

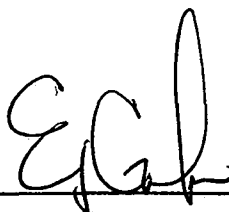
Rancho Seco

Final Status Survey Summary Report

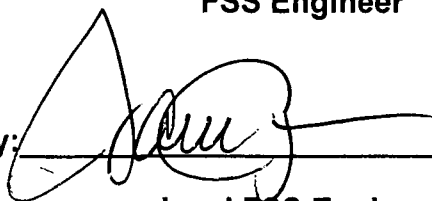
December 13, 2016

IOSB Storage Cell E-3

Survey Unit F8300303

Prepared By:  Date: 12.14.16

FSS Engineer

Reviewed By:  Date: 12.14.16

Lead FSS Engineer

Approved By:  Date: 12/29/16

Manager, Rancho Seco Assets

## FINAL STATUS SURVEY F8300303

### Survey Unit:

F8300303, Interim Onsite Storage Building (IOSB) Storage Cell E-3

### 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 2,030 dpm/100 cm<sup>2</sup> and a maximum value of 2,483 dpm/100 cm<sup>2</sup>. 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**.

**FINAL STATUS SURVEY F8300303**

**Table 1, Survey Unit Design Parameters**

<b>Evaluation Input Values</b>		<b>Comments</b>
Survey Package:	F830	Storage Cell E-3
Survey Unit:	30	
Class	03	
SU Area (m <sup>2</sup> )	28	
Evaluator:	JR	
DCGL <sub>w</sub> :	43,000	Gross Activity DCGL
Area Factor	N/A	Class 3
Design DCGL <sub>emc</sub> (dpm/100cm <sup>2</sup> ):	N/A	Class 3
DCGL <sub>emc</sub> :	N/A	Class 3
LBGR:	21,500	Default = 50% DCGL
Sigma:	182	Scoping Survey Data
Type I error:	0.05	
Type II error:	0.05	
Predominant Nuclide	Cs-137	
Sample Area (m <sup>2</sup> )	N/A	
Total Instrument Efficiency:	0.132	
Total Area Scanned (m <sup>2</sup> ):	7.51	
Scan Coverage (%)	27%	Class 3
Material Type:	N/A	Choosing 'N/A' sets material background to "0"
<b>Calculated Values</b>		<b>Comments</b>
Z <sub>1-α</sub> :	1.645	
Z <sub>1-β</sub> :	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	118.1	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	

## FINAL STATUS SURVEY F8300303

### Survey Results:

A total of 15 direct measurements were made in F8300303. 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. One alpha swipe indicated removable levels of alpha radiation at a location where the paint was peeling. This area was investigated via additional swipes, alpha/beta static measurements, and use of in-situ gamma spectroscopy. No additional removable contamination was identified and static measurements were consistent with background levels. The results of the in-situ gamma spectroscopy indicated the contaminant was thorium 232. It was postulated that the thorium was a component of the construction material and the swipe had collected a small portion of the concrete dust giving rise to the elevated alpha levels. Swipe data did not indicate elevated activity levels above the MDA.

**Table 2, Static Measurement Results**

Number	Sample #	Beta (cpm)	Beta (dpm)
1	F8300303X00001	276	2,091
2	F8300303X00002	264	2,000
3	F8300303X00003	286	2,167
4	F8300303X00004	256	1,939
5	F8300303X00005	285	2,159
6	F8300303X00006	268	2,030
7	F8300303X00007	286	2,167
8	F8300303X00008	318	2,409
9	F8300303X00009	259	1,962
10	F8300303X00010	269	2,038
11	F8300303X00011	277	2,098
12	F8300303X00012	261	1,977
13	F8300303X00013	265	2,008
14	F8300303X00014	281	2,129
15	F8300303X00015	283	2,144

**Table 3** contains the statistical summary of the static measurement data for the Storage Cell E-3.

**Table 3, Beta Summary Statistics**

<i>Beta Static Storage Cell E-3</i>	
Mean	2,088
Median	2,091
Standard Deviation	118
Minimum	1,939
Maximum	2,409
Count	15

