Rancho Seco

Final Status Survey Summary Report

July 2, 2008

Chemical Storage Balcony ceiling and upper walls Room 133

Survey Unit F8131222

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FSS Engineer

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Lead FSS Engineer

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Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8131222, Chemical Storage Balcony ceiling and upper walls Room 133

Survey Unit Description:

Operating History: The reinforced concrete structure contained the RadWaste processing and supporting systems. The building contained six main elevations. Residual radioactive material was known to be present on all levels of the interior of the building. Operating records and the HSA document several events with the potential for a release of radioactivity inside this structure. One report documented contamination of the auxiliary building roof. The roof was later replaced.

Site Characterization: Direct measurements were made of each of the interior elevation surfaces as well as the exterior surfaces of the structure. These measurements confirmed the presence of plant-derived radionuclides. Direct measurements on the –47' elevation showed a mean gross activity level of 320,071 dpm/100 cm^2 and a maximum value of 5,720,000 dpm/100 cm^2. Direct measurements on the –29' elevation showed a mean gross activity level of 544,756 dpm/100 cm^2 and a maximum value of 11,370,000 dpm/100 cm^2. Direct measurements on the –20' elevation showed a mean gross activity level of 247,831 dpm/100 cm^2 and a maximum value of 10,080,000 dpm/100 cm^2. Direct measurements on the grade elevation showed a mean gross activity level of 373,758 dpm/100 cm^2 and a maximum value of 5,800,000 dpm/100 cm^2. Direct measurements on the +20' elevation showed a mean gross activity level of 85,408 dpm/100 cm^2 and a maximum value of 1,900,000 dpm/100 cm^2. Direct measurements on the +40' elevation showed a mean gross activity level of 3,288 dpm/100 cm^2 and a maximum value of 24,781 dpm/100 cm^2. Direct measurements on the building exterior, including the mezzanine roof, showed a mean gross activity level of 1,897 dpm/100 cm^2 and a maximum value of 2,990 dpm/100 cm^2. (The roof had been replaced prior to the classification survey.) Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the auxiliary building was determined to be a Class 1, 2 area and the exterior was a Class 2,3.

HSA Events: HSA Report pg. 63.

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. Direct measurement locations were determined using a random-start, fixed grid pattern and 90 m^2 were scanned for approximately 33% coverage. Samples of removable contamination were collected at each direct measurement location. The instrumentation used for the survey along with the MDC values are listed in Tables 2-1 and 2-2 in Attachment 2.

Table 1. Survey Unit Design Parameters

Survey Design Parameter	Value	Comment
Survey Area:	F813	Chemical Storage Balcony ceiling and upper walls Room 133
Survey Unit:	1222	Structure Surface
Class:	2	LTP Table 5-4
SU Area (m^2)**:**	270.9	
Evaluator:	Erin L. Brown	
DCGL (dpm/100 cm^2)**:**	43000	Gross Activity DCGL
Area Factor:	N/A	Class 2
Design DCGLemc (dpm/100 cm^2)**:**	N/A	Class 2
LBGR (dpm/100 cm^2)**:**	21500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	6935	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	19.35	Class 2
Scan Area (m^2)**:**	90	
Scan Coverage (%):	33%	Class 2
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.99865	
Calculated Relative Shift:	3.1	
Relative Shift Used:	3	Uses 3.0 if Relative Shift is >3
N-Value:	11	
Design N-Value + 20%:	14	NUREG-1575 Table 5-5
Design Min Samples N:	14	Class 2
Grid Spacing L:	4.3	Class 2

Survey Results:

A total of 16 direct measurements were made in F8131222. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. None of the scan measurements indicated areas of elevated activity. Scan activity ranged from 1318 to 24396 dpm/100 cm², based on a surveyor efficiency of 0.5 and no background subtracted. Samples for removable surface activity were all less than 10% of the DCGL as shown in Table 3. Removable surface activity samples were counted for alpha activity and none was detected at the MDC shown in Table 2-1 of Attachment 2.

Table 2. Direct Measurement Results

Measurement ID	Gross Activity (dpm/100 cm^2)
F8131222-C0001BD	2260
F8131222-C0002BD	2337
F8131222-C0003BD	2381
F8131222-C0004BD	2127
F8131222-C0005BD	2690
F8131222-C0006BD	2712
F8131222-C0007BD	2646
F8131222-C0008BD	2094
F8131222-C0009BD	2293
F8131222-C0010BD	2690
F8131222-C0011BD	2745
F8131222-C0012BD	2502
F8131222-C0013BD	2480
F8131222-C0014BD	2579
F8131222-C0015BD	2094
F8131222-C0016BD	2260
Mean:	2431
Median:	2431
Standard Deviation:	230
Range:	2094 - 2745

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8131222C0001SM	-3.53
F8131222C0002SM	1.64
F8131222C0003SM	-0.95
F8131222C0004SM	-2.24
F8131222C0005SM	-2.24
F8131222C0006SM	-4.82
F8131222C0007SM	1.64
F8131222C0008SM	-0.95
F8131222C0009SM	1.64
F8131222C0010SM	-2.24
F8131222C0011SM	0.34
F8131222C0012SM	-2.24
F8131222C0013SM	-4.82
F8131222C0014SM	-0.95
F8131222C0015SM	0.34
F8131222C0016SM	-2.24
Mean:	-1.35
Median:	-1.59
Standard Deviation:	2.09
Range:	-4.82 to 1.64

Survey Unit Data Assessment:

The survey design required 16 direct measurements for the Sign Test. 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. The sample standard deviation was less than the design standard deviation so no additional samples were required.

Table 4. Data Assessment Results

Survey Results Parameter	Value	Comment
Material Background Used (dpm/100 cm^2):	N/A	
Ambient Background Used (dpm/100 cm^2):	N/A	Average Ambient BKG = 0
Actual Direct Measurements (N):	16	
Median (dpm/100 cm^2):	2431	
Mean (dpm/100 cm^2):	2431	
Direct Measurement Standard Deviation (dpm/100 cm^2):	230	
Total Standard Deviation (dpm/100 cm^2):	230	Based on samples and backgrounds.
Maximum (dpm/100 cm^2):	2745	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	16	
S+ Value:	16	
Critical Value:	11	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGLemc:	N/A	Class 2
Total Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
Does the Survey Unit Pass All Criteria?	Yes	

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 (i.e. the survey unit average activity 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 structure 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 2 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. No direct measurements exceeded the DCGL of 43000 dpm/100 cm^2 and none of the removable surface activity measurements exceeded 10% of the DCGL. No investigations were required.

The direct 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.

