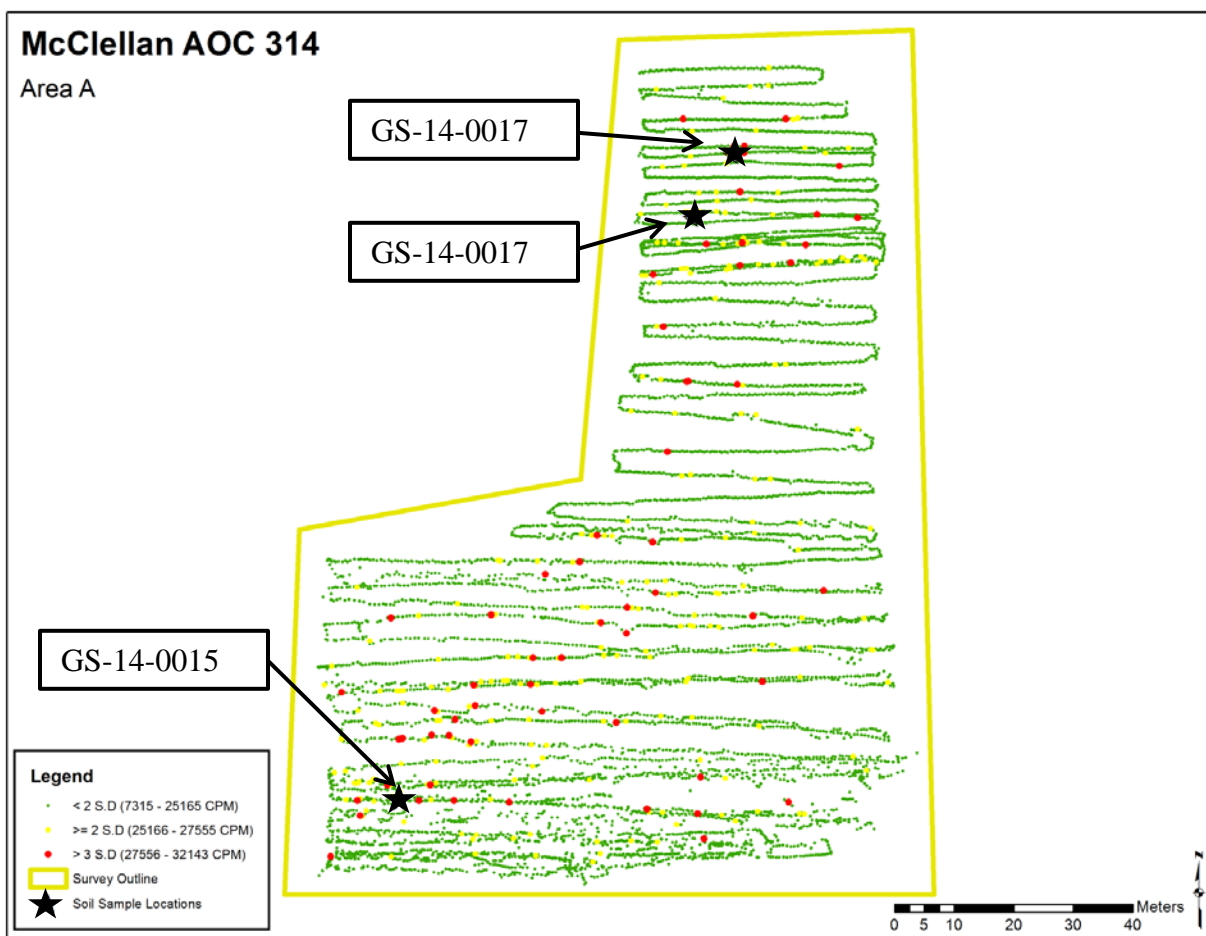


Figure 2. Area A Walkover Survey with Soil Sample Locations

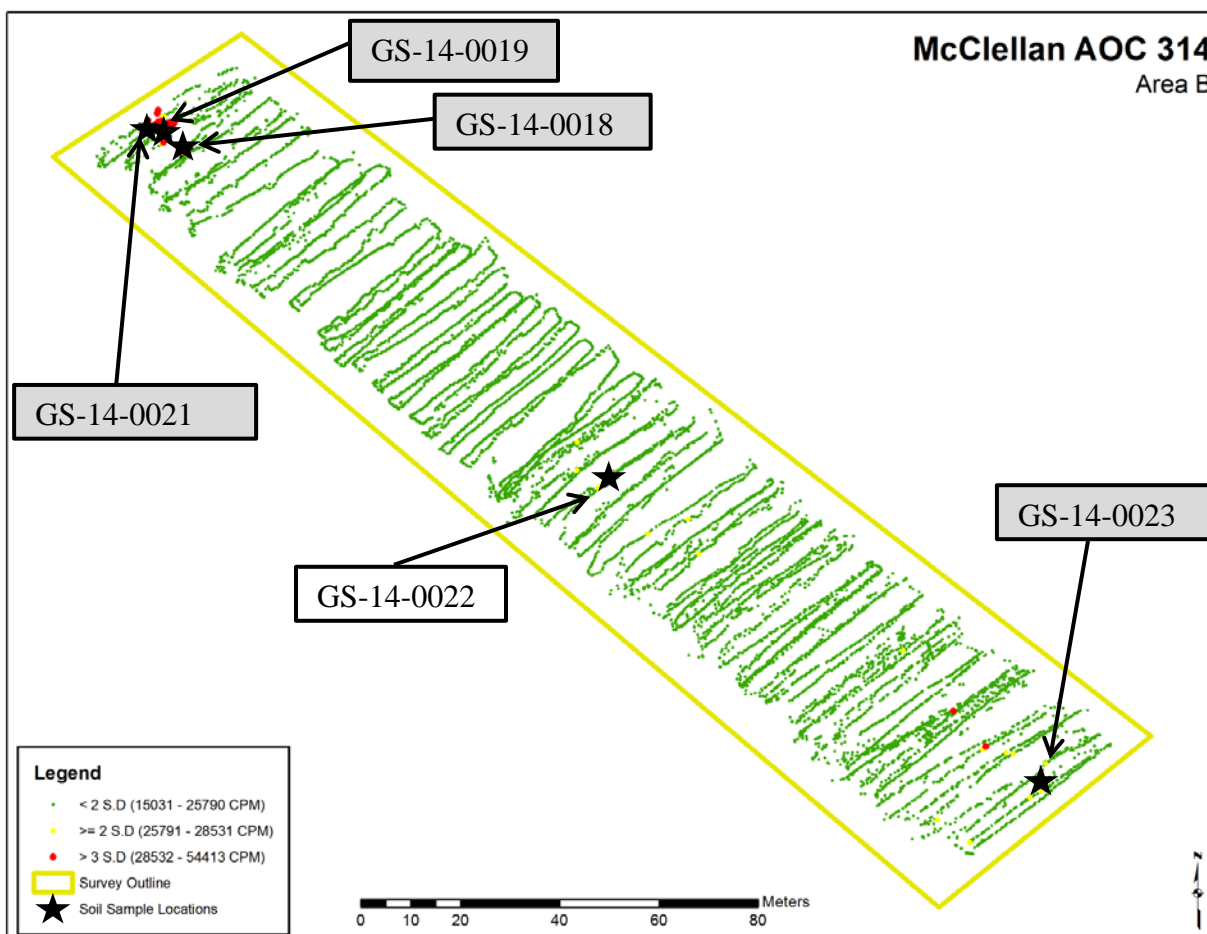


Figure 3. Area B Walkover Survey with Soil Sample Locations

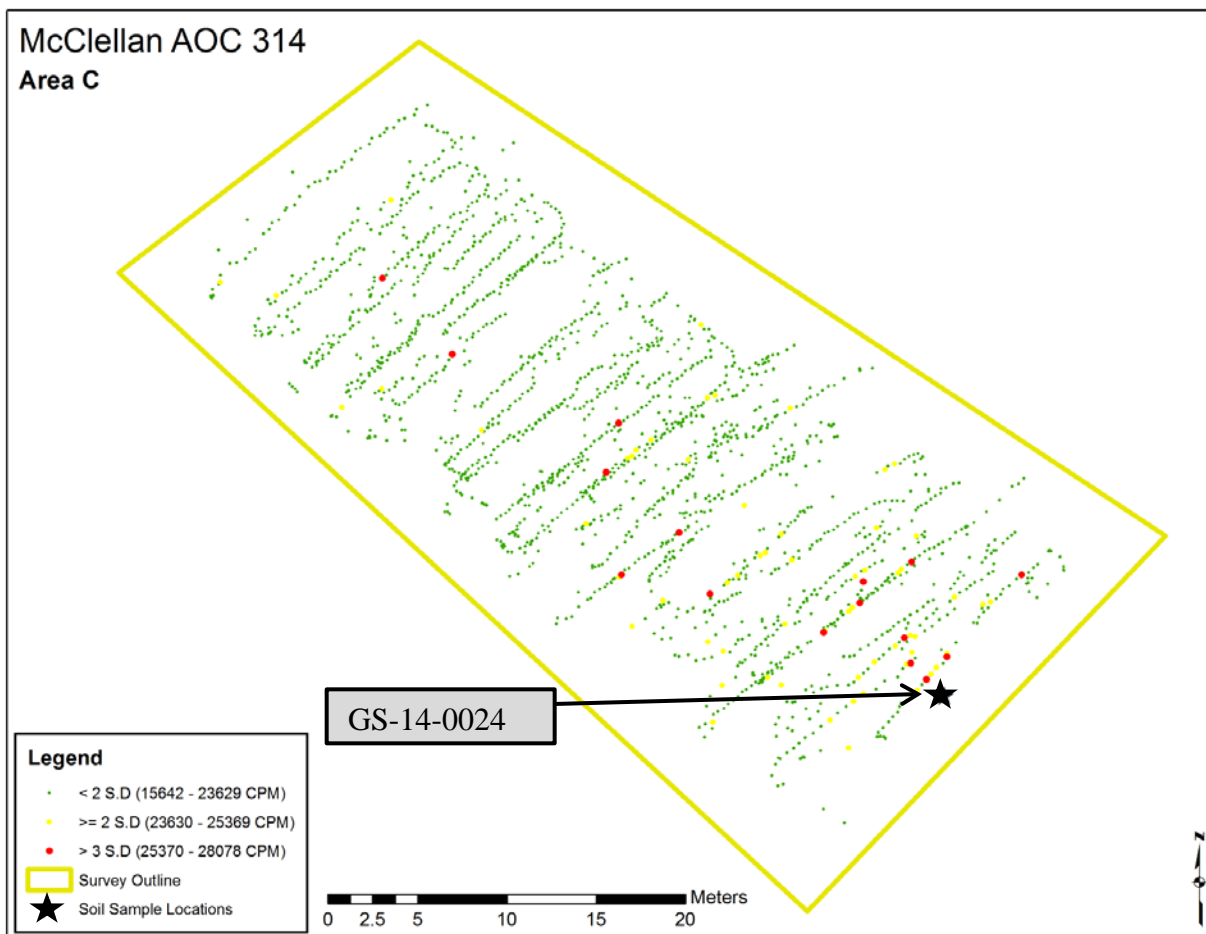


Figure 4. Area C Walkover Survey with Soil Sample Locations

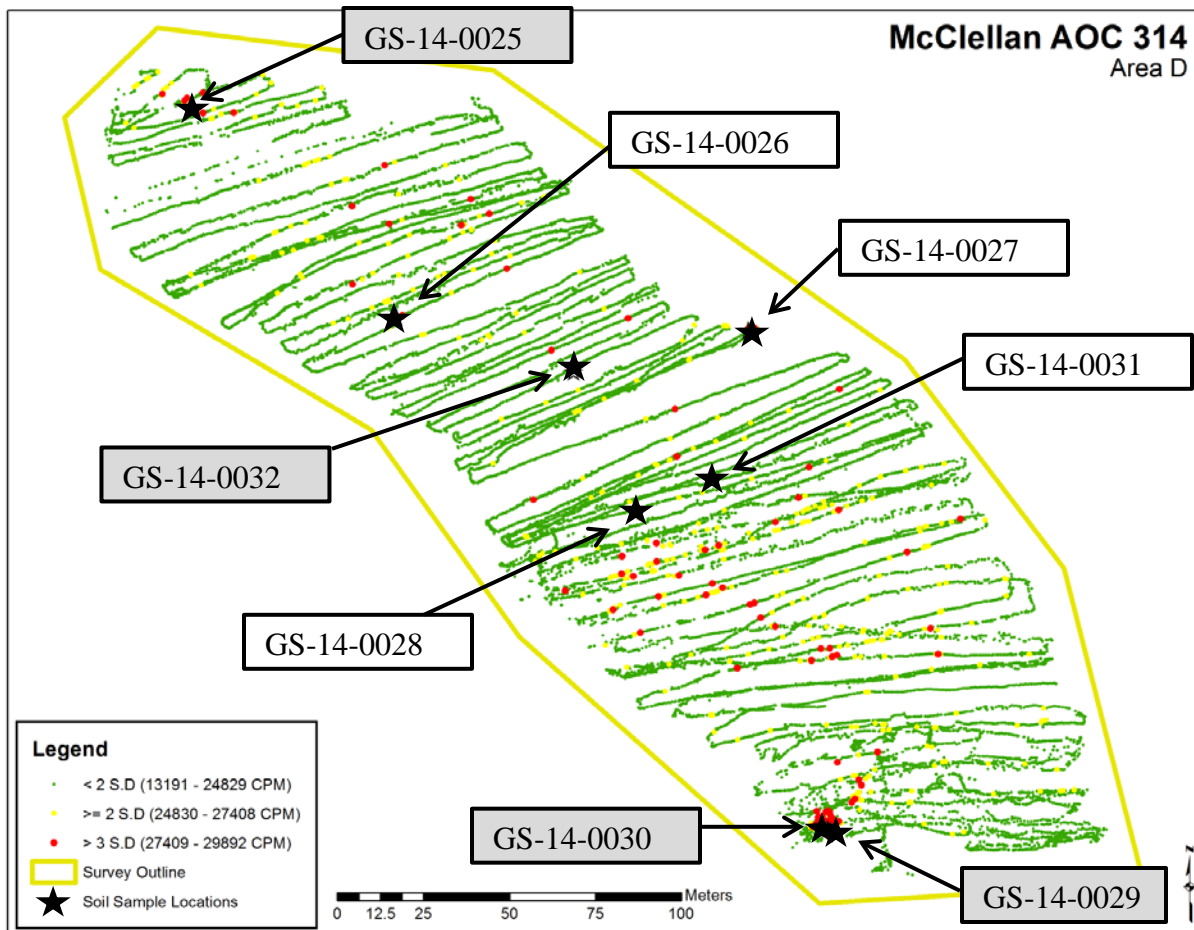
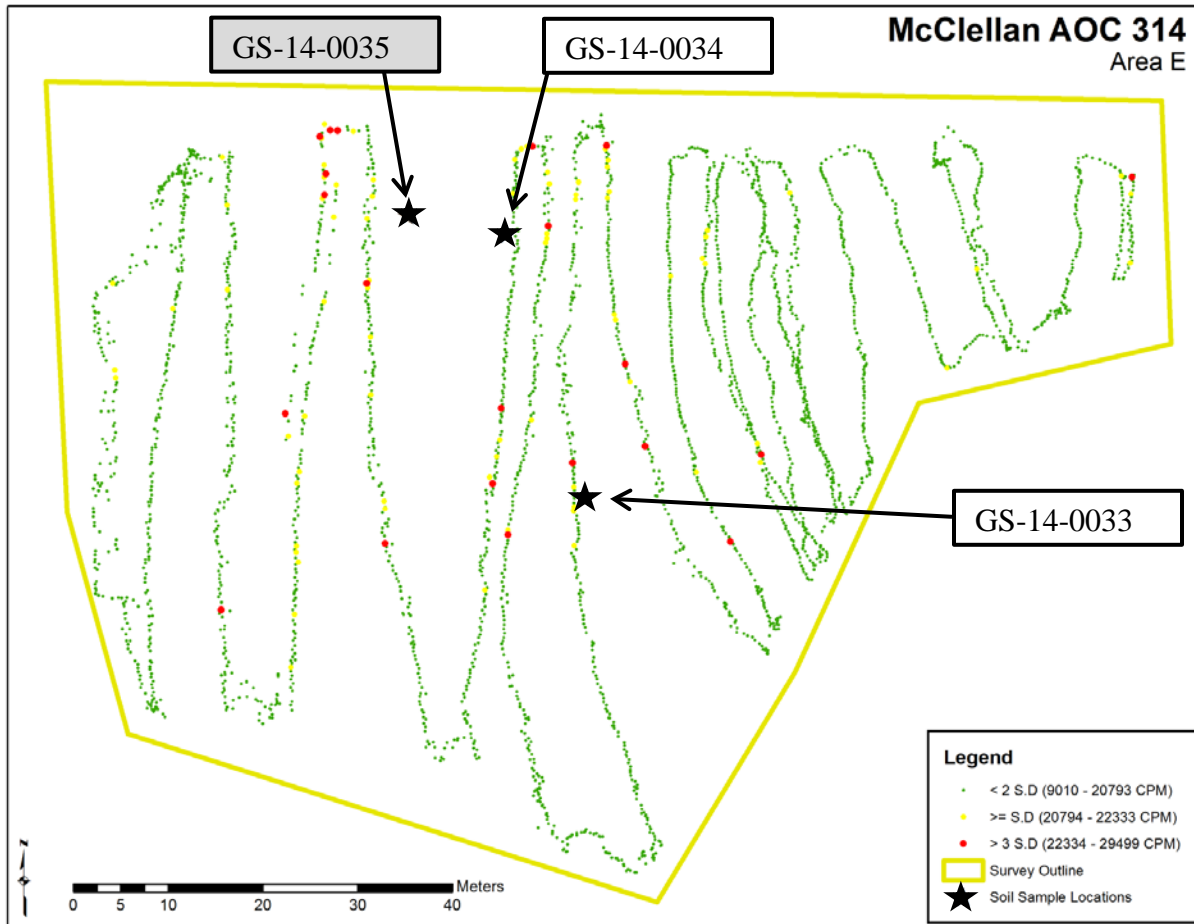


Figure 5. Area D Walkover Survey with Soil Sample Locations



c. *Survey Personnel:*

- (1) Health Physicist, USAFSAM/OEC
- (2) Health Physics Technician, USAFSAM/OEC
- (3) Health Physics Technician, USAFSAM/OEC

d. *Personnel Contacted:*

- (1) Radiation Safety Officer, AFCEC/CIBW
- (2) Base Realignment and Closure Program Management/Western Region, AFCEC/CIBW
- (3) Radiation Project Manager, Tetra Tech Services, Inc.

e. *Equipment:*

(1) Ludlum Model 2221 with Scionix 76BRS76/2ME1-X 3x3 Sodium Iodide Detector, Meter SN 287511, Detector SN SAG420, Calibration date 16 Jun 2014

(2) Ludlum Model 2221 with Scionix 76BRS76/2ME1-X 3x3 Sodium Iodide Detector, Meter SN 287537, Detector SN SAG423, Calibration date 24 Jun 2014

3. METHODOLOGY

a. *Overview:* USAFSAM/OEC performed a gamma walkover survey and collected soil samples as part of this verification survey. The goal of the walkover survey was to identify locations for USAFSAM/OEC's soil sampling. This verification survey required performing gamma walkover scans of 10% of the Class 1 and Class 2 SUs within Areas A-E and collecting at least 10% of the number of soil samples collected by Cabrera Services. Prior to the survey, the contractor identified 40 total soil sample locations from the five areas. Therefore, a minimum of four soil samples was necessary to meet the 10% minimum sampling requirement. USAFSAM/OEC personnel used the gamma walkover data to pinpoint areas of higher radiation activity levels for soil sampling.

b. *Soil Sampling:* USAFSAM/OEC personnel took each soil from an area of approximately 8 square inches to a depth of 6 inches. The volume sampled was sufficient for laboratory analysis (approximately 1 quart). Survey personnel followed field soil sampling procedures to prevent cross contamination of samples. Personnel also collected two background samples from uncontaminated soil in an area adjacent to the five areas (see Figure 1). The USAFSAM Radioanalytical Laboratory (OEA) at Wright-Patterson AFB, Ohio, analyzed soil samples using a high purity germanium detector to determine Ra-226 levels. OEA sifted the soil samples to remove any rocks and large debris and then dried them to remove any moisture that could have potentially affected analysis.

c. *Gamma Walkover Survey:* The survey team used the Scionix Model 76BRS76/3M-E1-X 3x3-inch thallium-doped sodium iodide (NaI) detectors and Ludlum Model 2221 ratemeters/scalers as the primary radiation detection instruments during the gamma walkover survey. The Trimble GeoXT handheld GPS units with RS-232 serials logged observed count rates with corresponding GPS coordinates at 1-second intervals. For the walkover survey, technicians held the detectors at a height of 10 centimeters