Rancho Seco

Final Status Survey Summary Report

February 1, 2017

IOSB Office Area

Survey Unit F8300133

Prepared By: _____ Date: 2.1.17

FSS Engineer

Reviewed By: _____ Date: 2.3.17

Lead FSS Engineer

Approved By: _____ Date: 2/24/17

Manager, Rancho Seco Assets

Survey Unit:

F8300133, Interim Onsite Storage Building (IOSB) Office Area

Survey Unit Description:

Operating History: Designed primarily to store packaged radioactive waste containers safely, protected from the elements, and maintain radiological dose as low as reasonably achievable (ALARA), the IOSB possibly stored media of many types, including filters, resins, contaminated chemicals, DAW, activated reactor components, contaminated plant components and other contaminated items. The office area was outside the radiologically controlled area during operations at the facility.

Site Characterization: Static measurements were made of the floor, walls, and ceiling, to confirm the absence or presence of plant-derived radionuclides. Static measurements showed a mean gross beta activity level of 2,047 dpm/100 cm^2 and a maximum value of 2,742 dpm/100 cm^2. Based on the levels of gross activity reported, the area was determined to be a Class 3 area.

Survey Unit Design Information:

The Survey Unit Design Parameters are presented in **Table 1** below. The survey unit and measurement locations are depicted on the maps in **Attachment 1**. Static measurement locations were randomly determined and approximately 3% of the area scanned by beta scanning. The instrumentation used for the survey along with the MDC values are listed in **Table 2-1 Attachment 2**.

Table 1, Survey Unit Design Parameters

Evaluation Input Values		Comments
Survey Package:	**F830**	Office
Survey Unit:	**13**	
Class	**03**	
SU Area (m^2)	**370**	
Evaluator:	JR	
$DCGL_w$:	43,000	Gross Activity DCGL
Area Factor	NA	Class 3
Design DCGLemc ($dpm/100cm^2$):	NA	Class 3
$DCGL_{emc}$:	NA	Class 3
LBGR:	21,500	Default = 50% DCGL
Sigma:	334	Scoping Survey
Type I error:	0.05	
Type II error:	0.05	
Predominant Nuclide	Cs-137	
Sample Area (m^2)	N/A	
Total Instrument Efficiency:	0.132	
Total Area Scanned (m^2):	11.1	
Scan Coverage (%)	3%	Class 3
Material Type:	N/A	Choosing 'N/A' sets material background to "0"
Calculated Values		**Comments**
$Z_{1-\alpha}$:	1.645	
$Z_{1-\beta}$:	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	64.3	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	

Survey Results:

A total of 30 direct measurements were made in F8300133 floor, ceiling, and walls. The results of the static measurements are shown in **Table 2**. All of the static measurements were less than the DCGL. None of the scan measurements indicated areas of elevated activity. Swipe data did not indicate elevated activity levels above the MDA.

Table 2, Static Measurement Results

Number	Sample #	Beta (cpm)	Beta (dpm)
1	F8300313C00001	269	1,795
2	F8300313C00002	272	1,848
3	F8300313C00003	240	2,182
4	F8300313C00004	237	2,152
5	F8300313C00005	270	1,652
6	F8300313C00006	262	1,932
7	F8300313C00007	251	2,402
8	F8300313C00008	211	2,038
9	F8300313C00009	297	2,061
10	F8300313C00010	267	1,818
11	F8300313C00011	275	1,795
12	F8300313C00012	297	2,045
13	F8300313C00013	246	1,985
14	F8300313C00014	239	1,902
15	F8300313C00015	229	1,598
16	F8300313C00016	318	2,250
17	F8300313C00017	263	2,023
18	F8300313C00018	217	2,083
19	F8300313C00019	254	2,250
20	F8300313C00020	263	1,864
21	F8300313C00021	290	1,811
22	F8300313C00022	223	1,735
23	F8300313C00023	277	2,409
24	F8300313C00024	269	1,992
25	F8300313C00025	272	1,644
26	F8300313C00026	240	1,924
27	F8300313C00027	237	1,992
28	F8300313C00028	270	2,197
29	F8300313C00029	262	1,689
30	F8300313C00030	251	2,098

Table 3 contains the statistical summary of the static measurement data for the office area.

