Rancho Seco

Final Status Survey Summary Report

October 3, 2016

IOSB ROOF

Survey Unit F8300153

Prepared By: _____ Date: 1.12.17

FSS Engineer

Reviewed By: _____ Date: 1.12.17

Lead FSS Engineer

Approved By: _____ Date: 1/30/2017

Manager, Rancho Seco Assets

Survey Unit:

F8300153, Interim Onsite Storage Building (IOSB) Roof

Survey Unit Description:

Operating History: The current roof of the IOSB is not the original surface material. The roof surface material has been replaced since construction. The roof is occasionally exposed to high wind conditions and damage has occurred as a result. Additionally, a portion the roof is the closest horizontal surface to the IOSB ventilation stack. However, no records indicating measurable releases of radioactivity had been discovered. In March of 2016, the center section of the roof was replaced following a wind storm that removed most of the original material. The removed material was surveyed as material and equipment in accordance with SMUD's procedures and released for disposal.

Site Characterization: Static measurements were made of the surface of the roof, to confirm the absence or presence of plant-derived radionuclides. Static measurements showed a mean gross beta activity level of 2,496/100 cm^2 and a maximum value of 3,766 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 1% 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**	IOSB Roof
Survey Unit:	**015**	
Class	**3**	
SU Area (m^2)	**1735**	
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:	707	Scoping Survey Data for Roof
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):	22.85	
Scan Coverage (%)	1%	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:	30.4	
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 F8300153. The results of the static measurements are shown in **Table 2**. All of the static measurements were less than the DCGL. The western roof is an asphalt surface verses the membrane surface for the center and eastern roofs. The asphalt portion results in higher activity (locations 1 – 3) than the membrane sections. None of the scan measurements indicated areas of elevated activity.

Table 2, Static Measurement Results

Number	Sample #	Beta (cpm)	Beta (dpm)
1	F8300153Z00001	288	2,233
2	F8300153Z00002	302	2,341
3	F8300153Z00003	297	2,302
4	F8300153Z00004	171	1,326
5	F8300153Z00005	171	1,326
6	F8300153Z00006	253	1,961
7	F8300153Z00007	176	1,364
8	F8300153Z00008	171	1,326
9	F8300153Z00009	171	1,326
10	F8300153Z00010	184	1,426
11	F8300153Z00011	169	1,310
12	F8300153Z00012	143	1,109
13	F8300153Z00013	184	1,426
14	F8300153Z00014	162	1,256
15	F8300153Z00015	161	1,248

Table 3 contains the statistical summary of the static measurement data for the IOSB Roof.

Table 3, Beta Summary Statistics

Beta Static IOSB Roof	
Mean	1,552
Median	1,326
Standard Deviation	425
Minimum	1,109
Maximum	2,341
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:	1,326	
Mean:	1,552	
Static Data Standard Deviation:	425	
Maximum:	2,341	
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 higher than the characterization data used for survey design. However the relative shift exceeded 3 and had to be adjusted. 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.