above the ground and scanned at a speed of approximately 0.5 meters per second. The survey team also performed instrument function checks at the start and end of each workday to ensure the instrument response was within a 10% field check tolerance. See Attachment 1 for the documentation of these function checks. See Attachment 2 for the annual calibration certificates for all instruments used during this survey. Personnel used the mean count rate as the background for the scanned area and did not survey a reference area. USAFSAM/OEC personnel then used the geometric mean count rate and its associated statistical analysis to develop a site picture for the scanned area, using commercial geospatial mapping software.

4. RESULTS

a. *Soil Sampling*: USAFSAM/OEC personnel collected a total of 22 soil samples from AOC 314: 3 samples from Area A, 6 samples from Area B, 1 sample from Area C, 8 samples from Area D, 3 samples from Area E, and 2 background samples from two separate non-contaminated locations outside of the five survey areas. Table 1 displays the gross Ra-226 soil sample analysis results, which are inclusive of the background Ra-226 concentration levels and can be compared directly to the cleanup goal of 2.0 pCi/g. Ten of the soil samples exceeded the cleanup goal of 2.0 pCi/g. See Attachment 3 for laboratory analysis results.

Note: Ra-226 concentrations are labeled as “Ra_D_214” in Attachment 3, since the Ra-226 concentrations were determined by gamma spectroscopy analysis of Ra-226 and its progeny. The locations and results of the soil samples are also plotted in Figures 1-6.

Table 1. Soil Sample Analysis Results for AOC 314

Lab Sample ID	GPS Coordinates (WGS1984, Decimal Degrees, N/E)	Location	Gross Ra-226 Concentration (pCi/g) ¹
GS-14-0015	38.660943596, -121.409530789	Area A	1.24 ± .06
GS-14-0016	38.661822700, -121.409088892	Area A	0.78 ± .04
GS-14-0017	38.661917301, -121.409028498	Area A	1.10 ± .05
GS-14-0018	38.664218315, -121.408480740	Area B	15.90 ± .02
GS-14-0019	38.664257786, -121.408514713	Area B	9.00 ± .02
GS-14-0021	38.664262356, -121.408547278	Area B	25.80 ± .03
GS-14-0022	38.663622754, -121.407710823	Area B	1.07 ± .05
GS-14-0023	38.663073426, -121.406930429	Area B	4.68 ± .01
GS-14-0024	38.662452298, -121.404714553	Area C	2.32 ± .09
GS-14-0025	38.661915377, -121.405229532	Area D	3.02 ± .08
GS-14-0026	38.661366649, -121.404695981	Area D	1.04 ± .05
GS-14-0027	38.661332237, -121.403774808	Area D	1.86 ± .06
GS-14-0028	38.660857015, -121.404071542	Area D	0.72 ± .04
GS-14-0029	38.660029370, -121.403567525	Area D	21.80 ± .03
GS-14-0030	38.660038999, -121.403581534	Area D	21.50 ± .03
GS-14-0031	38.660950511, -121.403872917	Area D	0.76 ± .04
GS-14-0032	38.661224181, -121.404232279	Area D	5.77 ± .01
GS-14-0033	38.658911662, -121.404129523	Area E	0.93 ± .04
GS-14-0034	38.659161239, -121.404203819	Area E	0.72 ± .04
GS-14-0035	38.659178636, -121.404297863	Area E	2.10 ± .07
GS-14-0036	38.659735718, -121.406246860	Background	0.61 ± .04
GS-14-0037	38.659107919, -121.408280844	Background	0.61 ± .04

¹ Ra-226 concentrations with associated uncertainties from soil sample results.

