Rancho Seco

Final Status Survey Summary Report

October 24, 2007

Aux. Bldg (-) 20' El., Rm 49, Crud Tank Pump Room

Survey Unit F8130671

Prepared By: D. Anderson Date: 10/24/2007

FSS Engineer

Reviewed By: [signature] Date: 10/24/07

Lead FSS Engineer

Approved By: [signature] Date: 11-8-07

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8130671, Aux. Bldg (-) 20' El, Rm 49, Crud Tank Pump Room

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 24.5 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	Aux. Bldg (-) 20' El, Rm 49, Crud Tank Pump Room
Survey Unit:	0671	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	24.5	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	16,000	Gross Activity DCGL
Area Factor:	8.9	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	142,400	Class 1
LBGR (dpm/100 cm^2)**:**	15,691	Adjusted
Design Sigma (dpm/100 cm^2)**:**	103	Based on post-remediation data.
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Co-60	
Sample Area (m^2)**:**	1.75	Class 1
Scan Area (m^2)**:**	24.5	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$:	1.645	
$Z_{1-\beta}$:	1.645	
Sign P:	0.99865	
Calculated Relative Shift:	3	
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 1
Grid Spacing L:	1.32	Class 1

Survey Results:

A total of 16 direct measurements were made in F8130671. 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 4,207 dpm/100 cm^2 to 53,875 dpm/100 cm^2 for floor, wall and juncture surfaces, based on a surveyor efficiency of 0.5 with 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)
F8130671-C0001BD	1,708
F8130671-C0002BD	1,835
F8130671-C0003BD	1,549
F8130671-C0004BD	1,606
F8130671-C0005BD	1,689
F8130671-C0006BD	1,416
F8130671-C0007BD	1,524
F8130671-C0008BD	1,625
F8130671-C0009BD	2,311
F8130671-C0010BD	2,076
F8130671-C0011BD	2,038
F8130671-C0012BD	1,771
F8130671-C0013BD	1,568
F8130671-C0014BD	1,721
F8130671-C0015BD	2,057
F8130671-C0016BD	1,956
Mean:	1,778
Median:	1,714
Standard Deviation:	247
Range:	1,416 – 2,311

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8130671C0001SM	3.58
F8130671C0002SM	-0.27
F8130671C0003SM	6.14
F8130671C0004SM	3.58
F8130671C0005SM	2.29
F8130671C0006SM	6.14
F8130671C0007SM	4.86
F8130671C0008SM	3.58
F8130671C0009SM	20.24
F8130671C0010SM	-1.55
F8130671C0011SM	4.86
F8130671C0012SM	8.7
F8130671C0013SM	2.29
F8130671C0014SM	1.01
F8130671C0015SM	3.58
F8130671C0016SM	2.29
Mean:	4.46
Median:	3.58
Standard Deviation:	4.9
Range:	-1.55 to 20.24

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 slightly greater than the design standard deviation. Both values of sigma result in a relative shift of greater than 3 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):	16	
Median (dpm/100 cm²):	1,714	
Mean (dpm/100 cm²):	1,778	
Direct Measurement Standard Deviation (dpm/100 cm²):	247	
Total Standard Deviation (dpm/100 cm²):	247	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	2,311	
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:	Yes	Class 1
Total Standard Deviation <= Sigma:	Investigate	No additional samples required.
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
Does the Survey Unit Pass All Criteria?	Investigate	No additional samples required..

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 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 slightly greater than the characterization data used for survey design. No potential areas of elevated activity were detected. 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 16,000 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.

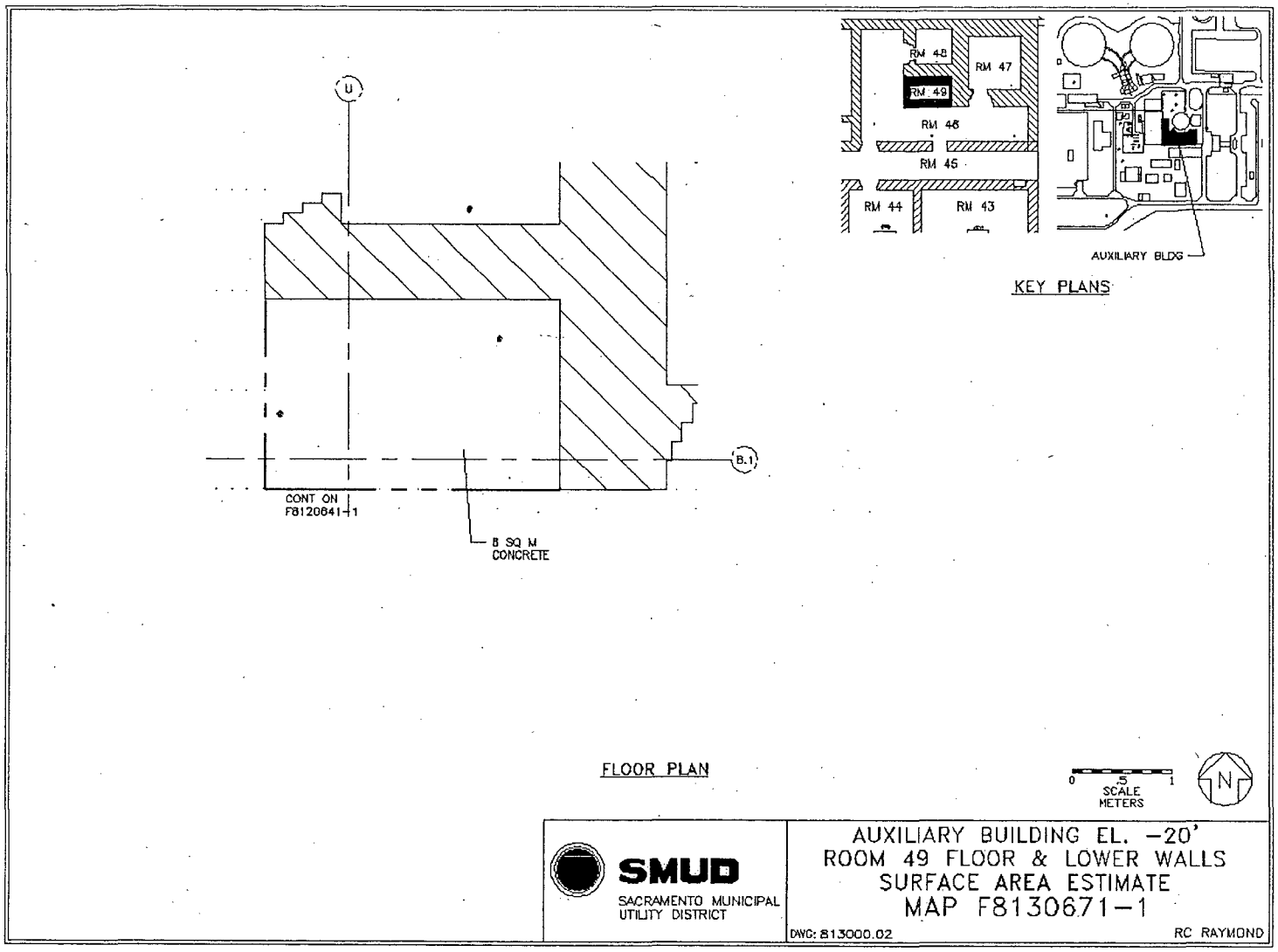
It is concluded that survey unit F8130671 meets the release criteria of 10CFR20.1402.