Table 3, Beta Summary Statistics

Beta Static Office	
Mean	1,972
Median	1,989
Standard Deviation	215
Minimum	1,598
Maximum	2,409
Count	30

Survey Unit Data Assessment:

The survey design required 14 static measurements for the Sign Test. A total of 30 static measurements were collected. The critical value and the results of the Sign Test are presented in **Table 4**. The sample mean and median values were less than the DCGL. The sample standard deviation was greater than the design standard deviation but both values of sigma resulted in a relative shift greater than three (3), no additional samples were required.

Table 4, Data Assessment Results

Static Data Values		**Comments**
Number of Samples:	30	
Median:	1,989	
Mean:	1,972	
Static Data Standard Deviation:	215	
Maximum:	2,409	
Sign Test Results		**Comments**
Adjusted N Value:	14	
S+ Value:	30	
Critical Value:	10	
Criteria Satisfaction		**Comments**
Sufficient samples collected:	Pass	
Maximum value <$DCGL_W$:	Pass	
Median value <$DCGL_W$:	Pass	
Mean value <$DCGL_W$:	Pass	
Maximum value <$DCGL_{emc}$:	NA	
Sign test results:	Pass	
Final Status		**Comments**
The survey unit passes all conditions:	Pass	

Survey Unit Investigations and Results:

No investigations were required for either direct or scan measurements and no investigation results are reported.

ALARA Statement:

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL, the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 3 survey and the sample results are consistent with that classification. No individual measurement exceeded the DCGL. No potential areas of elevated activity were detected.

Conclusion:

The FSS of this survey unit was properly designed as a Class 3 survey based on the results of the investigation survey. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. All of the static measurements were less than the DCGL. No investigations were required.

The static measurement data support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and that the data quality objectives were met.

