Rancho Seco

Final Status Survey Summary Report

January 30, 2017

IOSB Hot Cell Class 2

Survey Unit F8300062

Prepared By: _____ Date: 1.30.17

FSS Engineer

Reviewed By: _____ Date: 1.30.17

Lead FSS Engineer

Approved By: _____ Date: 3/24/17

Manager, Rancho Seco Assets

Survey Unit:

F8300062, Interim Onsite Storage Building (IOSB) Hot Cell Class 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), the hot cell possibly stored media of many types, including filters, resins, contaminated chemicals, DAW, activated reactor components, contaminated plant components and other contaminated items. The Class 2 survey area encompasses the the walls above six feet up to and including the ledge where the lid rests.

Site Characterization: Static measurements were made on the floor and wall surfaces, to confirm the absence or presence of plant-derived radionuclides. Static measurements showed a mean gross beta activity level of 2,880 dpm/100 cm^2 and a maximum value of 5,112 dpm/100 cm^2. Previous surveys and floor scanning indicated significant contamination in excess of the DCGLw. This area was identified and characterized separately as a hot spot. The average static measurement in the hot spot was 390,104 dpm/100 cm^2 and a maximum value of 2,285,918 dpm/100 cm^2. Based upon the hot spot the Hot Cell was classified as a MARSSIM Class 1 survey unit. A Class 2 survey area was designated for the walls above six feet to the ledge where the lid rests.

Survey Unit Design Information:

In accordance with MARSSIM Section 4.6, special considerations may be necessary for survey units with structure surface areas less than 10 m^2 or land areas less than 100 m^2. In this case, the number of data points obtained from the statistical tests is unnecessarily large and not appropriate for smaller survey unit areas. The data generated from these smaller survey units should be obtained based on judgment, rather than on systematic or random design, and compared individually to the DCGLs. This survey unit meets this criterion as the size is less than ten square meter (7.6 m^2).

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 determined by professional judgment in accordance with MARSSIM guidance and approximately 100% 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	Hot Cell Class 2
Survey Unit:	06	
Class	02	
SU Area (m^2)	08	
Evaluator:	JR	
$DCGL_W$:	43,000	Gross Activity DCGL
Area Factor	NA	Class 2
Design DCGLemc ($dpm/100cm^2$):	NA	Class 2
LBGR:	21,500	Default = 50% DCGL
Sigma:	740	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):	7.6	
Scan Coverage (%)	100%	Class 2
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:	29.0	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	15	Values selected based upon Judgement
N-Value+20%:	15	Values selected based upon Judgement

Survey Results:

A total of 15 direct measurements were made in F8300062 following the guidance from MARSSIM section 4.6. 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	F8300062X00001	314	2,379
2	F8300062X00002	299	2,265
3	F8300062X00003	392	2,970
4	F8300062X00004	272	2,061
5	F8300062X00005	378	2,864
6	F8300062X00006	303	2,295
7	F8300062X00007	324	2,455
8	F8300062X00008	311	2,356
9	F8300062X00009	313	2,371
10	F8300062X00010	310	2,348
11	F8300062X00011	245	1,856
12	F8300062X00012	255	1,932
13	F8300062X00013	279	2,114
14	F8300062X00014	306	2,318
15	F8300062X00015	300	2,273

Table 3 contains the statistical summary of the static measurement data for the Hot Cell Class 2.

Table 3, Beta Summary Statistics

Beta Static Hot Cell Class 2	
Mean	2,324
Median	2,318
Standard Deviation	296
Minimum	1,856
Maximum	2,970
Count	15

Survey Unit Data Assessment:

The survey design was based upon professional judgement and resulted in 15 static measurements. Following the guidance in MARSSIM Section 4.6, these values are compared directly to the DCGLw.

The comparison and the results 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:	2,318	
Mean:	2,324	
Static Data Standard Deviation:	296	
Maximum:	2,970	
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:	N/A	
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 2 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 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 2 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.