Note: The uncertainties listed are at the 95% confidence level [2 standard deviations (SD)].

Note: The gray shaded rows contain measured values above the 2.0 pCi/g cleanup goal.

b. *Gamma Walkover Survey*: Figures 2 through 6 display the aggregated walkover survey data. The locations marked with green dots correspond to the lowest measured readings of the survey and are below 2 SD above the mean background value of each area. Locations marked with yellow and red dots correspond to greater than 2 and greater than 3 SD above the mean

count rate for each area, respectively. The color scheme demonstrates a scale of instrument data based upon SDs above background. See Figures 2 through 6 for the count per minute (CPM) readings that correspond to each color. In the display figures, no regulatory values or limits are implied. See Attachment 4 for the statistics compiled for each area.

5. DISCUSSION

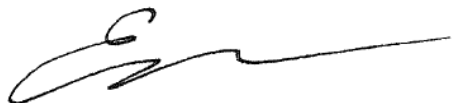
a. *Soil Sampling*: Laboratory analysis results showed that 10 soil samples exceeded the cleanup goal of 2.0 pCi/g. Six of these samples exceeded twice the cleanup goal, and of these six, three samples were more than an order of magnitude higher than the cleanup goal.

b. *Gamma Walkover Survey*: Although this verification survey required performing gamma walkover scans of only 10% of the Class 1 and Class 2 SUs within Areas A-E, the survey team scanned more than the minimum walkover scan goal to ensure adequate coverage of the site.

6. CONCLUSIONS AND RECOMMENDATIONS

a. Based on the laboratory analysis results, there is a potential that the total effective dose equivalent from residual radioactivity (distinguishable from background) to the average member of the critical group is not as low as reasonably achievable and may exceed 25 mrem (0.25 mSv) per year. As a result, the site conditions are not suitable for unrestricted release in accordance with 10 CFR 20.1403. USAFSAM/OEC recommends additional remediation and survey activities at the locations of the derived concentration guideline level exceedences displayed in Table 1.

b. If you have any questions regarding this report, please contact the ESOH Service Center at (888)-232-3764 (DSN 798-3764) or ESOH.Service.Center@us.af.mil.



EMILY C. ARCEO, SSgt, USAF
Radiation Health Consultant

4 Attachments:

1. Radiation Meter Quality Control (QC) Log
2. Instrument Calibration Sheets
3. Laboratory Sample Analysis
4. Statistical Summary of Walkover Data

Attachment 1
Radiation Meter Quality Control (QC) Log

Model	Serial Number	Date/Time	HV/Cable/Battery Check	Check Source Reading	Acceptable Range ± 20%
Ludlum 2221 Scionix 3x3	290803 SAG427	14 Oct 14 0820	674/good/6.1	20589	16471-24706
Ludlum 2221 Scionix 3x3	287511 SAG420	14 Oct 14 0830	700/good/6.1	21228	16982-25473
Ludlum 2221 Scionix 3x3	290803 SAG427	14 Oct 14 1743	673/good/5.9	22978	16471-24706
Ludlum 2221 Scionix 3x3	287511 SAG420	14 Oct 14 1743	700/good/5.9	23976	16982-25473
Ludlum 2221 Scionix 3x3	290803 SAG427	15 Oct 14 0800	673/good/6.3	23083	16471-24706
Ludlum 2221 Scionix 3x3	287511 SAG420	15 Oct 14 0800	699/good/5.9	24668	16982-25473
Ludlum 2221 Scionix 3x3	287511 SAG420	15 Oct 14 1716	698/good/5.7	23827	16982-25473
Ludlum 2221 Scionix 3x3	290803 SAG427	15 Oct 14 1716	673/good/5.8	22481	16471-24706
Ludlum 2221 Scionix 3x3	287511 SAG420	16 Oct 14 0811	700/good/5.8	23728	16982-25473
Ludlum 2221 Scionix 3x3	290803 SAG427	16 Oct 14 0811	674/good/5.8	23518	16471-24706
Ludlum 2221 Scionix 3x3	290803 SAG427	16 Oct 14 1716	674/good/5.7	22953	16471-24706
Ludlum 2221 Scionix 3x3	287511 SAG420	16 Oct 14 1716	699/good/5.8	24210	16982-25473

Check Source Type: Th-232 Lantern Mantle
Check Source Activity: 0.003 µCi

Attachment 2
Instrument Calibration Sheets

pg 1 of 3



**DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION**

Mfg. Ludlum Model 2221 Serial # 287511 Index # 102209 Date: 16-Jun-14
Mfg. Scionix Model 768RS76/3M-E1-X Serial # SAG 420 Index # N/A Cal. Due Date: 16-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources				Reference Instruments			
<i>Isotope</i>	<i>Serial #</i>	<i>Cert. Date</i>	<i>DPM</i>	<i>Mfg.</i>	<i>Model</i>	<i>Serial #</i>	<i>Cal. Due Date</i>
Cs 137	MU851	01-Nov-04	1974084	Ludlum	500-1	102952	4 DEC 2014

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

☒ Battery Ck. ☒ Mechanical Ck. ☒ Meter Zeroed ☒ Reset Ck. ☐ Alarm Ck.
☒ Audio Ck. ☒ Geotropism Ck. ☒ F/S Resp. Ck. ☒ Window Op.

As Found HV 494 VDC Temperature 70.1 °F Relative Humidity 62.4 %

Final Volt. Set 700 VDC Threshold (LLD) 9 mV Window (ULD) 20 mV Window width 11 mV

HV Readout (2 points) Reference: 500 V Reference: 1000 V
Inst. Readout: 497 V \pm 2% Inst. Readout: 1,012 V \pm 2%

RANGE MULTIPLIER	REFERENCE CAL. POINT	"AS FOUND" READING	CORRECTED READING
x 1000	400 CPM	380,000 CPM	400,000 CPM
x 1000	100 CPM	110,000 CPM	110,000 CPM
x 100	400 CPM	40,000 CPM	40,000 CPM
x 100	100 CPM	11,000 CPM	11,000 CPM
x 10	400 CPM	4,000 CPM	4,000 CPM
x 10	100 CPM	1,100 CPM	1,100 CPM
x 1	400 CPM	400 CPM	400 CPM
x 1	100 CPM	110 CPM	110 CPM
Log Scale	200 CPM	200 CPM	200 CPM

DIGITAL SCALER READOUT

CAL. REF. POINT	AS FOUND READING	CORRECTED READING
40,000 CPM	40,000 CPM	40,000 CPM

*UNCERTAINTY WITHIN \pm 10% CORRECTION FACTOR WITHIN \pm 20%

COMMENTS: Calibration Interval = 1 year Use "Window OUT"

Detector Parameters: Page2- 3

Procedural Authority - ICP#22210000

Calibrated By: Kurt Shotts
Reviewed By: Matthew Faltus

Date: 16-Jun-2014

Date: 17 June 2014

Page 1



DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION

Mfg. Ludlum Model 2221 Serial # 287511 Index # 102209 Date: 16-Jun-14
Mfg. Scionix Model 76BRS76/3M-E1-X Serial # SAG 420 Index # N/A Cal. Due Date: 16-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources

Isotope	Serial #	Cert. Date	DPM
Cs 137	MU851	01-Nov-04	1974084

Reference Instruments

Mfg.	Model	Serial #	Cal. Due Date
Ludlum	500-1	102952	4 DEC 2014

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

NaI DETECTOR HIGH VOLTAGE OPTIMIZATION

Probe #1

Mfg. Scionix
Model 76BRS76/3M-E1-X
Serial # SAG 420
Index # N/A
Isotope: Cs-137 @ 6"

Probe #2

Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

Probe #3

Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

High Voltage	CPM
550	28235
600	28832
650	28783
675	29077
*700	28870
725	29263
750	29144
800	30660
-----	-----
-----	-----
-----	-----
-----	-----
-----	-----
Bkgd @ 700v	9,928

High Voltage	CPM

High Voltage	CPM

Final Volt. Set 700 VDC

Efficiency 6800 CPM/ μ ci/m² @12"

Final Volt. Set _____ VDC

Efficiency _____ CPM/ μ ci/m² @12"

Final Volt. Set _____ VDC

Efficiency _____ CPM/ μ ci/m² @12"

COMMENTS: Calibration Interval = 1 year Use "Window OUT"

Procedural Authority - ICP#22210000

Calibrated By: Ken Sheets

Date: 16-Jun-2014

Reviewed By: Matthew Catlett

Date: 17 June 2014

Jun 16 2014 03 13 PM Kurt Shorts
HotSpot FIDLER Calibration Information

Report Date : Jun 16 2014 03:13 PM
Calibration Date : 16 June 2014
Target Mix : Other Nuclide Check Source
Radionuclide : Cs-137
Detector Barcode Number : N/A
Meter Barcode Number : 102209
Detector Manufacturer : Scionix
Detector Model Number : 76BRS76/3M-E1-X
Detector Serial Number : SAG420
Meter Manufacturer : Ludlum
Meter Model Number : 2221
Meter Serial Number : 287511

Check Source I.D. : RP 3067
Calibration Date : 16 June 2014
Calibrated by : Kurt Shorts
Check Source Activity (uCi): 8.890E-01

Sample Counting Time (minutes) : 1.000E+00
Detector Height (cm) : 3.000E+01

Cs-137 Window Information:

Background (cpm) : 9,928
Areal Limit of Sensitivity (uCi/m2) : 6.9E-02
Point Limit of Sensitivity (uCi) : 6.4E-02
K-factor (m2) : 0.92

Counting Data (counts):

0-cm: 16455
20-cm: 14967
40-cm: 12820
60-cm: 11625
80-cm: 11051
100-cm: 10321

Instrument Type : Other

Window Option: Only 60 keV

Units: Classic

This is an actual 3x3 calibration, and the values are typical of most 3x3 configurations.

Detector Calibration Results

Cs-137 Window Information:

Cs-137 Detector Efficiency (cpm/(uCi/m2)): 6.8E+03
Cs-137 Detector Areal LOS (uCi/m2) : 6.9E-02
Cs-137 Detector Point LOS (uCi) : 6.4E-02
Cs-137 Detector Background Rate (cpm) : 9,928
Cs-137 Detector Check Source Rate (cpm) : 6,527
Cs-137 Detector K-Factor (m2) : 0.92
Cs-137 Detector K-Factor sdev (%) : 5.3



**DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION**

Mfg. Ludlum Model 2221 Serial # 287537 Index # 102210 Date: 24-Jun-14
Mfg. Scionix Model 76BRS76/2ME1-X Serial # SAG 423 Index # 08335 Cal. Due Date: 24-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources

Isotope	Serial #	Cert. Date	DPM
Cs 137	RP3067	01-Nov-04	1972997

Reference Instruments

Mfg.	Model	Serial #	Cal. Due Date
Ludlum	500-1	102951	06 MAR 2015

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

☒ Battery Ck. ☒ Mechanical Ck. ☒ Meter Zeroed ☒ Reset Ck. ☐ Alarm Ck.
☒ Audio Ck. ☒ Geotropism Ck. ☒ F/S Resp. Ck. ☒ Window Op.