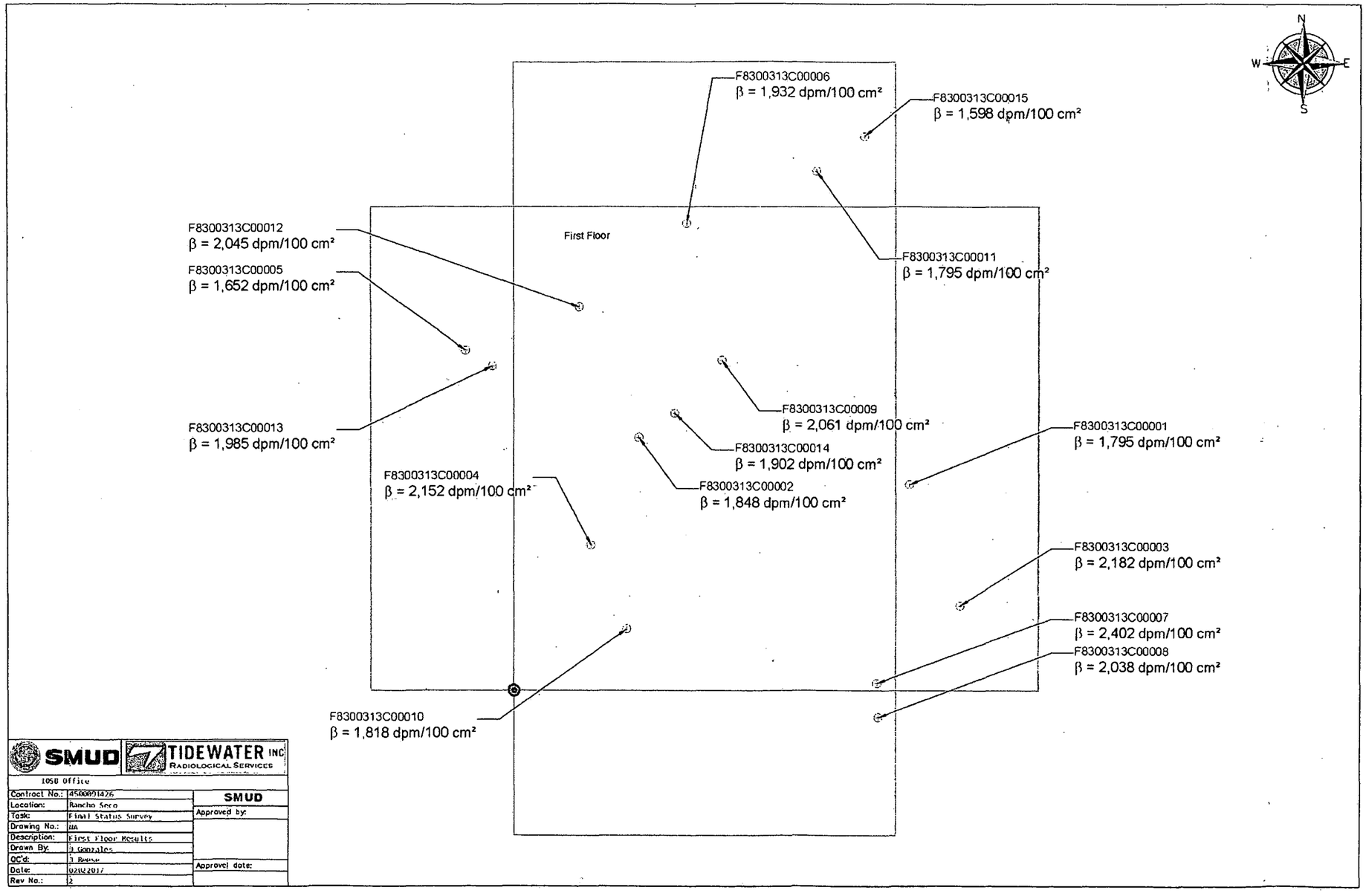
It is concluded that survey unit F8300133 meets the release criteria of 10CFR20.1402.

