Rancho Seco

Final Status Survey Summary Report

October 21, 2016

IOSB Storage Cell A-2

Survey Unit F8300173

Prepared By: _____ Date: 11.21.16

FSS Engineer

Reviewed By: _____ Date: 11-21-16

Lead FSS Engineer

Approved By: _____ Date: 11/23/16

Manager, Rancho Seco Assets

Survey Unit:

F8300173, Interim Onsite Storage Building (IOSB) Storage Cell A-2

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), each storage cell possibly stored media of many types, including filters, resins, contaminated chemicals, DAW, activated reactor components, contaminated plant components and other contaminated items.

Site Characterization: Static measurements were made of the interior surfaces of the storage cell, to confirm the absence or presence of plant-derived radionuclides. Static measurements showed a mean gross activity level of 2,125 dpm/100 cm^2 and a maximum value of 2,528 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 27% of the area scanned. 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**	Storage Cell A-2
Survey Unit:	**17**	
Class	**03**	
SU Area (m^2)	**28.3**	
Evaluator:	JR	
$DCGL_W$:	43,000	Gross Activity DCGL
Area Factor	N/A	Class 3
Design DCGLemc ($dpm/100cm^2$):	N/A	Class 3
$DCGL_{emc}$:	N/A	Class 3
LBGR:	21,500	Default = 50% DCGL
Sigma:	170	Scoping Survey Data
Type I error:	0.05	
Type II error:	0.05	
Predominant Nuclide	Cs-137	
Sample Area (m^2)	N/A	
Total Instrument Efficiency:	0.129	
Total Area Scanned (m^2):	7.51	
Scan Coverage (%)	27%	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:	126.4	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	

Survey Results:

A total of 15 direct measurements were made in F8300173. 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	F8300173X0001	237	1,837
2	F8300173X0002	303	2,349
3	F8300173X0003	261	2,023
4	F8300173X0004	250	1,938
5	F8300173X0005	251	1,946
6	F8300173X0006	279	2,163
7	F8300173X0007	250	1,938
8	F8300173X0008	237	1,837
9	F8300173X0009	279	2,163
10	F8300173X0010	262	2,031
11	F8300173X0011	261	2,023
12	F8300173X0012	262	2,031
13	F8300173X0013	228	1,767
14	F8300173X0014	291	2,256
15	F8300173X0015	239	1,853

Table 3 contains the statistical summary of the static measurement data for the Storage Cell A-2.

Table 3, Beta Summary Statistics

Beta Static Cell A-2	
Mean	2,010
Median	2,023
Standard Deviation	165
Minimum	1,767
Maximum	2,349
Count	15

Survey Unit Data Assessment:

The survey design required 14 static measurements for the Sign Test. A total of 15 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.

Table 4, Data Assessment Results

Static Data Values		Comments
Number of Samples:	15	
Median:	2,023	
Mean:	2,010	
Static Data Standard Deviation:	165	
Maximum:	2,349	
Sign Test Results		**Comments**
Adjusted N Value:	14	
S+ Value:	15	
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 <$DCGL_{EMC}$:	N/A	
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. The variability of the survey results was less than the characterization data used for survey design. 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 scoping 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.

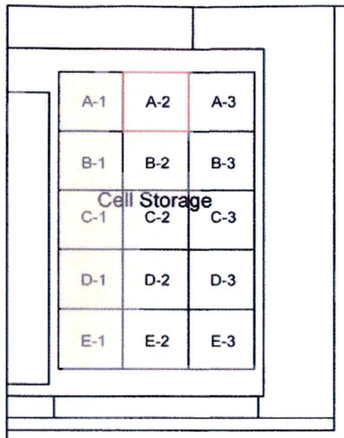
It is concluded that survey unit F8300173 meets the release criteria of 10CFR20.1402.

