Rancho Seco

Final Status Survey Summary Report

October 8, 2008

East Heat Removal Cooler Room North of Column 9.1, Room 051 Floor, Walls, and Ceiling

Survey Unit F8130731

Prepared By: _____ **Date:** 10/8/2008

FSS Engineer

Reviewed By: _____ **Date:** 10/13/08

Lead FSS Engineer

Approved By: _____ **Date:** 2-6-09

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8130731, East Heat Removal Cooler Room North of Column 9.1, Room 051 Floor, Walls, and Ceiling

Survey Unit Description:

Operating History: The East Heat Removal Cooler Room is located on the -20' elevation of the Auxiliary Building. The Auxiliary Building is a reinforced concrete structure that, during power operations, contained the Radwaste processing and supporting systems. The building has six main elevations. Residual levels of surface radioactivity were detected on all interior elevations of the building. Operating records and the HSA document several events with the potential for a release of radioactivity inside this structure.

Site Characterization: Direct measurements were taken on each interior elevation of the Auxiliary Building. These measurements confirmed the presence of plant-derived radionuclides. Direct measurements taken 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. Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior surfaces of the Auxiliary Building were determined primarily to be a Class 1 for the floors and lower walls (bottom 2 meters of the walls), and Class 2 for the upper walls and ceiling. Inside the East Heat Removal Cooler Room there were a number of areas on the floor and walls where the gross surface activity levels were higher than the DCGL prior to remediation. Therefore, a Class 1 final status survey was performed on the floor, walls, and ceiling of the East Heat Removal Cooler Room North of Column 9.1.

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 142 m^2 were scanned for 100% 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	East Heat Removal Cooler Room North of Column 9.1, Room 051 Floor, Walls, and Ceiling
Survey Unit:	0731	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	142	
Evaluator:	Michael Stein	
DCGL (dpm/100 cm^2)**:**	43000	Gross Activity DCGL
Area Factor:	3.6	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	154800	Class 1
LBGR (dpm/100 cm^2)**:**	21500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	12035	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	6.8	Class 1
Scan Area (m^2)**:**	142	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.955435	
Calculated Relative Shift:	1.7	
Relative Shift Used:	1.7	Uses 3.0 if Relative Shift is >3
N-Value:	14	
Design N-Value + 20%:	17	NUREG-1575 Table 5-5
Design Min Samples N:	21	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 23 direct measurements were made in F8130731. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. Two of the beta scan measurements (C0112BS and C0116BS) indicated areas of elevated activity as shown in Attachment 3. Scan activity ranged from 645 to 293,443 dpm/100 cm², based on a surveyor efficiency of 0.5 and no background subtracted. Four of the gamma scan measurements taken in the recess area around reactor wall penetrations (C0007GS, C0010GS, C0011GS, C0012GS, and C0017GS) indicated areas of elevated activity as shown in Attachment 3. Gamma scan activity ranged from 37,587 to 461,140 dpm/100 cm² Cs-137. Only two of the gamma scan measurements detected Co-60 at 9,900 and 10,604 dpm/100 cm². The MDCs for the gamma scan measurements were 4,630 to 5,428 dpm/100 cm² for Co-60 and 4,410 to 12,400 dpm/100 cm² for Cs-137. Scan measurement locations for both beta and gamma emissions are identified in Attachment 1 of this report. 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 cm²)
F8130731-C0001BD	1950
F8130731-C0002BD	1852
F8130731-C0003BD	1779
F8130731-C0004BD	2614
F8130731-C0005BD	2132
F8130731-C0006BD	3953
F8130731-C0007BD	2635
F8130731-C0008BD	1805
F8130731-C0009BD	1758
F8130731-C0010BD	1561
F8130731-C0011BD	1784
F8130731-C0012BD	1655
F8130731-C0013BD	1696
F8130731-C0014BD	1722
F8130731-C0015BD	1707
F8130731-C0016BD	4508
F8130731-C0017BD	1681
F8130731-C0018BD	1551
F8130731-C0019BD	1608
F8130731-C0020BD	1541
F8130731-C0021BD	2085
F8130731-C0022BD	1816
F8130731-C0023BD	1758
Mean:	2050
Median:	1779
Standard Deviation:	751
Range:	1541 - 4508

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8130731C0001SM	-0.95
F8130731C0002SM	2.93
F8130731C0003SM	0.34
F8130731C0004SM	2.93
F8130731C0005SM	0.34
F8130731C0006SM	4.22
F8130731C0007SM	18.42
F8130731C0008SM	1.64
F8130731C0009SM	1.64
F8130731C0010SM	-0.95
F8130731C0011SM	27.46
F8130731C0012SM	52
F8130731C0013SM	13.26
F8130731C0014SM	-4.82
F8130731C0015SM	-0.95
F8130731C0016SM	265.09
F8130731C0017SM	27.46
F8130731C0018SM	37.8
F8130731C0019SM	-0.95
F8130731C0020SM	8.09
F8130731C0021SM	36.5
F8130731C0022SM	13.26
F8130731C0023SM	-3.53
Mean:	21.79
Median:	2.93
Standard Deviation:	55.25
Range:	-4.82 to 265.09

Survey Unit Data Assessment:

The survey design required 21 direct measurements for the Sign Test. In actuality 23 direct measurements were obtained. 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 cm²):	N/A	
Ambient Background Used (dpm/100 cm²):	N/A	Average Ambient BKG = 0
Actual Direct Measurements (N):	23	
Median (dpm/100 cm²):	1779	
Mean (dpm/100 cm²):	2050	
Direct Measurement Standard Deviation (dpm/100 cm²):	751	
Total Standard Deviation (dpm/100 cm²):	751	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	4508	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	23	
S+ Value:	23	
Critical Value:	15	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGLemc:	Yes	Class 1
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:

An investigation was required for two of the beta scan measurements (C0112BS and C0116BS) as indicated in Attachment 3. Investigation of these two areas resulted in the decision to perform additional remediation. The investigation results in Attachment 3 represent the residual beta radioactivity levels achieved after additional remediation. An investigation was also required for four of the gamma scan measurements taken in the recess area around reactor wall penetrations (C0007GS, C0010GS, C0011GS, C0012GS, and C0017GS) indicated in Attachment 3. The EMC unity rule was not exceeded as shown in Table 3-1.

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 and the EMC criterion has been met), the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 1 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. Potential areas of elevated activity were detected and evaluated as shown in Attachment 3. Therefore, the EMC criterion was met.

Conclusion:

The FSS of this survey unit was properly designed as a Class 1 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.

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.