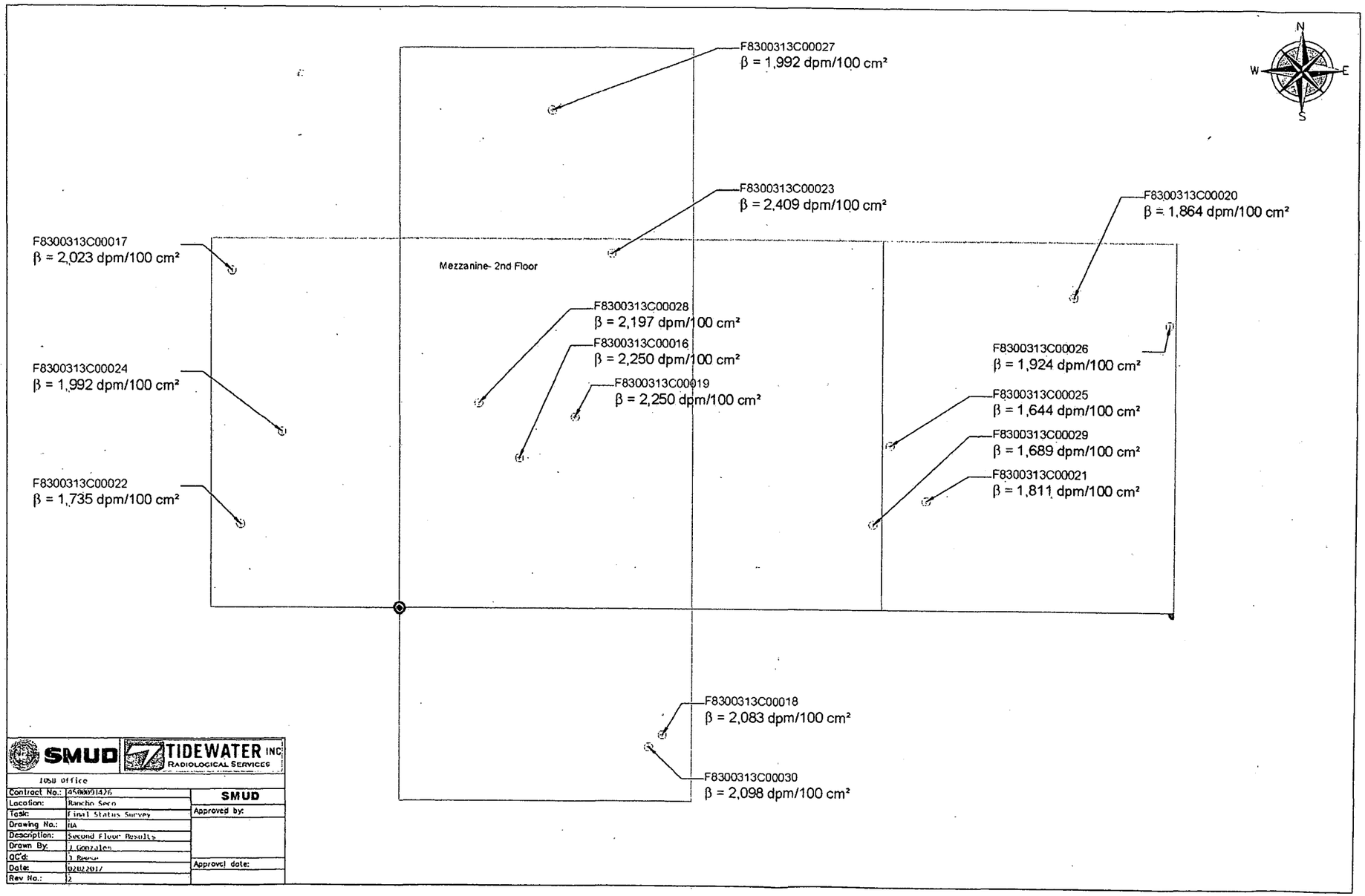
Attachment 1

Maps

February 3, 2017

Survey Unit F8300133


N
W
E
S
First Floor
F8300313C00006
β = 1,932 dpm/100 cm²
F8300313C00015
β = 1,598 dpm/100 cm²
F8300313C00012
β = 2,045 dpm/100 cm²
F8300313C00005
β = 1,652 dpm/100 cm²
F8300313C00011
β = 1,795 dpm/100 cm²
F8300313C00009
β = 2,061 dpm/100 cm²
F8300313C00013
β = 1,985 dpm/100 cm²
F8300313C00014
β = 1,902 dpm/100 cm²
F8300313C00001
β = 1,795 dpm/100 cm²
F8300313C00004
β = 2,152 dpm/100 cm²
F8300313C00002
β = 1,848 dpm/100 cm²
F8300313C00003
β = 2,182 dpm/100 cm²
F8300313C00007
β = 2,402 dpm/100 cm²
F8300313C00008
β = 2,038 dpm/100 cm²
F8300313C00010
β = 1,818 dpm/100 cm²
SMUD
TIDEWATER INC
RADIOLOGICAL SERVICES
1050 Office
Contract No.: 4500091476
Location: Rancho Seco
Task: Final Status Survey
Drawing No.: 8A
Description: First Floor Results
Drawn By: J Gonzales
QC'd: J Reese
Date: 02/02/2017
Rev No.: 2
SMUD
Approved by:
Approval date:


N
W
E
S
F8300313C00027
β = 1,992 dpm/100 cm²
F8300313C00023
β = 2,409 dpm/100 cm²
F8300313C00020
β = 1,864 dpm/100 cm²
F8300313C00017
β = 2,023 dpm/100 cm²
Mezzanine- 2nd Floor
F8300313C00028
β = 2,197 dpm/100 cm²
F8300313C00016
β = 2,250 dpm/100 cm²
F8300313C00019
β = 2,250 dpm/100 cm²
F8300313C00026
β = 1,924 dpm/100 cm²
F8300313C00024
β = 1,992 dpm/100 cm²
F8300313C00025
β = 1,644 dpm/100 cm²
F8300313C00029
β = 1,689 dpm/100 cm²
F8300313C00022
β = 1,735 dpm/100 cm²
F8300313C00021
β = 1,811 dpm/100 cm²
F8300313C00018
β = 2,083 dpm/100 cm²
F8300313C00030
β = 2,098 dpm/100 cm²
SMUD
TIDEWATER INC
RADIOLOGICAL SERVICES
Job Office
Contract No.: 4500091426
Location: Rancho Seco
Task: Final Status Survey
Drawing No.: NA
Description: Second Floor Results
Drawn By: J Gonzales
QC'd: J Reese
Date: 02022017
Rev No.: 2
SMUD
Approved by:
Approval date:

Attachment 2

Instrumentation

February 3, 2017

Survey Unit F8300133

Table 2-1. Survey Unit Instrumentation

Measurement Type	Instrument Type	Minimum Detectable Activity[a]	Detector Efficiencies	Calibration Due Date[b]
Beta Static Measurement	Ludlum Model 2350-1 Ludlum Model 44-116 B Detector	Beta – 502 dpm/100 cm^2	13.2%	317897/331972 2/10/17
Swipe Measurements	Ludlum Model 2929 Ludlum Model 44-10-1	Beta – 78dpm/100 cm^2	36.9% 42.8%	166716/170380 5/13/17

[a] Minimum detectable activities for the count rate instrumentation were calculated in accordance with NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions" (U.S. NRC, 1997).

[b] Detectors are required to be calibrated once every 12 months. Calibration due date indicates the date by which the detector must be calibrated again.

cm^2 = square centimeters
cpm = counts per minute
dpm = disintegrations per minute

Static Measurement MDA

Beta	Survey Type
PR331972	Detector Number
185	Background count rate (cpm)
1	Count Time (min)
0.132	Efficiency
100	Area of Detector (cm^2)

Constants

60	sec/min
2.54	cm/in

Assumptions

Background count time and sample count time are equivalent

Calculate Static MDA

Static MDA $= 3 + 4.65(B_r * t)^{0.5}/t * E * A/100$ (NUREG 1507)

Where:

B_r	Background Countrate
t	Count Time (min)
E	Efficiency
A	Area of detector (cm^2)