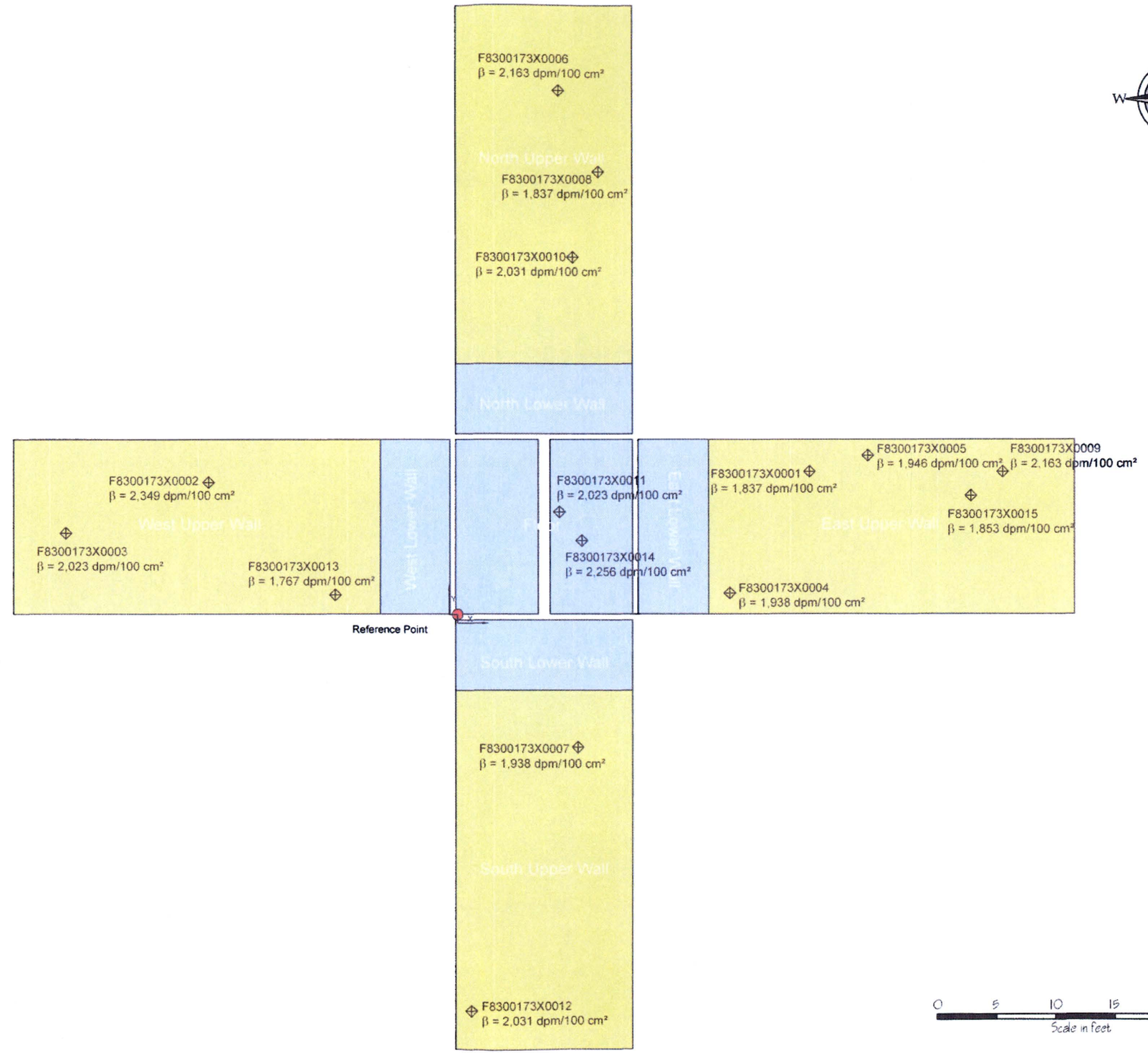
Attachment 1

Maps

September 26, 2016

Survey Unit F8300173





SMUD | TIDEWATER INC RADIOLOGICAL SERVICES

INTERIM ONSITE STORAGE BUILDING (IOSB)