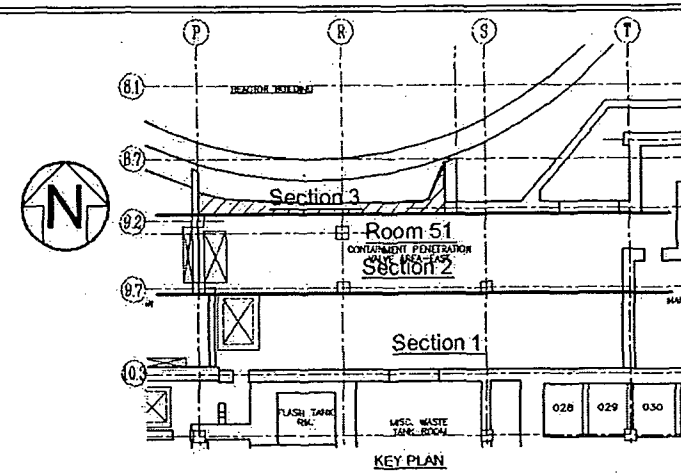
It is concluded that survey unit F8130731 meets the release criteria of 10CFR20.1402.

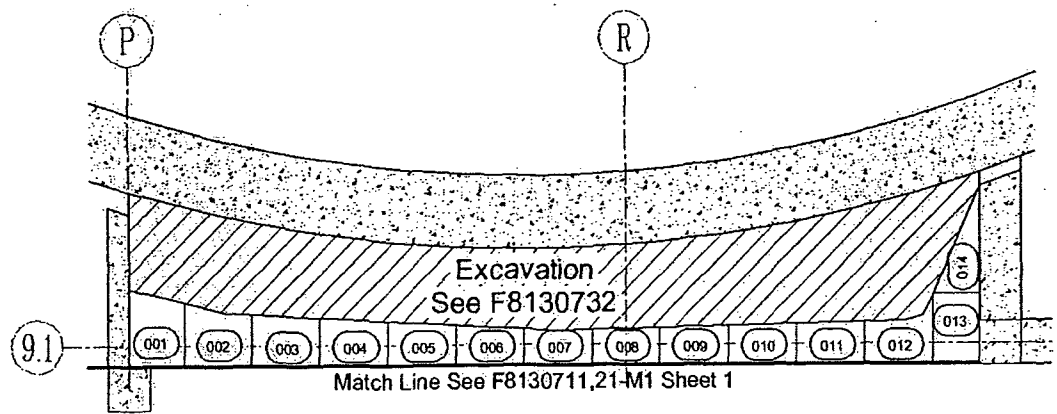
Attachment 1

Maps

October 8, 2008

Survey Unit F8130731





Floor

ESTIMATED AREA

Floor	8.7 m²
Walls	106.5 m²
Ceiling	26.5 m²
TOTAL	141.7 m²

Scale Feet
1/8" = 1'-0"

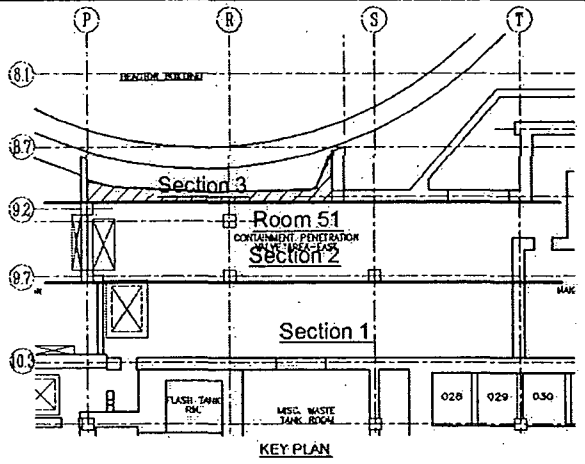
Scale Meters

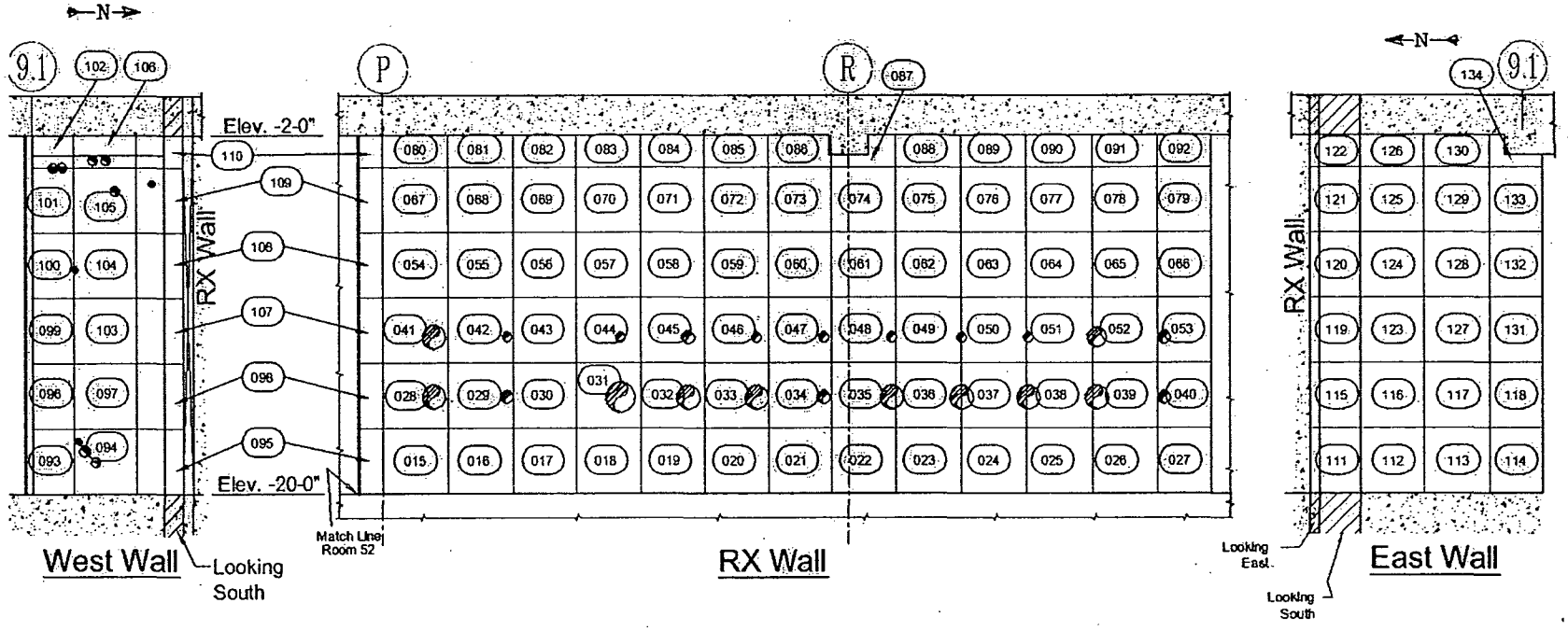
0 1 2 3

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 FLOOR
BETA SCAN MEASUREMENT LOCATIONS
F8130731-M1

DWG: 813000.02c SHEET 1 OF 3 TC HILL





Scale Feet

1/8" = 1'-0"

