Rancho Seco

Final Status Survey Summary Report

July 22, 2008

Fuel Storage Bldg (+) 40' El., Auxiliary Bldg end, Lower Walls

Survey Unit F8121003

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FSS Engineer

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Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8121003, Fuel Storage Bldg (+) 40' El., Auxiliary Bldg end, Lower Walls

Survey Unit Description:

Operating History: The reinforced concrete structure contained the spent fuel pool and supporting systems. The building contained three main elevations including the pool. 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. Three documented instances of contamination through the common fuel building/turbine building wall were noted.

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 pool elevation showed a mean gross activity level of 16,900,000 dpm/100 cm^2 and a maximum value of 200,000,000 dpm/100 cm^2. Direct measurements on the +40' elevation showed a mean gross activity level of 5,942 dpm/100 cm^2 and a maximum value of 19,357 dpm/100 cm^2. Direct measurements on the building exterior showed a mean gross activity level of 1,408 dpm/100 cm^2 and a maximum value of 21,600 dpm/100 cm^2. Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the spent fuel 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 115.8 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:	F812	Fuel Storage Bldg (+) 40' El., Auxiliary Bldg end, Lower Walls
Survey Unit:	1003	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	115.8	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	43,000	Gross Activity DCGL
Area Factor:	3.4	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	146,200	Class 1
LBGR (dpm/100 cm^2)**:**	29,107	Adjusted
Design Sigma (dpm/100 cm^2)**:**	4,631	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	2.6	Class 1
Scan Area (m^2)**:**	115.8	
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:	17	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 26 direct measurements were made in F8121003. 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. The gamma activity ranged from < 943 dpm/100 cm^2 Co-60 and < 1,310 dpm/100 cm^2 to 917 dpm/100 cm^2 Cs-137. Beta scan activity ranged from 5,510 to 10,804 dpm/100 cm^2, 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)
F8121003-C0001BD	3,329
F8121003-C0002BD	3,417
F8121003-C0003BD	4,321
F8121003-C0004BD	3,869
F8121003-C0005BD	3,693
F8121003-C0006BD	3,274
F8121003-C0007BD	4,387
F8121003-C0008BD	3,913
F8121003-C0009BD	3,704
F8121003-C0010BD	3,505
F8121003-C0011BD	3,792
F8121003-C0012BD	4,078
F8121003-C0013BD	4,189
F8121003-C0014BD	3,858
F8121003-C0015BD	3,627
F8121003-C0016BD	3,957
F8121003-C0017BD	3,472
F8121003-C0018BD	3,549
F8121003-C0019BD	3,153
F8121003-C0020BD	3,869
F8121003-C0021BD	3,417
F8121003-C0022BD	3,814
F8121003-C0023BD	3,902
F8121003-C0024BD	4,023
F8121003-C0025BD	3,770
F8121003-C0026BD	2,756
Mean:	3,717
Median:	3,781
Standard Deviation:	368
Range:	2,756 – 4,387

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8121003C0001SM	0.34
F8121003C0002SM	6.8
F8121003C0003SM	0.34
F8121003C0004SM	0.34
F8121003C0005SM	2.93
F8121003C0006SM	-4.82
F8121003C0007SM	-3.53
F8121003C0008SM	-0.95
F8121003C0009SM	-2.24
F8121003C0010SM	-2.24
F8121003C0011SM	0.34
F8121003C0012SM	-0.95
F8121003C0013SM	1.64
F8121003C0014SM	-2.24
F8121003C0015SM	0.34
F8121003C0016SM	-3.53
F8121003C0017SM	-2.24
F8121003C0018SM	-4.82
F8121003C0019SM	-4.82
F8121003C0020SM	-3.53
F8121003C0021SM	-2.24
F8121003C0022SM	6.8
F8121003C0023SM	2.93
F8121003C0024SM	1.64
F8121003C0025SM	1.64
F8121003C0026SM	-0.95
Mean:	-0.5
Median:	-0.95
Standard Deviation:	3.14
Range:	-4.82 to 6.8

Survey Unit Data Assessment:

The survey design required 26 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 cm²):	N/A	
Ambient Background Used (dpm/100 cm²):	N/A	Average Ambient BKG = 0
Actual Direct Measurements (N):	26	
Median (dpm/100 cm²):	3,781	
Mean (dpm/100 cm²):	3,717	
Direct Measurement Standard Deviation (dpm/100 cm²):	368	
Total Standard Deviation (dpm/100 cm²):	368	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	4,387	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	26	
S+ Value:	26	
Critical Value:	17	
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:

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 less 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 43,000 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 F8121003 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

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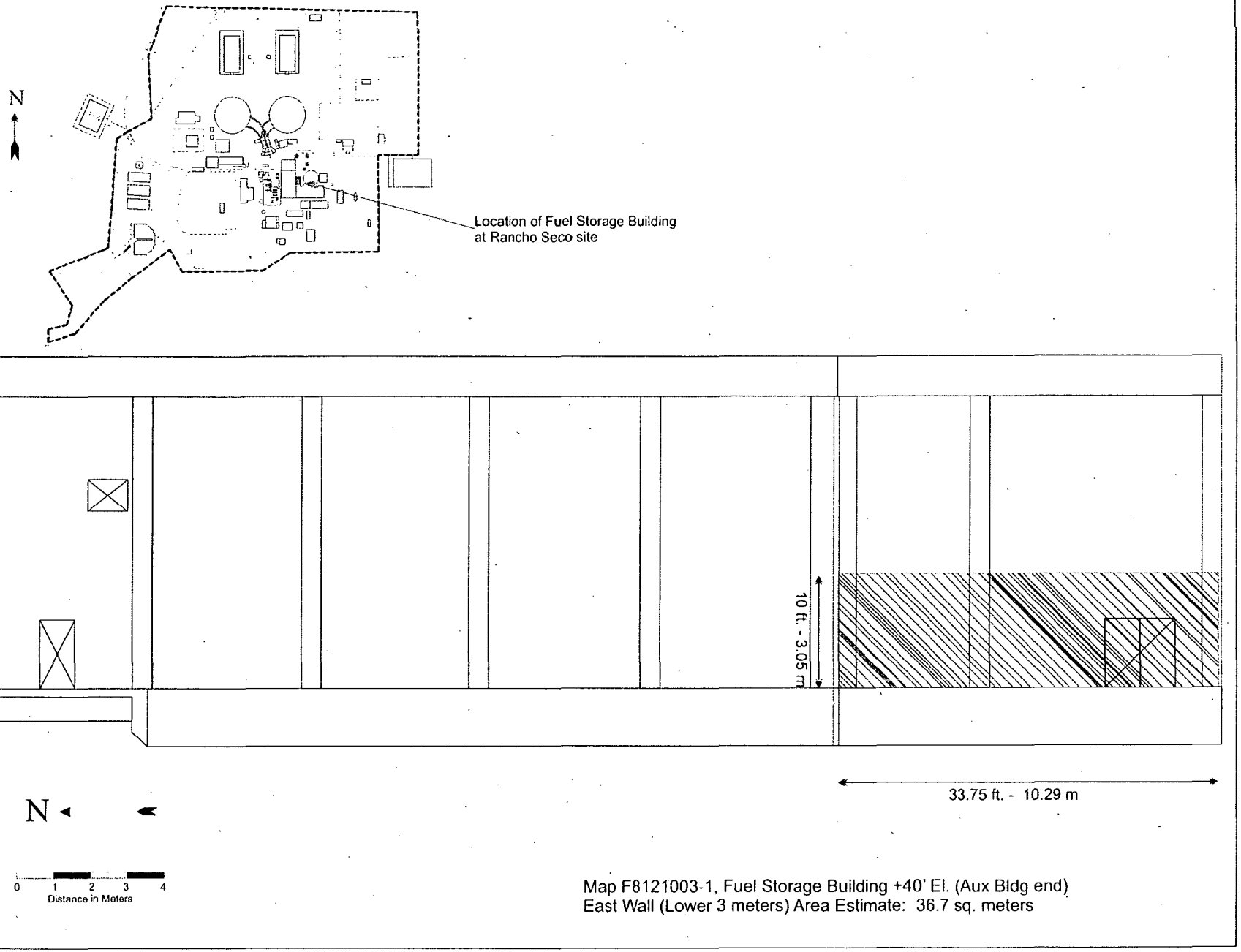
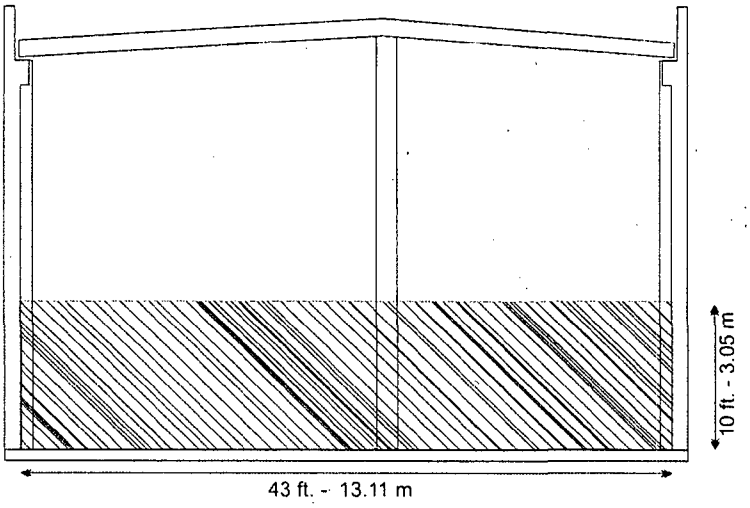
Survey Unit F8121003