Contract No.:	4500091426	SMUD
Location:	Rancho Seco	Approved by:
Task:	Final Status	
Drawing No.:	IOSB Final Status Survey	
Description:	Cell A-2 Upper Wall Results	
Drawn By:	C Gray	
QC'd:	J Reese	Approval date:
Date:	271016	
Rev No.:	1	

Attachment 2

Instrumentation

September 26, 2016

Survey Unit F8300173

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 – 523 dpm/100 cm^2	12.9%	317899/331973 2/10/17
Swipe Measurements	Ludlum Model 2929 Ludlum Model 44-10-1	Alpha – 25 dpm/100 cm^2 Beta – 81 dpm/100 cm^2	36.9% 42.8%	166716/170380 11/3/16

[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

Variables

Beta	Survey Type
317899	Detector Number
195	Background count rate (cpm)
1	Count Time (min)
0.130	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	523	dpm/100 cm^2

Attachment 3

Investigation

September 26, 2016

Survey Unit F8300173

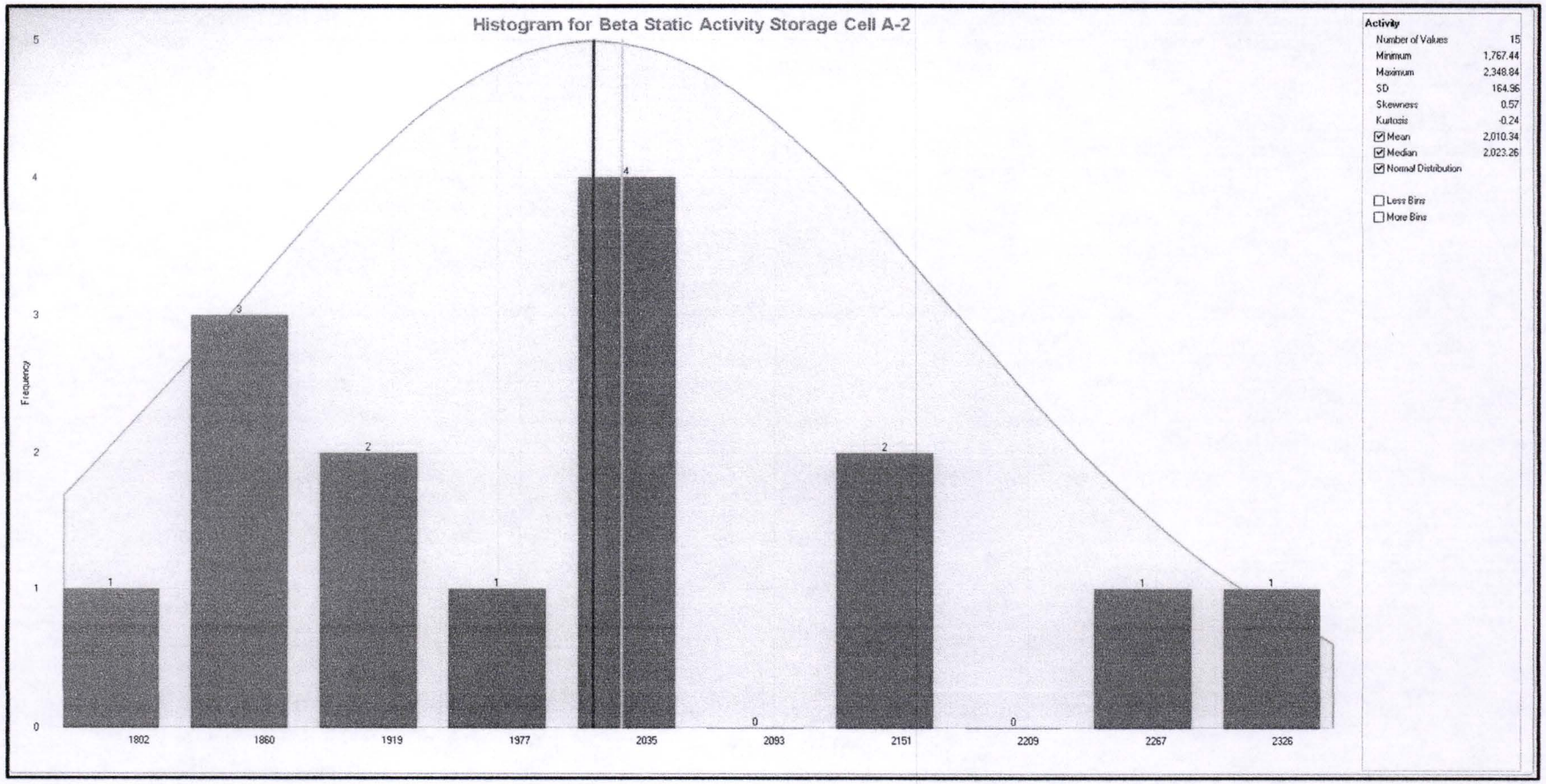
(none required)