Scale Meters

0 1 2 3

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

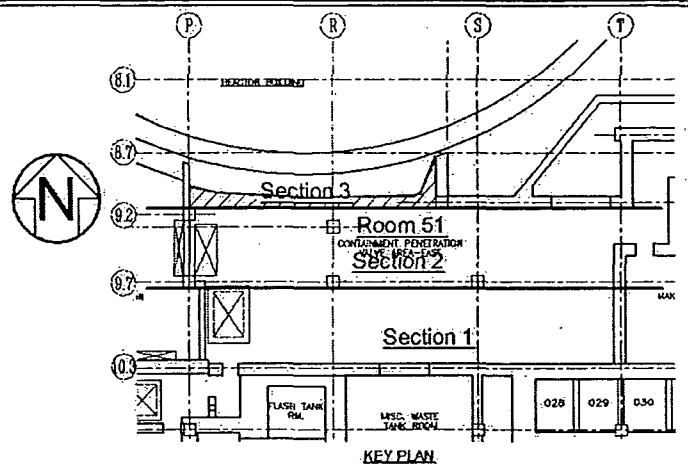
AUXILIARY BUILDING EL. -20'

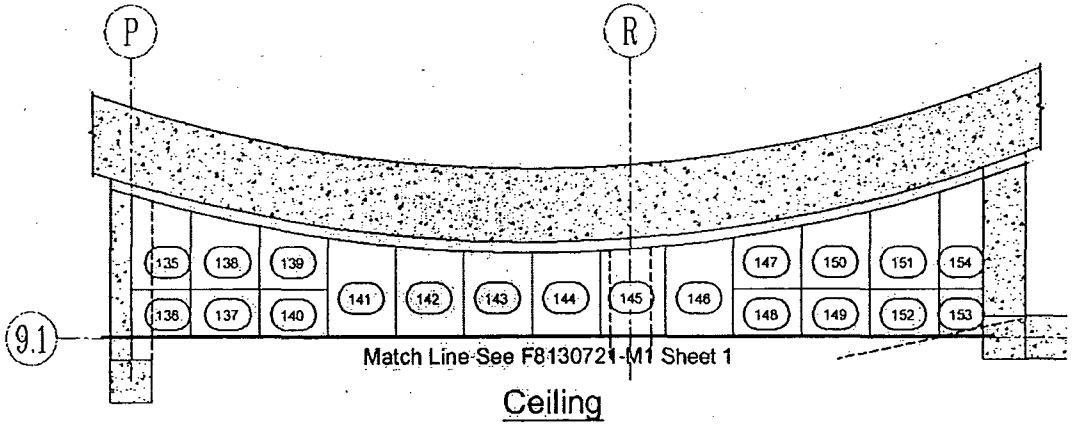
ROOM 51 SECTION 3 WALL

BETA SCAN MEASUREMENT LOCATIONS

F8130731-M1

DWG: 813000.02c SHEET 2 OF 3 TC HILL





Ceiling

Scale Feet
$\frac{1}{8}$" = 1'-0"