Static MDA 502 dpm/100 cm^2

Attachment 3

Investigation

February 1, 2017

Survey Unit F8300133

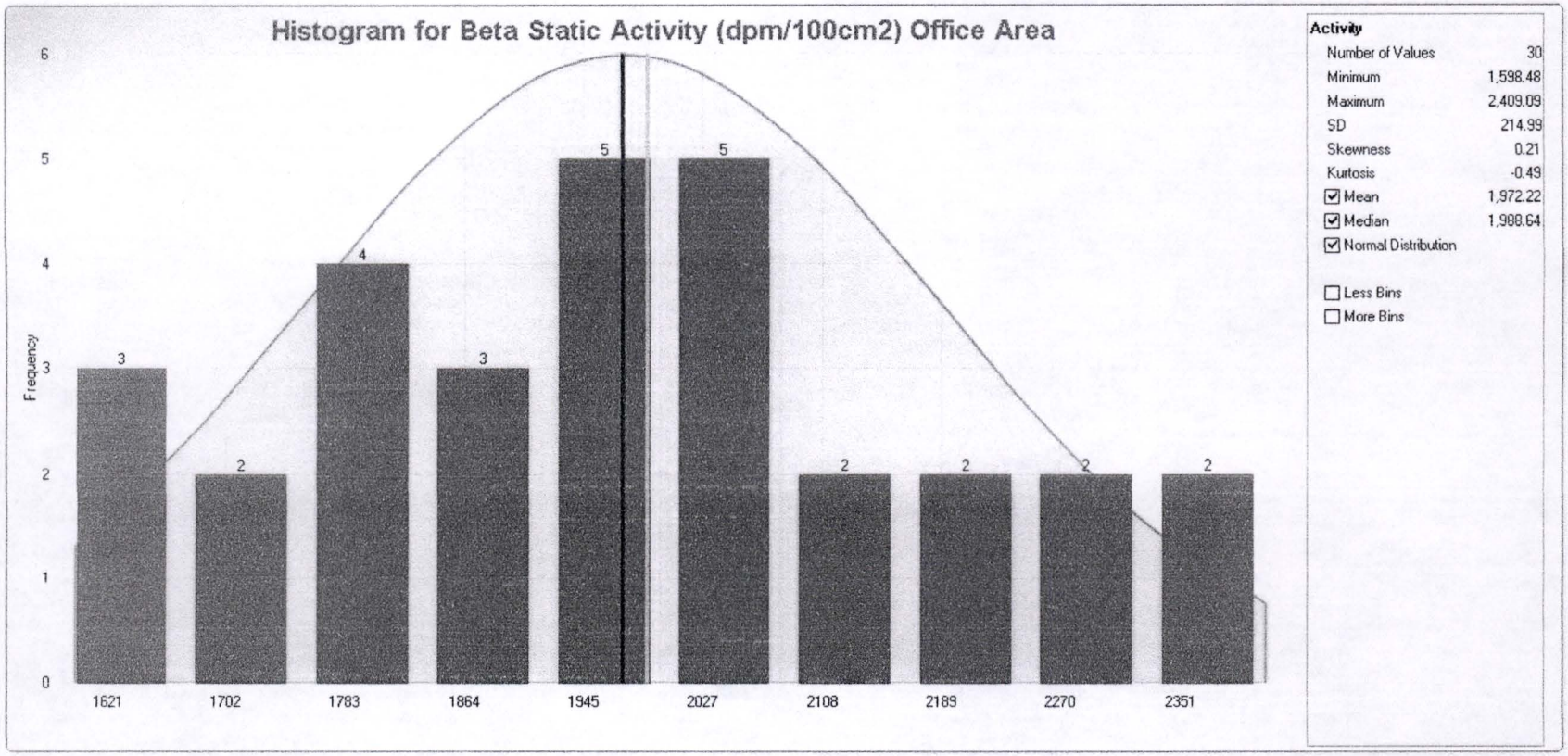
(none required)