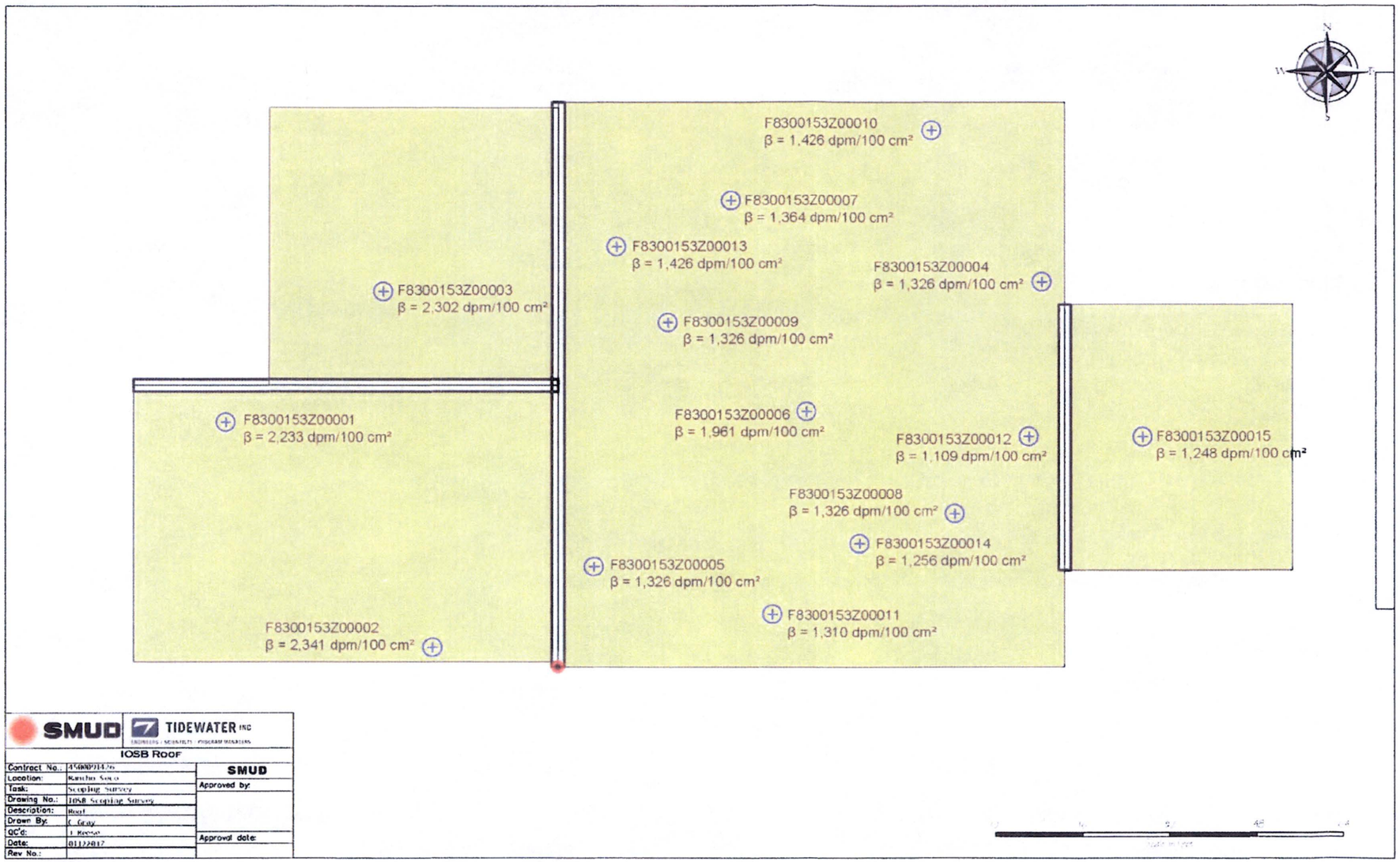
It is concluded that survey unit F8300153 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

October 3, 2016

Survey Unit F8300153


F8300153Z00010
β = 1,426 dpm/100 cm²
F8300153Z00007
β = 1,364 dpm/100 cm²
F8300153Z00013
β = 1,426 dpm/100 cm²
F8300153Z00004
β = 1,326 dpm/100 cm²
F8300153Z00003
β = 2,302 dpm/100 cm²
F8300153Z00009
β = 1,326 dpm/100 cm²
F8300153Z00001
β = 2,233 dpm/100 cm²
F8300153Z00006
β = 1,961 dpm/100 cm²
F8300153Z00012
β = 1,109 dpm/100 cm²
F8300153Z00015
β = 1,248 dpm/100 cm²
F8300153Z00008
β = 1,326 dpm/100 cm²
F8300153Z00014
β = 1,256 dpm/100 cm²
F8300153Z00005
β = 1,326 dpm/100 cm²
F8300153Z00011
β = 1,310 dpm/100 cm²
F8300153Z00002
β = 2,341 dpm/100 cm²
N
W
E
S
SMUD
TIDEWATER INC
IOSB Roof
Contract No.: 4500070476
Location: Rancho Seco
Task: Scoping Survey
Drawing No.: IOSB Scoping Survey
Description: Roof
Drawn By: C Gray
QC'd: L Reese
Date: 01122017
Rev No.:
SMUD
Approved by:
Approval date:

Attachment 2

Instrumentation

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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 – 512 dpm/100 cm^2	12.9%	317899/331973 2/10/17

[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

Variables

Beta	Survey Type
PR331973	Detector Number
184	Background count rate (cpm)
1	Count Time (min)
0.129	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 512 dpm/100 cm^2