As Found HV 647 VDC Temperature 68.0 °F Relative Humidity 63.8 %

Final Volt. Set 675 VDC Threshold (LLD) 10 mV Window (ULD) 19 mV Window width 9 mV

HV Readout (2 points) Reference: 500 V Reference: 1000 V
Inst. Readout: 500 V \pm 2% Inst. Readout: 1,006 V \pm 2%

RANGE MULTIPLIER	REFERENCE CAL. POINT	"AS FOUND" READING	CORRECTED READING
x 1000	400 CPM	400,000 CPM	400,000 CPM
x 1000	100 CPM	100,000 CPM	100,000 CPM
x 100	400 CPM	40,000 CPM	40,000 CPM
x 100	100 CPM	10,000 CPM	10,000 CPM
x 10	400 CPM	4,000 CPM	4,000 CPM
x 10	100 CPM	1,000 CPM	1,000 CPM
x 1	400 CPM	400 CPM	400 CPM
x 1	100 CPM	100 CPM	100 CPM
Log Scale	200 CPM	200 CPM	200 CPM

DIGITAL SCALER READOUT

CAL. REF. POINT	AS FOUND READING	CORRECTED READING
40,000 CPM	40,067 CPM	40,067 CPM

*UNCERTAINTY WITHIN \pm 10% CORRECTION FACTOR WITHIN \pm 20%

COMMENTS: Calibration Interval = 1 year Use "Window OUT"

Detector Parameters: Page2- 3

Procedural Authority - ICP#22210000

Calibrated By: [Signature]

Date: 24-Jun-2014

Reviewed By: [Signature]

Date: 25-Jun-2014



**DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION**

Mfg. Ludlum Model 2221 Serial # 287537 Index # 102210 Date: 24-Jun-14
Mfg. Scionix Model 76BRS76/2ME1-X Serial # SAG 423 Index # 08335 Cal. Due Date: 24-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources

Isotope	Serial #	Cert. Date	DPM
Cs 137	RP3067	01-Nov-04	1972997

Reference Instruments

Mfg.	Model	Serial #	Cal. Due Date
Ludlum	500-1	102951	06 MAR 2015

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

NaI DETECTOR HIGH VOLTAGE OPTIMIZATION

Probe #1

Mfg. Scionix
Model 76BRS76/2ME1-X
Serial # SAG 423
Index # 08335
Isotope: Cs-137 @ 6"

Probe #2

Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

Probe #3

Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

High Voltage	CPM
500	25427
550	27564
600	27876
650	28510
*675	28290
700	29123
750	28905
800	29710
850	33455
Bkgd @ 675v	9,258

Final Volt. Set 675 VDC

Efficiency 40000 CPM/ $\mu\text{Ci}/\text{m}^2$ @12"

High Voltage	CPM

Final Volt. Set _____ VDC

Efficiency _____ CPM/ $\mu\text{Ci}/\text{m}^2$ @12"

High Voltage	CPM

Final Volt. Set _____ VDC

Efficiency _____ CPM/ $\mu\text{Ci}/\text{m}^2$ @12"

COMMENTS: Calibration Interval = 1 year Use "Window OUT"

Procedural Authority - ICP#22210000

Calibrated By: [Signature]

Reviewed By: [Signature]

Date: 24-Jun-2014

Date: 25-Jun-2014

Page 3 of 3

Jun 24 2014 01 40 PM Willis Hosley
HotSpot FIDLER Calibration Information

Report Date : Jun 24 2014 01:40 PM
Calibration Date : June 24 2014
Target Mix : Other Nuclide Check Source
Radionuclide : Cs-137
Detector Barcode Number : 08335
Meter Barcode Number : 102210
Detector Manufacturer : Scionix
Detector Model Number : 76BRS76/3M-E1-X
Detector Serial Number : SAG423
Meter Manufacturer : Ludlum
Meter Model Number : 2221
Meter Serial Number : 287537

Check Source I.D. : RP 3067
Calibration Date : June 24 2014
Calibrated by : Willis Hosley
Check Source Activity (uCi): 8.890E-01

Sample Counting Time (minutes) : 1.000E+00
Detector Height (cm) : 3.000E+01

Cs-137 Window Information:

Background (cpm) : 9,258
Areal Limit of Sensitivity (uCi/m2) : 1.1E-02
Point Limit of Sensitivity (uCi) : 5.5E-02
K-factor (m2) : 4.83

Counting Data (counts):

0-cm: 16549
20-cm: 14818
40-cm: 12314
60-cm: 11101
80-cm: 10529
100-cm: 10378

Instrument Type : Other

Window Option: Only 60 keV

Units: Classic

This is an actual 3x3 calibration, and the values are typical of most 3x3 configurations.

Detector Calibration Results

Cs-137 Window Information:

Cs-137 Detector Efficiency (cpm/(uCi/m2)): 4.0E+04
Cs-137 Detector Areal LOS (uCi/m2) : 1.1E-02
Cs-137 Detector Point LOS (uCi) : 5.5E-02
Cs-137 Detector Background Rate (cpm) : 9,258
Cs-137 Detector Check Source Rate (cpm) : 7,291
Cs-137 Detector K-Factor (m2) : 4.83
Cs-137 Detector K-Factor sdev (%) : 5.2

Page 3 of 3



DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION

Mfg. Ludlum Model 2221 Serial # 290803 Index # 102204 Date: 03-Jun-14
Mfg. Scionix Model 768RS70/3M-E1-X Serial # SAG 427 Index # N/A Cal. Due Date: 03-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources

Isotope	Serial #	Cert. Date	DPM
Cs 137	MU851	01-Nov-04	1975850

Reference Instruments

Mfg.	Model	Serial #	Cal. Due Date
Ludlum	500-1	102952	4 DEC 2014

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

☒ Battery Ck. ☒ Mechanical Ck. ☒ Meter Zeroed ☒ Reset Ck. ☐ Alarm Ck.
☒ Audio Ck. ☒ Geotropism Ck. ☒ F/S Resp. Ck. ☒ Window Op.

As Found HV 694 VDC Temperature 64.8 °F Relative Humidity 69.7 %

Final Volt. Set 675 VDC Threshold (LLD) 10 mV Window (ULD) 20 mV Window width 10 mV

HV Readout (2 points) Reference: 500 V Reference: 1000 V
Inst. Readout: 497 V $\pm 2\%$ Inst. Readout: 1,010 V $\pm 2\%$

RANGE MULTIPLIER	REFERENCE CAL. POINT	"AS FOUND" READING	CORRECTED READING
x 1000	400 CPM	420,000 CPM	400,000 CPM
x 1000	100 CPM	100,000 CPM	100,000 CPM
x 100	400 CPM	40,000 CPM	40,000 CPM
x 100	100 CPM	10,000 CPM	10,000 CPM
x 10	400 CPM	4,000 CPM	4,000 CPM
x 10	100 CPM	1,000 CPM	1,000 CPM
x 1	400 CPM	400 CPM	400 CPM
x 1	100 CPM	100 CPM	100 CPM
Log Scale	200 CPM	200 CPM	200 CPM

DIGITAL SCALER READOUT

CAL. REF. POINT	AS FOUND READING	CORRECTED READING
40,000 CPM	40,304 CPM	40,304 CPM

*UNCERTAINTY WITHIN $\pm 10\%$ CORRECTION FACTOR WITHIN $\pm 20\%$

COMMENTS: Calibration Interval = 1 year Use "Window OUT

Detector Parameters: Page2- 3

Procedural Authority - ICP#22210000

Calibrated By: Kevin Shorts

Date: 03-Jun-2014

Reviewed By: Mauricio L. Torres

Date: 3 Jun '14

Page 1

pg 2 of 3



**DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
OCCUPATIONAL ENVIRONMENTAL HEALTH
WRIGHT-PATTERSON AFB OHIO
CERTIFICATE OF CALIBRATION**

Mfg. Ludlum Model 2221 Serial # 290803 Index # 102204 Date: 03-Jun-14
Mfg. Scionix Model 76BRS76/3M-E1-X Serial # SAG 427 Index # N/A Cal. Due Date: 03-Jun-15

TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT

NIST Traceable Check Sources				Reference Instruments			
Isotope	Serial #	Cert. Date	DPM	Mfg.	Model	Serial #	Cal. Due Date
Cs 137	MU851	01-Nov-04	1975850	Ludlum	500-1	102952	4 DEC 2014

Measurement Standards and test equipment used are traceable to the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities.

NaI DETECTOR HIGH VOLTAGE OPTIMIZATION

Probe #1
Mfg. Scionix
Model 76BRS76/3M-E1-X
Serial # SAG 427
Index # N/A
Isotope: Cs-137 @ 6"

Probe #2
Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

Probe #3
Mfg. N/A
Model _____
Serial # _____
Index # _____
Isotope: _____

High Voltage	CPM
500	26601
550	27584
600	27895
650	27826
*675	27780
700	28274
750	28287
800	28173
850	30217
900	41729
-----	-----
-----	-----
Bkgd@ 675v	8,781

High Voltage	CPM

High Voltage	CPM

Final Volt. Set 675 VDC Final Volt. Set _____ VDC Final Volt. Set _____ VDC
Efficiency 9900 CPM/μCi/m² @12" Efficiency _____ CPM/μCi/m² @12" Efficiency _____ CPM/μCi/m² @12"

COMMENTS: Calibration Interval = 1 year Use "Window OUT"

Procedural Authority - ICP#22210000

Calibrated By: Kurt Sharts
Reviewed By: Martino

Date : 03-Jun-2014
Date: 3 Jun '14

Jun 03 2014 11 07 AM Kurt Shorts
HotSpot FIDLER Calibration Information

Report Date : Jun 03 2014 11:07 AM
Calibration Date : 03 June 2014
Target Mix : Other Nuclide Check Source
Radionuclide : Cs-137
Detector Barcode Number : N/A
Meter Barcode Number : 102204
Detector Manufacturer : Scionix
Detector Model Number : 76BRS76/3M-E1-X
Detector Serial Number : SAG427
Meter Manufacturer : Ludlum
Meter Model Number : 2221
Meter Serial Number : 290803

Check Source I.D. : RP 3067
Calibration Date : 03 June 2014
Calibrated by : Kurt Shorts
Check Source Activity (uCi): 8.900E-01

Sample Counting Time (minutes) : 1.000E+00
Detector Height (cm) : 3.000E+01

Cs-137 Window Information:

Background (cpm) : 8,781
Areal Limit of Sensitivity (uCi/m2) : 4.4E-02
Point Limit of Sensitivity (uCi) : 5.5E-02
K-factor (m2) : 1.24

Counting Data (counts):

0-cm: 15887
20-cm: 13996
40-cm: 12147
60-cm: 10389
80-cm: 10225
100-cm: 9606

Instrument Type : Other

Window Option: Only 60 keV

Units: Classic

This is an actual 3x3 calibration, and the values are typical of most 3x3 configurations.

Detector Calibration Results

Cs-137 Window Information:

Cs-137 Detector Efficiency (cpm/(uCi/m2)): 9.9E+03
Cs-137 Detector Areal LOS (uCi/m2) : 4.4E-02
Cs-137 Detector Point LOS (uCi) : 5.5E-02
Cs-137 Detector Background Rate (cpm) : 8,781
Cs-137 Detector Check Source Rate (cpm) : 7,106
Cs-137 Detector K-Factor (m2) : 1.24
Cs-137 Detector K-Factor sdev (%) : 5.3

Attachment 3
Laboratory Sample Analysis



MEMORANDUM FOR: SSgt Emily Arceo
USAFSAM/OEC
2510 Fifth St. Bldg. 840
WRIGHT-PATTERSON AFB, OH 45433

12/8/2014 4:43:42 PM

FROM: USAFSAM OE Industrial Hygiene
2510 Fifth Street, Bldg 20840, Room W327
Wright Patterson Air Force Base, OH 45433-7913

REF: Order No.: S1410031

Dear SSgt Emily Arceo:

Enclosed are the sample reports from 22 samples received on 10/20/2014.

Samples, not consumed in analysis, will be held according to the appropriate regulatory authority unless you specifically request otherwise. Should you choose to reproduce this report, we recommend you do so in its entirety so that the integrity of the data package is kept intact.

If you have questions, or if we may be of further assistance to you, please do not hesitate to contact us.

Sincerely,

CRYSTAL C. BROWN, Capt, USAF
Analytical Services Program Manager
Tel: (937) 938-2523 (DSN Prefix: 798)
<https://hpws.afrl.af.mil/dhp/OE/ESOHSC/pages/index.cfm?id=742>

Note: Sample analysis performed by: USAFSAM/OE Radioanalytical Division

This report is intended solely for the purpose of the person to whom it is addressed. If received in error, please notify the Program Manager listed above.

USAFSAM OE Industrial Hygiene

CLIENT: USAFSAM/OEC

Project:

CASE NARRATIVE

Lab Work Order: S1410031

There were no problems associated with the samples or analysis except where noted below. Unless otherwise noted, sample results are not blank corrected, and all quality control associated with the samples were within acceptable limits.

These results relate only to the items tested.

Results for Ra226 reported as Ra_D_214 due to ingrowth of radium daughters Bi214/Pb214.