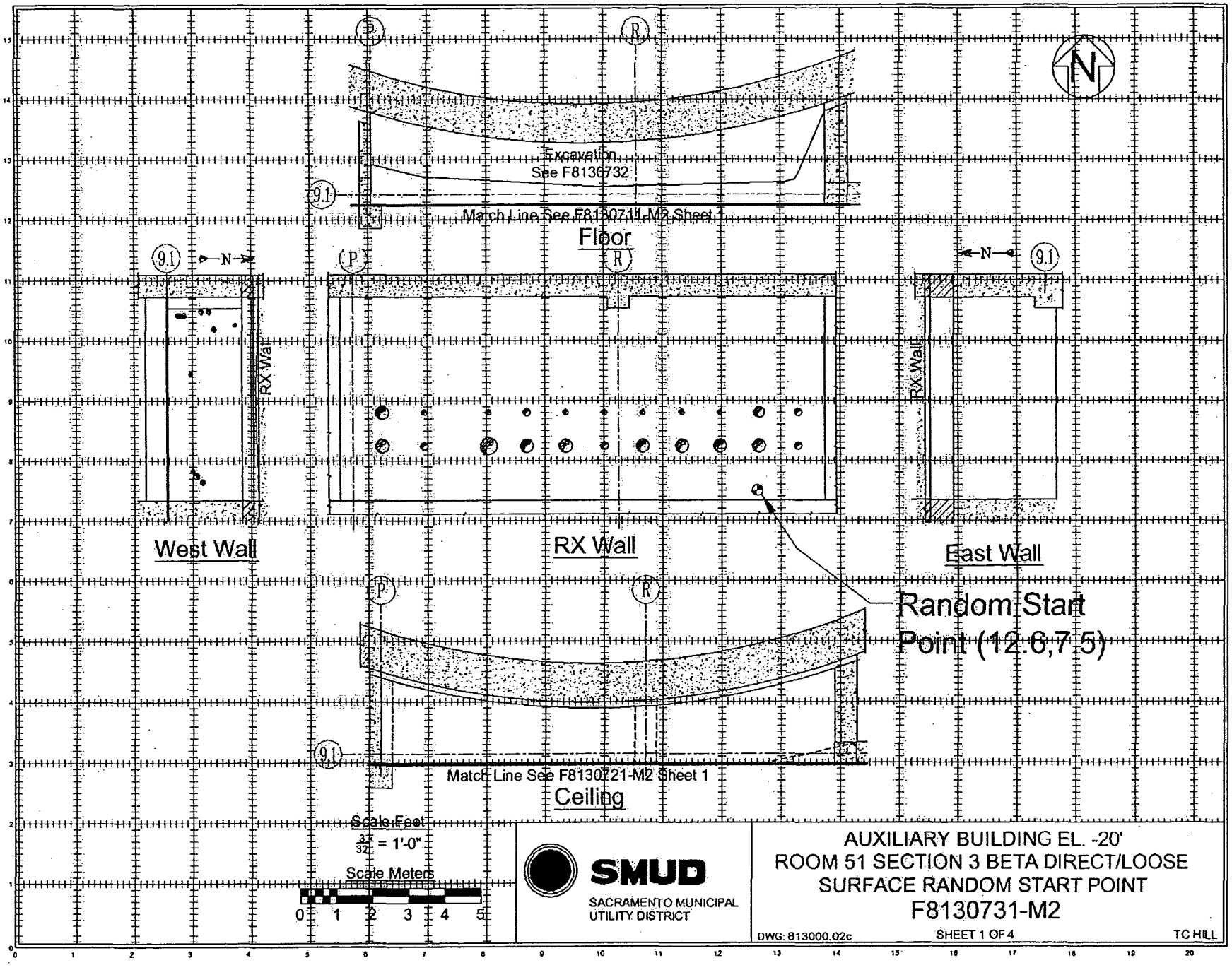
Scale Meters

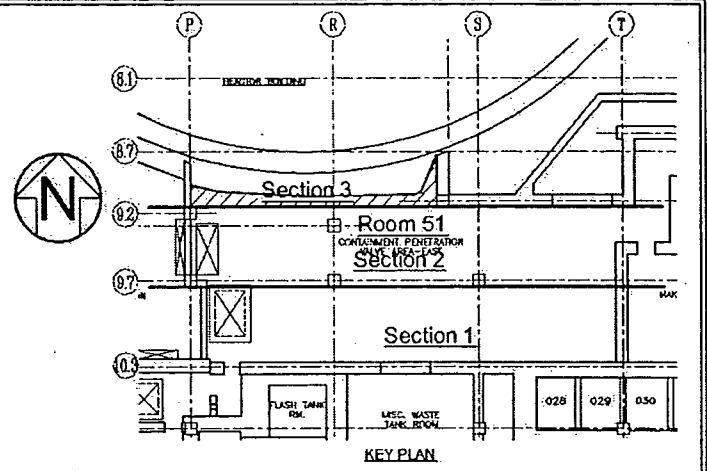
0 1 2 3

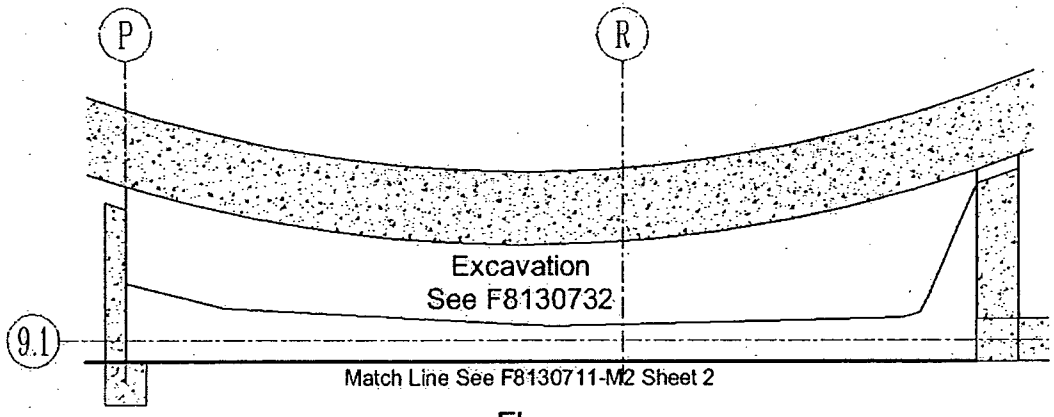
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 CEILING
BETA SCAN MEASUREMENT LOCATIONS
F8130731-M1

DWG: 813000.02c SHEET 3 OF 3 TC HILL


N
Excavation
See F8130732
Match Line See F8130711-M2 Sheet 1
Floor
RX Wall
West Wall
RX Wall
East Wall
Random Start
Point (12.6,7.5)
Match Line See F8130721-M2 Sheet 1
Ceiling
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3 4 5
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 BETA DIRECT/LOOSE
SURFACE RANDOM START POINT
F8130731-M2
DWG: 813000.02c
SHEET 1 OF 4
TC HILL





Floor

Scale Feet
1/8" = 1'-0"