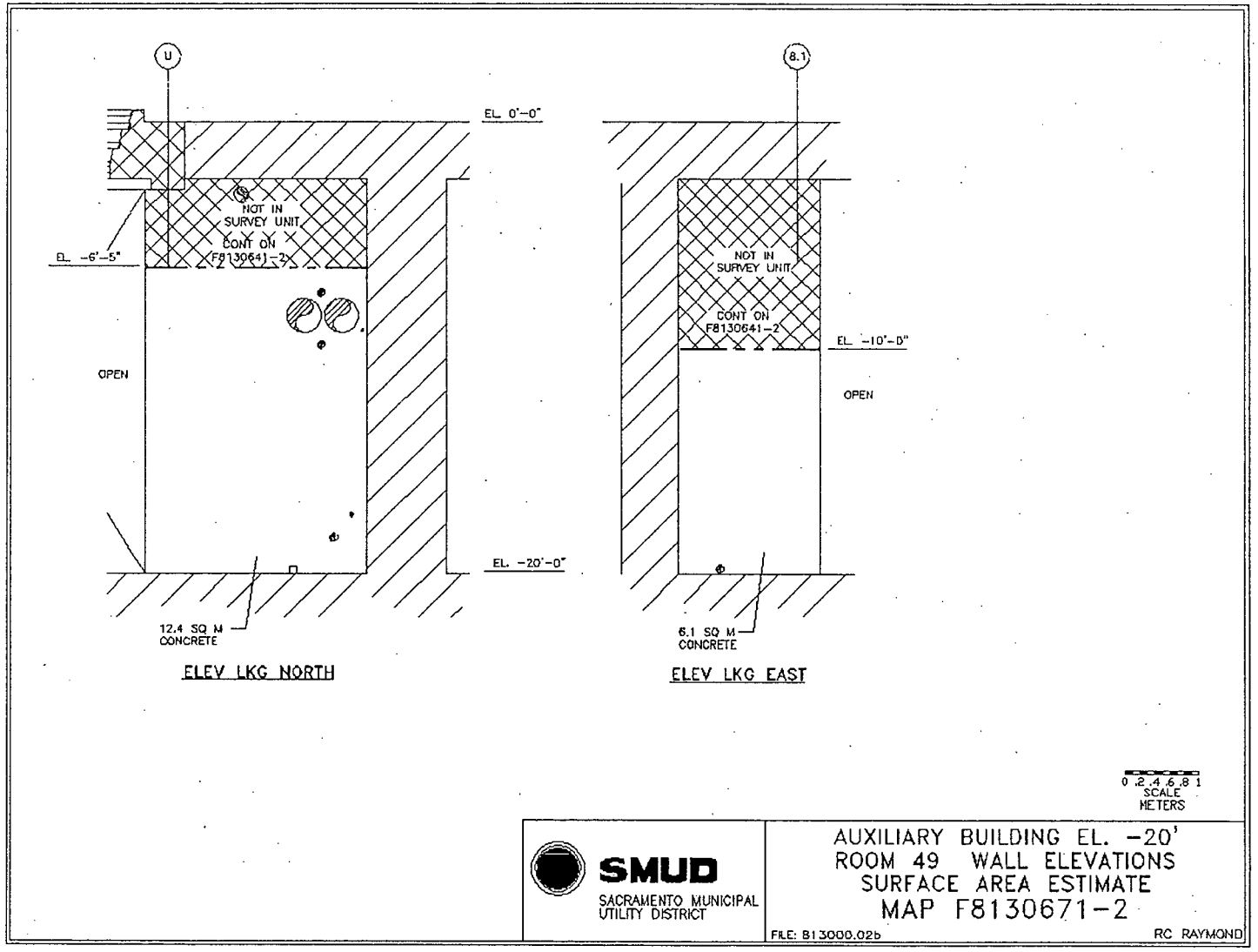
Attachment 1

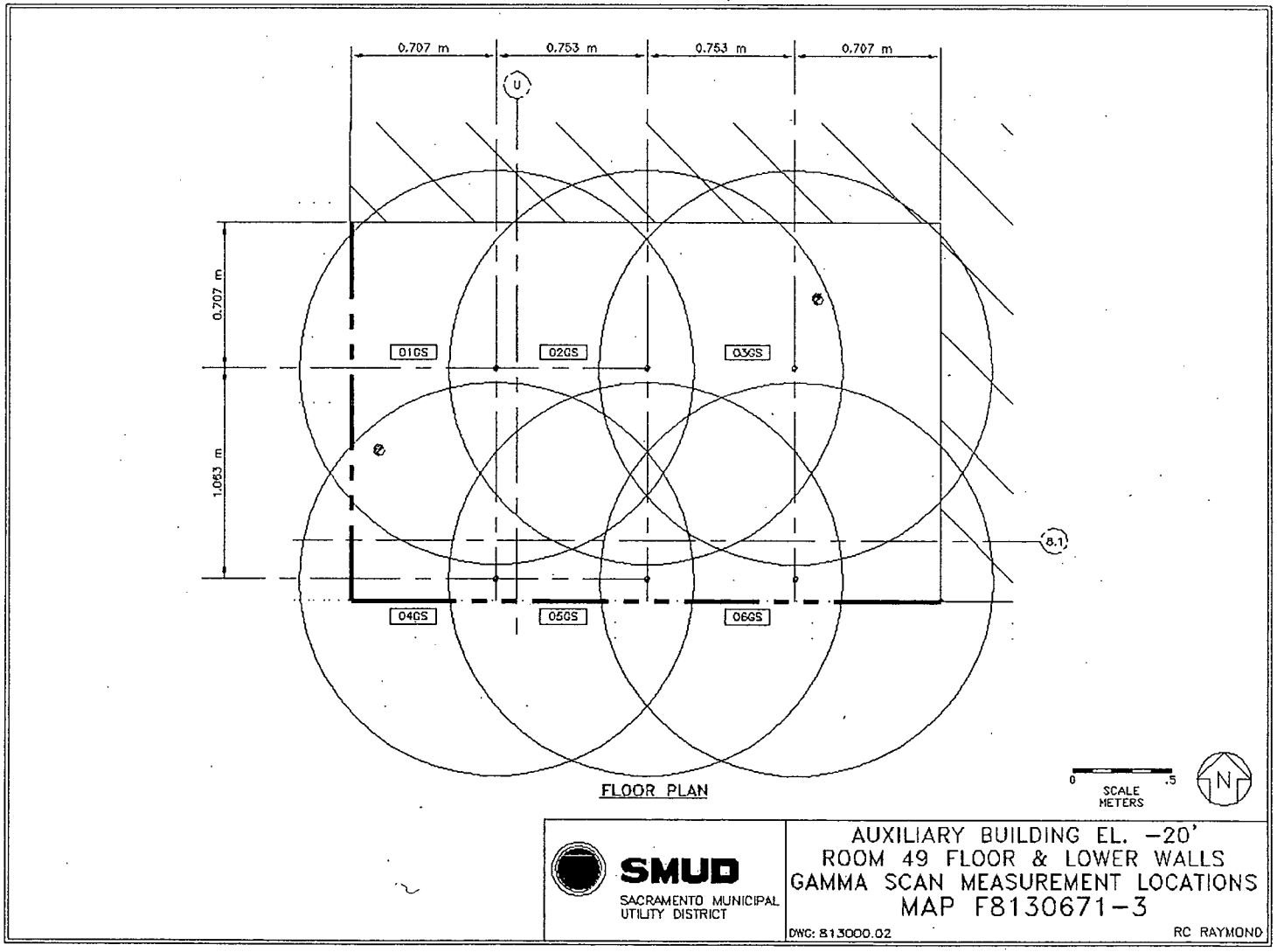
Maps

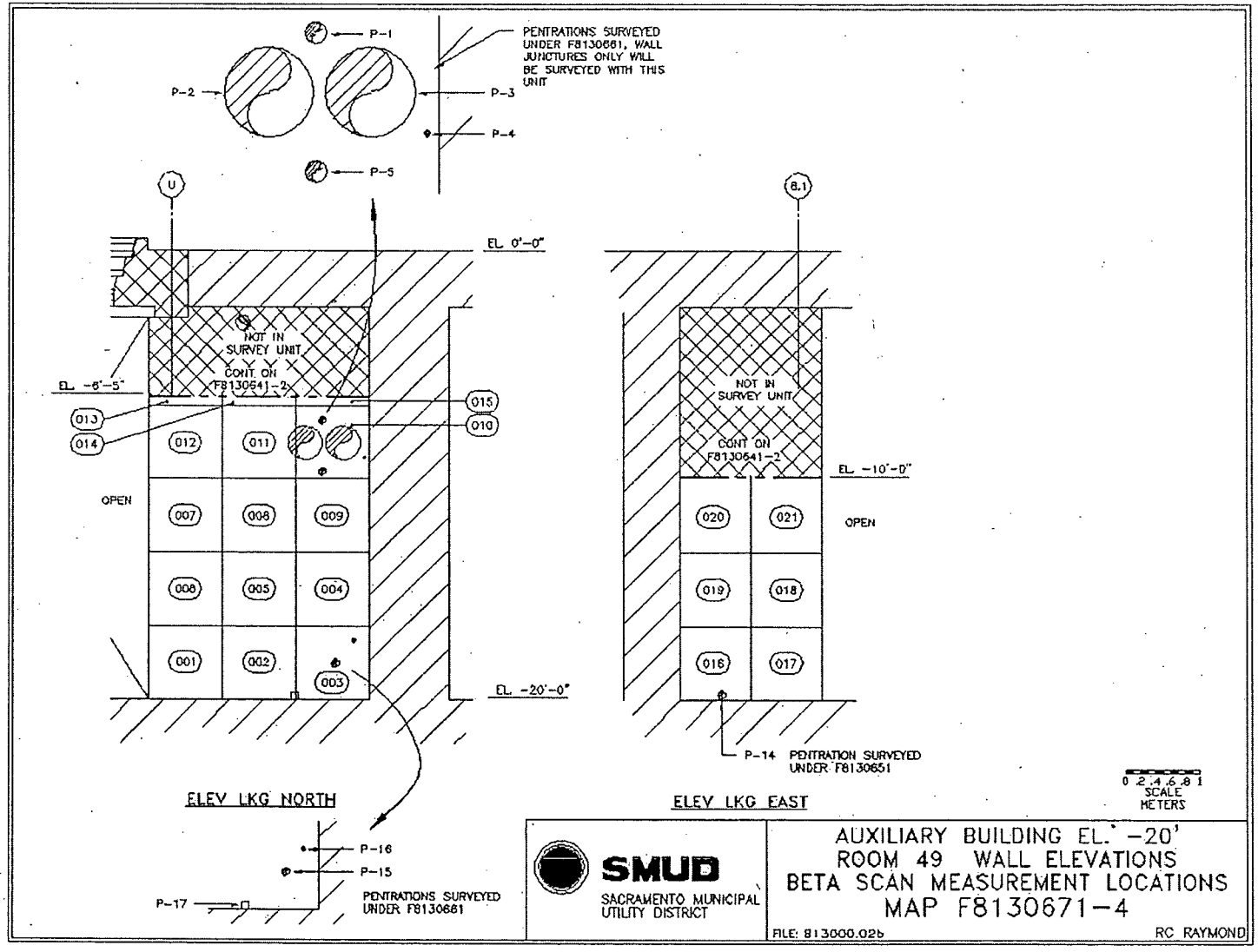
October 24, 2007

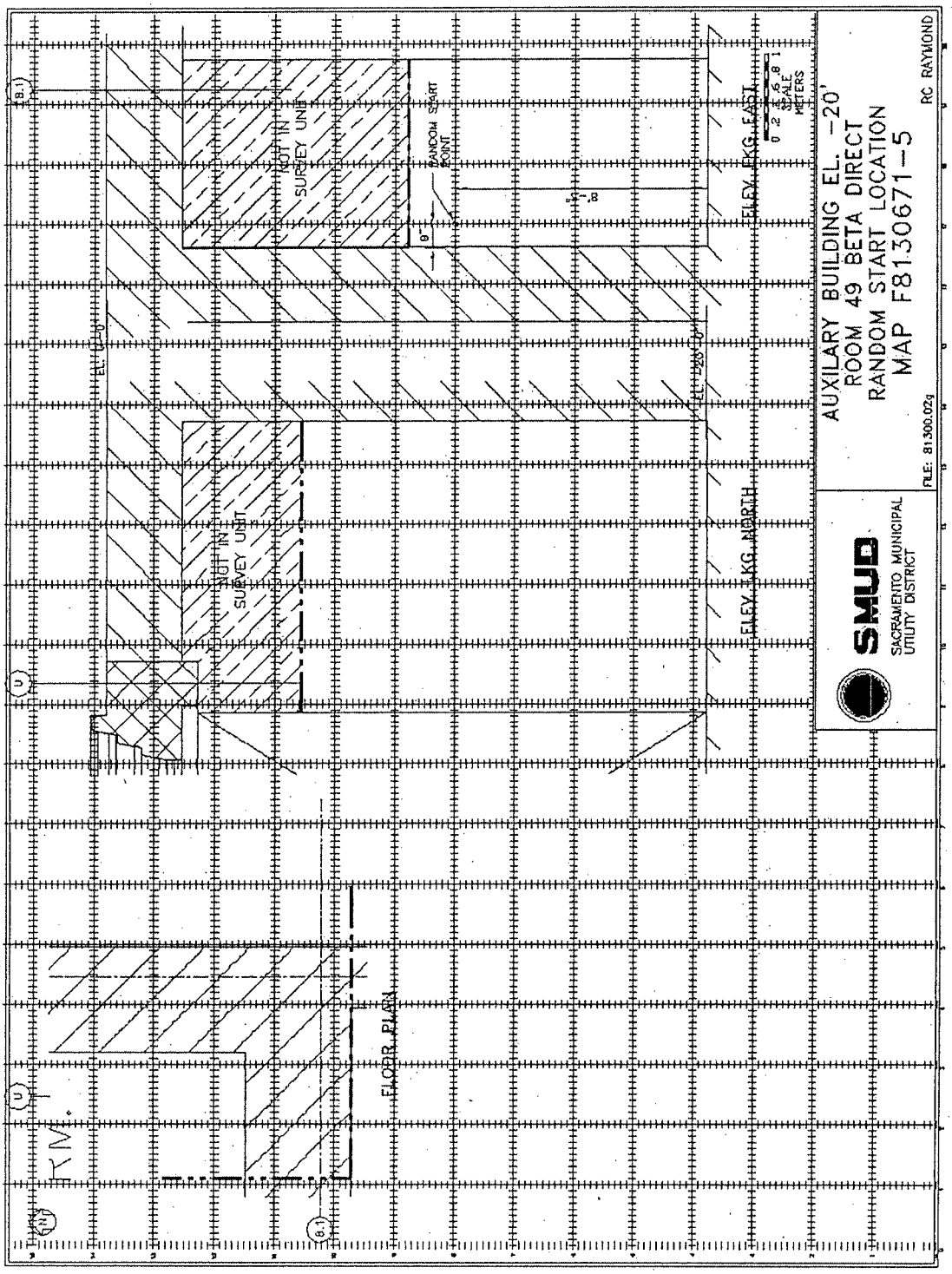
Survey Unit F8130671

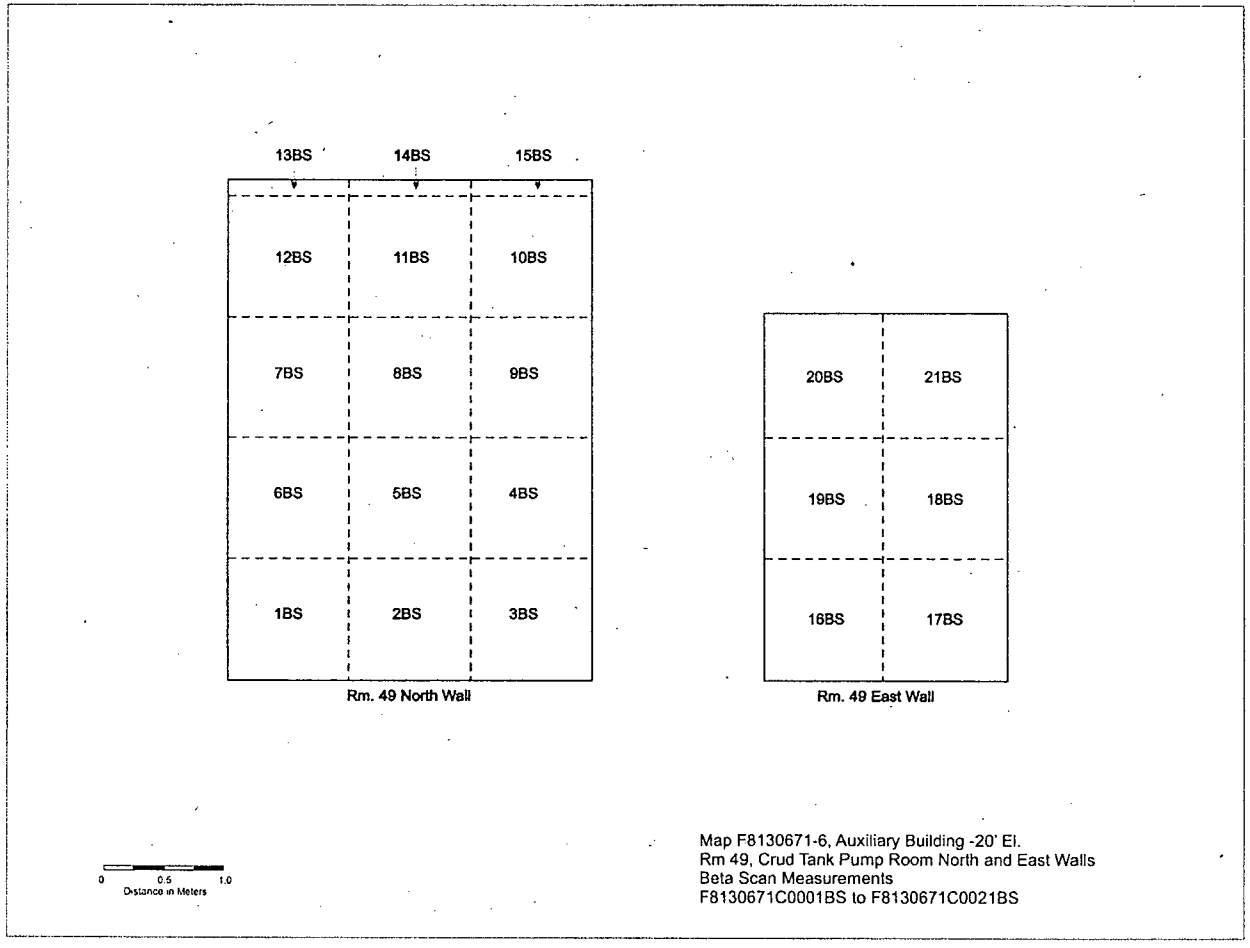

RM 48
RM 47
RM 49
RM 46
RM 45
RM 44
RM 43
AUXILIARY BLDG
KEY PLANS
B.1
CONT ON
F8120641-1
8 SQ M
CONCRETE
FLOOR PLAN
0
.5
1
SCALE
METERS
N