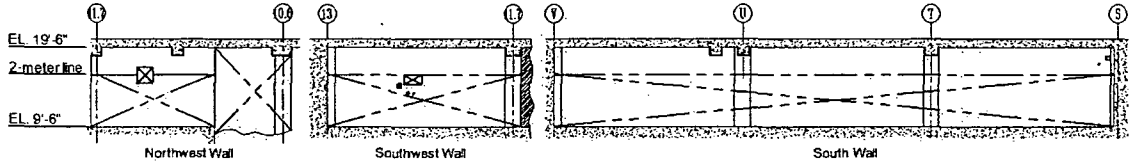
It is concluded that survey unit F8131222 meets the release criteria of 10CFR20.1402.

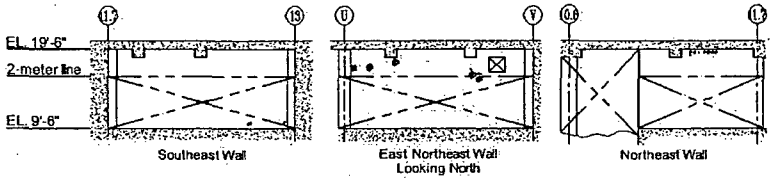
Attachment 1

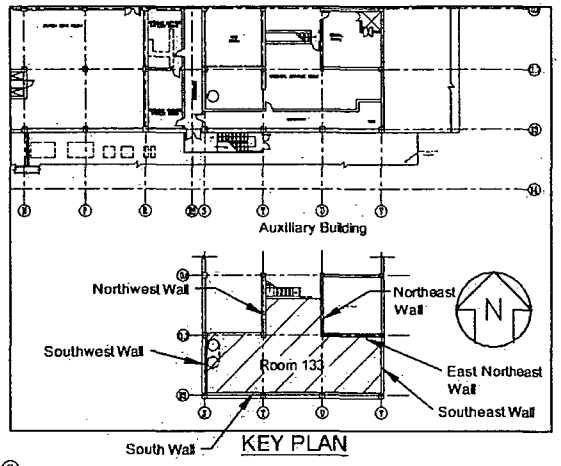
Maps

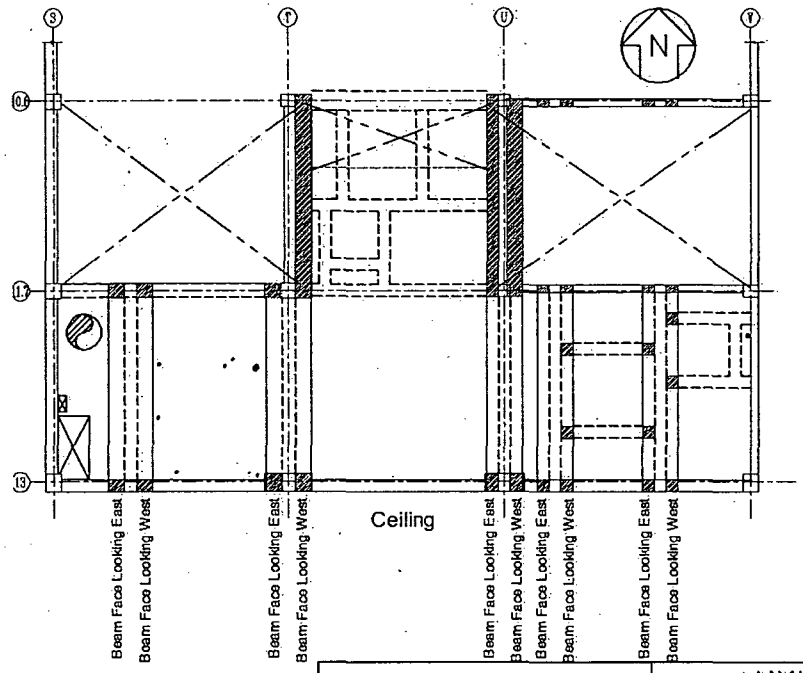
July 2, 2008

Survey Unit F8131222









ESTIMATED SURFACE AREA

Upper Walls - 58.3 m²
Ceiling - 214.6 m²

Total Area - 270.9 m²

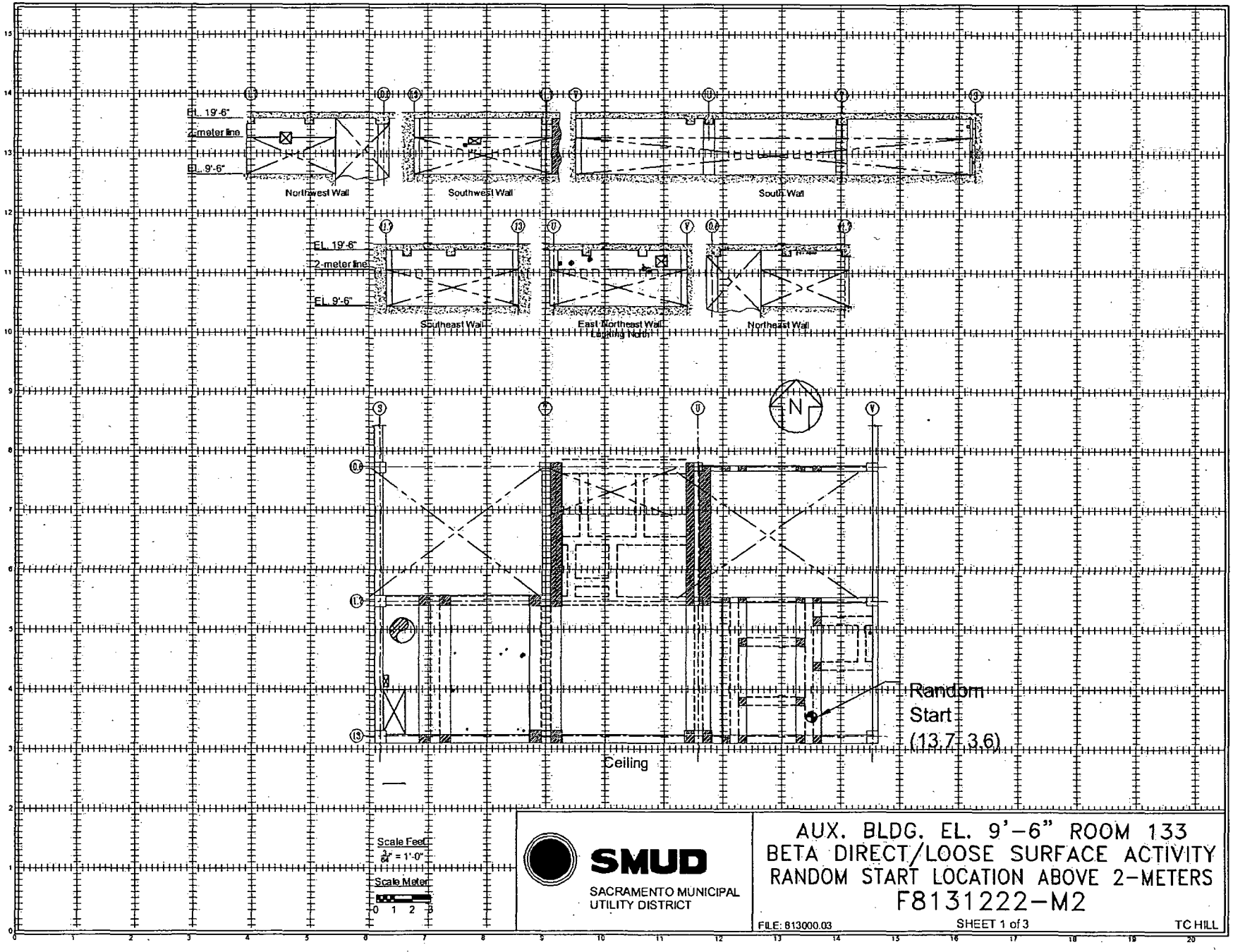
Scale Feet
$\frac{1}{4}$" = 1'-0"