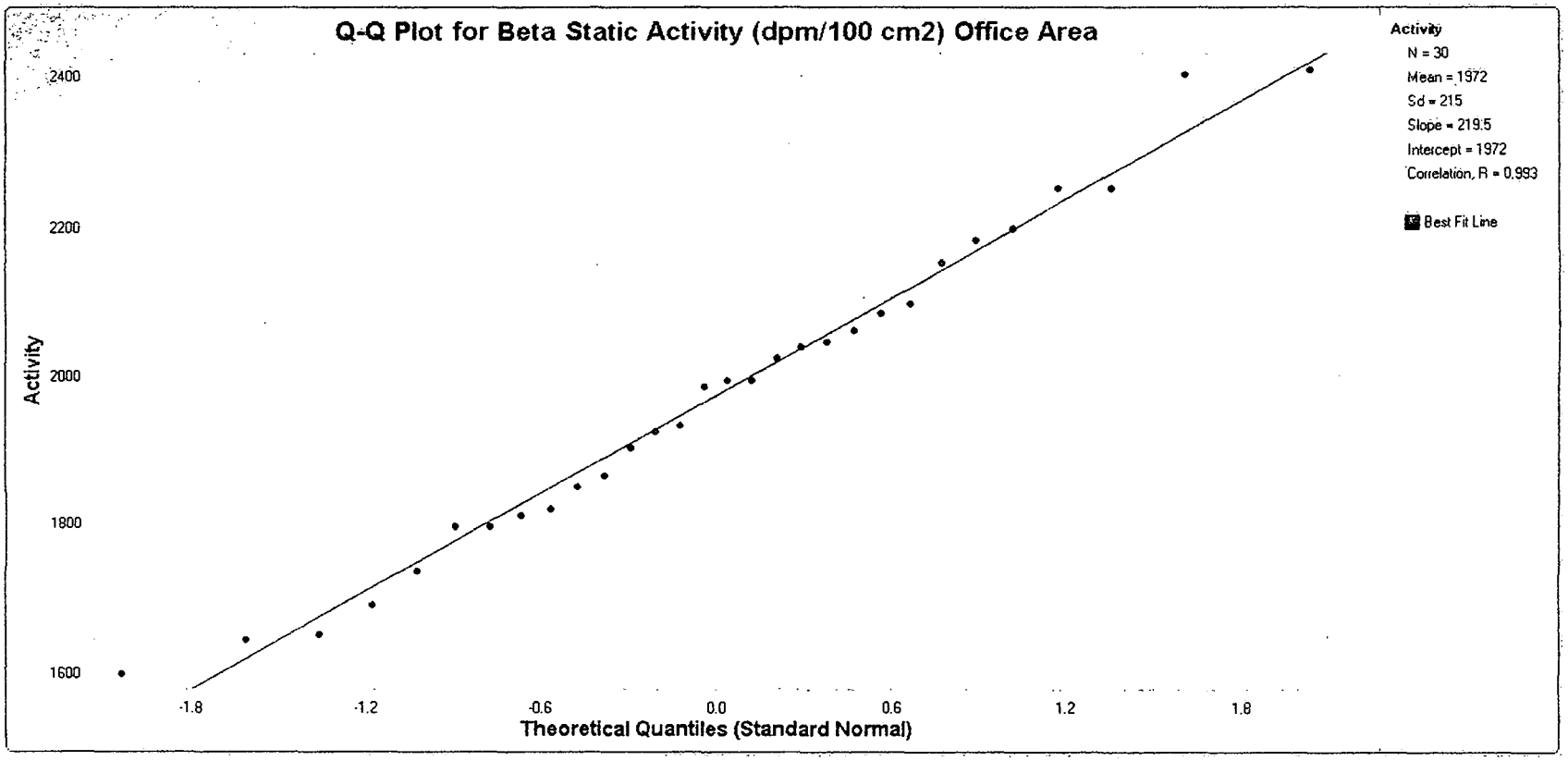
Attachment 4

Data Assessment

February 3, 2017

Survey Unit F8300133


Histogram for Beta Static Activity (dpm/100cm2) Office Area
Frequency
0
1
2
3
4
5
6
3
2
4
3
5
5
2
2
2
2
1621
1702
1783
1864
1945
2027
2108
2189
2270
2351
Activity
Number of Values 30
Minimum 1,598.48
Maximum 2,409.09
SD 214.99
Skewness 0.21
Kurtosis -0.49
Mean 1,972.22
Median 1,988.64
Normal Distribution
Less Bins
More Bins


Q-Q Plot for Beta Static Activity (dpm/100 cm2) Office Area
Activity
N = 30
Mean = 1972
Sd = 215
Slope = 219.5
Intercept = 1972
Correlation, R = 0.993
Best Fit Line
Activity
2400
2200
2000
1800
1600
-1.8
-1.2
-0.6
0.0
0.6
1.2
1.8
Theoretical Quantiles (Standard Normal)