**FINAL STATUS SURVEY F8300303**

**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**

<b>Static Data Values</b>		<b>Comments</b>
Number of Samples:	15	
Median:	2,091	
Mean:	2,088	
Static Data Standard Deviation:	118	
Maximum:	2,409	
<b>Sign Test Results</b>		<b>Comments</b>
Adjusted N Value:	14	
S+ Value:	15	
Critical Value:	10	
<b>Criteria Satisfaction</b>		<b>Comments</b>
Sufficient samples collected:	Pass	
Maximum value <DCGL <sub>w</sub> :	Pass	
Median value <DCGL <sub>w</sub> :	Pass	
Mean value <DCGL <sub>w</sub> :	Pass	
Maximum value <DCGL <sub>emc</sub> :	N/A	
Sign test results:	Pass	
<b>Final Status</b>		<b>Comments</b>
The survey unit passes all conditions:	Pass	

**Survey Unit Investigations and Results:**

Investigations were required for the quality control survey package associated with this final status survey unit. The results are discussed in Attachment 3 Investigation.

**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.

## FINAL STATUS SURVEY F8300303

### **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.

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.

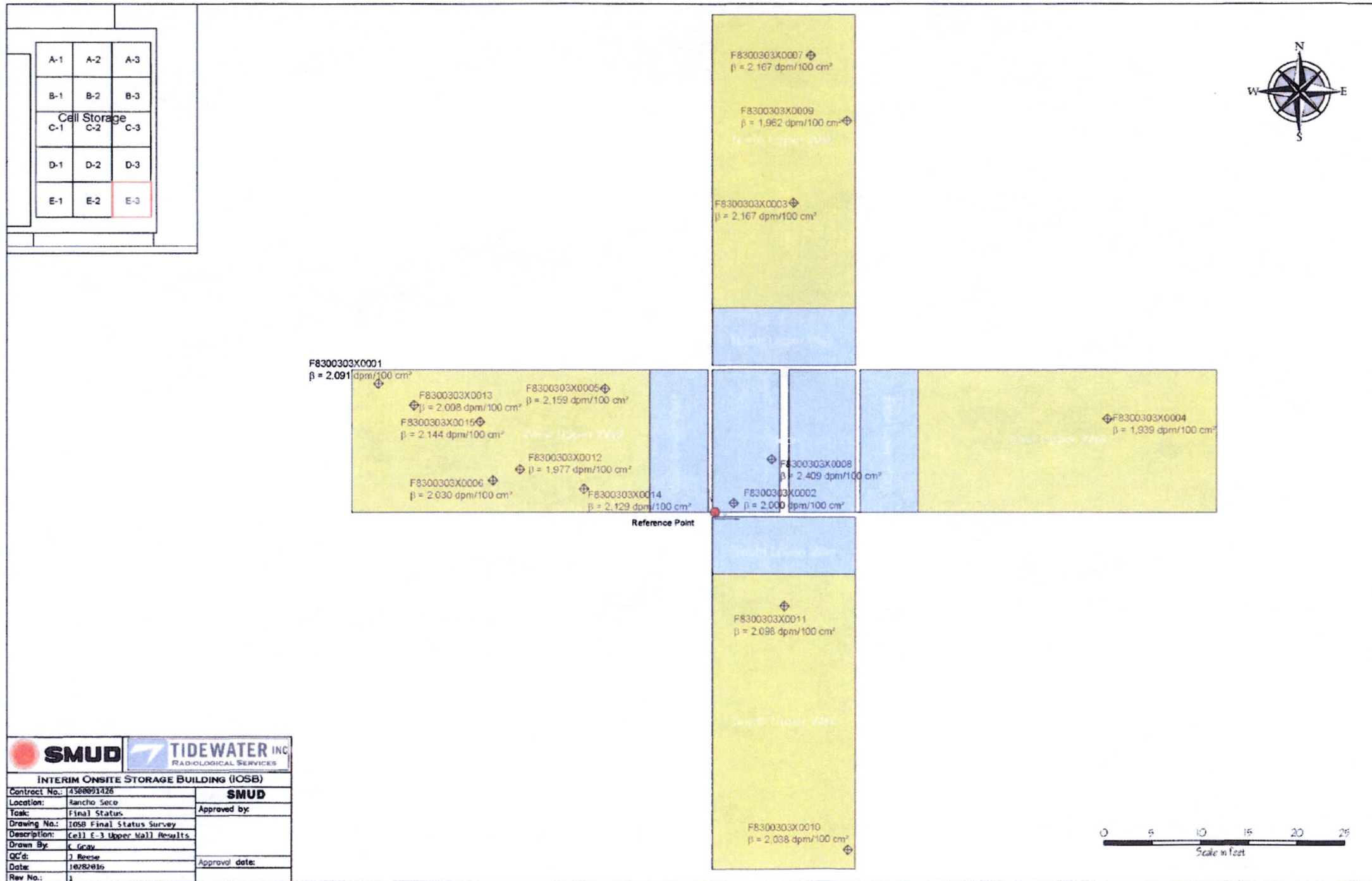
It is concluded that survey unit F8300303 meets the release criteria of 10CFR20.1402.