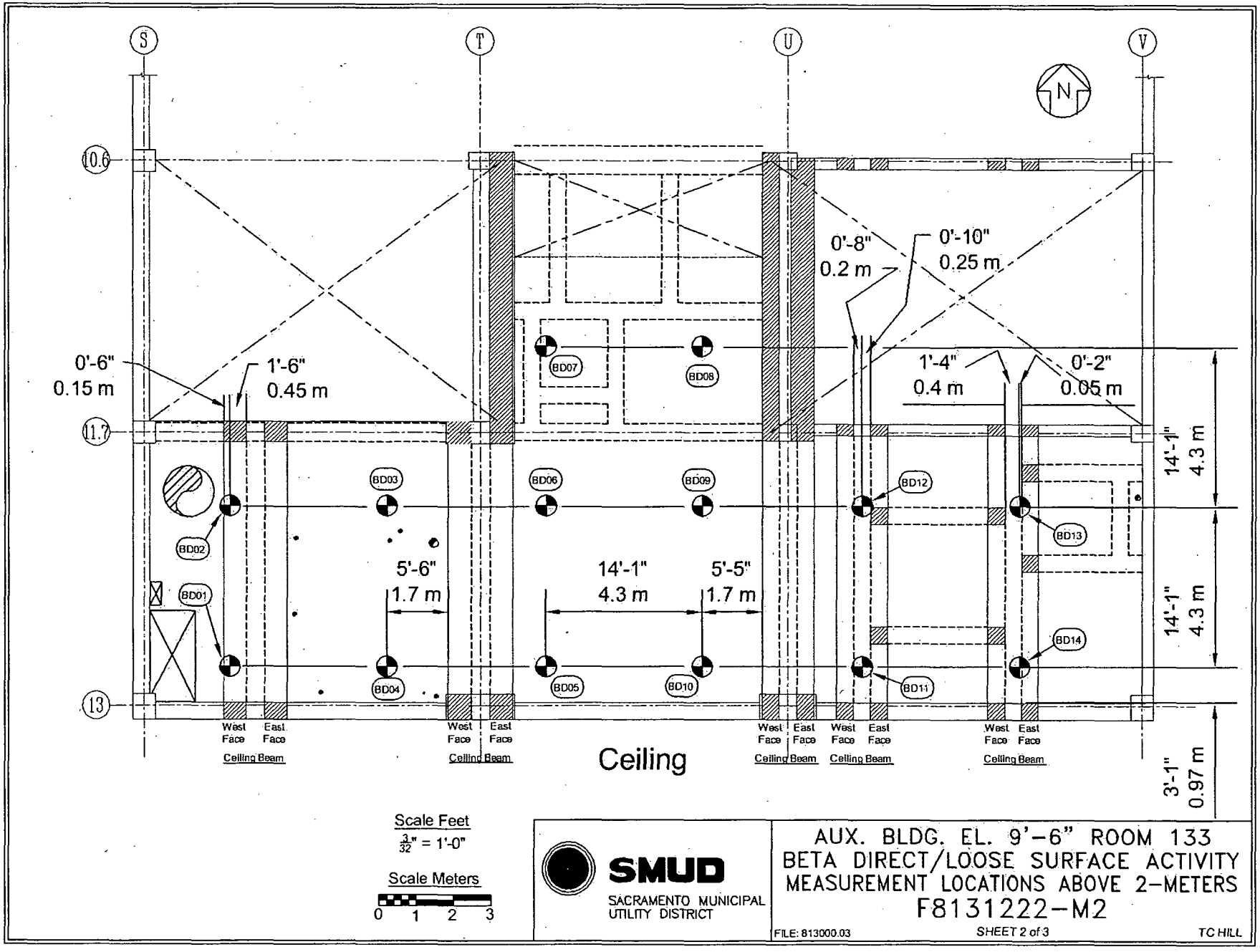
Scale Meter
0 1 2 3

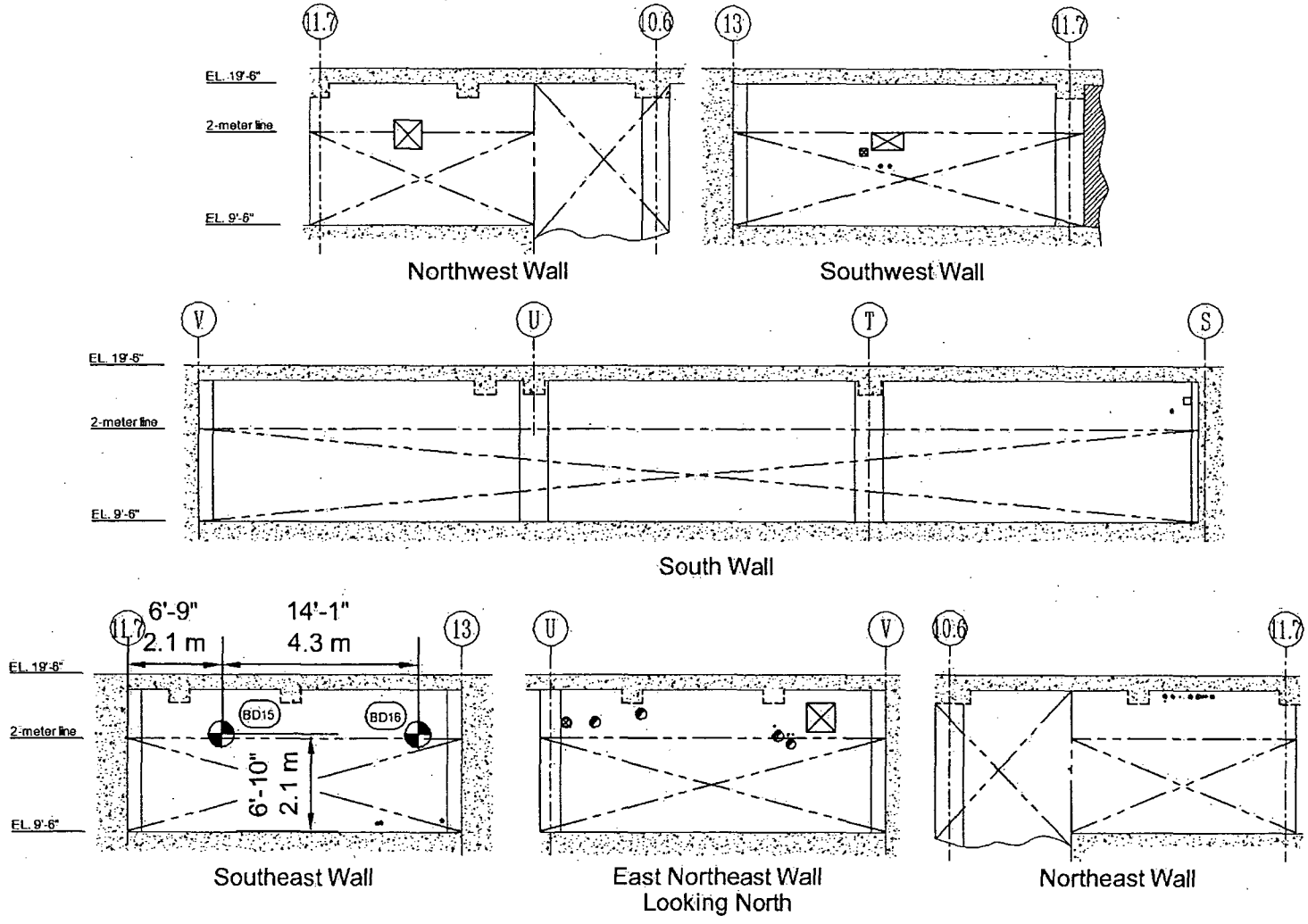
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 9'-6"
ROOM 133 CEILING AND UPPER WALLS
ESTIMATED GENERAL SURFACE AREAS
F8131222-M1