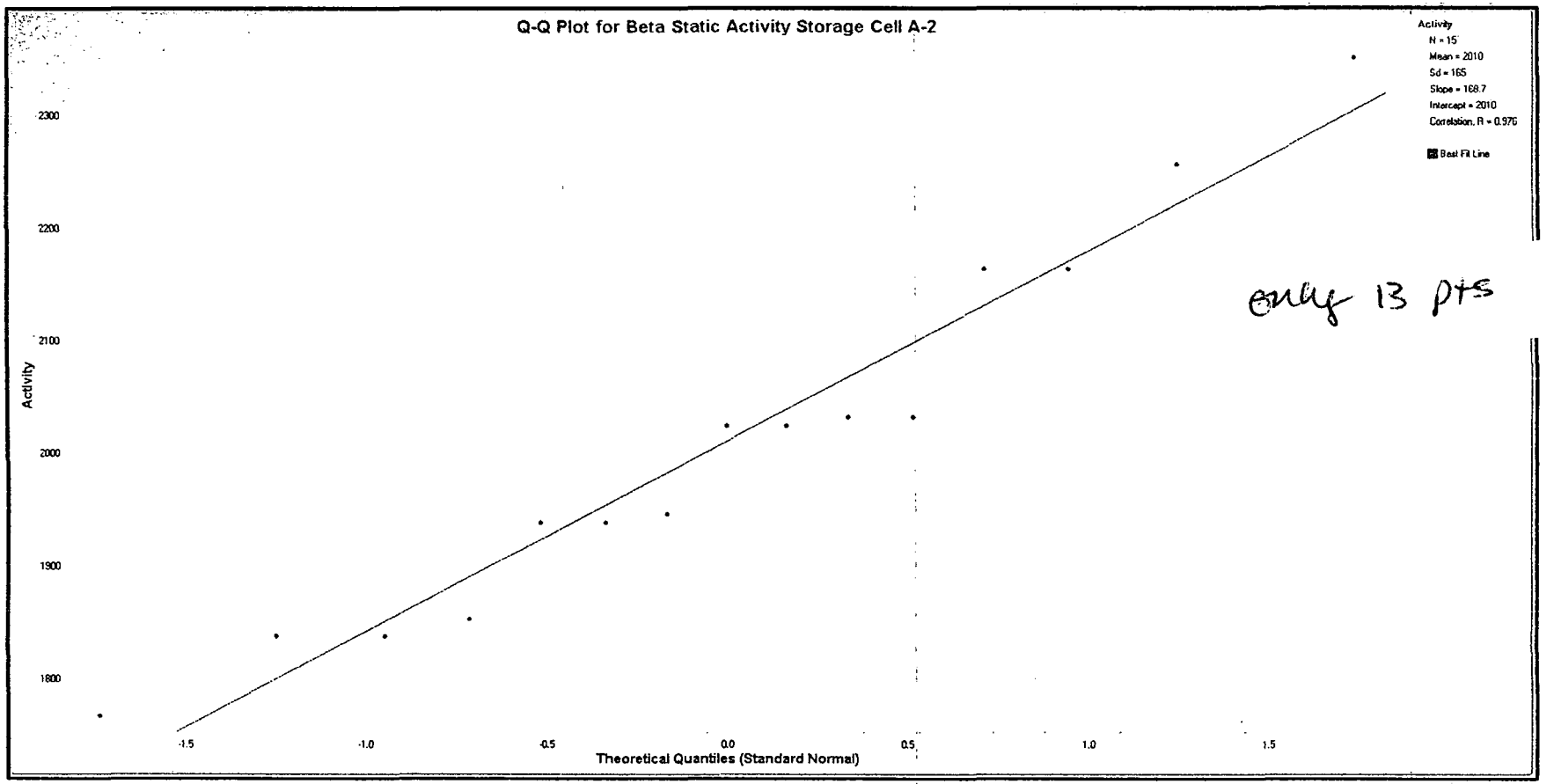
Attachment 4

Data Assessment

September 26, 2016

Survey Unit F8300173


Histogram for Beta Static Activity Storage Cell A-2
Frequency
0
1
2
3
4
5
1
3
2
1
4
0
2
0
1
1
1802
1860
1919
1977
2035
2093
2151
2209
2267
2326
Activity
Number of Values 15
Minimum 1,767.44
Maximum 2,348.84
SD 164.96
Skewness 0.57
Kurtosis -0.24
Mean 2,010.34
Median 2,023.26
Normal Distribution
Less Bins
More Bins


Q-Q Plot for Beta Static Activity Storage Cell A-2
Activity
N = 15
Mean = 2010
Sd = 165
Slope = 168.7
Intercept = 2010
Correlation, R = 0.976
Best Fit Line
only 13 pts
Activity
2300
2200
2100
2000
1900
1800
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Theoretical Quantiles (Standard Normal)

IOSB Final Status Survey

	LC1	LC2	LC3	LC4	LC6	LC5		β CPM	β dpm	Date/Time of Count		Sample Comments
1	*F830*	*017*	*3*	*X*	*00001*	*SM*	Cell A-2	44	-16	09/07/16	12:56	
2	F830	017	3	X	*00002*	SM	Cell A-2	47	-9	09/07/16	12:58	
3	F830	017	3	X	*00003*	SM	Cell A-2	56	12	09/07/16	13:00	