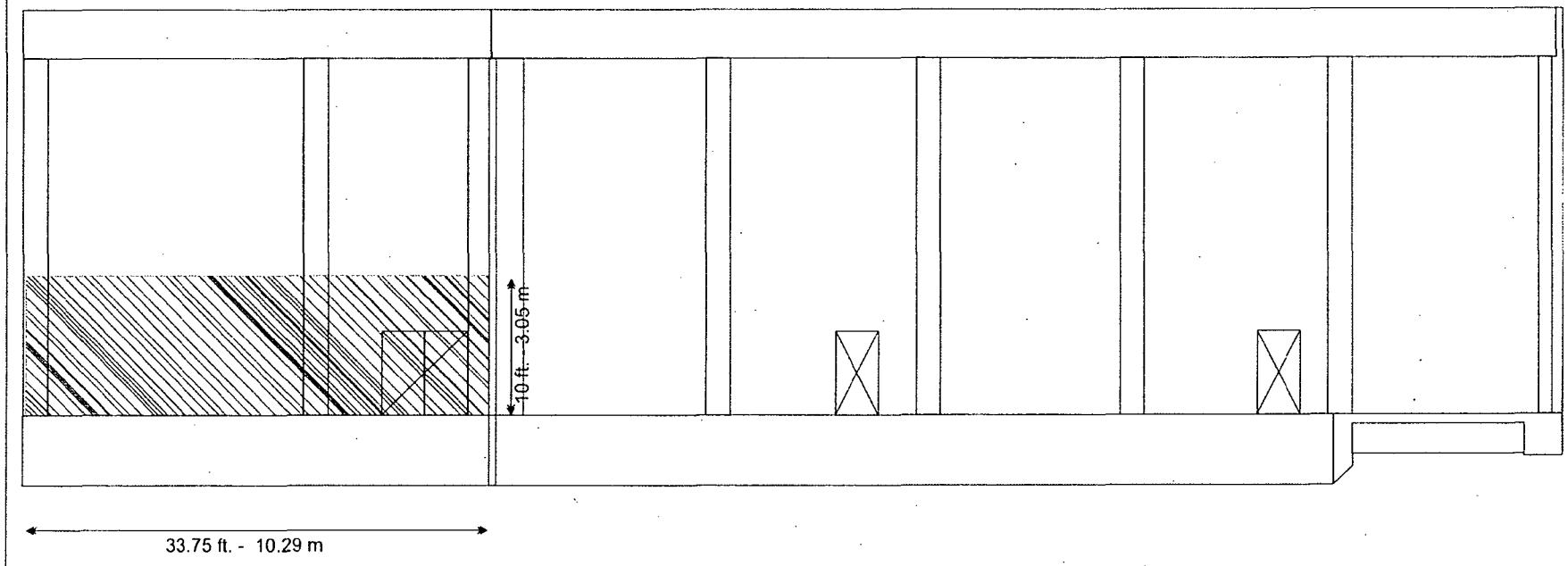
Map F8121003-1, Fuel Storage Building +40' El. (Aux Bldg end)
East Wall (Lower 3 meters) Area Estimate: 36.7 sq. meters