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 - (937) 938-2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg 840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140015
Lab Sample ID: S1410031-01A
Matrix: Soil
Collection Date: 10/16/2014
Receive Date: 10/20/2014
Collector: Client
Report Date: 12/8/2014 4:43:42 PM
Client ID: 0206OC

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		3.05E-01	3.46E-02	2.15E-02	4.44E-02	pCi/g	RJP	11/21/14 1048	7710
TH-234		1.39E+00	8.13E-01	9.98E-01	2.03E+00	pCi/g	RJP	11/21/14 1048	7710
TH-228		9.02E-01	8.59E-01	1.18E+00	2.41E+00	pCi/g	RJP	11/21/14 1048	7710
RA-224		1.01E+00	3.41E-01	3.18E-01	6.51E-01	pCi/g	RJP	11/21/14 1048	7710
Ra_D_214		1.24E+00	5.58E-02	4.27E-02	8.75E-02	pCi/g	RJP	11/21/14 1048	7710
PB-214		8.39E-01	1.80E-01	1.87E-01	3.81E-01	pCi/g	RJP	11/21/14 1048	7710
PB-212		1.09E+00	5.79E-02	3.15E-02	6.44E-02	pCi/g	RJP	11/21/14 1048	7710
K-40		1.21E+01	8.49E-01	2.31E-01	4.85E-01	pCi/g	RJP	11/21/14 1048	7710
CS-137		2.98E-02	1.77E-02	1.33E-02	2.81E-02	pCi/g	RJP	11/21/14 1048	7710
BI-212		9.59E-01	3.89E-01	2.94E-01	6.08E-01	pCi/g	RJP	11/21/14 1048	7710
AC-228		9.78E-01	7.64E-02	8.15E-02	1.69E-01	pCi/g	RJP	11/21/14 1048	7710

BRIAN J STROH, Capt, USAF
Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140016
Lab Sample ID: S1410031-02A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.76E-01	3.10E-02	1.90E-02	3.93E-02	pCi/g	RJP	11/21/14 1649	7710
TH-234		2.32E+00	7.35E-01	9.24E-01	1.88E+00	pCi/g	RJP	11/21/14 1649	7710
TH-228		2.33E+00	8.08E-01	1.09E+00	2.22E+00	pCi/g	RJP	11/21/14 1649	7710
PA-224		8.72E-01	2.85E-01	2.87E-01	5.89E-01	pCi/g	RJP	11/21/14 1649	7710
Ra_D_214		7.83E-01	4.10E-02	4.34E-02	8.92E-02	pCi/g	RJP	11/21/14 1649	7710
PB-214		6.97E-01	1.64E-01	1.80E-01	3.66E-01	pCi/g	RJP	11/21/14 1649	7710
PB-212		9.75E-01	5.34E-02	3.17E-02	6.47E-02	pCi/g	RJP	11/21/14 1649	7710
K-40		1.38E+01	9.12E-01	2.23E-01	4.68E-01	pCi/g	RJP	11/21/14 1649	7710
BI-210		1.18E+00	3.14E-01	2.32E-01	4.85E-01	pCi/g	RJP	11/21/14 1649	7710
AC-228		9.05E-01	7.19E-02	7.53E-02	1.57E-01	pCi/g	RJP	11/21/14 1649	7710

BRIAN J STROH, Capt, USAF
Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS14007
Lab Sample ID: S1410031-03A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.28E-01	2.66E-02	1.68E-02	3.47E-02	pCi/g	RJP	11/21/14 2251	7710
TH-234		1.32E+00	7.08E-01	8.74E-01	1.77E+00	pCi/g	RJP	11/21/14 2251	7710
RA-224		5.85E-01	2.84E-01	2.81E-01	5.74E-01	pCi/g	RJP	11/21/14 2251	7710
Ra_D-214		1.10E+00	4.53E-02	4.19E-02	8.56E-02	pCi/g	RJP	11/21/14 2251	7710
PB-214		7.19E-01	2.54E-01	1.64E-01	3.34E-01	pCi/g	RJP	11/21/14 2251	7710
PB-212		7.99E-01	4.53E-02	2.83E-02	5.78E-02	pCi/g	RJP	11/21/14 2251	7710
K-40		1.50E+01	9.55E-01	2.86E-01	5.91E-01	pCi/g	RJP	11/21/14 2251	7710
Bi-214		5.19E+00	3.74E+00	2.20E+00	4.46E+00	pCi/g	RJP	11/21/14 2251	7710
Bi-212		7.76E-01	2.69E-01	2.12E-01	4.42E-01	pCi/g	RJP	11/21/14 2251	7710
Ac-228		7.72E-01	6.67E-02	9.29E-02	1.91E-01	pCi/g	RJP	11/21/14 2251	7710

BRIAN J STROH, Capt, USAF
Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/CBC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emaly Arceo
Client Sample ID: GS1400:8
Lab Sample ID: S1410031-04A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.78E-01	8.29E-02	2.99E-02	6.13E-02	pCi/g	RJP	11/22/14 452	7710
FA-224		3.42E+00	2.42E+00	5.97E-01	1.21E+00	pCi/g	RJP	11/22/14 452	7710
Ra-D-214		1.59E+01	2.28E-01	6.59E-02	1.34E-01	pCi/g	RJP	11/22/14 452	7710
Pb-214		1.51E+01	7.64E-01	3.56E-01	7.20E-01	pCi/g	RJP	11/22/14 452	7710
Pb-212		9.82E-01	9.24E-02	5.69E-02	1.15E-01	pCi/g	RJP	11/22/14 452	7710
K-40		1.42E+01	1.07E+00	4.59E-01	9.43E-01	pCi/g	RJP	11/22/14 452	7710
Cs-137		2.19E-01	6.47E-02	2.69E-02	5.54E-02	pCi/g	RJP	11/22/14 452	7710
Bi-214		8.53E+00	2.78E+00	4.79E+00	9.67E+00	pCi/g	RJP	11/22/14 452	7710
Bi-212		1.40E+00	4.90E-01	3.73E-01	7.67E-01	pCi/g	RJP	11/22/14 452	7710
Ac-228		8.94E-01	1.19E-01	1.38E-01	2.82E-01	pCi/g	RJP	11/22/14 452	7710

BRIAN J STROH, Capt, USAF
Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 840
Report Date: 12/8/2014 4:43:42 PM
Contact: SSgt Emily Arceo
Client Sample ID: GS140019
Lab Sample ID: S1410031-05A
Matrix: Soil
Client ID: C2C60C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.82E-01	3.20E-02	2.77E-02	5.70E-02	pCi/g	RJP	11/22/14 1054	7710
FA-224		1.99E+00	9.26E-01	5.16E-01	1.05E+00	pCi/g	RJP	11/22/14 1054	7710
Ra_D-214		9.00E+00	1.55E-01	7.02E-02	1.43E-01	pCi/g	RJP	11/22/14 1054	7710
Pb-214		8.93E+00	4.10E-01	3.35E-01	6.78E-01	pCi/g	RJP	11/22/14 1054	7710
Pb-212		1.01E+00	6.53E-02	4.73E-02	9.63E-02	pCi/g	RJP	11/22/14 1054	7710
K-40		1.37E+01	1.03E+00	3.73E-01	7.74E-01	pCi/g	RJP	11/22/14 1054	7710
Cs-137		1.84E-01	2.75E-02	2.15E-02	4.48E-02	pCi/g	RJP	11/22/14 1054	7710
Bi-214		1.78E+01	7.11E+00	4.83E+00	9.77E+00	pCi/g	RJP	11/22/14 1054	7710
Bi-212		6.96E-01	9.85E-02	3.65E-01	7.56E-01	pCi/g	RJP	11/22/14 1054	7710
Ac-228		9.73E-01	1.42E-01	1.34E-01	2.76E-01	pCi/g	RJP	11/22/14 1054	7710

BRIAN J STROH, Capt, USAF
Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140021
Lab Sample ID: S1410031-06A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.40E-01	4.04E-02	4.29E-02	8.79E-02	pCi/g	RJP	11/22/14 1655	7710
FA-224		5.58E+00	3.85E+00	8.68E-01	1.76E+00	pCi/g	RJP	11/22/14 1655	7710
Ra_D_214		2.58E+01	3.48E-01	7.80E-02	1.60E-01	pCi/g	RJP	11/22/14 1655	7710
PB-214		2.58E+01	1.04E+00	5.44E-01	1.10E+00	pCi/g	RJP	11/22/14 1655	7710
PB-212		9.37E-01	1.04E-01	8.58E-02	1.74E-01	pCi/g	RJP	11/22/14 1655	7710
K-40		1.34E+01	1.21E+00	5.83E-01	1.20E+00	pCi/g	RJP	11/22/14 1655	7710
CS-137		3.52E-01	4.24E-02	3.72E-02	7.67E-02	pCi/g	RJP	11/22/14 1655	7710
CS-134		3.90E-02	2.42E-02	3.29E-02	6.76E-02	pCi/g	RJP	11/22/14 1655	7710
Bi-214		2.05E+01	4.42E+00	6.82E+00	1.38E+01	pCi/g	RJP	11/22/14 1655	7710
Ac-228		7.76E-01	1.60E-01	2.07E-01	4.23E-01	pCi/g	RJP	11/22/14 1655	7710

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Certificate of Analysis

Company: USAFSAM/OEC
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Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140022
Lab Sample ID: S141031-07A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
U-235		9.23E-02	3.58E-02	2.91E-02	5.90E-02	pCi/g	RJP	11/22/14 2257	7710
TL-208		2.48E-01	3.15E-02	2.08E-02	4.30E-02	pCi/g	RJP	11/22/14 2257	7710
TH-234		7.74E-01	7.86E-01	9.74E-01	1.98E+00	pCi/g	RJP	11/22/14 2257	7710
PA-234		8.67E-01	3.13E-01	3.10E-01	6.35E-01	pCi/g	RJP	11/22/14 2257	7710
Ra-D-214		1.07E+01	4.57E-02	4.06E-02	8.37E-02	pCi/g	RJP	11/22/14 2257	7710
PB-214		3.44E-01	2.71E-01	1.83E-01	3.72E-01	pCi/g	RJP	11/22/14 2257	7710
PB-212		9.93E-01	5.33E-02	3.14E-02	6.41E-02	pCi/g	RJP	11/22/14 2257	7710
K-40		1.58E+01	1.01E+00	2.49E-01	5.21E-01	pCi/g	RJP	11/22/14 2257	7710
CS-137		2.87E-02	2.63E-02	1.21E-02	2.57E-02	pCi/g	RJP	11/22/14 2257	7710
BI-212		9.24E-01	2.93E-01	2.09E-01	4.38E-01	pCi/g	RJP	11/22/14 2257	7710
AC-228		9.06E-01	7.43E-02	7.94E-02	1.65E-01	pCi/g	RJP	11/22/14 2257	7710

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Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140023
Lab Sample ID: S1410031-06A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		3.07E-01	3.94E-02	2.77E-02	5.69E-02	pCi/g	RJP	11/23/14 458	7710
TH-234		2.87E+00	1.04E+00	1.38E+00	2.78E+00	pCi/g	RJP	11/23/14 458	7710
TH-228		2.66E+00	1.12E+00	1.44E+00	2.94E+00	pCi/g	RJP	11/23/14 458	7710
PA-224		1.64E+00	6.20E-01	4.23E-01	8.62E-01	pCi/g	RJP	11/23/14 458	7710
Ra_D_214		4.69E+00	1.07E-01	5.10E-02	1.05E-01	pCi/g	RJP	11/23/14 458	7710
PB-214		3.89E+00	3.55E-01	2.64E-01	5.34E-01	pCi/g	RJP	11/23/14 458	7710
PB-212		1.19E+00	6.41E-02	4.27E-02	8.68E-02	pCi/g	RJP	11/23/14 458	7710
K-40		1.38E+01	1.49E+00	2.44E-01	5.12E-01	pCi/g	RJP	11/23/14 458	7710
CS-137		2.05E-01	6.85E-02	2.01E-02	4.18E-02	pCi/g	RJP	11/23/14 458	7710
Bi-214		1.86E+01	5.86E+00	3.69E+00	7.46E+00	pCi/g	RJP	11/23/14 458	7710
BI-212		1.07E+00	3.61E-01	2.65E-01	5.52E-01	pCi/g	RJP	11/23/14 458	7710
AC-228		1.12E+00	1.01E-01	1.25E-01	2.62E-01	pCi/g	RJP	11/23/14 458	7710

