Rancho Seco

Final Status Survey Summary Report

January 25, 2017

IOSB Loading Dock Class 2

Survey Unit F8300082

Prepared By: _____ Date: 2.1.17

FSS Engineer

Reviewed By: _____ Date: 2.1.17

Lead FSS Engineer

Approved By: _____ Date: 2/21/17

Manager, Rancho Seco Assets

Survey Unit:

F8300082, Interim Onsite Storage Building (IOSB) Loading Dock 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), 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: Based upon the scanning results of the Truck Bay elevated areas were identified on the floor around and including the loading dock. Certain spots in the area exceeded the $DCGL_w$ but not the $DCGL_{EMC}$. This area required remediation. The Truck bay was divided into a small Class 1 Survey Unit, buffered by a Class 2 Survey Unit. The remainder of the Bay was designated as a Class 3 Survey Unit. This report addresses the Class 2 survey 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 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**	Loading Dock Class 2
Survey Unit:	**008**	
Class	**2**	
SU Area (m^2)	**19.9**	
Evaluator:	JR	
$DCGL_W$:	43,000	Gross Activity DCGL
Area Factor	NA	Class 2
Design DCGLemc ($dpm/100cm^2$):	NA	Class 2
$DCGL_{emc}$:	NA	Class 2
LBGR:	21,500	Default = 50% DCGL
Sigma:	466	Truck Bay Scoping
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):	15.2	
Scan Coverage (%)	76%	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:	46.1	
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 F8300082. 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	F8300082C00001	379	2,871
2	F8300082C00002	383	2,902
3	F8300082C00003	373	2,826
4	F8300082C00004	380	2,879
5	F8300082C00005	389	2,947
6	F8300082C00006	349	2,644
7	F8300082C00007	405	3,068
8	F8300082C00008	410	3,106
9	F8300082C00009	366	2,773
10	F8300082C00010	390	2,955
11	F8300082C00011	376	2,848
12	F8300082C00012	337	2,553
13	F8300082C00013	327	2,477
14	F8300082C00014	299	2,265
15	F8300082C00015	394	2,985

Table 3 contains the statistical summary of the static measurement data for the Loading Dock Class 2.

Table 3, Beta Summary Statistics

Beta Static Loading Dock Class 2	
Mean	2,807
Median	2,871
Standard Deviation	231
Minimum	2,265
Maximum	3,106
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 $DCGL_W$.

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:	2,871	
Mean:	2,807	
Static Data Standard Deviation:	231	
Maximum:	3,106	
Sign Test Results		**Comments**
Adjusted N Value:	14	
S+ Value:	15	
Critical Value:	11	
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 2 survey and the sample results are consistent with that classification. The variability of the survey results was greater than the characterization data used for survey design. However, 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.

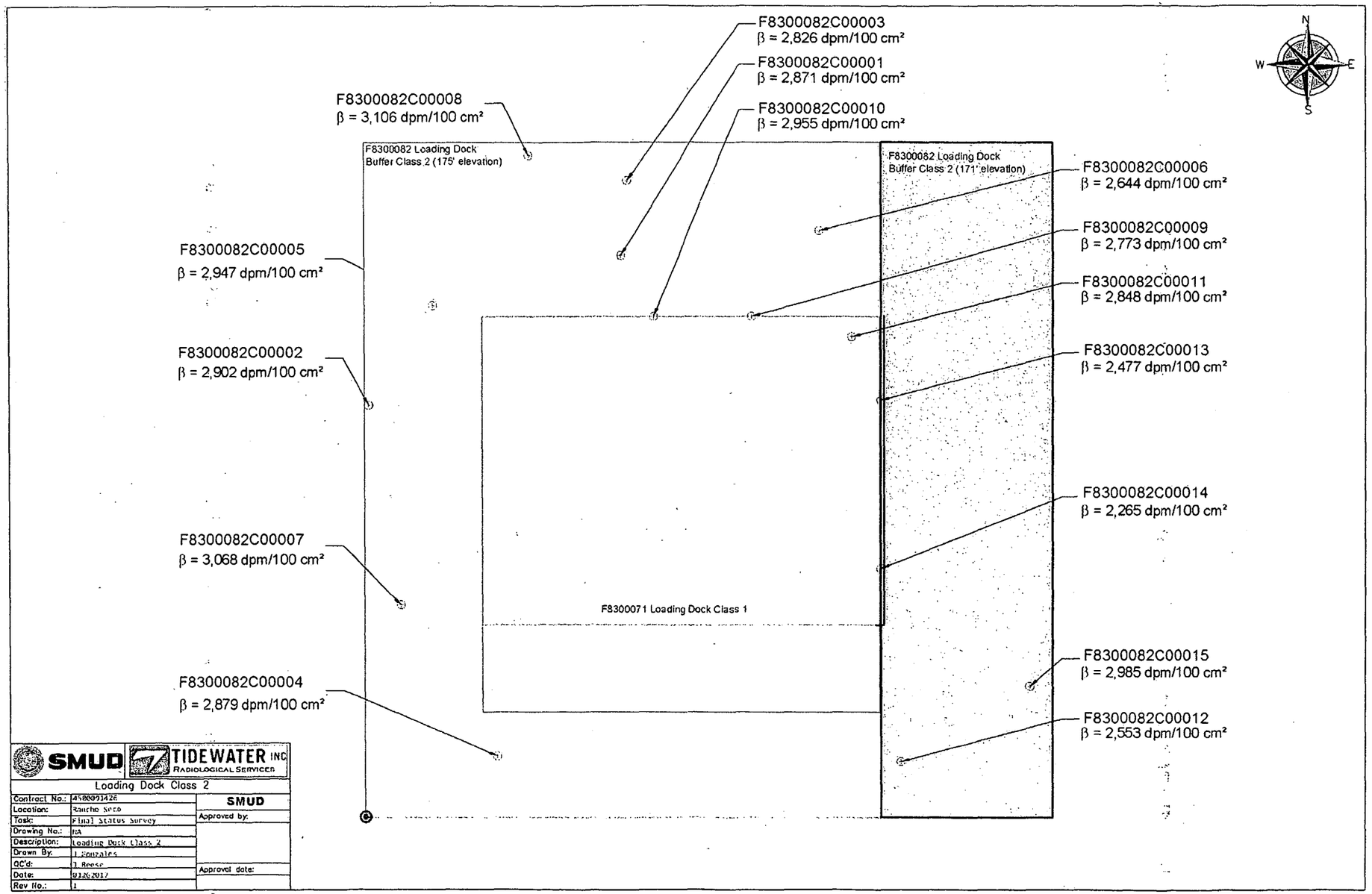
It is concluded that survey unit F8300082 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