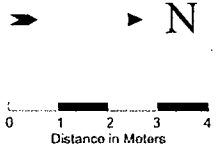


South Wall

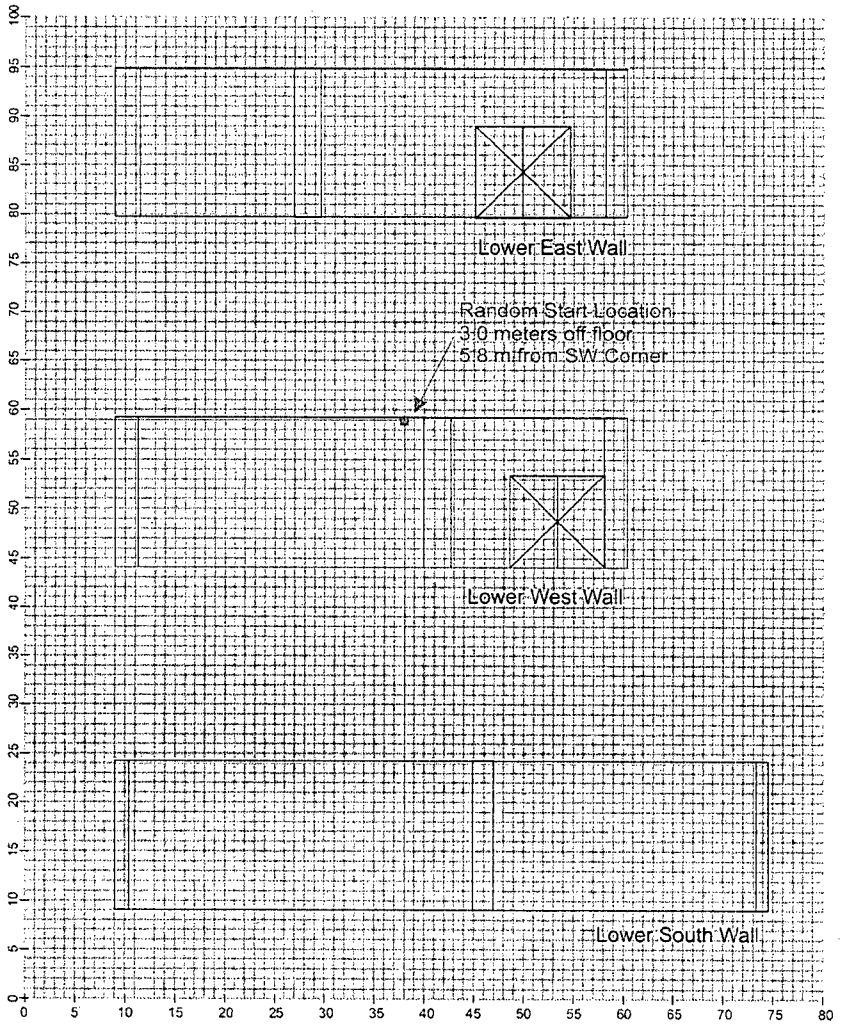
0 1 2 3 4
Distance in Meters

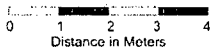
Map F8121003-2, Fuel Storage Building +40' El. (Aux Bldg end)
South Wall (Lower 3 meters) Area Estimate: 43.2 sq. meters