FILE: 813000.03 SHEET 1 of 1 TC HILL


EL. 19'-6"
2-meter line
EL. 9'-6"
Northwest Wall
Southwest Wall
South Wall
EL. 19'-6"
2-meter line
EL. 9'-6"
Southeast Wall
East Northeast Wall
Looking North
Northeast Wall
N
Random
Start
(13.7, 3.6)
Ceiling
Scale Feet
3/64" = 1'-0"
Scale Meter
0 1 2 3
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUX. BLDG. EL. 9'-6" ROOM 133
BETA DIRECT/LOOSE SURFACE ACTIVITY
RANDOM START LOCATION ABOVE 2-METERS
F8131222-M2
FILE: 813000.03
SHEET 1 of 3
TC HILL


S
T
U
V
N
10.6
11.7
13
0'-6"
0.15 m
1'-6"
0.45 m
0'-8"
0.2 m
0'-10"
0.25 m
1'-4"
0.4 m
0'-2"
0.05 m
14'-1"
4.3 m
14'-1"
4.3 m
3'-1"
0.97 m
5'-6"
1.7 m
14'-1"
4.3 m
5'-5"
1.7 m
BD01
BD02
BD03
BD04
BD05
BD06
BD07
BD08
BD09
BD10
BD11
BD12
BD13
BD14
West Face
East Face
Ceiling Beam
Ceiling
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUX. BLDG. EL. 9'-6" ROOM 133
BETA DIRECT/LOOSE SURFACE ACTIVITY
MEASUREMENT LOCATIONS ABOVE 2-METERS
F8131222-M2
FILE: 813000.03
SHEET 2 of 3
TC HILL



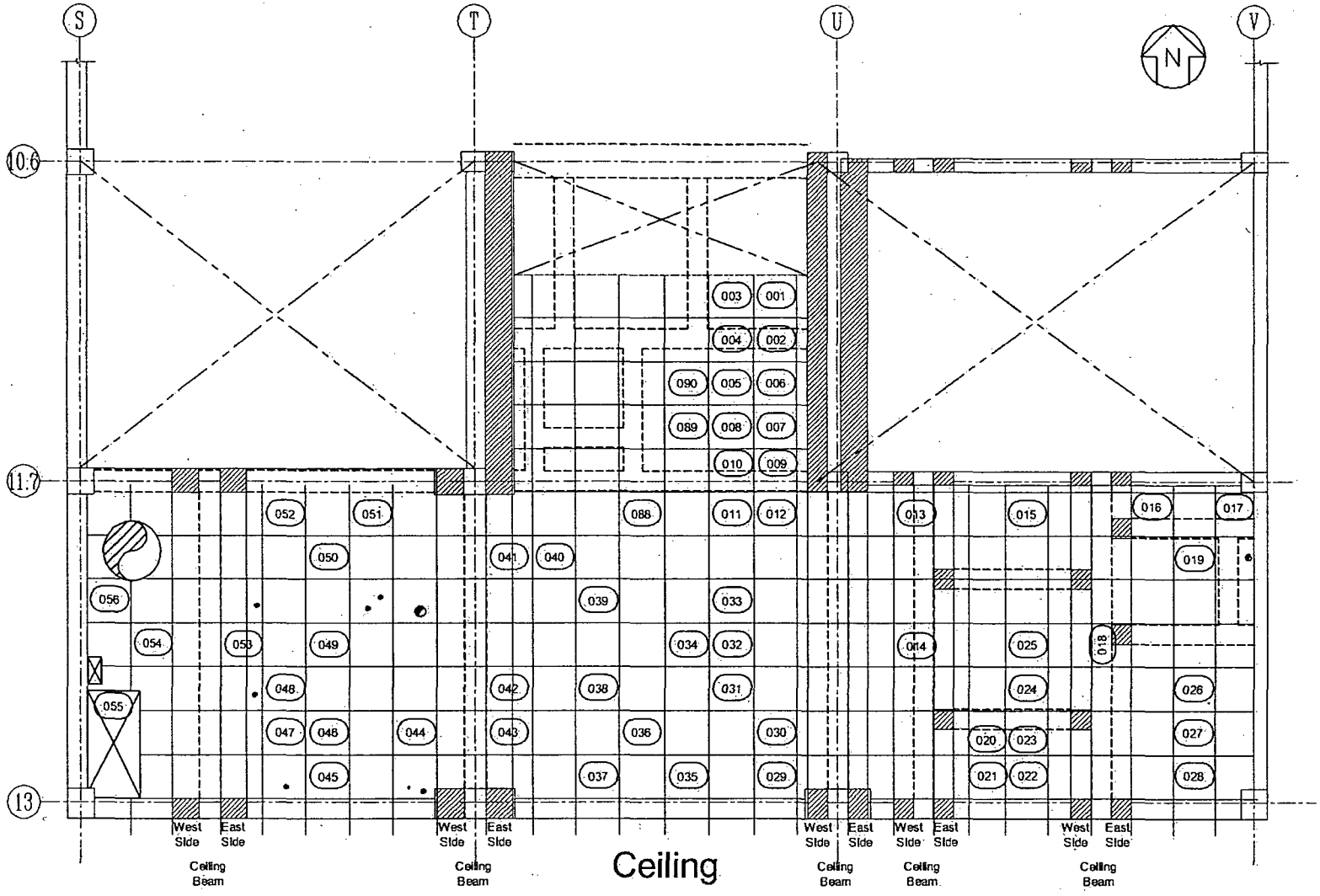
Scale Feet
$\frac{3}{32}$" = 1'-0"