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 49 FLOOR & LOWER WALLS
SURFACE AREA ESTIMATE
MAP F8130671-1
DWG: 813000.02
RC RAYMOND


U
EL. 0'-0"
NOT IN SURVEY UNIT
CONT ON F8130641-2
EL. -6'-5"
OPEN
EL. -20'-0"
12.4 SQ M CONCRETE
ELEV LKG NORTH
8.1
NOT IN SURVEY UNIT
CONT ON F8130641-2
EL. -10'-0"
OPEN
6.1 SQ M CONCRETE
ELEV LKG EAST
0 .2 .4 .6 .8 1
SCALE METERS
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 49 WALL ELEVATIONS
SURFACE AREA ESTIMATE
MAP F8130671-2
FILE: B13000.02b
RC RAYMOND

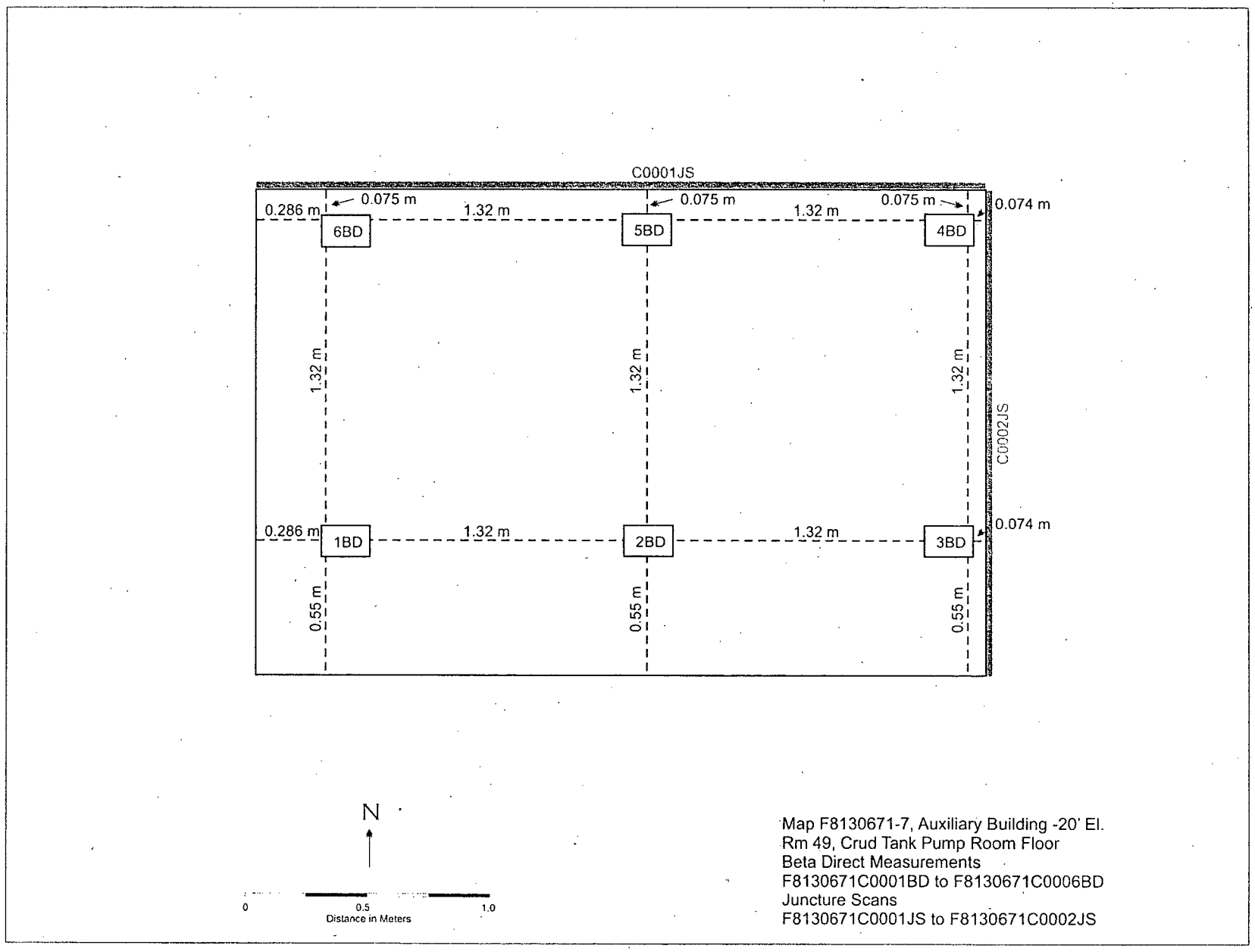

0.707 m
0.753 m
0.753 m
0.707 m
U
0.707 m
1.063 m
01GS
02GS
03GS
04GS
05GS
06GS
8.1
FLOOR PLAN
0
.5
SCALE
METERS
N
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 49 FLOOR & LOWER WALLS
GAMMA SCAN MEASUREMENT LOCATIONS
MAP F8130671-3
DWG: 813000.02
RC RAYMOND