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Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH 45433
Contact: SSgt Emaly Arceo
Client Sample ID: GS140024
Lab Sample ID: S1410031-J9A
Matrix: Soil
Client ID: C2C60C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		3.89E-01	4.50E-02	2.77E-02	5.73E-02	pCi/g	RJP	11/21/14 1200	7711
TH-234		2.40E+00	1.30E+00	1.67E+00	3.38E+00	pCi/g	RJP	11/21/14 1200	7711
TH-228		3.36E+00	1.45E+00	1.96E+00	3.99E+00	pCi/g	RJP	11/21/14 1200	7711
PA-224		7.57E-01	7.97E-01	5.14E-01	1.05E+00	pCi/g	RJP	11/21/14 1200	7711
Ra_D_214		2.32E+00	8.70E-02	6.32E-02	1.30E-01	pCi/g	RJP	11/21/14 1200	7711
PB-214		2.28E+00	3.83E-01	3.00E-01	6.10E-01	pCi/g	RJP	11/21/14 1200	7711
PB-212		1.33E+00	1.70E-01	5.62E-02	1.14E-01	pCi/g	RJP	11/21/14 1200	7711
K-40		1.68E+01	1.20E+00	3.41E-01	7.15E-01	pCi/g	RJP	11/21/14 1200	7711
CS-137		2.19E-01	2.96E-02	2.07E-02	4.34E-02	pCi/g	RJP	11/21/14 1200	7711
BI-212		1.10E+00	4.93E-01	3.71E-01	7.71E-01	pCi/g	RJP	11/21/14 1200	7711
AC-228		1.23E+00	1.27E-01	1.09E-01	2.28E-01	pCi/g	RJP	11/21/14 1200	7711

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Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140025
Lab Sample ID: S1410031-10A
Matrix: Soil
Collection Date: 10/16/2014
Receive Date: 10/20/2014
Collector: Client
Report Date: 12/8/2014 4:43:42 PM
Client ID: 0206OC

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
CS-134	D, E, N	1.41E-02	1.19E-02	1.66E-02	3.48E-02	pCi/g	RJP	11/21/14 1801	7711
TL-208		2.38E-01	3.70E-02	2.40E-02	4.97E-02	pCi/g	RJP	11/21/14 1801	7711
RA-224		1.75E+00	1.10E+00	4.68E-01	9.55E-01	pCi/g	RJP	11/21/14 1801	7711
Ra_D_214		3.02E+00	8.18E-02	4.37E-02	9.06E-02	pCi/g	RJP	11/21/14 1801	7711
PB-214		2.43E+00	3.60E-01	2.79E-01	5.66E-01	pCi/g	RJP	11/21/14 1801	7711
PB-212		8.36E-01	1.39E-01	5.24E-02	1.07E-01	pCi/g	RJP	11/21/14 1801	7711
K-40		1.24E+01	9.64E-01	3.11E-01	6.53E-01	pCi/g	RJP	11/21/14 1801	7711
CS-137		1.03E-01	2.15E-02	1.81E-02	3.81E-02	pCi/g	RJP	11/21/14 1801	7711
Bi-214		7.09E+00	5.46E+00	4.22E+00	8.55E+00	pCi/g	RJP	11/21/14 1801	7711
BI-212		8.15E-01	3.56E-01	2.65E-01	5.56E-01	pCi/g	RJP	11/21/14 1801	7711
AC-228		7.79E-01	8.62E-02	1.05E-01	2.17E-01	pCi/g	RJP	11/21/14 1801	7711

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Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140026
Lab Sample ID: S1410031-11A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.94E-01	3.69E-02	2.38E-02	4.92E-02	pCi/g	RJP	11/22/14 003	7711
TH-234		8.68E-01	1.00E+00	1.16E+00	2.37E+00	pCi/g	RJP	11/22/14 003	7711
RA-224		7.64E-01	4.72E-01	3.71E-01	7.58E-01	pCi/g	RJP	11/22/14 003	7711
Ra_D-214		1.04E+00	5.42E-02	4.28E-02	8.84E-02	pCi/g	RJP	11/22/14 003	7711
PB-212		1.09E+00	1.06E-01	4.12E-02	8.40E-02	pCi/g	RJP	11/22/14 003	7711
K-40		1.21E+01	8.78E-01	2.46E-01	5.18E-01	pCi/g	RJP	11/22/14 003	7711
BI-212		1.09E+00	3.14E-01	2.25E-01	4.72E-01	pCi/g	RJP	11/22/14 003	7711
AC-228		9.93E-01	9.42E-02	7.81E-02	1.63E-01	pCi/g	RJP	11/22/14 003	7711

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Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140027
Lab Sample ID: S1410031-12A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.43E-01	2.96E-02	1.93E-02	3.99E-02	pCi/g	RJP	11/22/14 604	7711
TH-234		1.78E+00	8.61E-01	1.12E+00	2.28E+00	pCi/g	RJP	11/22/14 604	7711
TH-228		2.40E+00	9.89E-01	1.43E+00	2.91E+00	pCi/g	RJP	11/22/14 604	7711
PA-224		5.52E-01	5.78E-01	3.32E-01	6.77E-01	pCi/g	RJP	11/22/14 604	7711
Ra_D_214		1.86E+00	5.56E-02	3.95E-02	8.11E-02	pCi/g	RJP	11/22/14 604	7711
PB-214		1.28E+00	2.93E-01	1.97E-01	3.99E-01	pCi/g	RJP	11/22/14 604	7711
PB-212		7.81E-01	1.05E-01	3.65E-02	7.43E-02	pCi/g	RJP	11/22/14 604	7711
K-40		1.34E+01	8.81E-01	2.30E-01	4.81E-01	pCi/g	RJP	11/22/14 604	7711
CS-137		8.29E-02	1.57E-02	1.30E-02	2.72E-02	pCi/g	RJP	11/22/14 604	7711
Bi-214		1.00E+01	4.49E+00	2.96E+00	6.01E+00	pCi/g	RJP	11/22/14 604	7711
Bi-212		8.10E-01	2.94E-01	2.35E-01	4.89E-01	pCi/g	RJP	11/22/14 604	7711
Ac-228		7.72E-01	6.91E-02	8.07E-02	1.67E-01	pCi/g	RJP	11/22/14 604	7711

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Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140028
Lab Sample ID: S1410031-13A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.95E-01	3.16E-02	1.87E-02	3.88E-02	pCi/g	RJP	11/22/14 1205	7711
TH-228		1.57E+00	9.67E-01	1.35E+00	2.76E+00	pCi/g	RJP	11/22/14 1205	7711
RA-224		5.14E-01	3.59E-01	3.19E-01	6.52E-01	pCi/g	RJP	11/22/14 1205	7711
Pa_D-214		7.24E-01	4.41E-02	4.03E-02	8.26E-02	pCi/g	RJP	11/22/14 1205	7711
PB-214		3.67E-01	3.24E-01	2.03E-01	4.13E-01	pCi/g	RJP	11/22/14 1205	7711
PB-212		9.56E-01	1.12E-01	3.65E-02	7.44E-02	pCi/g	RJP	11/22/14 1205	7711
K-40		1.49E+01	9.58E-01	2.01E-01	4.25E-01	pCi/g	RJP	11/22/14 1205	7711
Bi-214		6.43E+00	4.52E+00	2.77E+00	5.63E+00	pCi/g	RJP	11/22/14 1205	7711
Bi-212		9.83E-01	2.74E-01	2.05E-01	4.31E-01	pCi/g	RJP	11/22/14 1205	7711
Ac-228		8.95E-01	8.26E-02	7.45E-02	1.55E-01	pCi/g	RJP	11/22/14 1205	7711

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Address: 2510 Fifth St. Bldg. 0840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140029
Lab Sample ID: S1410031-14A
Matrix: Soil
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client
Report Date: 12/8/2014 4:43:42 PM
Client ID: C2060C

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		3.05E-01	4.23E-02	3.92E-02	8.06E-02	pCi/g	RJP	11/22/14 1806	7711
Fa_D_214		2.18E+01	3.24E-01	1.20E-01	2.43E-01	pCi/g	RJP	11/22/14 1806	7711
Pb-214		2.27E+01	1.02E+00	5.33E-01	1.08E+00	pCi/g	RJP	11/22/14 1806	7711
Pb-212		9.41E-01	1.12E-01	8.30E-02	1.68E-01	pCi/g	RJP	11/22/14 1806	7711
K-40		1.15E+01	1.15E+00	5.89E-01	1.22E+00	pCi/g	RJP	11/22/14 1806	7711
CS-137		5.21E-01	4.92E-02	3.57E-02	7.36E-02	pCi/g	RJP	11/22/14 1806	7711
Bi-214		2.87E+01	4.75E+00	6.75E+00	1.37E+01	pCi/g	RJP	11/22/14 1806	7711
Bi-212		8.54E-01	6.04E-01	4.81E-01	9.95E-01	pCi/g	RJP	11/22/14 1806	7711
AC-228		6.06E-01	1.83E-01	1.77E-01	3.65E-01	pCi/g	RJP	11/22/14 1806	7711

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Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140030
Lab Sample ID: S1410031-15A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		1.92E-01	3.41E-02	3.93E-02	8.04E-02	pCi/g	RJP	11/23/14 008	7711
TH-228		3.52E+00	2.12E+00	2.64E+00	5.35E+00	pCi/g	RJP	11/23/14 008	7711
RA-224		4.25E+00	3.17E+00	7.64E-01	1.55E+00	pCi/g	RJP	11/23/14 008	7711
Ra_D-214		2.15E+01	3.02E-01	8.80E-02	1.79E-01	pCi/g	RJP	11/23/14 008	7711
Pb-214		2.25E+01	9.17E-01	4.65E-01	9.80E-01	pCi/g	RJP	11/23/14 008	7711
Pb-212		8.95E-01	9.81E-02	7.53E-02	1.53E-01	pCi/g	RJP	11/23/14 008	7711
K-40		1.17E+01	1.07E+00	5.38E-01	1.11E+00	pCi/g	RJP	11/23/14 008	7711
Cs-137		5.09E-01	4.43E-02	3.34E-02	5.86E-02	pCi/g	RJP	11/23/14 008	7711
Bi-214		2.49E+01	4.12E+00	5.82E+00	1.18E+01	pCi/g	RJP	11/23/14 008	7711
Ac-228		8.19E-01	2.02E-01	2.47E-01	5.08E-01	pCi/g	RJP	11/23/14 008	7711

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Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140031
Lab Sample ID: S1410031-16A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.72E-01	3.18E-02	2.01E-02	4.16E-02	pCi/g	RJP	11/23/14 609	7711
TH-234		1.40E+00	9.06E-01	1.12E+00	2.29E+00	pCi/g	RJP	11/23/14 609	7711
RA-224		7.40E-01	3.12E-01	3.31E-01	6.78E-01	pCi/g	RJP	11/23/14 609	7711
Ra_D-214		7.62E-01	4.12E-02	3.51E-02	7.28E-02	pCi/g	RJP	11/23/14 609	7711
PB-214		6.32E-01	1.77E-01	2.06E-01	4.20E-01	pCi/g	RJP	11/23/14 609	7711
PB-212		8.97E-01	5.71E-02	3.59E-02	7.33E-02	pCi/g	RJP	11/23/14 609	7711
K-40		1.36E+01	9.18E-01	2.23E-01	4.69E-01	pCi/g	RJP	11/23/14 609	7711
Bi-212		8.30E-01	3.01E-01	2.21E-01	4.64E-01	pCi/g	RJP	11/23/14 609	7711
AC-228		7.83E-01	7.04E-02	7.32E-02	1.53E-01	pCi/g	RJP	11/23/14 609	7711

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Chief, Radioanalytical Laboratory

AURELIE M SOREFAN, DR-II, PhD, DAF
Technical Director, Radioanalytical Laboratory