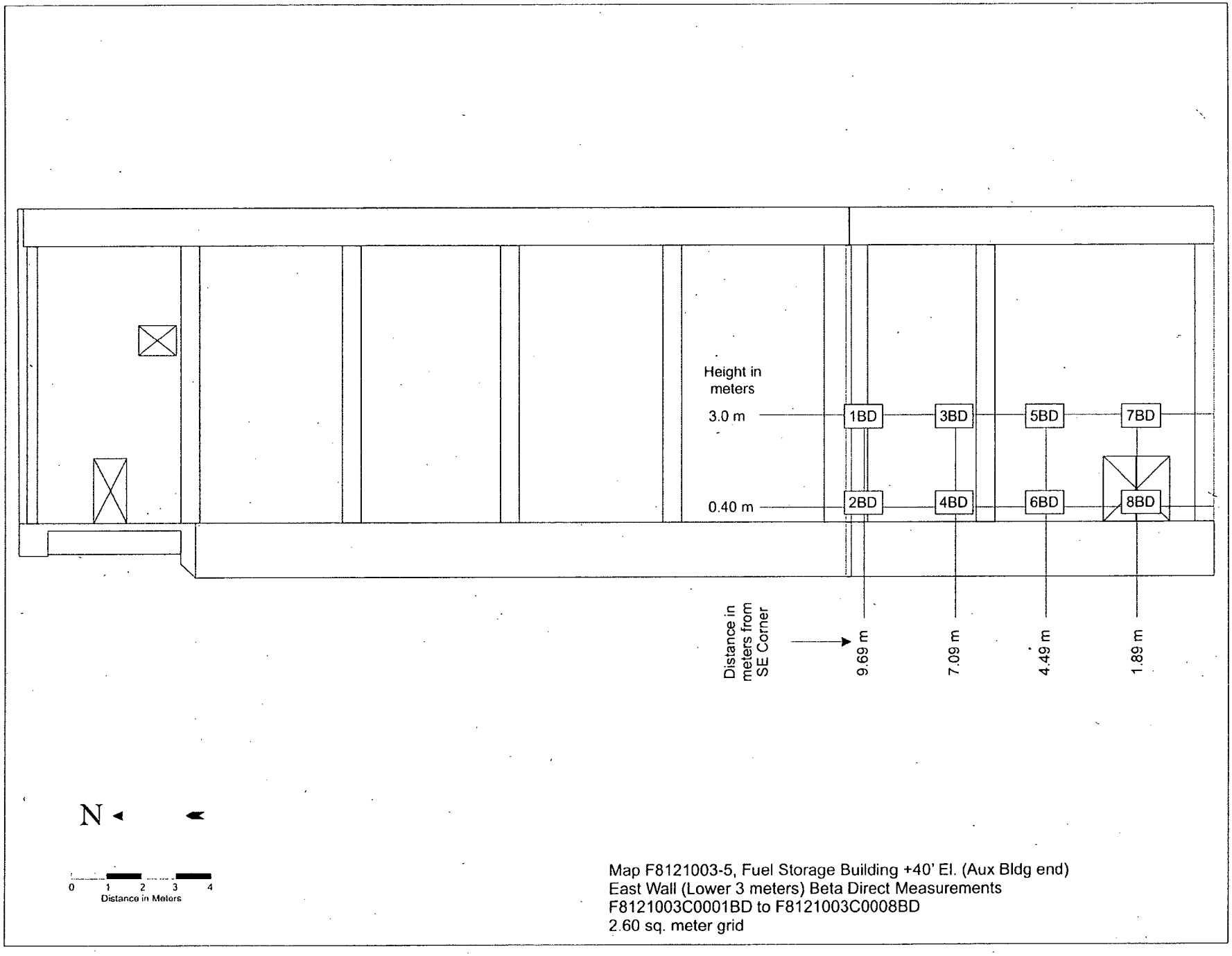


Map F8121003-3, Fuel Storage Building +40' El. (Aux Bldg end)
West Wall (Lower 3 meters) Area Estimate: 35.8 sq. meters