P-1
P-2
P-3
P-4
P-5
PENTRATIONS SURVEYED UNDER F8130661, WALL JUNCTURES ONLY WILL BE SURVEYED WITH THIS UNIT
U
8.1
EL 0'-0"
NOT IN SURVEY UNIT
CONT ON F8130641-2
EL -6'-5"
013
014
012
011
015
010
OPEN
007
008
009
006
005
004
001
002
003
EL -20'-0"
NOT IN SURVEY UNIT
CONT ON F8130641-2
EL -10'-0"
020
021
OPEN
019
018
016
017
P-14 PENTRATION SURVEYED UNDER F8130651
ELEV LKG NORTH
ELEV LKG EAST
P-16
P-15
P-17
PENTRATIONS SURVEYED UNDER F8130661
0 2 4 6 8 1
SCALE METERS
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUXILIARY BUILDING EL. -20'
ROOM 49 WALL ELEVATIONS
BETA SCAN MEASUREMENT LOCATIONS
MAP F8130671-4
FILE: 813000.02b
RC RAYMOND

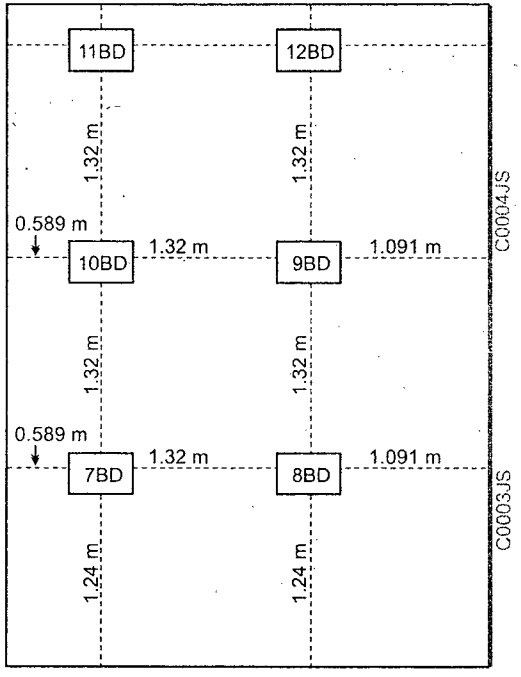

AUXILARY BUILDING EL. -20'
ROOM 49 BETA DIRECT
RANDOM START LOCATION
MAP F8130671-5
RC RAYMOND
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
FILE: 81300.02g
NOT IN SURVEY UNIT
SURVEY UNIT
RANDOM START POINT
FLOOR PLAN
ELEV. 1KG NORTH
ELEV. 1KG EAST
SCALE METERS
EL. 0'
EL. -20'
TYP.



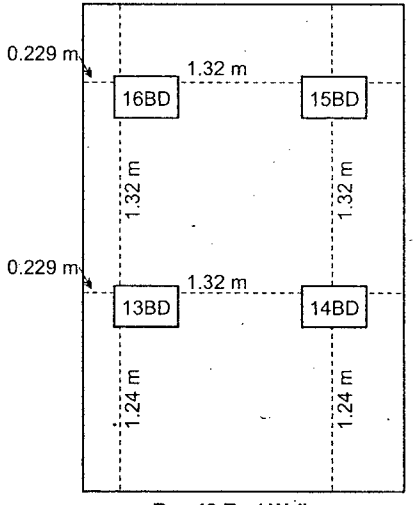
Map F8130671-6, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room North and East Walls
Beta Scan Measurements
F8130671C0001BS to F8130671C0021BS



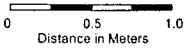
Map F8130671-7, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room Floor
Beta Direct Measurements
F8130671C0001BD to F8130671C0006BD
Juncture Scans
F8130671C0001JS to F8130671C0002JS