Scale Meters
0 1 2 3

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUX. BLDG. EL. 9'-6" ROOM 133
BETA DIRECT/LOOSE SURFACE ACTIVITY
MEASUREMENT LOCATIONS ABOVE 2-METERS
F8131222-M2

FILE: 813000.03 SHEET 3 of 3 TC HILL



Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

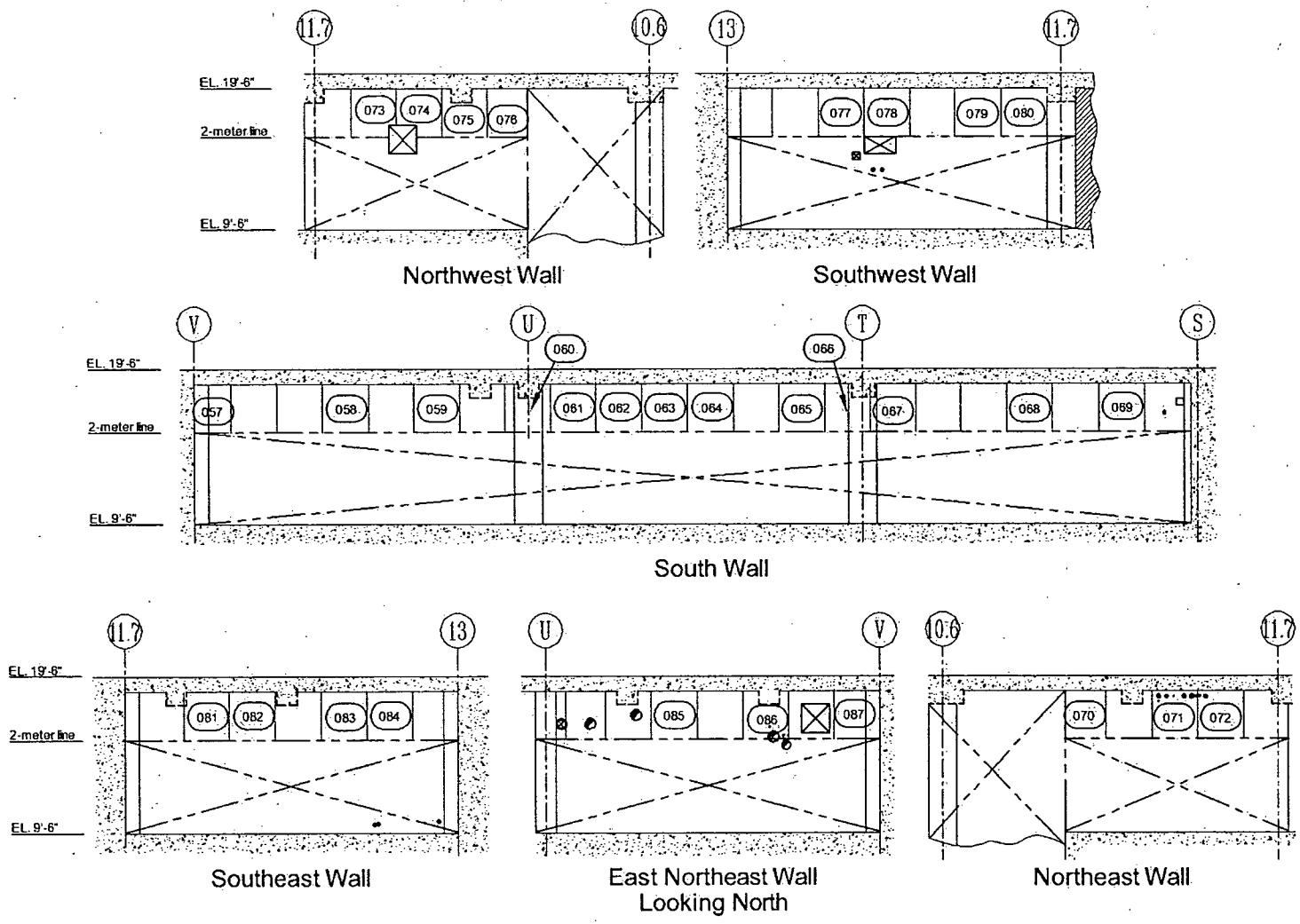
0 1 2 3

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUX. BLDG. EL. 9'-6" ROOM 133
BETA SCAN
MEASUREMENT LOCATIONS ABOVE 2-METERS
F8131222-M3