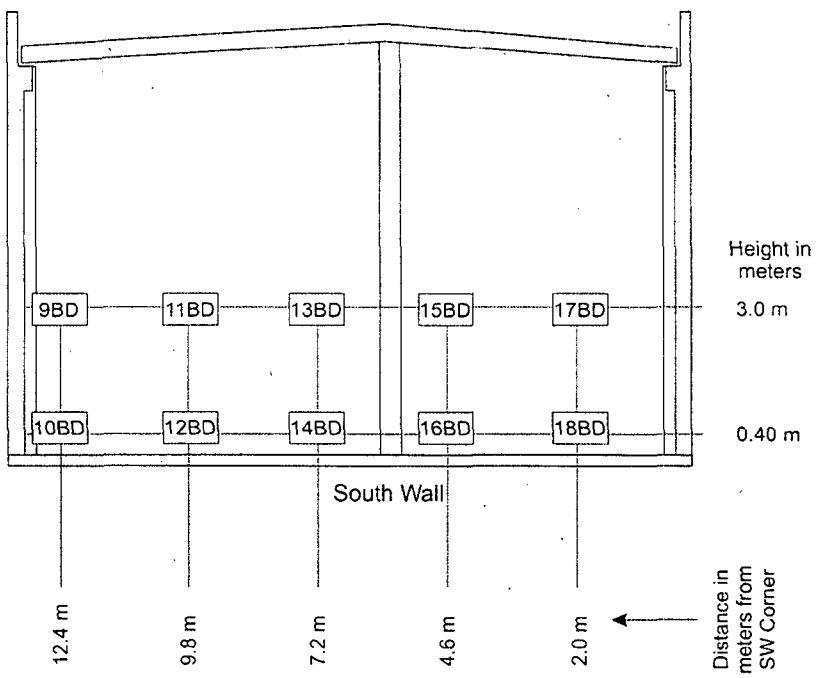


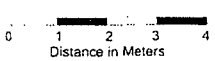


Map F8121002-4, Fuel Storage Building +40' El. (Aux Bldg end)
Lower Walls (Lower 3 meters) Random Start Location