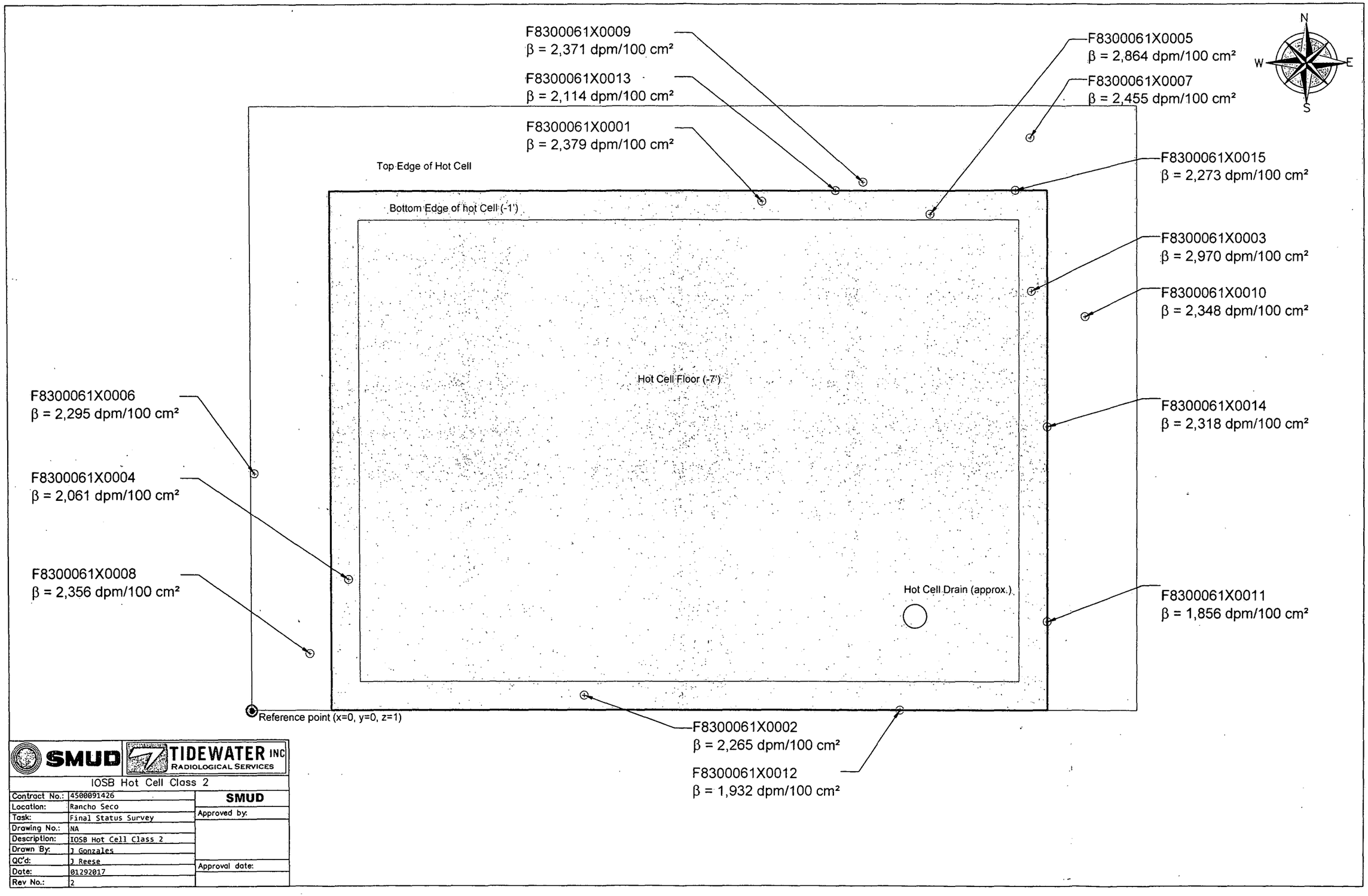
It is concluded that survey unit F8300062 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