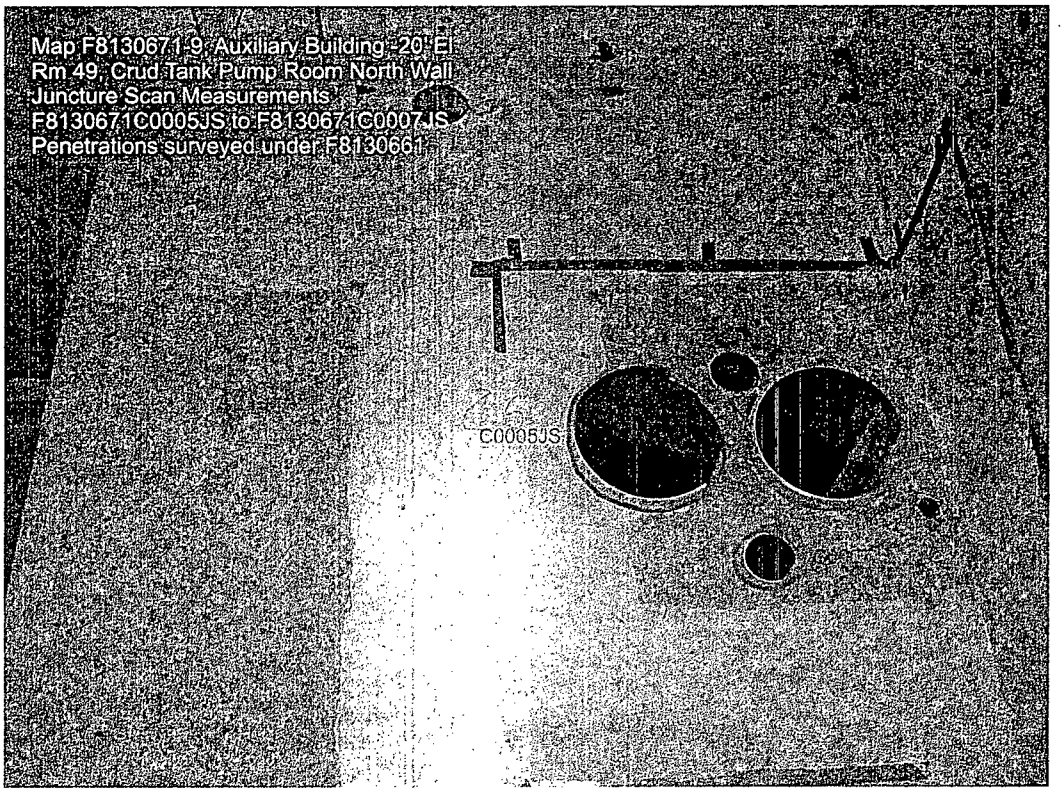
Rm. 49 North Wall

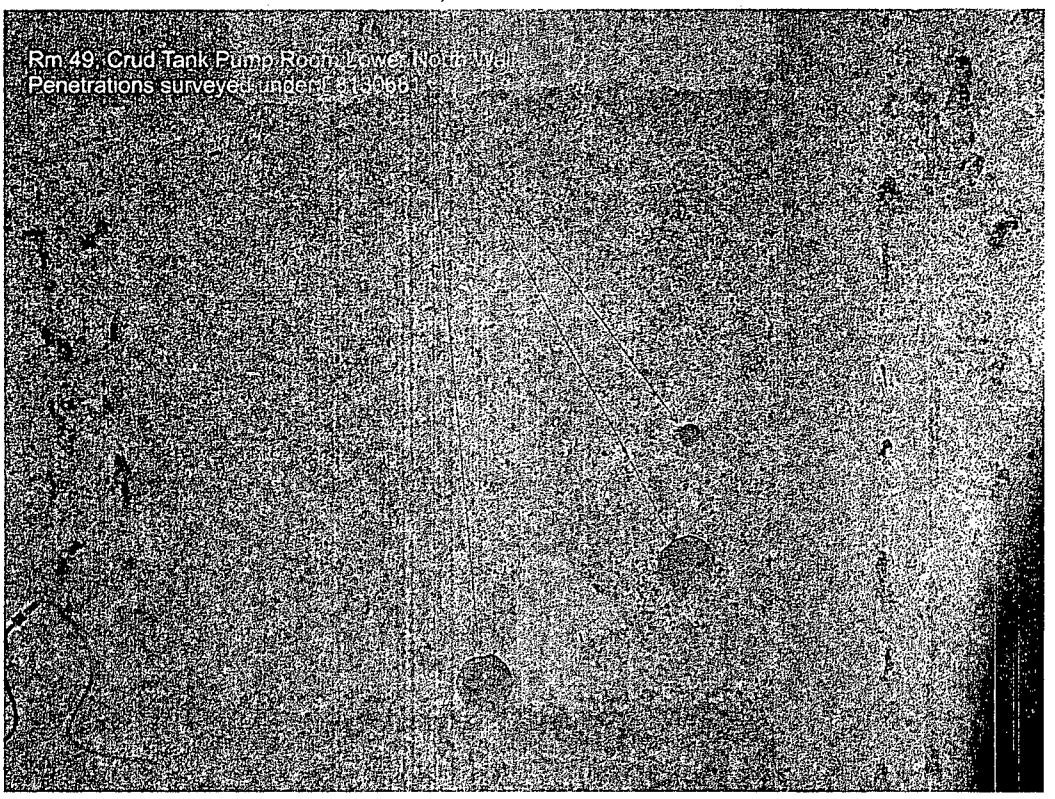


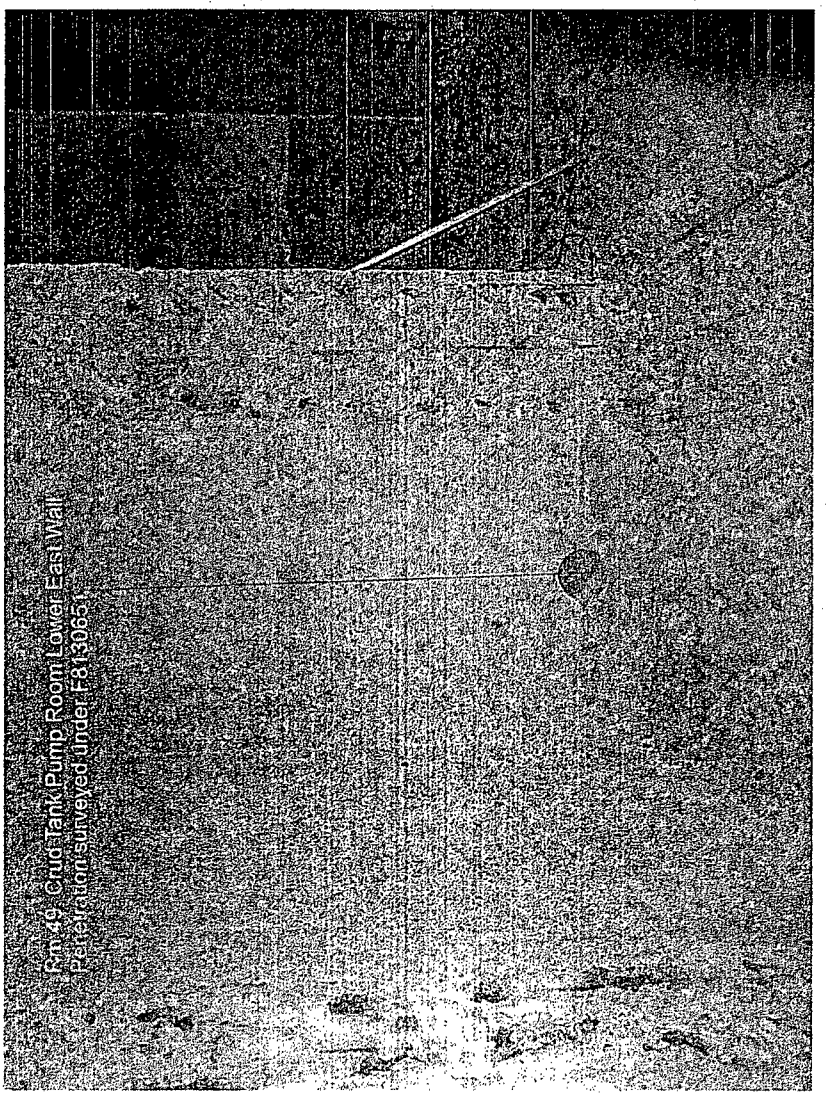
Rm. 49 East Wall



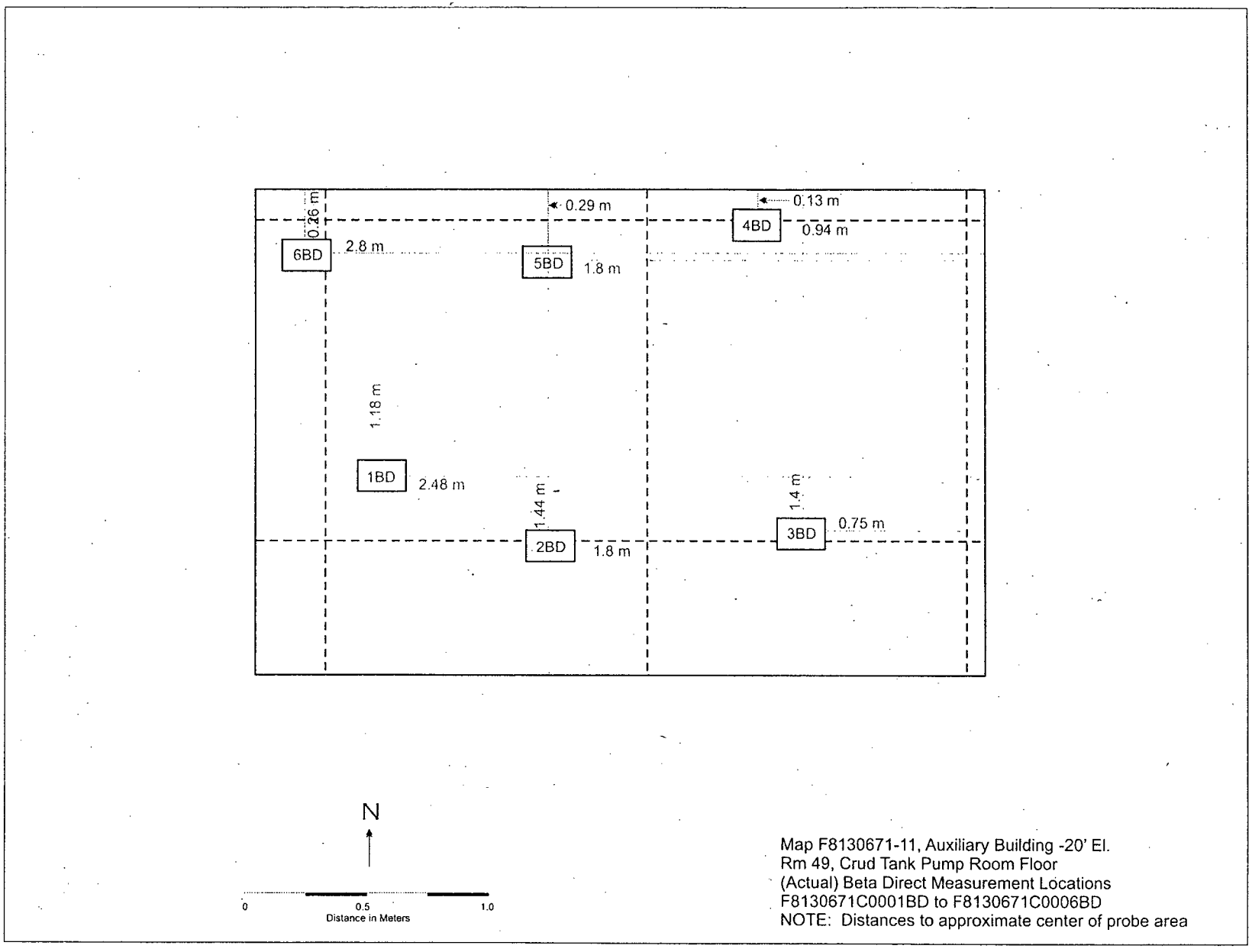
Map F8130671-8, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room North and East Walls
Beta Direct Measurements
F8130671C0007BD to F8130671C0016BD
Juncture Scan Measurements
F8130671C0003JS to F8130671C0004JS


Map F8130671-9, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room North Wall
Juncture Scan Measurements
F8130671C0005JS to F8130671C0007JS
Penetrations surveyed under F8130661
C0005JS