4	F830	017	3	X	*00004*	SM	Cell A-2	33	-42	09/07/16	13:02	
5	F830	017	3	X	*00005*	SM	Cell A-2	44	-16	09/07/16	13:03	
6	F830	017	3	X	*00006*	SM	Cell A-2	50	-2	09/07/16	13:05	
7	F830	017	3	X	*00007*	SM	Cell A-2	53	5	09/07/16	13:07	
8	F830	017	3	X	*00008*	SM	Cell A-2	53	5	09/07/16	13:08	
9	F830	017	3	X	*00009*	SM	Cell A-2	50	-2	09/07/16	13:10	
10	F830	017	3	X	*00010*	SM	Cell A-2	60	21	09/07/16	13:11	
11	F830	017	3	X	*00011*	SM	Cell A-2	53	5	09/07/16	13:12	
12	F830	017	3	X	*00012*	SM	Cell A-2	51	0	09/07/16	13:13	
13	F830	017	3	X	*00013*	SM	Cell A-2	59	19	09/07/16	13:14	
14	F830	017	3	X	*00014*	SM	Cell A-2	49	-4	09/07/16	13:15	
15	F830	017	3	X	*00015*	SM	Cell A-2	54	7	09/07/16	13:16	

Comments 9-7-16

Tech A Sign/ Date Hans Ullrich 10/13/16

Tech B Sign/ Date N/A

Ludlum 2929 Benchtop Instrument

2929 S/N: 166716

44-10-1 S/N: 170380

Cal Due Date: 11/3/2016

	efficiency	bkg rate	bkg count time	MDA
α	0.369	3 cpm	1 min	24.8 dpm per area
β	0.428	50.9 cpm	1 min	80.5 dpm per area