FILE: 813000.03 SHEET 1 of 2 TC HILL



Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

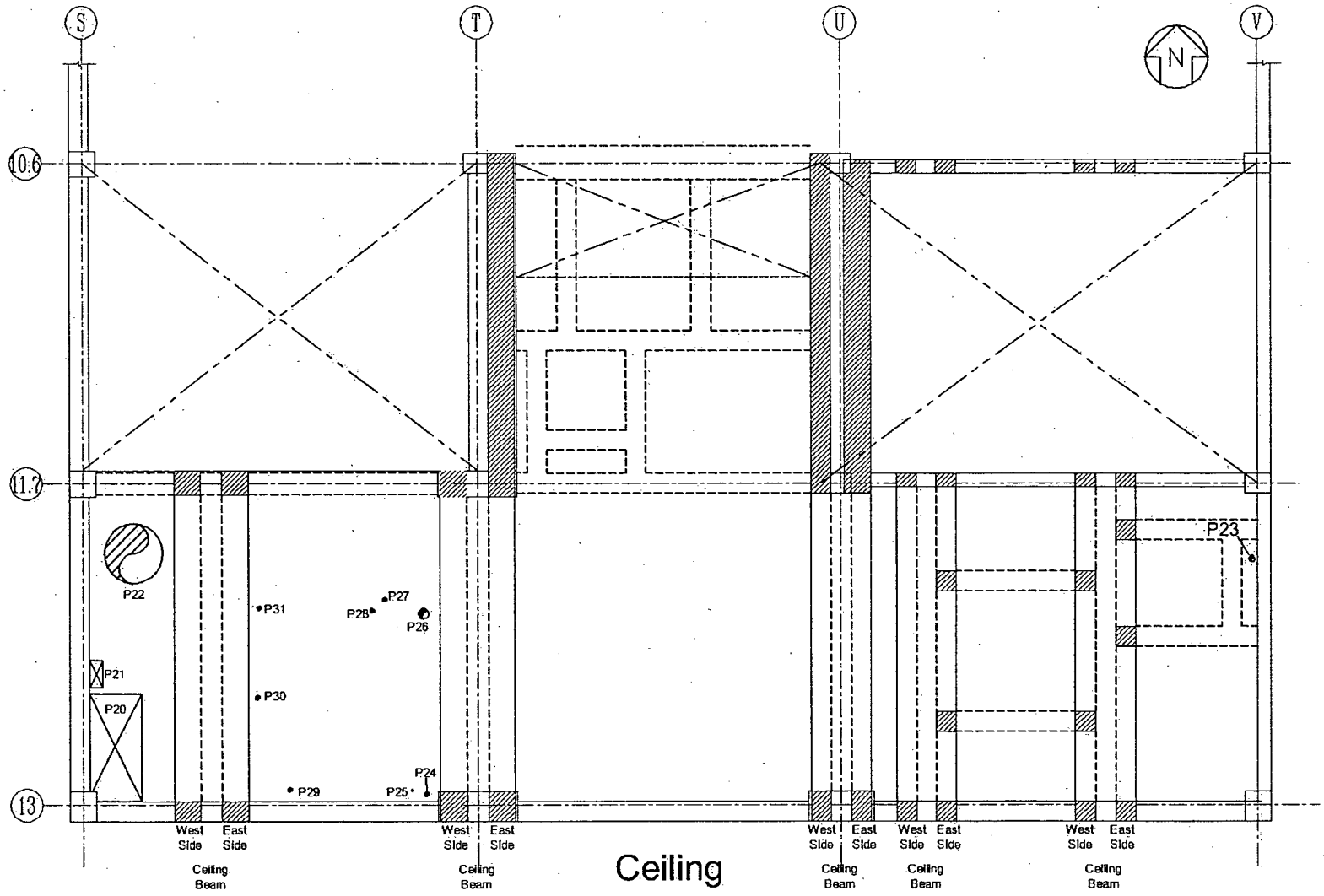
0 1 2 3

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUX. BLDG. EL. 9'-6" ROOM 133
BETA SCAN
MEASUREMENT LOCATIONS ABOVE 2-METERS
F8131222-M3

FILE: 813000.03 SHEET 2 of 2 TC HILL



Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

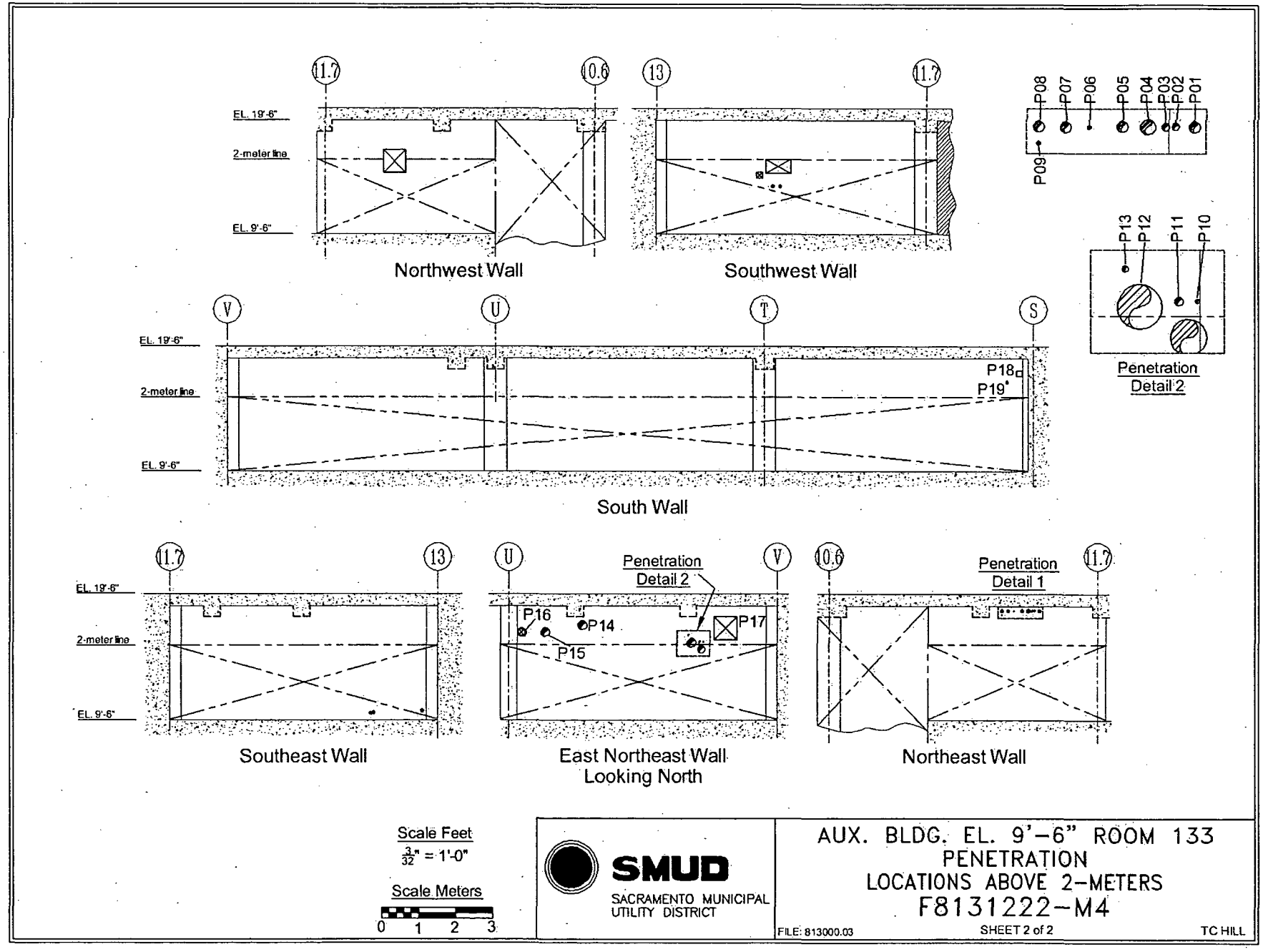
0 1 2 3

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUX. BLDG. EL. 9'-6" ROOM 133
PENETRATION
LOCATIONS ABOVE 2-METERS
F8131222-M4

FILE: 813000.03 SHEET 1 of 2 TC HILL


11.7
10.6
13
11.7
EL. 19'-6"
2-meter line
EL. 9'-6"
Northwest Wall
Southwest Wall
P08
P07
P06
P05
P04
P03
P02
P01
P09
P13
P12
P11
P10
Penetration Detail 2
V
U
T
S
P18
P19
South Wall
Southeast Wall
Penetration Detail 2
P16
P14
P15
P17
East Northeast Wall Looking North
Penetration Detail 1
Northeast Wall
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUX. BLDG. EL. 9'-6" ROOM 133
PENETRATION
LOCATIONS ABOVE 2-METERS
F8131222-M4
FILE: 813000.03
SHEET 2 of 2
TC HILL