January 30, 2017

Survey Unit F8300082


F8300082C00003
β = 2,826 dpm/100 cm²
F8300082C00001
β = 2,871 dpm/100 cm²
F8300082C00010
β = 2,955 dpm/100 cm²
F8300082C00008
β = 3,106 dpm/100 cm²
F8300082 Loading Dock
Buffer Class 2 (175' elevation)
F8300082 Loading Dock
Buffer Class 2 (171' elevation)
F8300082C00006
β = 2,644 dpm/100 cm²
F8300082C00009
β = 2,773 dpm/100 cm²
F8300082C00005
β = 2,947 dpm/100 cm²
F8300082C00011
β = 2,848 dpm/100 cm²
F8300082C00002
β = 2,902 dpm/100 cm²
F8300082C00013
β = 2,477 dpm/100 cm²
F8300082C00014
β = 2,265 dpm/100 cm²
F8300082C00007
β = 3,068 dpm/100 cm²
F8300071 Loading Dock Class 1
F8300082C00015
β = 2,985 dpm/100 cm²
F8300082C00004
β = 2,879 dpm/100 cm²
F8300082C00012
β = 2,553 dpm/100 cm²
N
W
E
S
SMUD
TIDEWATER INC
RADIOLOGICAL SERVICES
Loading Dock Class 2
Contract No.: 4500091426
Location: Rancho Seco
Task: Final Status Survey
Drawing No.: NA
Description: Loading Dock Class 2
Drawn By: J Gonzales
QC'd: J Reese
Date: 9/26/2017
Rev No.: 1
SMUD
Approved by:
Approval date:

Attachment 2

Instrumentation

January 30, 2017

Survey Unit F8300082

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 – 520 dpm/100 cm^2	13.2%	317897/331972 2/10/17
Swipe Measurements	Ludlum Model 2929 Ludlum Model 44-10-1	Beta – 75 dpm/100 cm^2	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

Beta	Survey Type
PR331972	Detector Number
199	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 520 dpm/100 cm^2