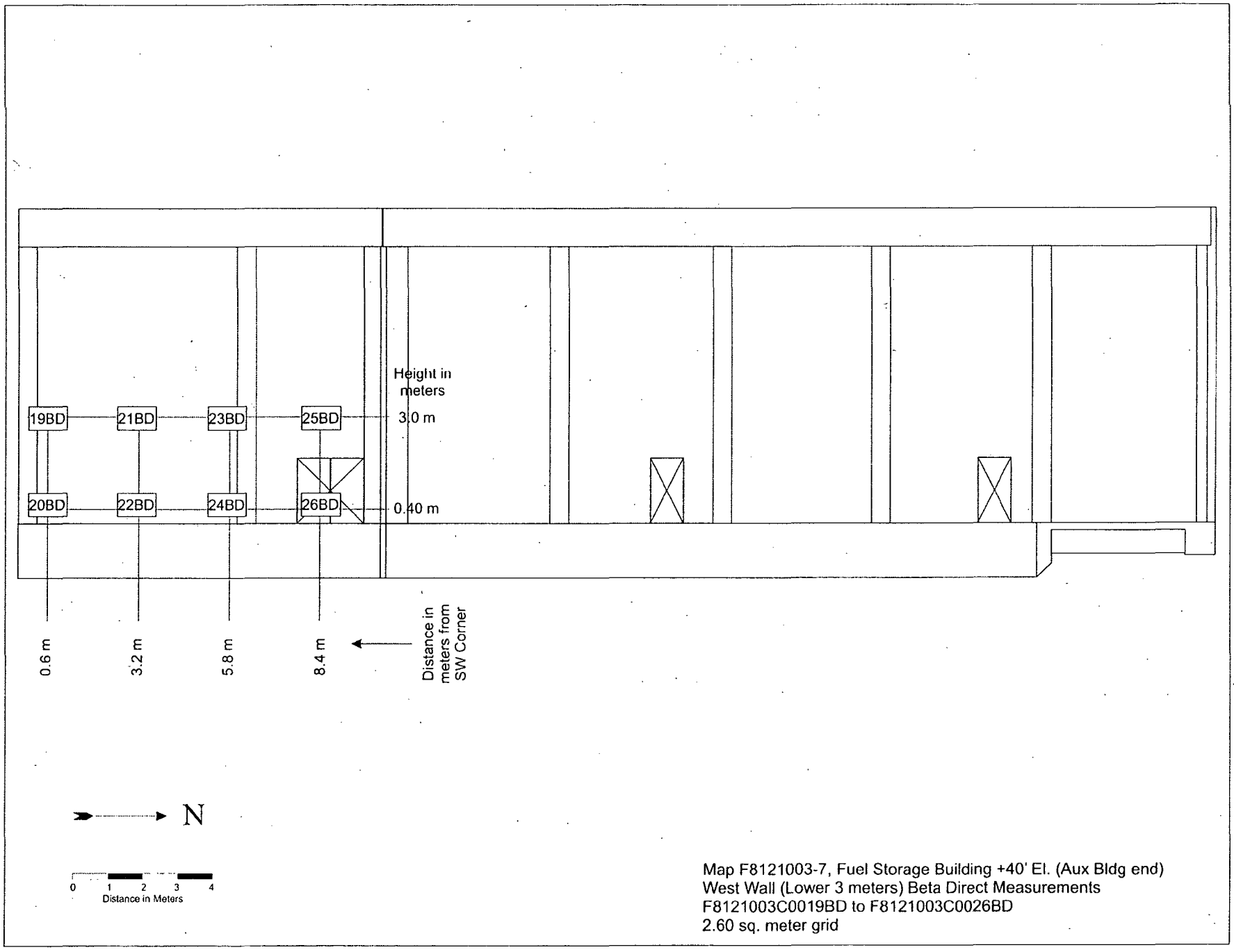


Map F8121003-5, Fuel Storage Building +40' El. (Aux Bldg end)
East Wall (Lower 3 meters) Beta Direct Measurements
F8121003C0001BD to F8121003C0008BD
2.60 sq. meter grid