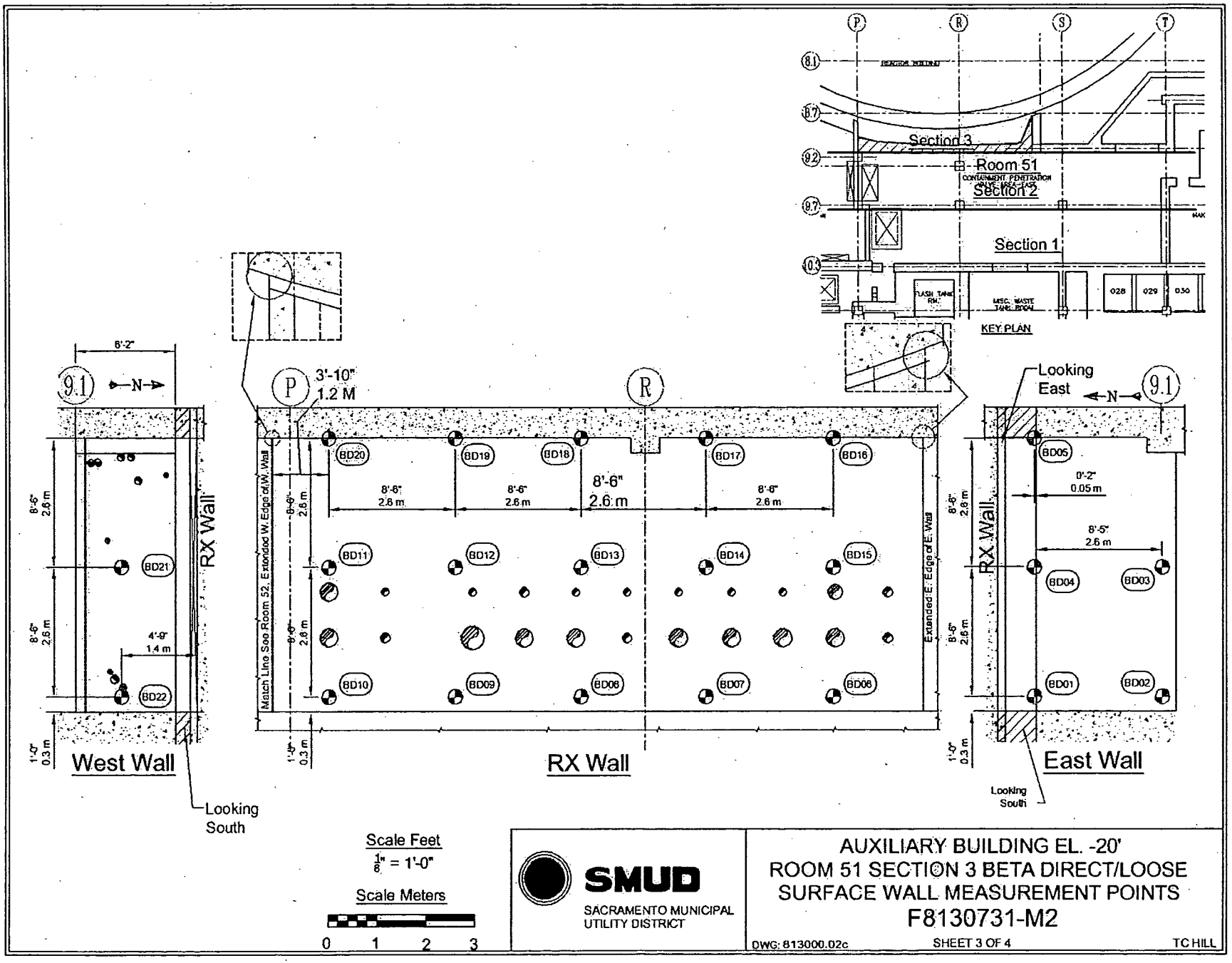
Scale Meters

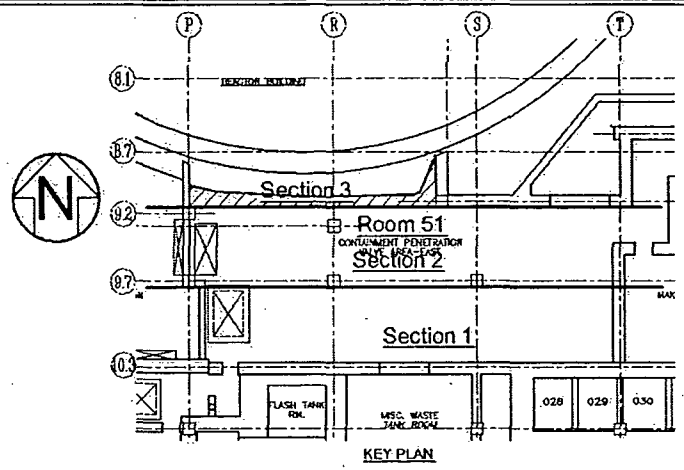
0 1 2 3

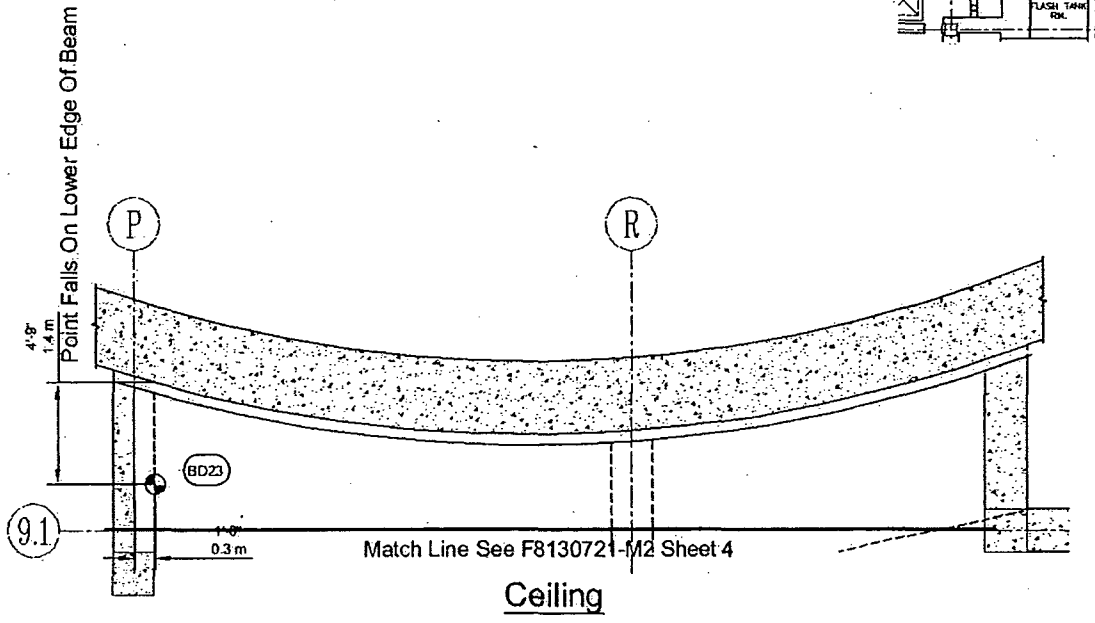
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 BETA DIRECT/LOOSE SURFACE FLOOR MEASUREMENT POINTS
F8130731-M2

DWG: 813000.02c SHEET 2 OF 4 TC HILL


Section 3
Room 51
Section 2
Section 1
KEY PLAN
West Wall
RX Wall
East Wall
Looking South
Looking East
Looking South
Match Line See Room 52, Extended W. Edge of W. Wall
Extended E. Edge of E. Wall
BD01
BD02
BD03
BD04
BD05
BD06
BD07
BD08
BD09
BD10
BD11
BD12
BD13
BD14
BD15
BD16
BD17
BD18
BD19
BD20
BD21
BD22
8'-6" 2.6 m
4'-9" 1.4 m
3'-10" 1.2 M
0'-2" 0.05 m
8'-5" 2.6 m
1'-0" 0.3 m
Scale Feet
1/8" = 1'-0"
Scale Meters
0 1 2 3
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 BETA DIRECT/LOOSE SURFACE WALL MEASUREMENT POINTS
F8130731-M2
DWG: 813000.02c
SHEET 3 OF 4
TC HILL





Ceiling

Scale Feet

$\frac{1}{8}$" = 1'-0"