Attachment 3

Investigation

January 25, 2017

Survey Unit F8300082

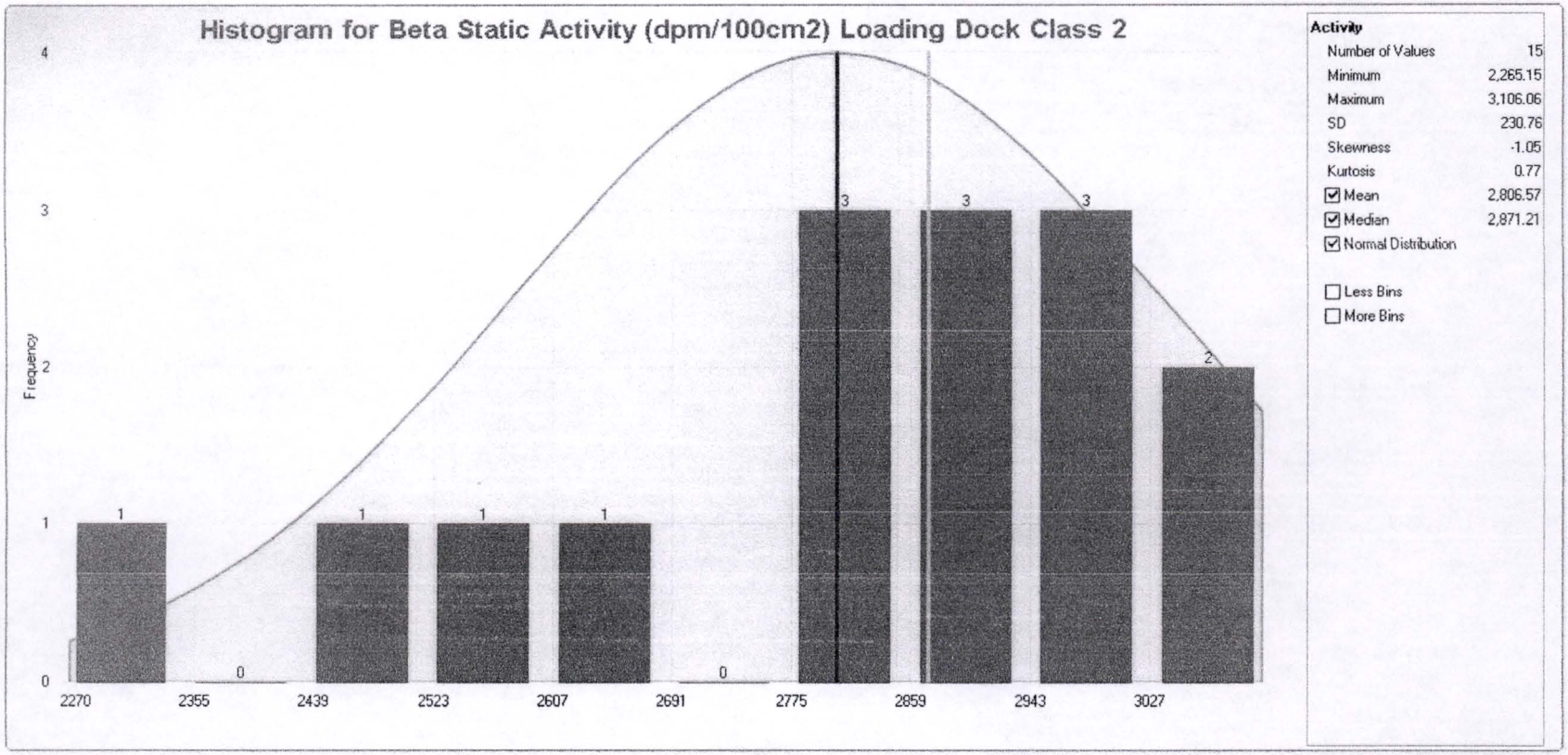
(none required)