**Attachment 1**

**Maps**

**December 13, 2016**

**Survey Unit F8300303**



<b>SMUD</b>		<b>TIDEWATER INC</b> RADIOLOGICAL SERVICES	
<b>INTERIM ONSITE STORAGE BUILDING (IOSB)</b>			
Contract No.:	4368091426	<b>SMUD</b>	
Location:	Rancho Seco	Approved by:	
Task:	Final Status		
Drawing No.:	IOSB Final Status Survey		
Description:	Cell E-3 Upper Hall Results		
Drawn By:	C. Gray		
QC'd:	J. Reese	Approval date:	
Date:	10/22/16		
Rev No.:	1		



**Attachment 2**

**Instrumentation**

**December 13, 2016**

**Survey Unit F8300303**

**Table 2-1. Survey Unit Instrumentation**

Measurement Type	Instrument Type	Minimum Detectable Activity <sup>a</sup>	Detector Efficiencies	Calibration Due Date <sup>b</sup>
Beta Static Measurement	Ludlum Model 2350-1	Beta – 506 dpm/100 cm <sup>2</sup>	13.2%	317897/331972 2/10/17
	Ludlum Model 44-116 B Detector			
Swipe Measurements	Ludlum Model 2929	Beta – 76 dpm/100 cm <sup>2</sup>	43.4%	1182597/188736 5/13/17
	Ludlum Model 44-10-1			

<sup>a</sup> 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).

<sup>b</sup> 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<sup>2</sup> = square centimeters

cpm = counts per minute

dpm = disintegrations per minute

## Static Measurement MDA

### Variables

Beta Survey Type  
PR331972 Detector Number  
188 Background count rate (cpm)  
1 Count Time (min)  
0.132 Efficiency  
100 Area of Detector (cm<sup>2</sup>)

### 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)

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Where:  $B_r$  Background Countrate  
 $t$  Count Time (min)  
 $E$  Efficiency  
 $A$  Area of detector (cm<sup>2</sup>)