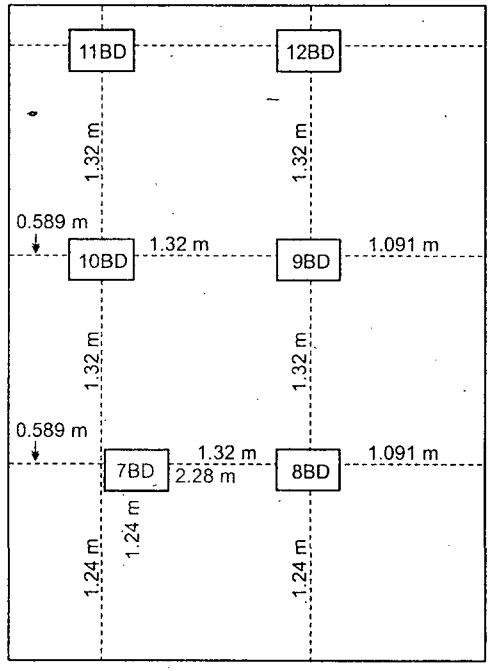

Rm 49, Crud Tank Pump Room, Lower North Wall
Penetrations surveyed under F8130661



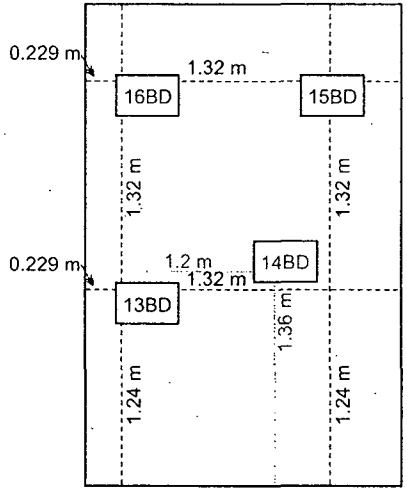
Map F8130671-10, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room East Wall
Penetration



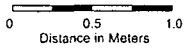
Map F8130671-11, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room Floor
(Actual) Beta Direct Measurement Locations
F8130671C0001BD to F8130671C0006BD
NOTE: Distances to approximate center of probe area



Rm. 49 North Wall



Rm. 49 East Wall



Map F8130671-12, Auxiliary Building -20' El.
Rm 49, Crud Tank Pump Room North and East Walls
(Actual) Beta Direct Measurement Locations
F8130671C0007BD to F8130671C0016BD
NOTE: Distances to approximate center of probe area

Attachment 2

Instrumentation

October 24, 2007

Survey Unit F8130671

Table 2-1. Survey Unit Instrumentation

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (dpm/100 cm² Co-60)	MDC Scan (dpm/100 cm² Co-60)
M2350; 149802	43-68B; 148453	530	1,263
M2350; 149794	43-51B; 190167[1]	1,505	5,084
M2350; 149794	43-51B; 190167[2]	1,017	1,680
M2350; 149802	43-116-1B; 190173	668	1,006
Tennelec; 0401171	N/A	5 dpm α, 11 dpm β	N/A

[1]43-51B Concrete surfaces
[2]43-51B Concrete junctures

Instrument	Detector Serial No.	MDC (dpm/100 cm²)
ISOCS	2983947	1,330 dpm/100 cm² Co-60 1,490 dpm/100 cm² Cs-137

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	142,400
Investigation Criteria – Scan	142,400
$DCGL_W$	16,000
$DCGL_{EMC}$	142,400

Instrument	Parameter	Value (dpm/100 cm²) To detect a 100 cm² hot spot at the EMC Criterion within the detector field of view
ISOCS	Investigation Criteria - Scan	Concrete – 86,480 dpm/100 cm² Co-60 88,700 dpm/100 cm² Cs-137

Attachment 3

Investigation

October 24, 2007

Survey Unit F8130671

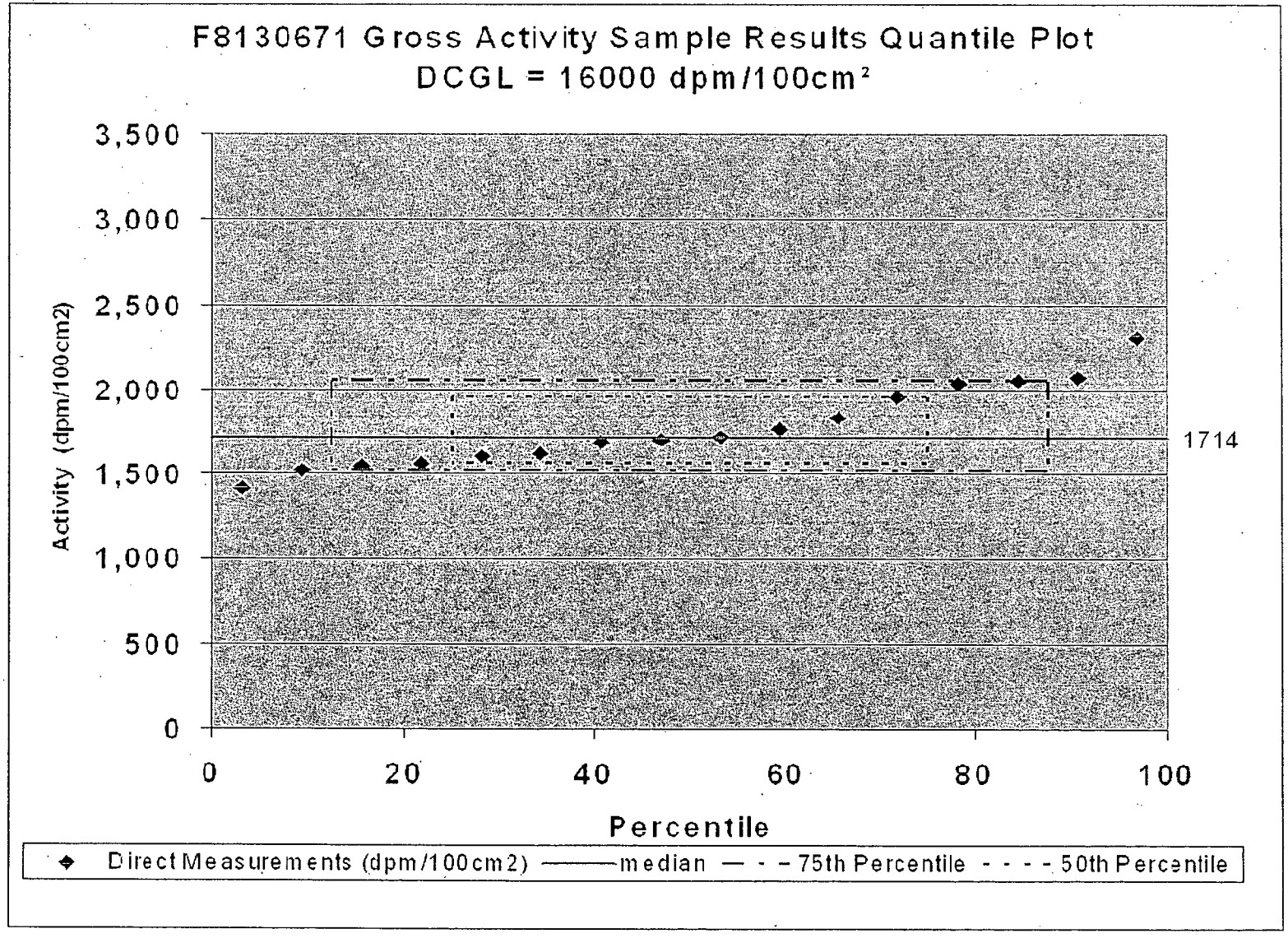
(none required)