Attachment 3

Investigation

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Survey Unit F8300153

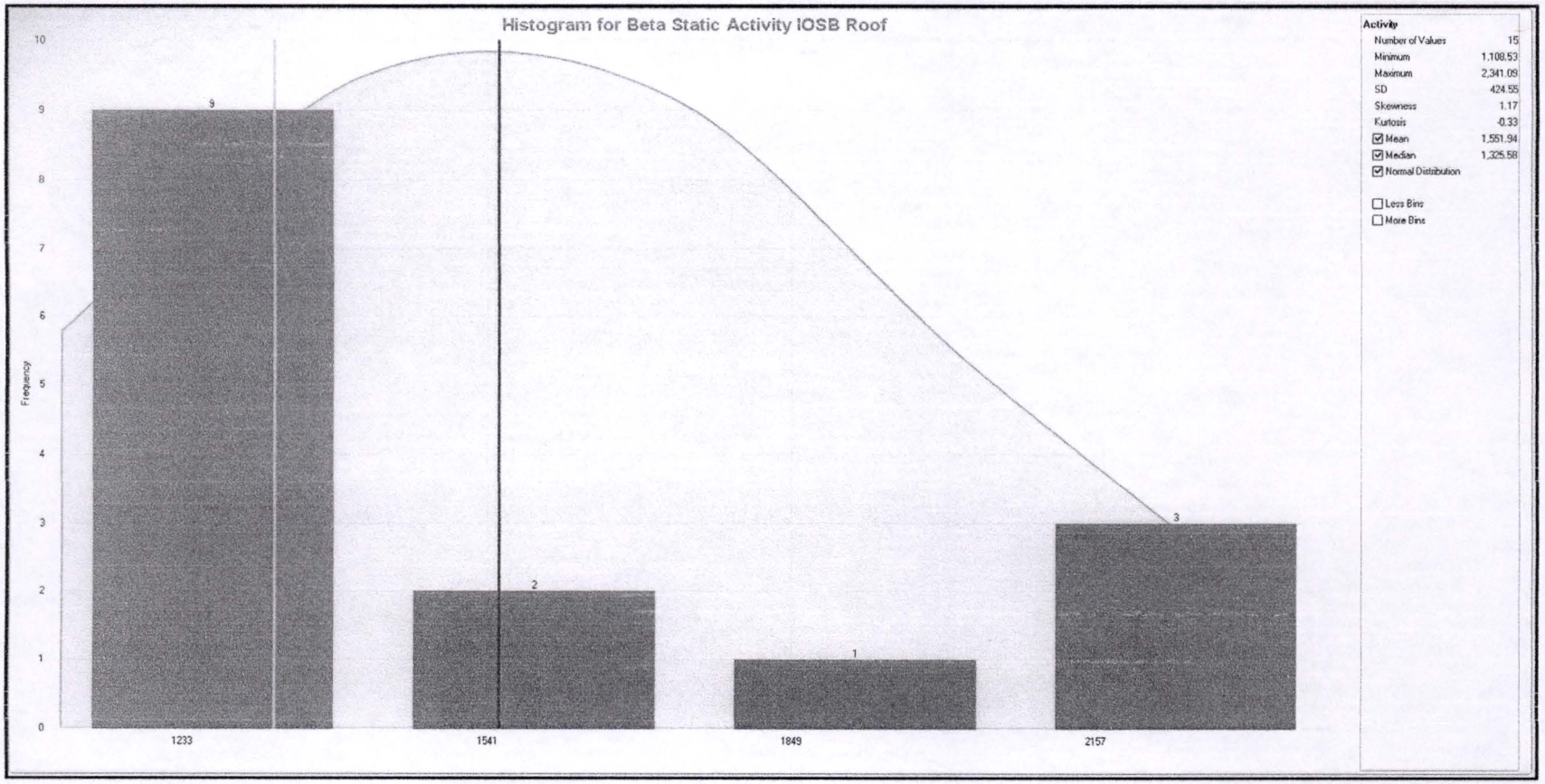
(none required)