Static MDA 506 dpm/100 cm<sup>2</sup>

**Attachment 3**

**Investigation**

**December 13, 2016**

**Survey Unit F8300303**

### Final Status Survey Data Investigation/Evaluation

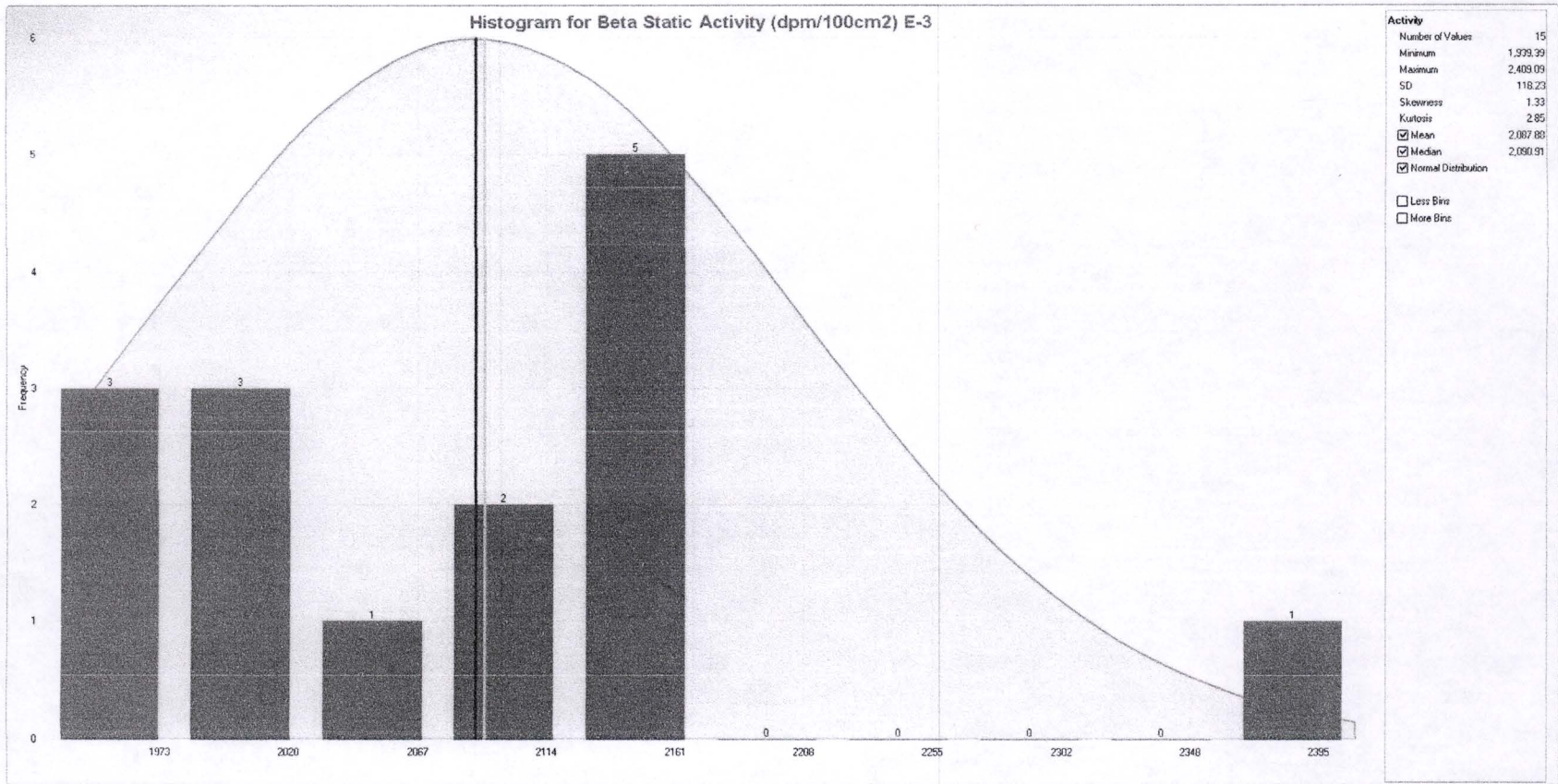
FSS Package No.	18300303	Date: 11-14-2016
Location/Description:	IOSB Storage Cell E-3 (QC Survey Package Data)	
Instrumentation Involved: (include serial numbers) N/A		
<p><b>Data Investigation:</b></p> <p><b>PROBLEM-</b> Elevated alpha and beta results were observed for sample ID Q830030-10 swipe from the QC package for IOSB Storage Cell E-3. Initial FSS results for this same sample location revealed results typical of those demonstrated throughout the IOSB FSS.</p> <p><b>RESOLUTION-</b>Recount of swipe sample resulted in continued elevated gross alpha results and diminished beta results. Multiple recounts of swipe results in same elevated alpha and near background beta results.</p> <p>Gamma spectrometric analysis (qualitative only) was performed with no nuclides of concern(per LTP) identified following sample count of the swipe. The gamma spectroscopic analysis resulted in identification of Th-232 and Ra-226 via gamma emitting daughter products, both are alpha-emitting nuclides. No further action necessary.</p> <p>Resurvey of subject area, Q8300303-10 was performed per instruction below and revealed satisfactory results of the area for 32 beta static measurements and 32 swipes of the entire 0.37m<sup>2</sup> area.</p>		