Attachment 2

Instrumentation

July 2, 2008

Survey Unit F8131222

Table 2-1. Survey Unit Instrumentation

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (dpm/100 cm²)	MDC Scan (dpm/100 cm²)
M2350; 180733	43-98B; 148638	N/A	1680
M2350; 180733	43-94; 148620	N/A	1610
M2350; 175834	43-68B; 190482	909	2169
M2350; 203486	43-68B; 161400	909	2169
M2350; 203486	43-116-1B; 190173	N/A	6854
Tennelec; 0401171	N/A	5.9 dpm α, 11.7 dpm β	N/A

The MDC noted for the detector model 43-98B is for the 3" diameter piping and detector model 43-94 is for the 2" diameter piping which is the most conservative.

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	43000
Investigation Criteria – Scan	43000
$DCGL_W$	43000
$DCGL_{EMC}$	N/A

Attachment 3

Investigation

July 2, 2008

Survey Unit F8131222

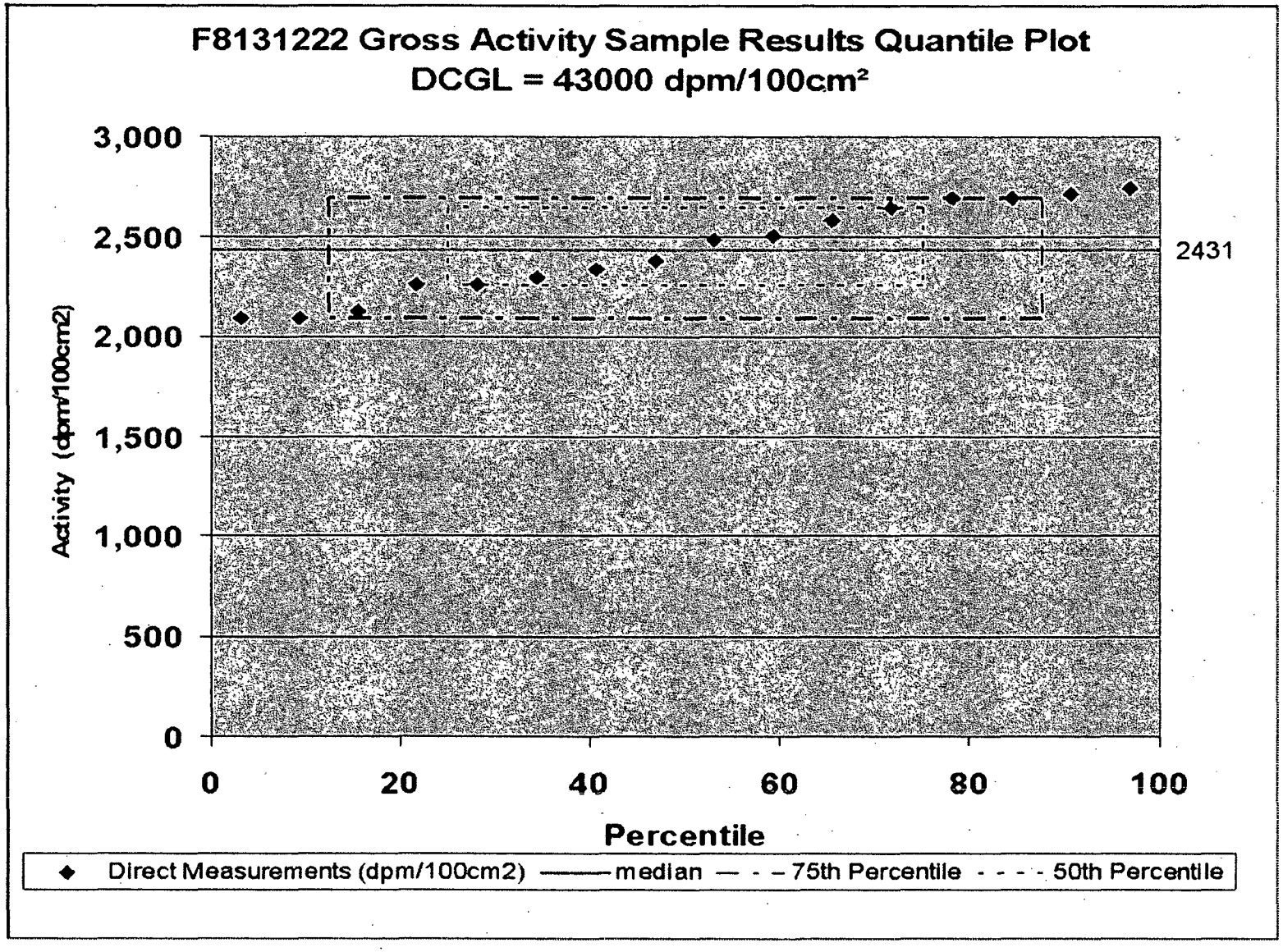
(none required)