Scale Meters

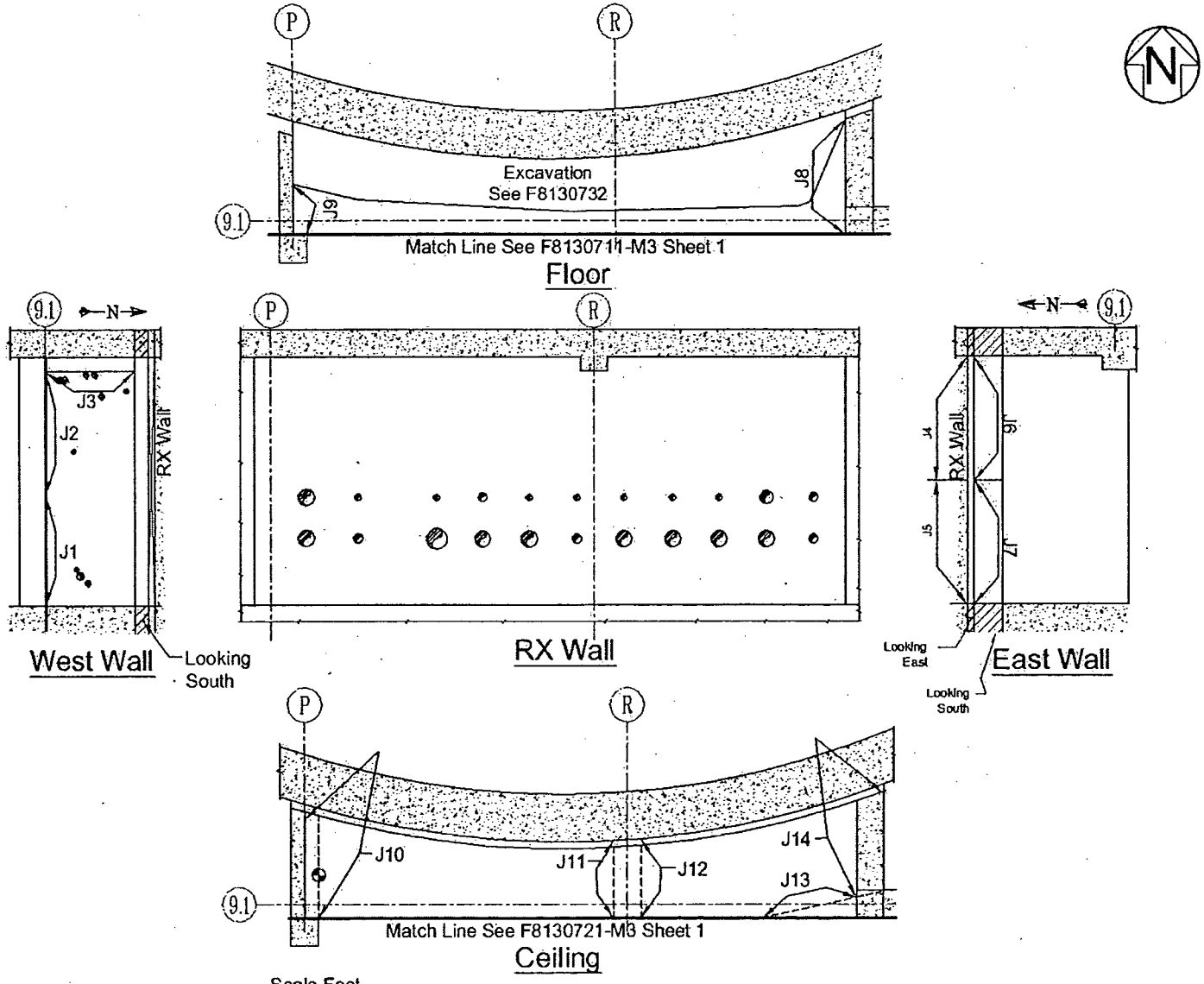
0 1 2 3

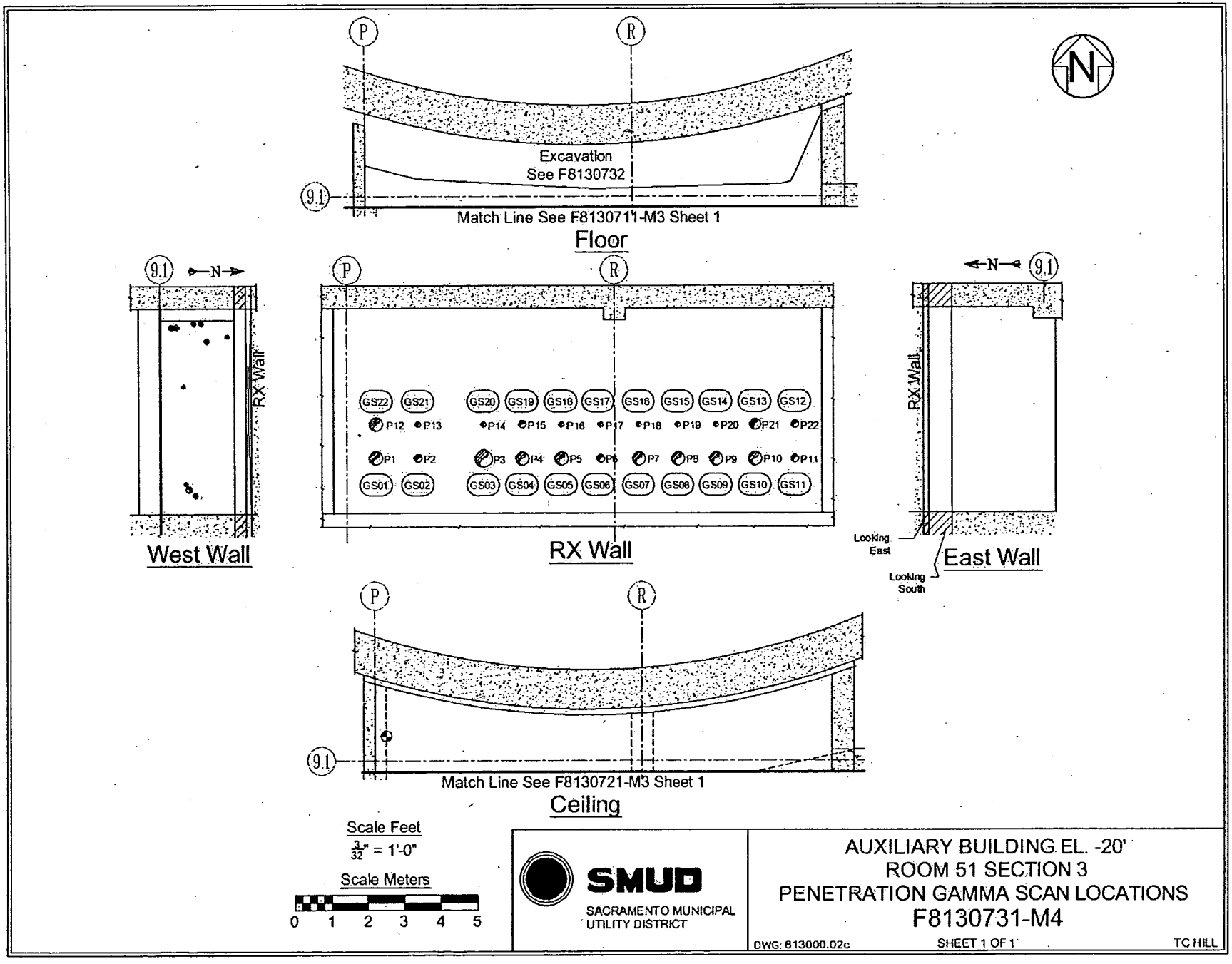
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3 BETA DIRECT/LOOSE SURFACE CEILING MEASUREMENT POINTS
F8130731-M2

DWG: 813000.02c SHEET 4 OF 4 TC HILL


P
R
N
Excavation
See F8130732
J8
J9
9.1
Match Line See F8130711-M3 Sheet 1
Floor
9.1
N
J3
J2
J1
RX Wall
West Wall
Looking
South
P
R
RX Wall
N
9.1
J4
RX Wall
J5
J6
J7
Looking
East
East Wall
Looking
South
P
R
J10
J11
J12
J14
J13
9.1
Match Line See F8130721-M3 Sheet 1
Ceiling
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3 4 5
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3
JUNCTURE BETA SCAN LOCATIONS
F8130731-M3
DWG: 813000.02c
SHEET 1 OF 1
TC HILL


P
R
N
Excavation
See F8130732
9.1
Match Line See F8130711-M3 Sheet 1
Floor
9.1
N
RX Wall
West Wall
P
R
GS22 GS21 GS20 GS19 GS18 GS17 GS16 GS15 GS14 GS13 GS12
P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22
P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11
GS01 GS02 GS03 GS04 GS05 GS06 GS07 GS08 GS09 GS10 GS11
RX Wall
N
9.1
RX Wall
Looking East
Looking South
East Wall
P
R
9.1
Match Line See F8130721-M3 Sheet 1
Ceiling
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3 4 5
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 51 SECTION 3
PENETRATION GAMMA SCAN LOCATIONS
F8130731-M4
DWG: 613000.02c
SHEET 1 OF 1
TC HILL

Attachment 2

Instrumentation

October 8, 2008

Survey Unit F8130731

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; 149789	43-68B; 161397	433	1033
M2350; 175834	43-68B; 148634	433	1033
M2350; 180738	43-68/5B; 148942	433	1033
M2350; 149789	43-116-1B; 256006	796	3258
M2350; 180738	43-116-1B; 216073	796	3258
M2350; 193715	43-116-1B; 190643	796	3258
Tennelec; 0401171	N/A	5.9 dpm α, 11.7 dpm β	N/A
InSpector 1000	10054579	N/A	12400 Cs-137 5428 Co-60

The scan and static MDC's provided represent the most conservative MDC values for the survey conducted.