<p><b>Data Evaluation and Investigation Resolution:</b></p> <p>The suspect area (0.37 m<sup>2</sup>) will be resurveyed and the results presented to the FSS/LFSSRE for review and resolution.</p> <ol style="list-style-type: none"> <li>1. Sample area Q8300303-10 will be divided into a grid of 100 cm<sup>2</sup> increments, total 32 areas.</li> <li>2. Each of the 32 locations within the grid will have a unique identifier,             <ol style="list-style-type: none"> <li>a. a static count performed for 60 seconds and</li> <li>b. a swipe sample obtained.</li> </ol> </li> <li>3. All of the swipe samples will be analyzed the same as the first (F8300303) FSS package and the second (Q8300303) quality control package, using the Ludlum 2929 gross alpha beta counter.</li> <li>4. Results of the static counts of each area along with the results of the swipe samples will be submitted to the FSS/LFSSRE for review and evaluation.</li> <li>5. This investigation report will be submitted to the LFSSRE for review and a copy included in both the FSS package (F8300303) and the quality control package (Q8300303) along with a copy of this DEC-045 Final Status Survey Data Investigation/Evaluation.</li> </ol>		
Based on the above resolution , the survey data is determined to be:		<input checked="" type="checkbox"/> Acceptable for use and inclusion in FSS Package  <input type="checkbox"/> Not Acceptable for use
Prepared by:	FSSE	Date 11-14-2016
Reviewed by:	LFSSRE	Date 11-16-2016