January 30, 2017

Survey Unit F8300062



SMUD | TIDEWATER INC RADIOLOGICAL SERVICES

IOSB Hot Cell Class 2

Contract No.:	4500091426	SMUD
Location:	Rancho Seco	Approved by:
Task:	Final Status Survey	
Drawing No.:	NA	
Description:	IOSB Hot Cell Class 2	
Drawn By:	J Gonzales	
QC'd:	J Reese	Approval date:
Date:	01292017	
Rev No.:	2	

Attachment 2

Instrumentation

January 30, 2017

Survey Unit F83000062

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 – 499 dpm/100 cm^2	13.2%	317897/331972 2/10/17
Swipe Measurements	Ludlum Model 2929 Ludlum Model 44-10-1	Beta – 77 dpm/100 cm^2	43.4%	182597/188736 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
183	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 499 dpm/100 cm^2

Attachment 3

Investigation

January 30, 2017

Survey Unit F8300062

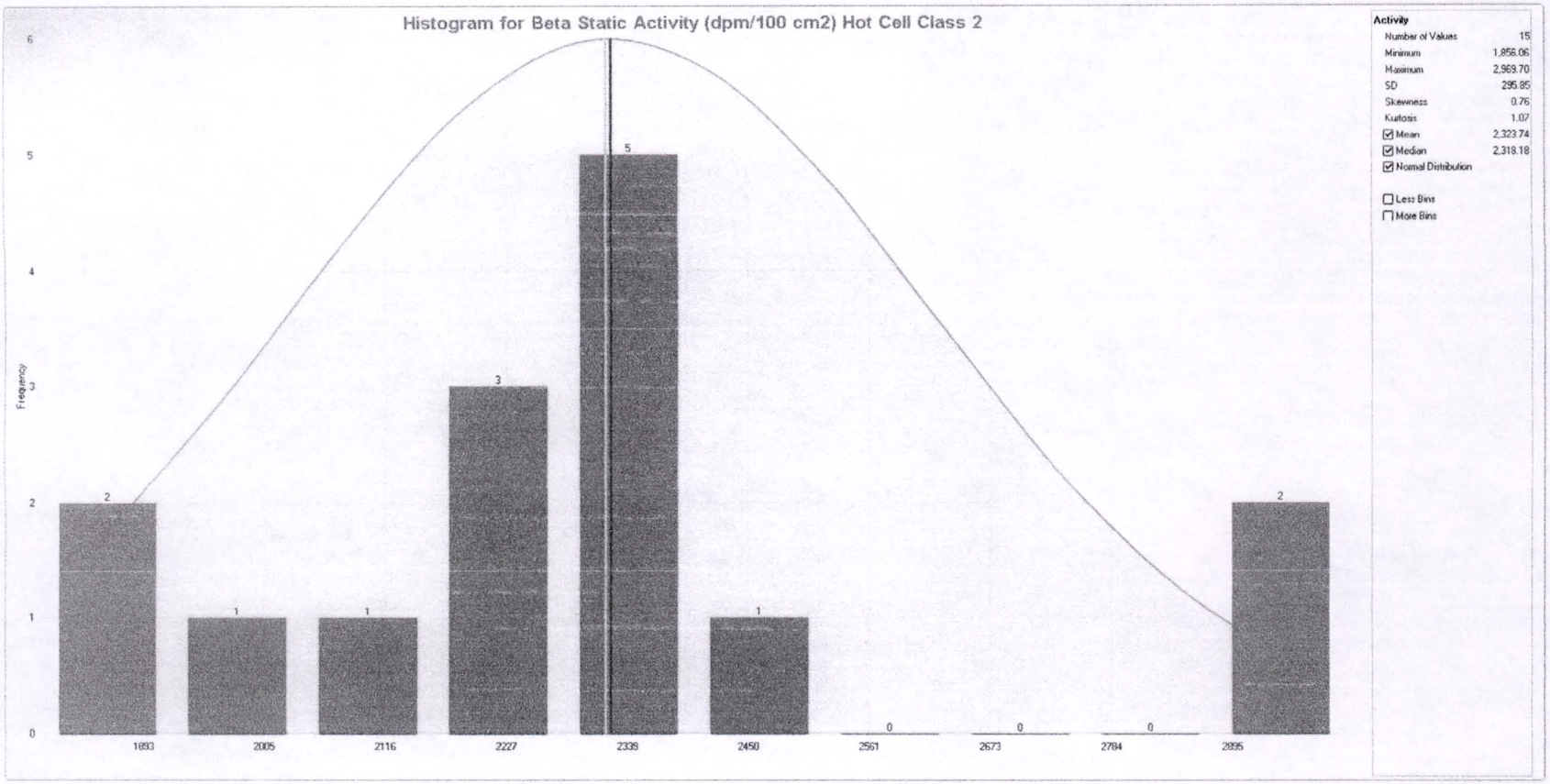
(none required)