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	154800
Investigation Criteria – Scan	154800
$DCGL_W$	43000
$DCGL_{EMC}$	154800

Attachment 3

Investigation

October 8, 2008

Survey Unit F8130731

Table 3-1 Survey Unit Investigation

Grid	*Investigation Level (cpm)*	*Initial Value (cpm)*	*Investigation Result (cpm)*	*Elevated Area (m^2)*	*Area Factor*	*$DCGL_{emc}$*	*Investigation Result ($dpm/100cm^2$)*	*$DCGL_{emc}$ Unity Fraction*
C0112BS	21,024	40,001	879	N/A	N/A	N/A	6,580	0.00
C0116BS	21,024	26,273	788	N/A	N/A	N/A	5,781	0.00
Grid	*Investigation Level ($dpm/100cm^2$)*	*Initial Value ($dpm/100cm^2$)*	*Investigation Result ($dpm/100cm^2$)*	*Elevated Area (m^2)*	*Area Factor*	*$DCGL_{emc}$*	*Higher Activity Initial Value or Investigation Result ($dpm/100cm^2$)*	
C0007GS	154,800	461,140	445,511	0.11	119	5,117,000	461,140	0.09
C0010GS	154,800	320,415	299,836	0.11	119	5,117,000	320,415	0.06
C0011GS	154,800	449,060	339,820	0.07	187	8,041,000	449,060	0.06
C0012GS	154,800	161,965	138,370	0.07	187	8,041,000	161,965	0.02
C0017GS	154,800	165,817	182,709	0.05	261	11,223,000	182,709	0.02
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2,050	0.05
							EMC Unity Sum	0.30

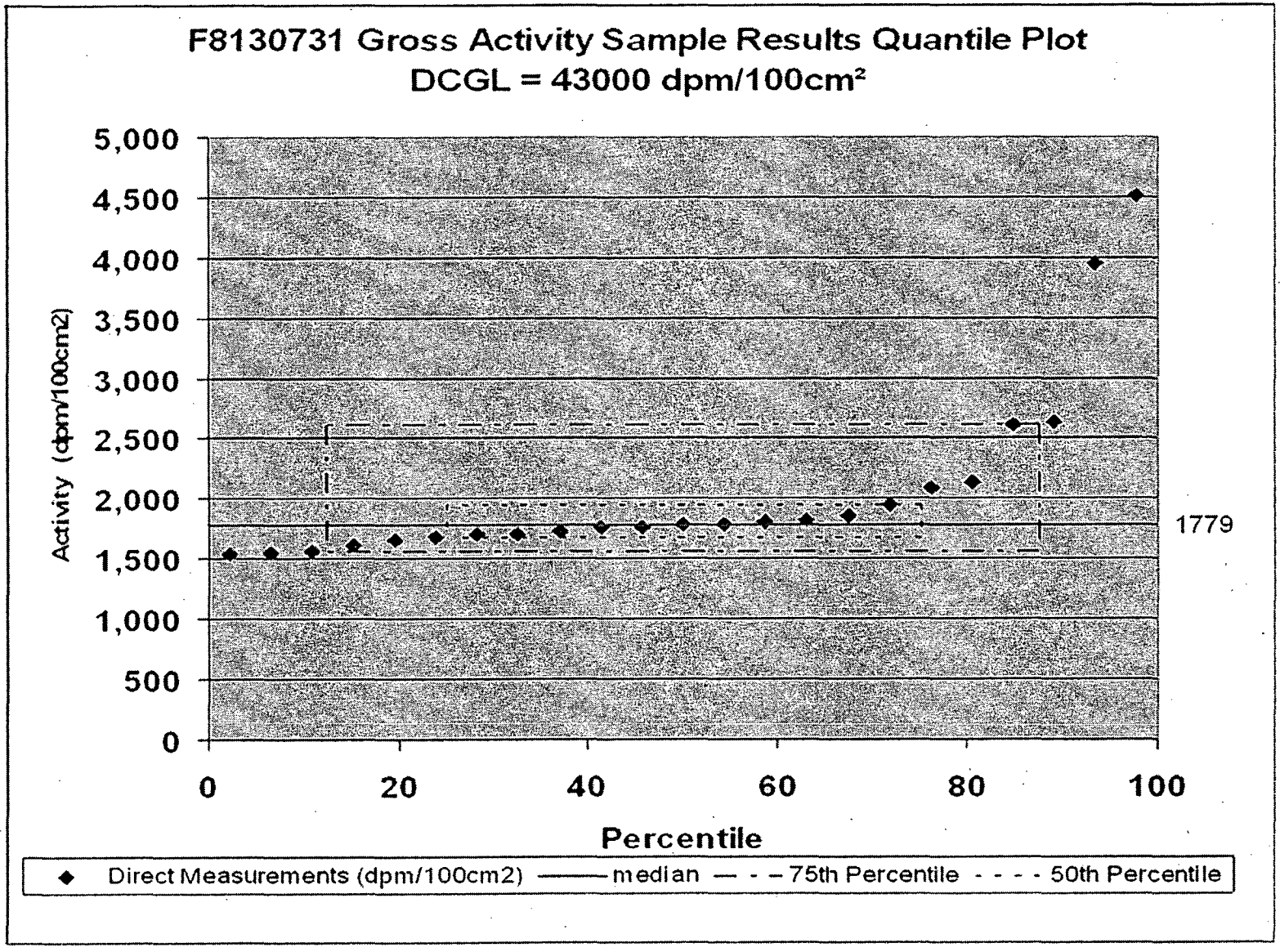
All of the grids above were initially greater than *DCGLemc*. Investigation of grids C0112BS and C0116BS resulted in the decision to perform additional remediation. The investigation results above represent the residual radioactivity levels after additional remediation. No additional remediation was performed at the elevated gamma scan measurement locations C0007GS, C0010GS, C0011GS, C0012GS, and C0017GS.