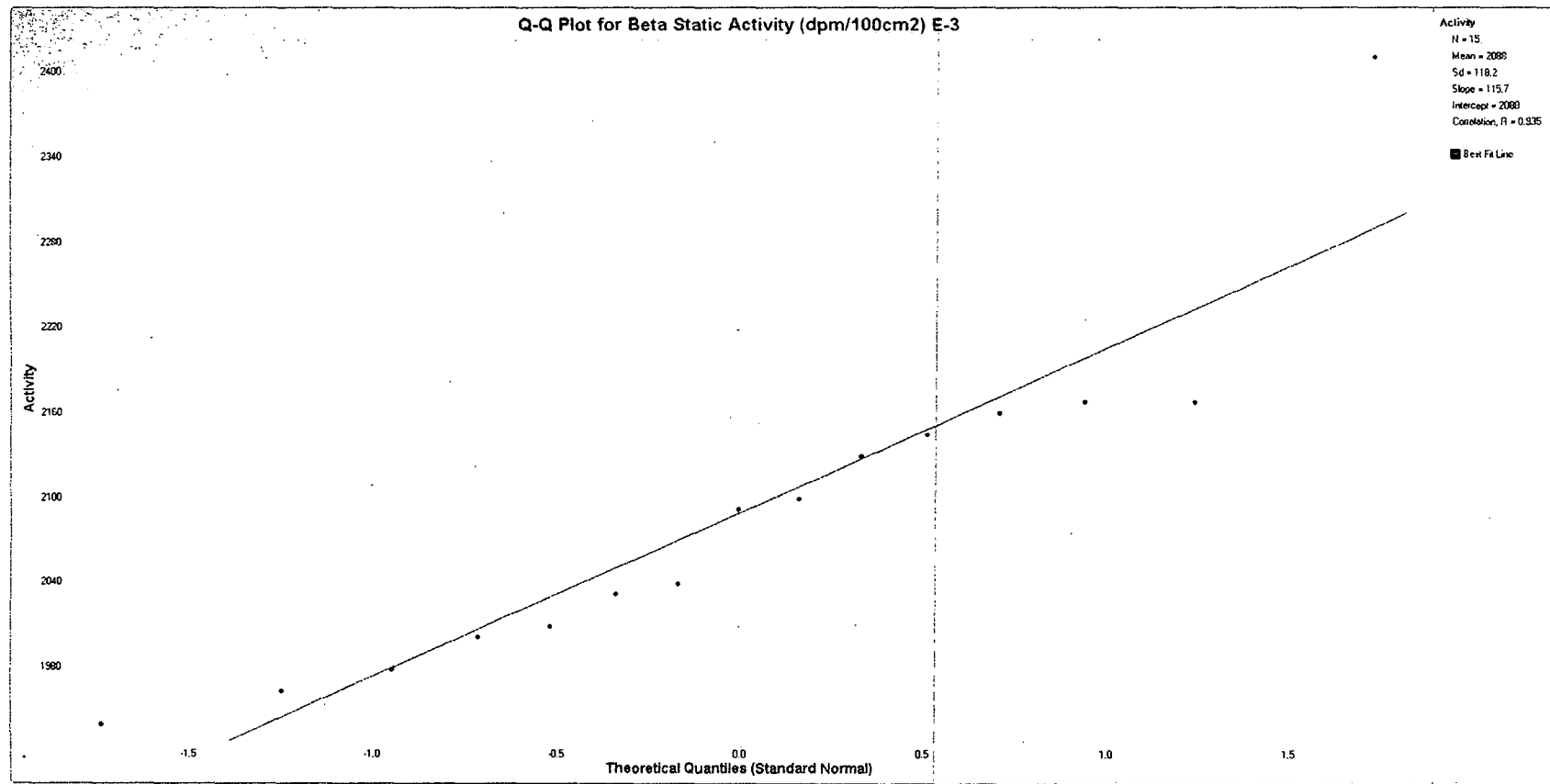
**Attachment 4**

**Data Assessment**

**December 13, 2016**

**Survey Unit F8300303**







Smear\_Data\_Calculation\_Sheet\_101316

IOSB Final Status Survey												
	LC1	LC2	LC3	LC4	LC6	LC5		$\beta$ CPM	$\beta$ dpm	Date/Time of Count		Sample Comments
1	F830	030	3	X	00001	SM	Cell E-3	44	-6	10/14/16	0945	
2	F830	030	3	X	00002	SM	Cell E-3	48	3	10/14/16	0947	
3	F830	030	3	X	00003	SM	Cell E-3	54	17	10/14/16	0948	
4	F830	030	3	X	00004	SM	Cell E-3	46	-2	10/14/16	0950	
5	F830	030	3	X	00005	SM	Cell E-3	56	21	10/14/16	0951	
6	F830	030	3	X	00006	SM	Cell E-3	48	3	10/14/16	0952	
7	F830	030	3	X	00007	SM	Cell E-3	39	-18	10/14/16	0953	
8	F830	030	3	X	00008	SM	Cell E-3	47	1	10/14/16	0954	
9	F830	030	3	X	00009	SM	Cell E-3	45	-4	10/14/16	0956	
10	F830	030	3	X	00010	SM	Cell E-3	42	-11	10/14/16	0958	
11	F830	030	3	X	00011	SM	Cell E-3	39	-18	10/14/16	0959	
12	F830	030	3	X	00012	SM	Cell E-3	47	1	10/14/16	1000	
13	F830	030	3	X	00013	SM	Cell E-3	45	-4	10/14/16	1001	
14	F830	030	3	X	00014	SM	Cell E-3	47	1	10/14/16	1003	
15	F830	030	3	X	00015	SM	Cell E-3	55	19	10/14/16	1004	
Comments: By signature below, the required source check and background checks were satisfactorily performed prior to use of the instrument identified below.												
							Ludlum 2929 Benchtop Instrument					
							2929 S/N: 182597	efficiency		bkg rate	bkg count time	MDA
							43-10-1 S/N: 188736	$\alpha$	0.364	cpm	min	#DIV/OI
Tech A Sign/ Date <i>Alan White</i> 12-2-16							Cal Due Date: 5/13/2017	$\beta$	0.434	46.7	1	76.2
Tech B Sign/ Date <i>N/A</i>									cpm	min	dpm per area	