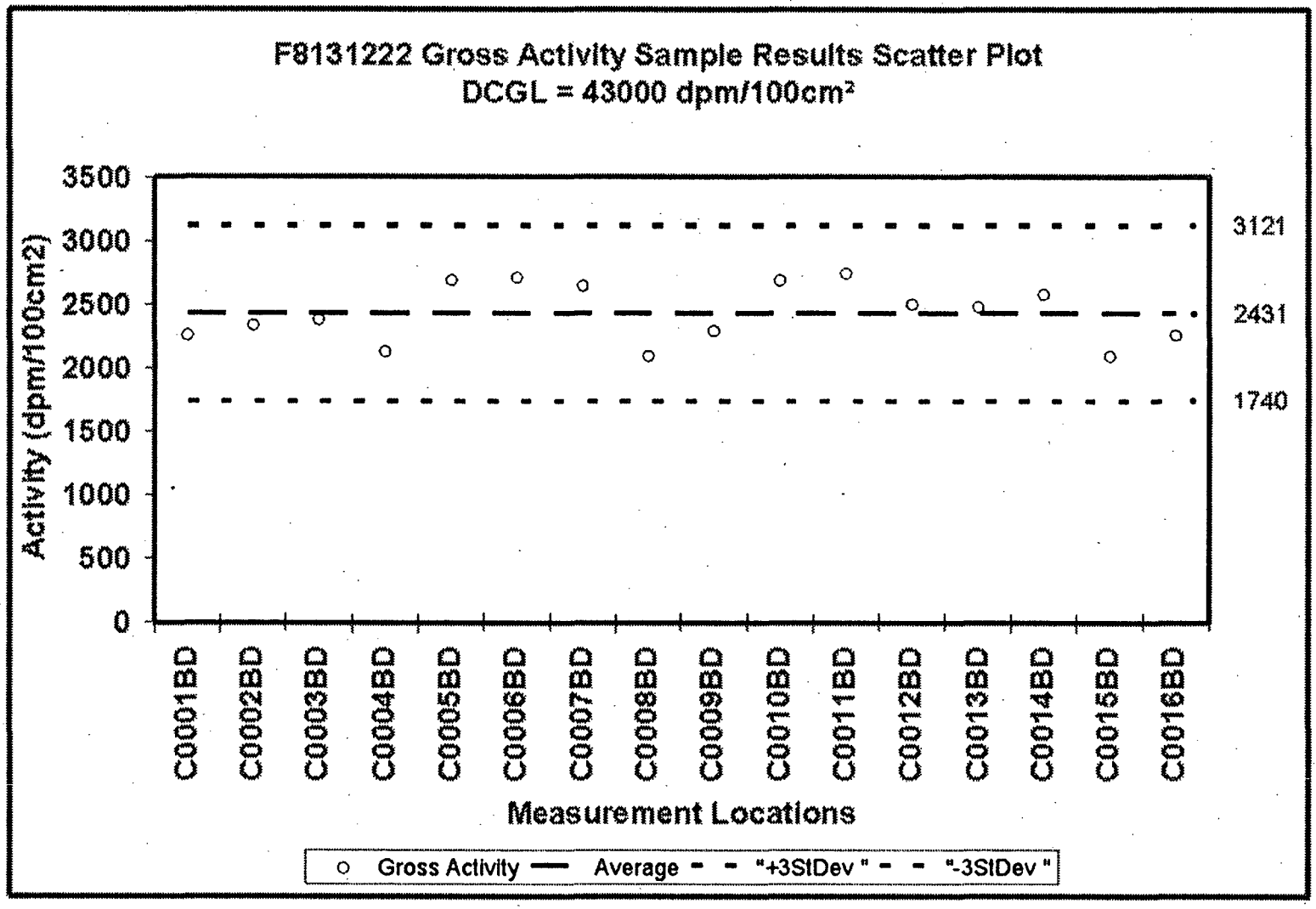
Attachment 4

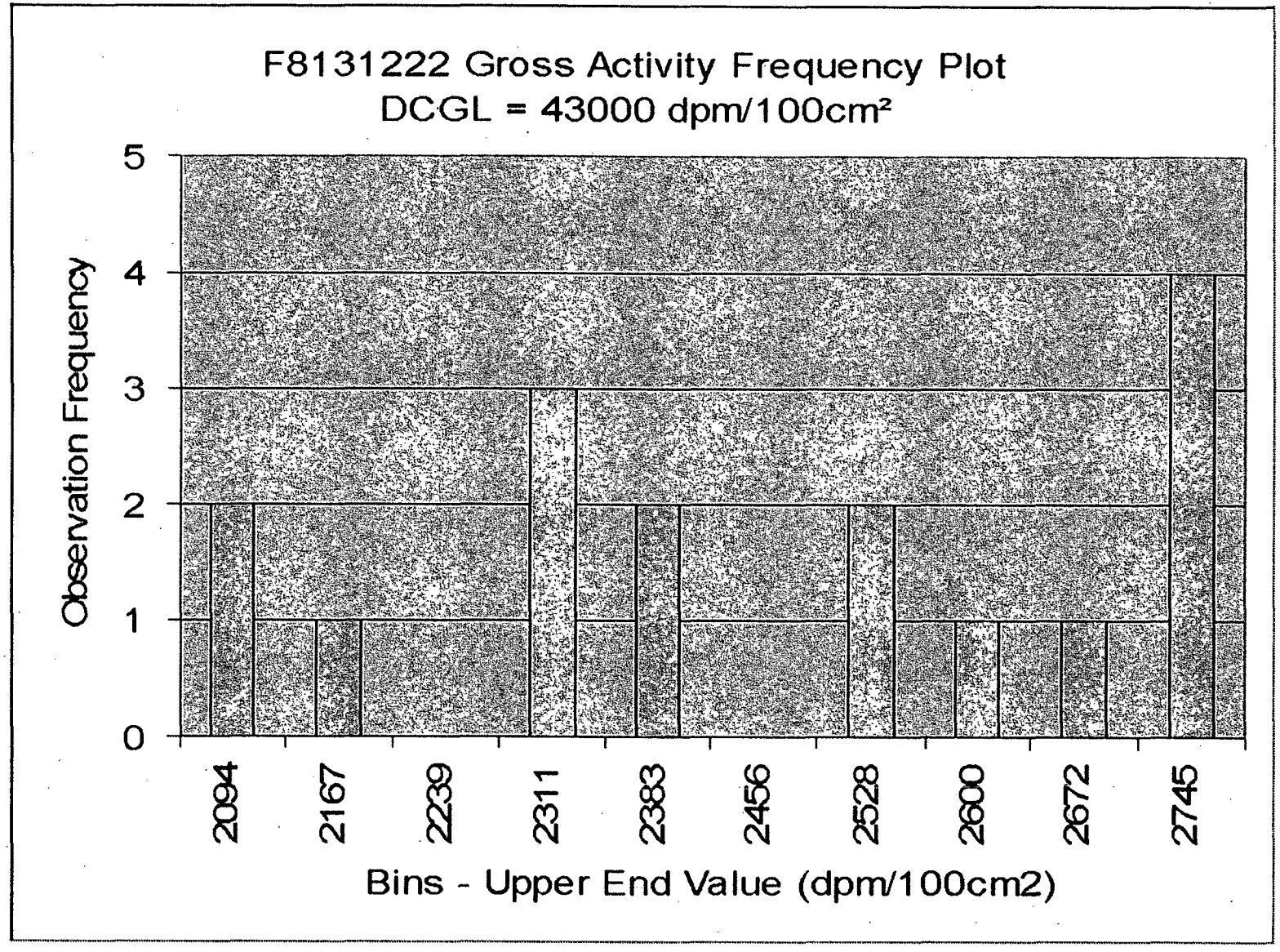
Data Assessment

July 2, 2008

Survey Unit F8131222


F8131222 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
3,000
2,500
2,000
1,500
1,000
500
0
Activity (dpm/100cm2)
2431
0
20
40
60
80
100
Percentile
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8131222 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
3500
3000
2500
2000
1500
1000
500
0
3121
2431
1740
C0001BD
C0002BD
C0003BD
C0004BD
C0005BD
C0006BD
C0007BD
C0008BD
C0009BD
C0010BD
C0011BD
C0012BD
C0013BD
C0014BD
C0015BD
C0016BD
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8131222 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
2094
2167
2239
2311
2383
2456
2528
2600
2672
2745
Bins - Upper End Value (dpm/100cm2)