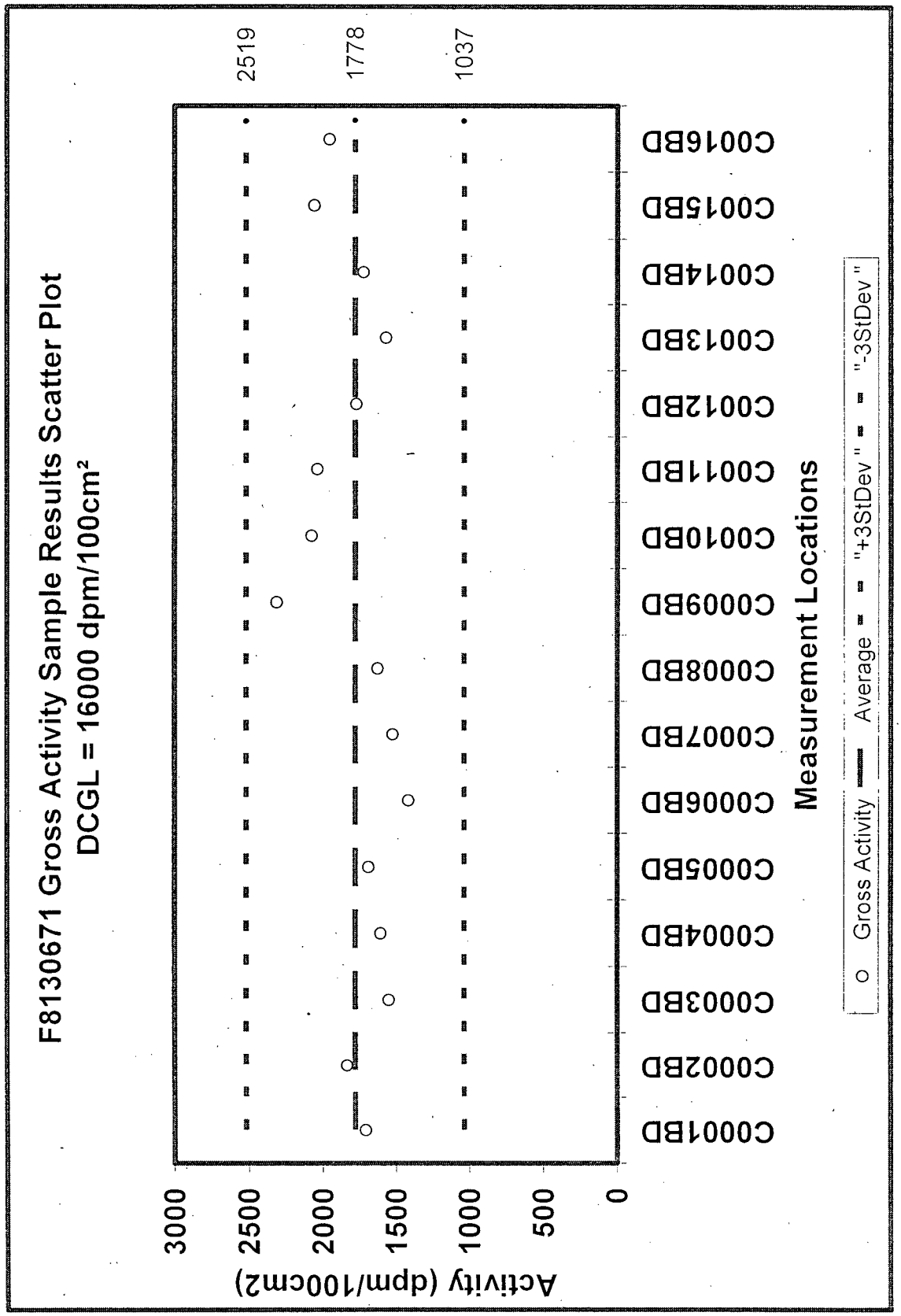
Attachment 4

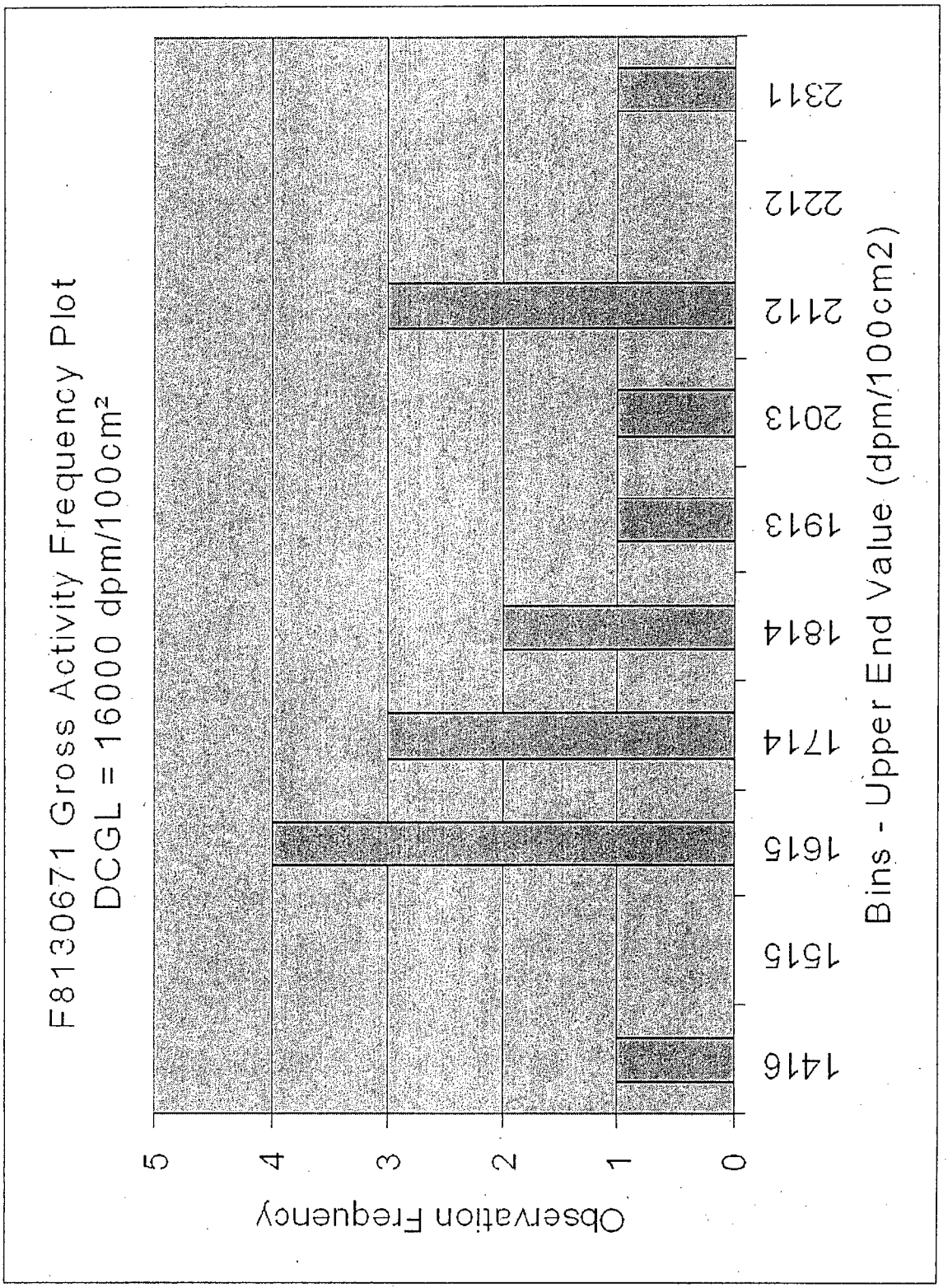
Data Assessment

October 24, 2007

Survey Unit F8130671


F8130671 Gross Activity Sample Results Quantile Plot
DCGL = 16000 dpm/100cm²
Activity (dpm/100cm2)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
20
40
60
80
100
Percentile
1714
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8130671 Gross Activity Sample Results Scatter Plot
DCGL = 16000 dpm/100cm²
2519
1778
1037
3000
2500
2000
1500
1000
500
0
Activity (dpm/100cm2)
C00016BD
C00015BD
C00014BD
C00013BD
C00012BD
C00011BD
C00010BD
C00009BD
C00008BD
C00007BD
C00006BD
C00005BD
C00004BD
C00003BD
C00002BD
C00001BD
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8130671 Gross Activity Frequency Plot
DCGL = 16000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
1416
1515
1615
1714
1814
1913
2013
2112
2212
2311
Bins - Upper End Value (dpm/100cm2)