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
WRIGHT-PATTERSON AFB OH 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140032
Lab Sample ID: S1410031-17A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
FE-59	E,N	7.27E-02	8.39E-02	3.21E-02	7.03E-02	pCi/g	RJP	11/21/14 1251	7712
TL-208		2.75E-01	3.85E-02	2.64E-02	5.41E-02	pCi/g	RJP	11/21/14 1251	7712
TH-228		2.08E+00	1.08E+00	1.44E+00	2.92E+00	pCi/g	RJP	11/21/14 1251	7712
PA-224		1.57E+00	1.24E+00	4.59E-01	9.34E-01	pCi/g	RJP	11/21/14 1251	7712
Ra_D-214		5.77E+00	1.21E-01	4.80E-02	9.86E-02	pCi/g	RJP	11/21/14 1251	7712
PB-214		5.62E+00	4.65E-01	2.28E-01	4.62E-01	pCi/g	RJP	11/21/14 1251	7712
PB-212		9.53E-01	1.07E-01	4.56E-02	9.27E-02	pCi/g	RJP	11/21/14 1251	7712
PB-210		2.72E+00	2.25E+00	2.40E+00	4.88E+00	pCi/g	RJP	11/21/14 1251	7712
K-40		1.28E+01	9.28E-01	3.18E-01	6.61E-01	pCi/g	RJP	11/21/14 1251	7712
CS-137		3.75E-02	1.51E-02	1.81E-02	3.77E-02	pCi/g	RJP	11/21/14 1251	7712
Bi-214		5.75E+00	2.09E+00	2.95E+00	5.98E+00	pCi/g	RJP	11/21/14 1251	7712
Bi-212		6.75E-01	3.16E-01	2.37E-01	4.96E-01	pCi/g	RJP	11/21/14 1251	7712
AC-228		8.30E-01	7.77E-02	1.34E-01	2.79E-01	pCi/g	RJP	11/21/14 1251	7712

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2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/CBC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH 45433
Contact: SSgt Emaly Arceo
Client Sample ID: GS140033
Lab Sample ID: S1410031-1&A
Matrix: Soil
Client ID: C2C60C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
EU-154	E.N	8.54E-02	1.01E-01	3.12E-02	6.34E-02	pCi/g	RJP	11/21/14 1853	7712
TL-208		2.41E-01	3.12E-02	2.00E-02	4.14E-02	pCi/g	RJP	11/21/14 1853	7712
TH-234		9.83E-01	7.84E-01	1.02E+00	2.07E+00	pCi/g	RJP	11/21/14 1853	7712
TH-228		9.63E-01	7.94E-01	1.23E+00	2.50E+00	pCi/g	RJP	11/21/14 1853	7712
RA-224		5.84E-01	3.03E-01	3.14E-01	6.43E-01	pCi/g	RJP	11/21/14 1853	7712
RA-D-214		9.31E-01	4.38E-02	4.00E-02	8.25E-02	pCi/g	RJP	11/21/14 1853	7712
PB-214		8.22E-01	2.66E-01	1.68E-01	3.42E-01	pCi/g	RJP	11/21/14 1853	7712
PB-212		8.67E-01	5.23E-02	3.09E-02	6.31E-02	pCi/g	RJP	11/21/14 1853	7712
K-40		1.37E+01	9.02E-01	1.97E-01	4.16E-01	pCi/g	RJP	11/21/14 1853	7712
CS-137		5.24E-02	5.44E-02	1.29E-02	2.73E-02	pCi/g	RJP	11/21/14 1853	7712
BI-212		8.62E-01	3.34E-01	2.74E-01	5.69E-01	pCi/g	RJP	11/21/14 1853	7712
AC-228		7.95E-01	7.38E-02	7.97E-02	1.66E-01	pCi/g	RJP	11/21/14 1853	7712

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Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140034
Lab Sample ID: S1410031-15A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.78E-01	2.71E-02	1.53E-02	3.17E-02	pCi/g	RJP	11/22/14 054	7712
TH-234		1.82E+00	7.35E-01	9.15E-01	1.86E+00	pCi/g	RJP	11/22/14 054	7712
TH-228		1.33E+00	7.28E-01	1.03E+00	2.10E+00	pCi/g	RJP	11/22/14 054	7712
Ra_D-214		7.18E-01	4.06E-02	3.26E-02	6.74E-02	pCi/g	RJP	11/22/14 054	7712
Pb-214		6.01E-01	1.88E-01	1.39E-01	2.83E-01	pCi/g	RJP	11/22/14 054	7712
Pb-212		8.06E-01	4.81E-02	2.85E-02	5.83E-02	pCi/g	RJP	11/22/14 054	7712
K-40		1.28E+01	8.41E-01	2.10E-01	4.41E-01	pCi/g	RJP	11/22/14 054	7712
Bi-212		9.27E-01	2.58E-01	1.90E-01	3.98E-01	pCi/g	RJP	11/22/14 054	7712
AC-228		8.03E-01	7.39E-02	6.55E-02	1.37E-01	pCi/g	RJP	11/22/14 054	7712

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Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emaly Arceo
Client Sample ID: GS140035
Lab Sample ID: S1410031-20A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.71E-01	3.08E-02	1.95E-02	4.01E-02	pCi/g	RJP	11/22/14 0556	7712
TH-234		1.19E+00	7.93E-01	1.02E+00	2.07E+00	pCi/g	RJP	11/22/14 0556	7712
TH-228		2.01E+00	8.25E-01	1.18E+00	2.40E+00	pCi/g	RJP	11/22/14 0556	7712
PA-224		1.15E+00	6.48E-01	3.42E-01	6.97E-01	pCi/g	RJP	11/22/14 0556	7712
Ra_D-214		2.10E+00	6.62E-02	3.55E-02	7.32E-02	pCi/g	RJP	11/22/14 0556	7712
PB-214		1.62E+00	3.32E-01	1.70E-01	3.46E-01	pCi/g	RJP	11/22/14 0556	7712
PB-212		8.73E-01	1.05E-01	3.34E-02	6.81E-02	pCi/g	RJP	11/22/14 0556	7712
PA-234M		5.75E+00	5.57E+00	4.42E+00	9.38E+00	pCi/g	RJP	11/22/14 0556	7712
K-40		1.38E+01	8.96E-01	2.23E-01	4.66E-01	pCi/g	RJP	11/22/14 0556	7712
CS-137		4.78E-02	6.20E-02	1.37E-02	2.87E-02	pCi/g	RJP	11/22/14 0556	7712
Bi-214		7.10E+00	4.27E+00	2.62E+00	5.31E+00	pCi/g	RJP	11/22/14 0556	7712
Bi-212		7.16E-01	2.45E-01	2.22E-01	4.62E-01	pCi/g	RJP	11/22/14 0556	7712
AC-228		8.25E-01	8.62E-02	7.59E-02	1.57E-01	pCi/g	RJP	11/22/14 0556	7712

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2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/CBC
Address: 2510 Fifth St. Bldg. 0840
Report Date: 12/8/2014 4:43:42 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140036
Lab Sample ID: S1410031-21A
Matrix: Soil
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
TL-208		2.50E-01	3.06E-02	1.87E-02	3.87E-02	pCi/g	RJP	11/22/14 1257	7712
TH-234		1.50E+00	7.92E-01	1.00E+00	2.04E+00	pCi/g	RJP	11/22/14 1257	7712
TH-228		1.39E+00	7.82E-01	1.15E+00	2.35E+00	pCi/g	RJP	11/22/14 1257	7712
PA-224		5.73E-01	2.75E-01	2.97E-01	6.08E-01	pCi/g	RJP	11/22/14 1257	7712
Ra_D_214		6.18E-01	3.71E-02	3.51E-02	7.26E-02	pCi/g	RJP	11/22/14 1257	7712
PB-214		4.31E-01	2.38E-01	1.77E-01	3.60E-01	pCi/g	RJP	11/22/14 1257	7712
PB-212		8.32E-01	5.01E-02	3.08E-02	6.29E-02	pCi/g	RJP	11/22/14 1257	7712
K-40		1.36E+01	9.01E-01	2.34E-01	4.90E-01	pCi/g	RJP	11/22/14 1257	7712
CS-137		2.24E-02	1.65E-02	1.27E-02	2.68E-02	pCi/g	RJP	11/22/14 1257	7712
BI-212		7.30E-01	2.98E-01	2.39E-01	4.98E-01	pCi/g	RJP	11/22/14 1257	7712
AC-228		8.73E-01	6.94E-02	6.54E-02	1.37E-01	pCi/g	RJP	11/22/14 1257	7712

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Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St. Bldg. 0840
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140037
Lab Sample ID: S1410031-22A
Matrix: Soil
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client
Report Date: 12/8/2014 4:43:42 PM
Client ID: C2060C

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
CD-109	E,N	4.35E-01	3.20E-01	4.17E-01	8.48E-01	pCi/g	RJP	11/22/14 1859	7712
TL-208		2.68E-01	3.20E-02	1.99E-02	4.12E-02	pCi/g	RJP	11/22/14 1859	7712
TH-234		1.01E+00	8.27E-01	1.05E+00	2.13E+00	pCi/g	RJP	11/22/14 1859	7712
TH-228		2.02E+00	8.18E-01	1.20E+00	2.45E+00	pCi/g	RJP	11/22/14 1859	7712
RA-224		4.41E-01	2.85E-01	3.34E-01	6.84E-01	pCi/g	RJP	11/22/14 1859	7712
Ra_D_214		6.12E-01	3.85E-02	3.91E-02	8.07E-02	pCi/g	RJP	11/22/14 1859	7712
PB-212		8.45E-01	5.12E-02	3.35E-02	6.84E-02	pCi/g	RJP	11/22/14 1859	7712
K-40		1.23E+01	9.03E-01	2.20E-01	4.63E-01	pCi/g	RJP	11/22/14 1859	7712
CS-137		1.26E-01	5.42E-02	1.58E-02	3.31E-02	pCi/g	RJP	11/22/14 1859	7712
Bi-214		6.76E+00	3.89E+00	2.46E+00	5.01E+00	pCi/g	RJP	11/22/14 1859	7712
BI-212		1.01E+00	2.88E-01	2.14E-01	4.48E-01	pCi/g	RJP	11/22/14 1859	7712
AC-228		7.57E-01	6.93E-02	6.78E-02	1.42E-01	pCi/g	RJP	11/22/14 1859	7712

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Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Radiation Qualifier List

Qualifier	Qualifier Description
A	Identification Rejected
B	(ELAP) Blank Contamination
C	Inconclusive
D	Misidentification
E	False Positive
F	Consistent with False Positive
G	Qualitatively consistent with detector background
H	Quantitatively consistent with detector background
I	Inconsistent energy shift
J	(ELAP) The reported results is an estimated value
N	(ELAP) Non-target analyte
Q	(ELAP) One or more quality control criteria failed
U	(ELAP) Analyte was not detected and is reported as less than the LOD
K	Inconsistent Full Width Half Max (FWHM)
L	Hold time exceeded
M	Results invalid



MEMORANDUM FOR: SSgt Emily Arceo
USAFSAM/OEC
2510 Fifth St. Bldg. 840
WRIGHT-PATTERSON AFB, OH 45433

12/8/2014 4:41:15 PM

FROM: USAFSAM OE Industrial Hygiene
2510 Fifth Street, Bldg 20840, Room W327
Wright Patterson Air Force Base, OH 45433-7913

REF: Order No.: S1410032

Dear SSgt Emily Arceo:

Enclosed are the sample reports from 1 sample received on 10/20/2014.

Samples, not consumed in analysis, will be held according to the appropriate regulatory authority unless you specifically request otherwise. Should you choose to reproduce this report, we recommend you do so in its entirety so that the integrity of the data package is kept intact.

If you have questions, or if we may be of further assistance to you, please do not hesitate to contact us.

Sincerely,

CRYSTAL C. BROWN, Capt, USAF
Analytical Services Program Manager
Tel: (937) 938-2523 (DSN Prefix: 798)
<https://hpws.afrl.af.mil/dhp/OE/ESOHSC/pages/index.cfm?id=742>

Note: Sample analysis performed by: USAFSAM/OE Radioanalytical Division

This report is intended solely for the purpose of the person to whom it is addressed. If received in error, please notify the Program Manager listed above.

USAFSAM OE Industrial Hygiene

CLIENT: USAFSAM/OEC

Project:

Lab Work Order: S1410032

CASE NARRATIVE

There were no problems associated with the samples or analysis except where noted below. Unless otherwise noted, sample results are not blank corrected, and all quality control associated with the samples were within acceptable limits.

These results relate only to the items tested.



Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Certificate of Analysis

Company: USAFSAM/OEC
Address: 2510 Fifth St, Bldg 0840
Report Date: 12/02/2014 4:41:15 PM
WRIGHT-PATTERSON AFB OH, 45433
Contact: SSgt Emily Arceo
Client Sample ID: GS140020
Lab Sample ID: S1410032-01A
Matrix: Vegetation
Client ID: C2060C
Collection Date: 11/16/2014
Receive Date: 11/20/2014
Collector: Client

Parameter	Qualifier	Activity	Uncertainty	Lc	MDA	Units	Analyst	Date/Time	Batch
Gamma Spec Full									
Ra D-214		8.79E-01	1.52E-01	1.70E-01	3.54E-01	pCi/g	RJP	11/21/14 1350	7722
Pb-214		9.06E-01	5.31E-01	6.55E-01	1.34E+00	pCi/g	RJP	11/21/14 1350	7722
Pb-212		5.33E-01	3.09E-01	1.86E-01	3.80E-01	pCi/g	RJP	11/21/14 1350	7722
K-40		8.94E+00	1.88E+00	1.13E+00	2.39E+00	pCi/g	RJP	11/21/14 1350	7722
Bi-214		2.14E+01	1.25E+01	1.01E+01	2.07E+01	pCi/g	RJP	11/21/14 1350	7722
Bi-212		1.50E+00	1.85E+00	1.50E+00	3.11E+00	pCi/g	RJP	11/21/14 1350	7722

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Radioanalytical Services Laboratory
2510 Fifth St, Area B Bldg 0840 WPAFB, OH 45433 (937) 938 2523

Radiation Qualifier List

Qualifier	Qualifier Description
A	Identification Rejected
B	(ELAP) Blank Contamination
C	Inconclusive
D	Misidentification
E	False Positive
F	Consistent with False Positive
G	Qualitatively consistent with detector background
H	Quantitatively consistent with detector background
I	Inconsistent energy shift
J	(ELAP) The reported results is an estimated value
N	(ELAP) Non-target analyte
Q	(ELAP) One or more quality control criteria failed
U	(ELAP) Analyte was not detected and is reported as less than the LOD
K	Inconsistent Full Width Half Max (FWHM)
L	Hold time exceeded
M	Results invalid

Attachment 4 Statistical Summary of Walkover Data

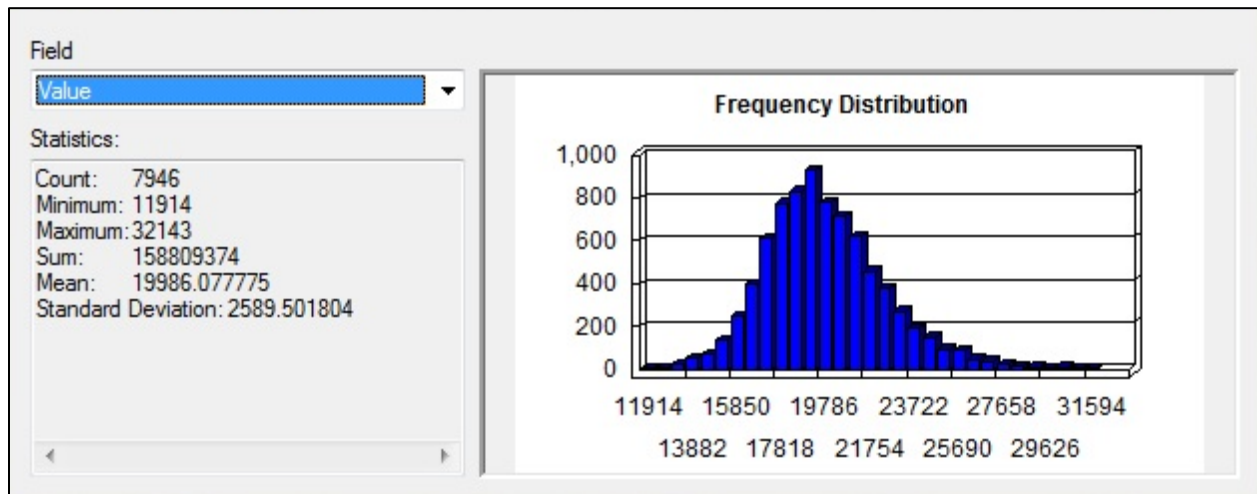


Figure A4-1. Area A Statistical Summary

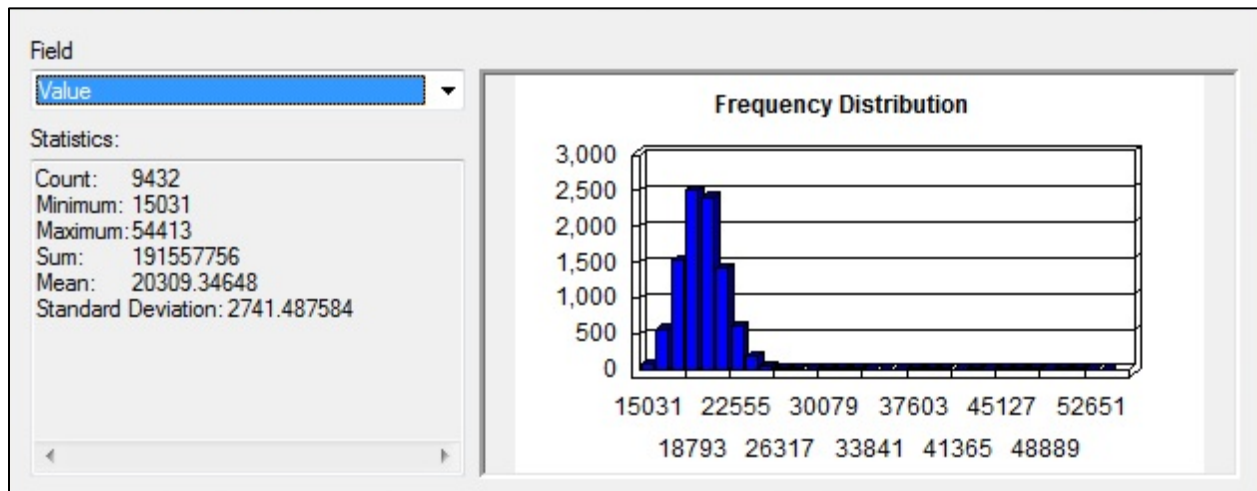


Figure A4-2. Area B Statistical Summary

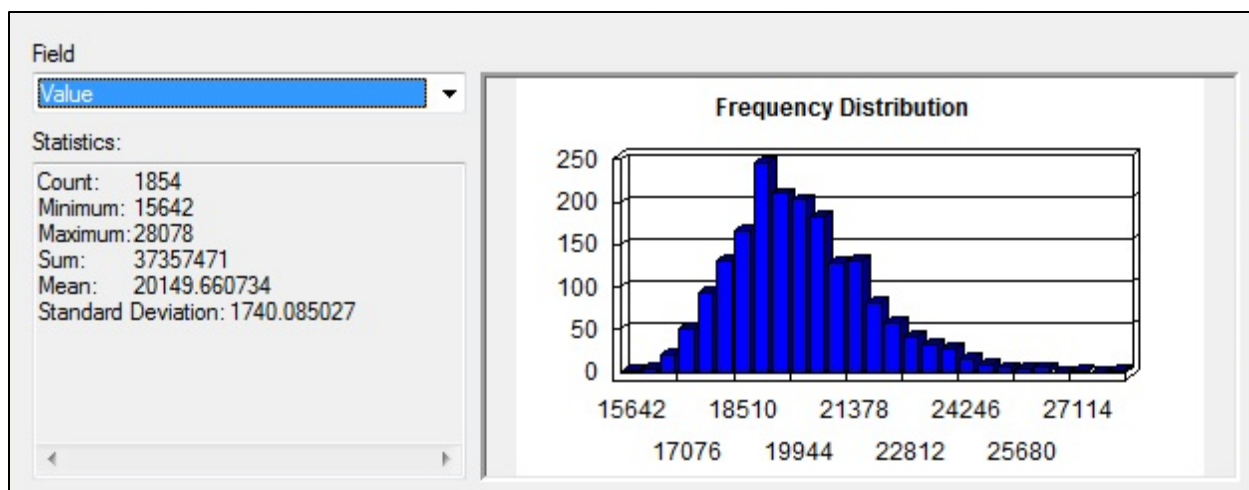


Figure A4-3. Area C Statistical Summary

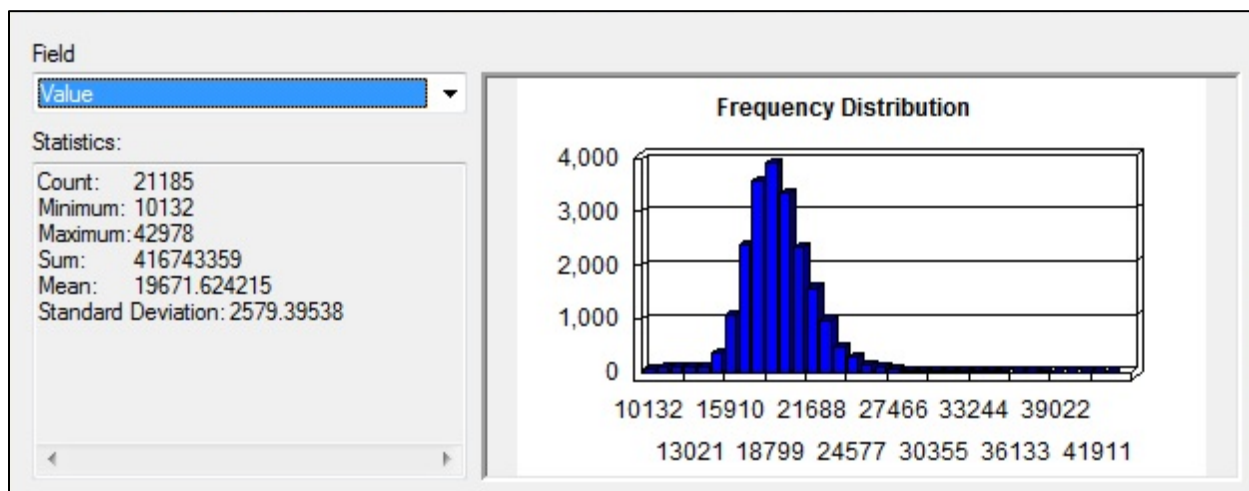


Figure A4-4. Area D Statistical Summary

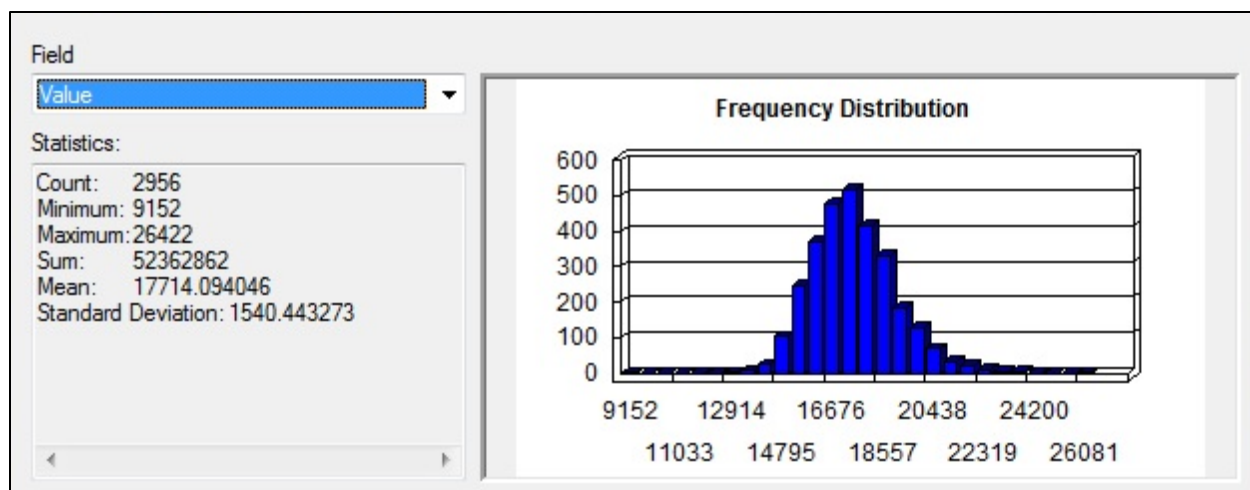


Figure A4-5. Area E Statistical Summary