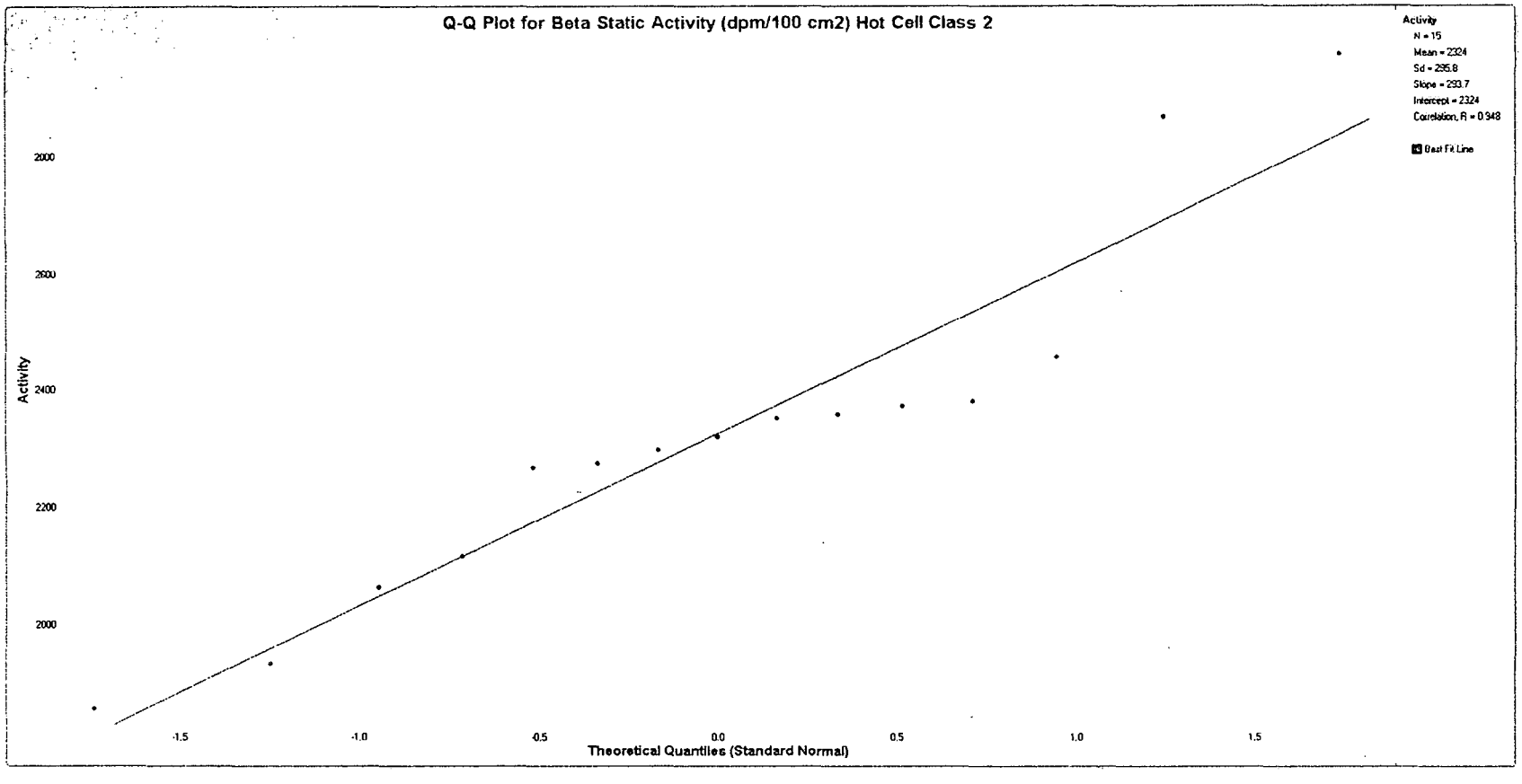
Attachment 4

Data Assessment

January 30, 2017

Survey Unit F8300062


Histogram for Beta Static Activity (dpm/100 cm2) Hot Cell Class 2
Frequency
0
1
2
3
4
5
6
2
1
1
3
5
1
0
0
0
2
1893
2005
2116
2227
2339
2450
2561
2673
2784
2895
Activity
Number of Values 15
Minimum 1,856.06
Maximum 2,969.70
SD 295.85
Skewness 0.76
Kurtosis 1.07
Mean 2,323.74
Median 2,318.18
Normal Distribution
Less Bins
More Bins


Q-Q Plot for Beta Static Activity (dpm/100 cm2) Hot Cell Class 2
Activity
N = 15
Mean = 2324
Sd = 295.8
Slope = 293.7
Intercept = 2324
Correlation, R = 0.948
Best Fit Line
Activity
2000
2200
2400
2600
-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	006	2	C	00001	SM	Hot Cell Buffer	42	-14	11/04/16	1323	
2	F830	006	2	C	00002	SM	Hot Cell Buffer	50	5	11/04/16	1324	
3	F830	006	2	C	00003	SM	Hot Cell Buffer	58	23	11/04/16	1325	
4	F830	006	2	C	00004	SM	Hot Cell Buffer	50	5	11/04/16	1326	