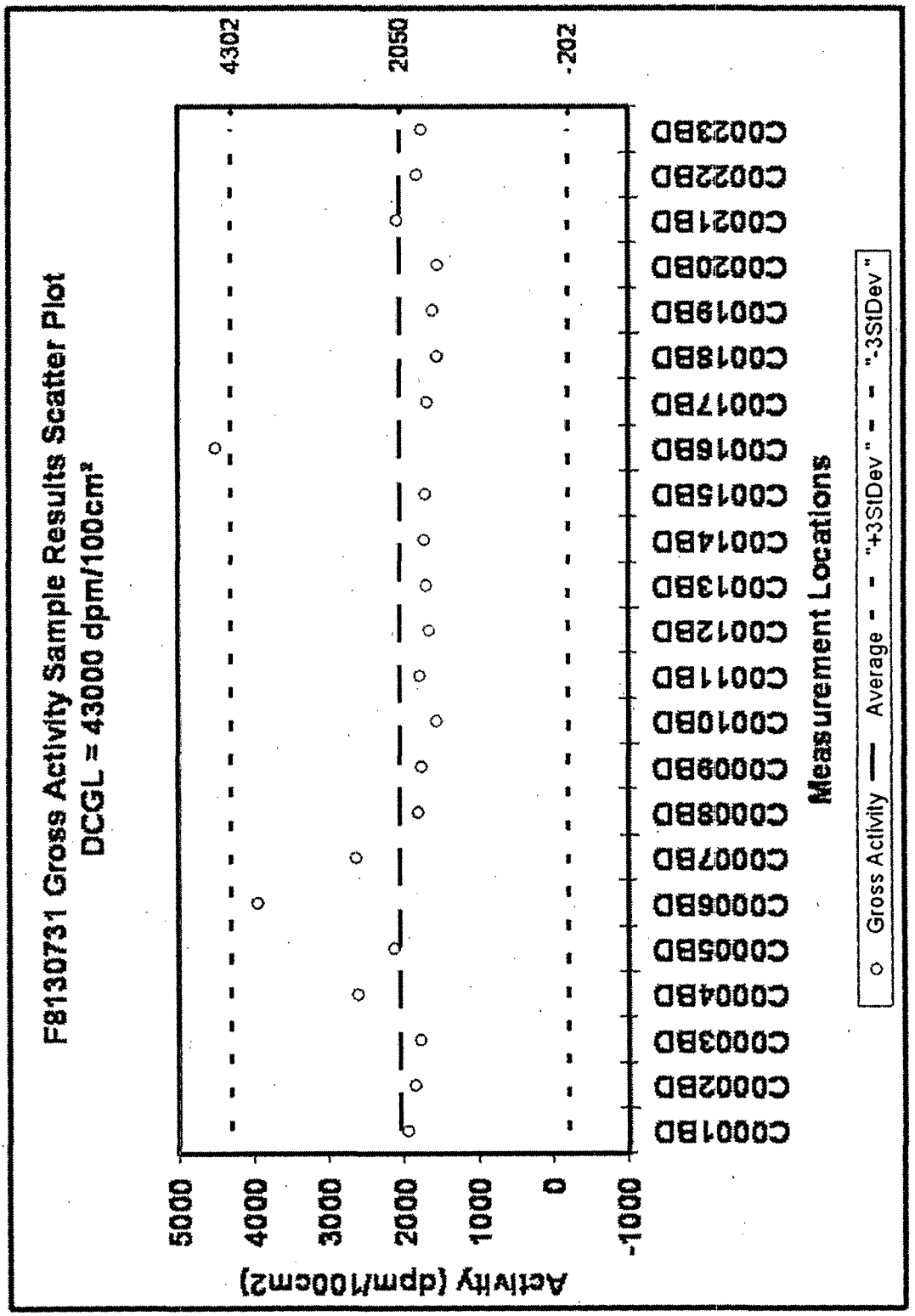
Attachment 4

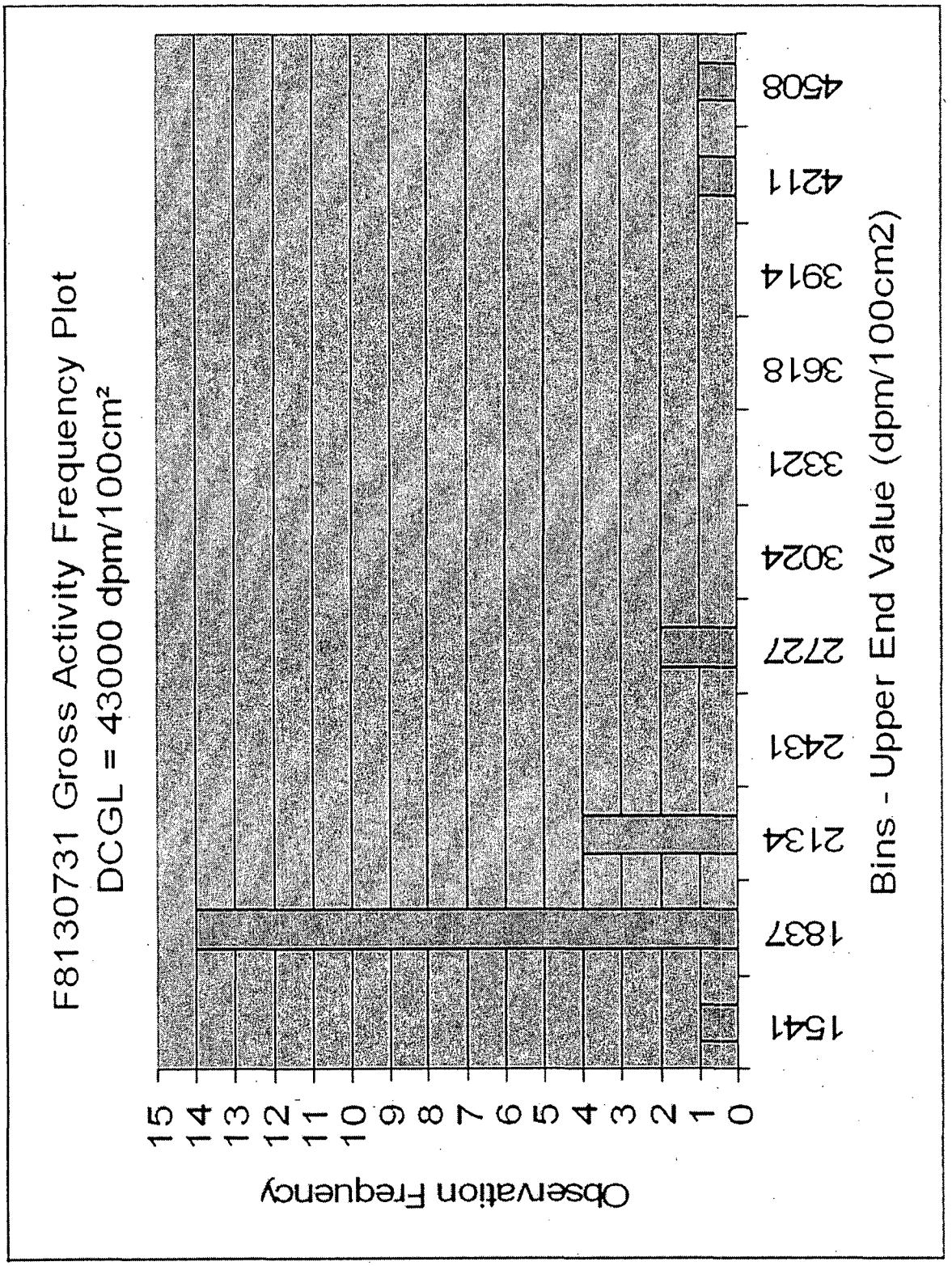
Data Assessment

October 8, 2008

Survey Unit F8130731


F8130731 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
20
40
60
80
100
Percentile
1779
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8130731 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
4302
2050
-202
5000
4000
3000
2000
1000
0
-1000
Activity (dpm/100cm2)
C00023BD
C00022BD
C00021BD
C00020BD
C00019BD
C00018BD
C00017BD
C00016BD
C00015BD
C00014BD
C00013BD
C00012BD
C00011BD
C00010BD
C00009BD
C00008BD
C00007BD
C00006BD
C00005BD
C00004BD
C00003BD
C00002BD
C00001BD
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8130731 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1541
1837
2134
2431
2727
3024
3321
3618
3914
4211
4508
Bins - Upper End Value (dpm/100cm2)