Swipe sheet office

IOSB Final Status Survey

	LC1	LC2	LC3	LC4*	LC6	LC5		β CPM	β dpm	Date/Time of Count		Sample Comments
1	*F830*	*013*	*3*		*00001*	*SM*	IOSB Offices	56	17			
2	F830	013	3		*00002*	SM	IOSB Offices	51	5			
3	F830	013	3		*00003*	SM	IOSB Offices	36	-29			
4	F830	013	3		*00004*	SM	IOSB Offices	37	-27			
5	F830	013	3		*00005*	SM	IOSB Offices	35	-32			
6	F830	013	3		*00006*	SM	IOSB Offices	58	21			
7	F830	013	3		*00007*	SM	IOSB Offices	44	-11			
8	F830	013	3		*00008*	SM	IOSB Offices	59	24			
9	F830	013	3		*00009*	SM	IOSB Offices	46	-6			
10	F830	013	3		*00010*	SM	IOSB Offices	40	-20			
11	F830	013	3		*00011*	SM	IOSB Offices	44	-11			
12	F830	013	3		*00012*	SM	IOSB Offices	49	1			
13	F830	013	3		*00013*	SM	IOSB Offices	55	15			
14	F830	013	3		*00014*	SM	IOSB Offices	44	-11			
15	F830	013	3		*00015*	SM	IOSB Offices	34	-34			

Comments By signature below, the required source check and background checks were satisfactorily performed prior to use of the instrument identified below.

Tech A Sign/ Date 2/3/17

Tech B Sign/ Date

Ludlum 2929 Benchtop Instrument

		efficiency	bkg rate	bkg count time	MDA
2929 S/N: 182597					
43-10-1 S/N: 188736	α	0.364	3 cpm	1 min	25.1 dpm per area
Cal Due Date: 5/13/2017	β	0.434	48.7 cpm	1 min	77.8 dpm per area

Swipe sheet office

IOSB Final Status Survey

	LC1	LC2	LC3	LC4*	LC6	LC5		β CPM	β dpm	Date/Time of Count		Sample Comments
1	*F830*	*013*	*3*		*00016*	*SM*	IOSB Offices	40	-20			
2	F830	013	3		*00017*	SM	IOSB Offices	31	-41			
3	F830	013	3		*00018*	SM	IOSB Offices	52	8			
4	F830	013	3		*00019*	SM	IOSB Offices	46	-6			
5	F830	013	3		*00020*	SM	IOSB Offices	43	-13			
6	F830	013	3		*00021*	SM	IOSB Offices	50	3			
7	F830	013	3		*00022*	SM	IOSB Offices	43	-13			
8	F830	013	3		*00023*	SM	IOSB Offices	42	-15			
9	F830	013	3		*00024*	SM	IOSB Offices	54	12			
10	F830	013	3		*00025*	SM	IOSB Offices	41	-18			
11	F830	013	3		*00026*	SM	IOSB Offices	50	3			
12	F830	013	3		*00027*	SM	IOSB Offices	39	-22			
13	F830	013	3		*00028*	SM	IOSB Offices	44	-11			
14	F830	013	3		*00029*	SM	IOSB Offices	32	-38			
15	F830	013	3		*00030*	SM	IOSB Offices	48	-2			

Comments By signature below, the required source check and background checks were satisfactorily performed prior to use of the instrument identified below.

Tech A Sign/ Date 2/3/17

Tech B Sign/ Date

Ludlum 2929 Benchtop Instrument

2929 S/N: 182597

43-10-1 S/N: 188736

Cal Due Date: 5/13/2017

	efficiency	bkg rate	bkg count time	MDA
α	0.364	3 cpm	1 min	25.1 dpm per area
β	0.434	48.7 cpm	1 min	77.8 dpm per area

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