5	F830	006	2	C	00005	SM	Hot Cell Buffer	41	-16	11/04/16	1328	
6	F830	006	2	C	00006	SM	Hot Cell Buffer	57	21	11/04/16	1329	
7	F830	006	2	C	00007	SM	Hot Cell Buffer	45	-7	11/04/16	1330	
8	F830	006	2	C	00008	SM	Hot Cell Buffer	49	2	11/04/16	1331	
9	F830	006	2	C	00009	SM	Hot Cell Buffer	46	-5	11/04/16	1333	
10	F830	006	2	C	00010	SM	Hot Cell Buffer	49	2	11/04/16	1334	
11	F830	006	2	C	00011	SM	Hot Cell Buffer	37	-25	11/04/16	1335	
12	F830	006	2	C	00012	SM	Hot Cell Buffer	45	-7	11/04/16	1336	
13	F830	006	2	C	00013	SM	Hot Cell Buffer	54	14	11/04/16	1337	
14	F830	006	2	C	00014	SM	Hot Cell Buffer	52	9	11/04/16	1339	
15	F830	006	2	C	00015	SM	Hot Cell Buffer	45	-7	11/04/16	1340	

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: 12-2-16

Tech B Sign/ Date: N/A

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	cpm	min	#DIV/0! dpm per area
β	0.434	48 cpm	1 min	77.2 dpm per area