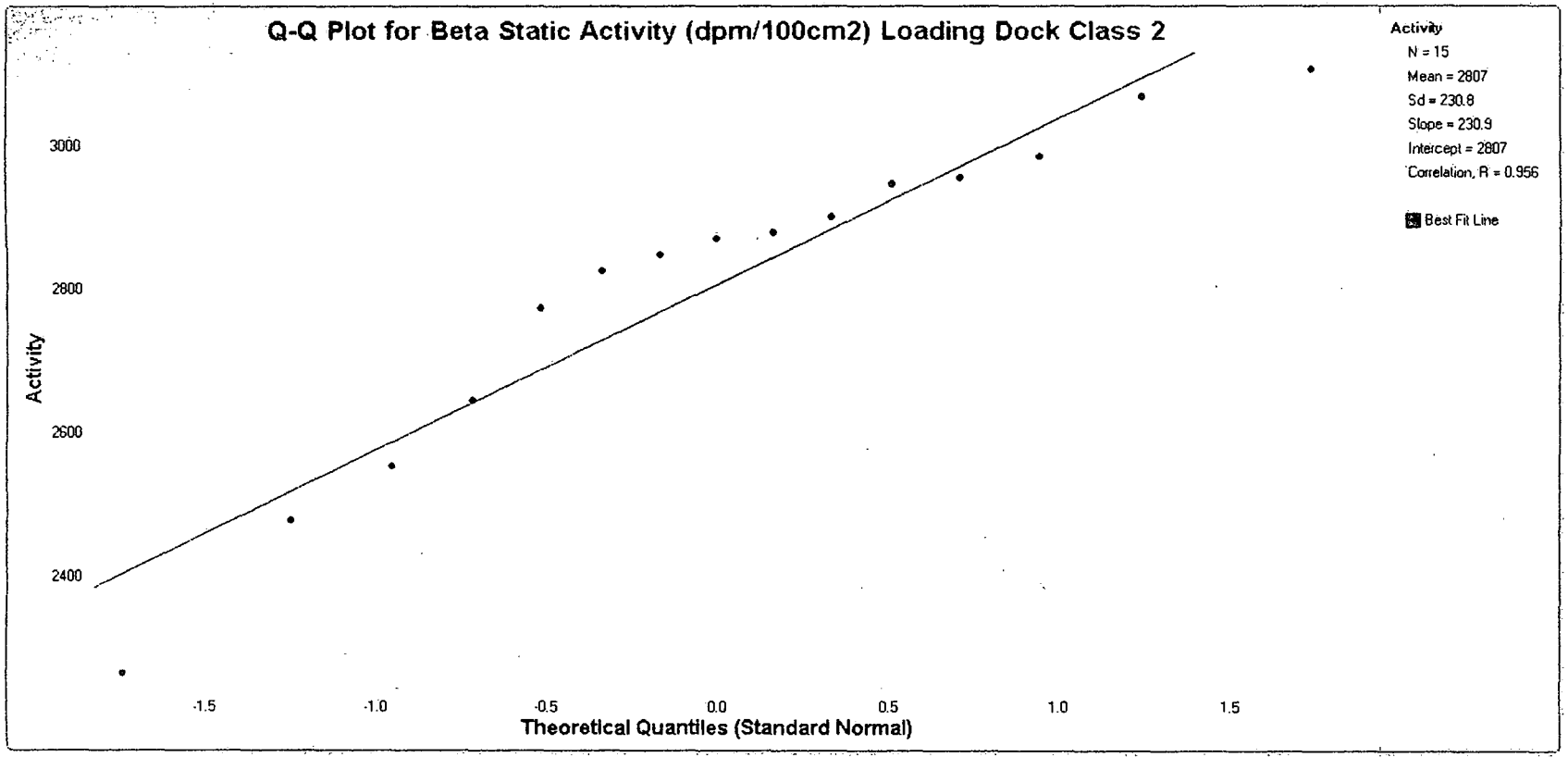
Attachment 4

Data Assessment

January 30, 2017

Survey Unit F8300082


Histogram for Beta Static Activity (dpm/100cm2) Loading Dock Class 2
Frequency
0
1
2
3
4
1
0
1
1
1
0
3
3
3
2
2270
2355
2439
2523
2607
2691
2775
2859
2943
3027
Activity
Number of Values 15
Minimum 2,265.15
Maximum 3,106.06
SD 230.76
Skewness -1.05
Kurtosis 0.77
Mean 2,806.57
Median 2,871.21
Normal Distribution
Less Bins
More Bins


Q-Q Plot for Beta Static Activity (dpm/100cm2) Loading Dock Class 2
Activity
N = 15
Mean = 2807
Sd = 230.8
Slope = 230.9
Intercept = 2807
Correlation, R = 0.956
Best Fit Line
3000
2800
2600
2400
Activity
-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	008	2	C	00001	SM	Load Dock Buffer	57	28	01/04/17	1140	
2	F830	008	2	C	00002	SM	Load Dock Buffer	50	12	01/04/17	1142	
3	F830	008	2	C	00003	SM	Load Dock Buffer	60	35	01/04/17	1143	
4	F830	008	2	C	00004	SM	Load Dock Buffer	54	21	01/04/17	1145	
5	F830	008	2	C	00005	SM	Load Dock Buffer	45	0	01/04/17	1146	
6	F830	008	2	C	00006	SM	Load Dock Buffer	54	21	01/04/17	1148	
7	F830	008	2	C	00007	SM	Load Dock Buffer	47	5	01/04/17	1150	
8	F830	008	2	C	00008	SM	Load Dock Buffer	46	3	01/04/17	1151	
9	F830	008	2	C	00009	SM	Load Dock Buffer	44	-2	01/04/17	1153	
10	F830	008	2	C	00010	SM	Load Dock Buffer	48	7	01/04/17	1155	
11	F830	008	2	C	00011	SM	Load Dock Buffer	48	7	01/04/17	1157	
12	F830	008	2	C	00012	SM	Load Dock Buffer	45	0	01/04/17	1159	
13	F830	008	2	C	00013	SM	Load Dock Buffer	49	10	01/04/17	1200	
14	F830	008	2	C	00014	SM	Load Dock Buffer	42	-6	01/04/17	1202	
15	F830	008	2	C	00015	SM	Load Dock Buffer	45	0	01/04/17	1204	

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: Joe Nanni 1-4-2017

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	1 min	3.0 dpm per area
β	0.434	44.8 cpm	1 min	74.7 dpm per area