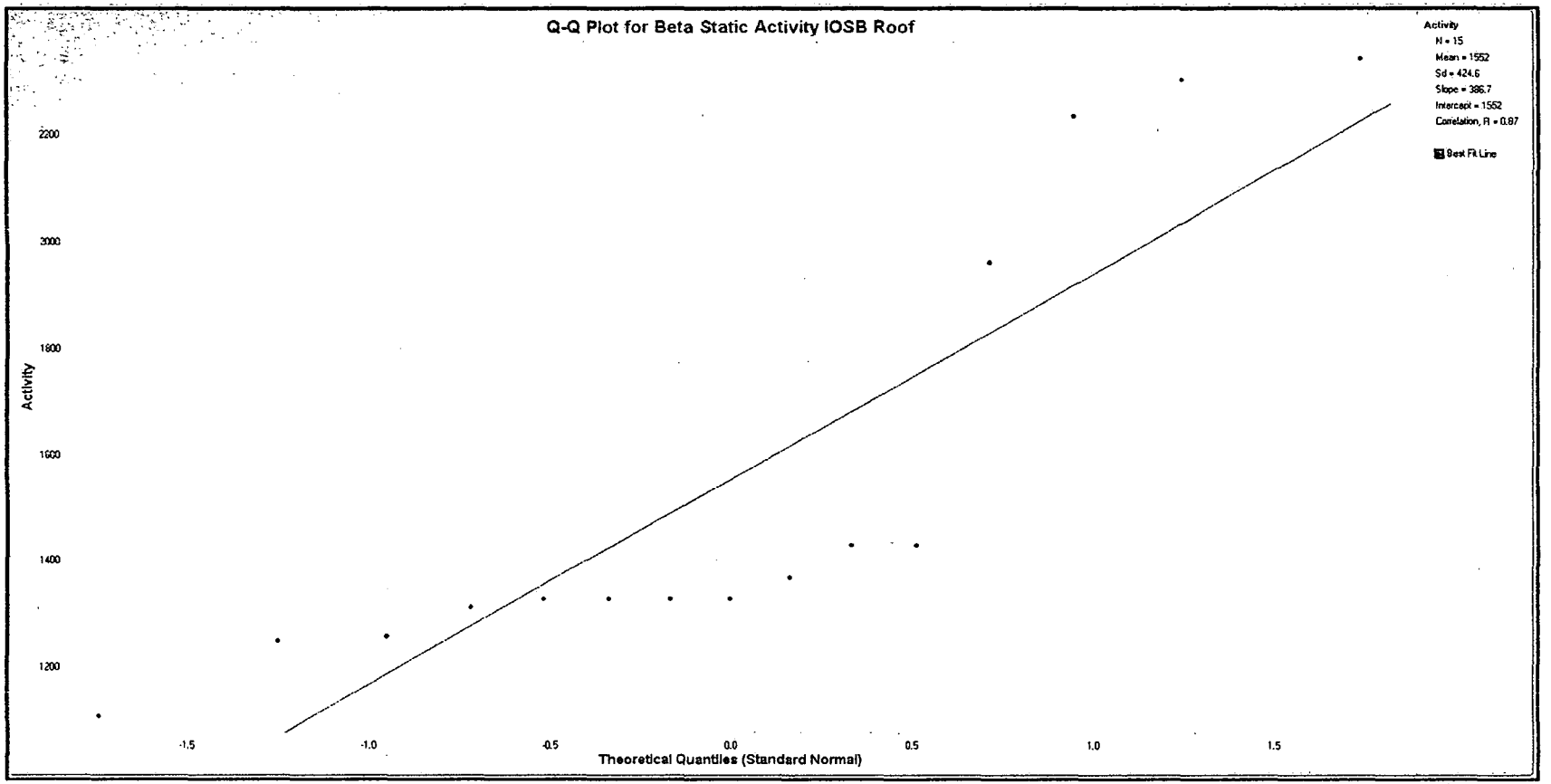
Attachment 4

Data Assessment

October 3, 2016

Survey Unit F8300153


Histogram for Beta Static Activity IOSB Roof
Frequency
0
1
2
3
4
5
6
7
8
9
10
9
2
1
3
1233
1541
1849
2157
Activity
Number of Values 15
Minimum 1,108.53
Maximum 2,341.09
SD 424.55
Skewness 1.17
Kurtosis -0.33
Mean 1,551.94
Median 1,325.58
Normal Distribution
Less Bins
More Bins


Q-Q Plot for Beta Static Activity IOSB Roof
Activity
N = 15
Mean = 1552
Sd = 424.6
Slope = 386.7
Intercept = 1552
Correlation, R = 0.87
Best Fit Line
2200
2000
1800
1600
1400
1200
Activity
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Theoretical Quantiles (Standard Normal)