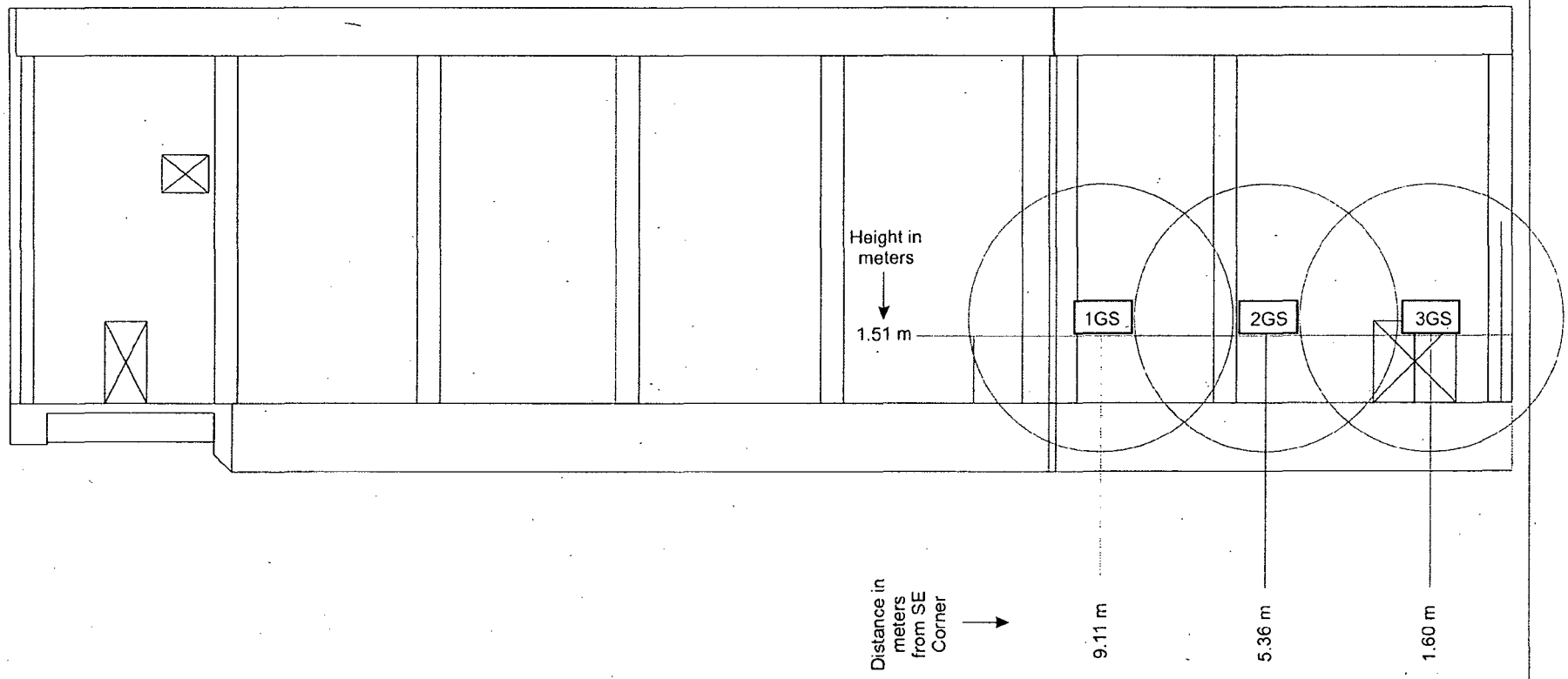


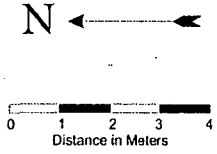


Map F8121003-6, Fuel Storage Building +40' El. (Aux Bldg end)
South Wall (Lower 3 meters) Beta Direct Measurements
F8121003C0009BD to F8121003C0018BD
2.60 sq. meter grid

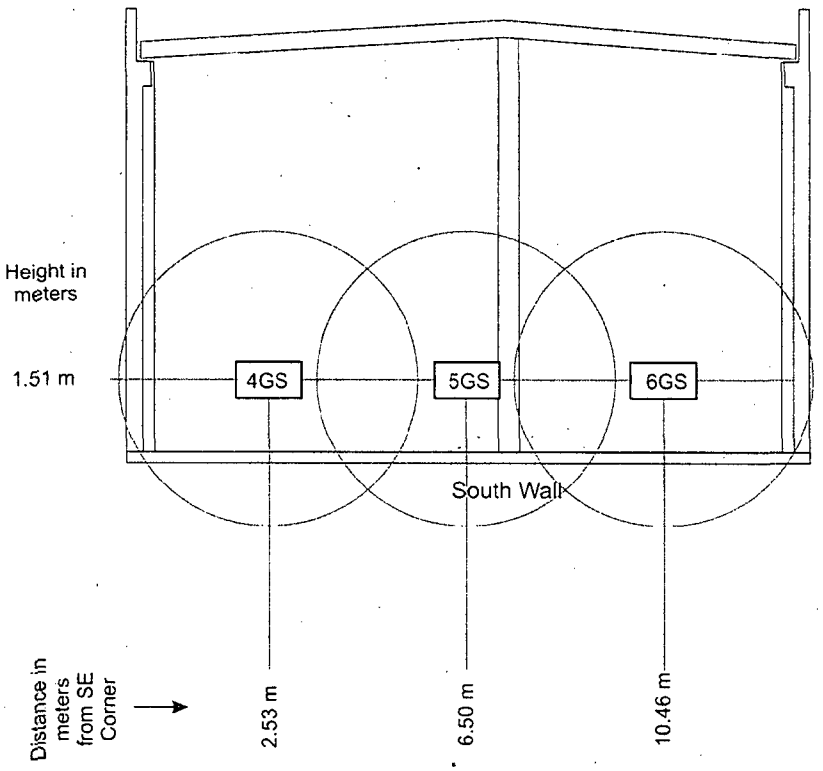


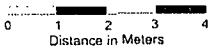
Map F8121003-7, Fuel Storage Building +40' El. (Aux Bldg end)
West Wall (Lower 3 meters) Beta Direct Measurements
F8121003C0019BD to F8121003C0026BD
2.60 sq. meter grid



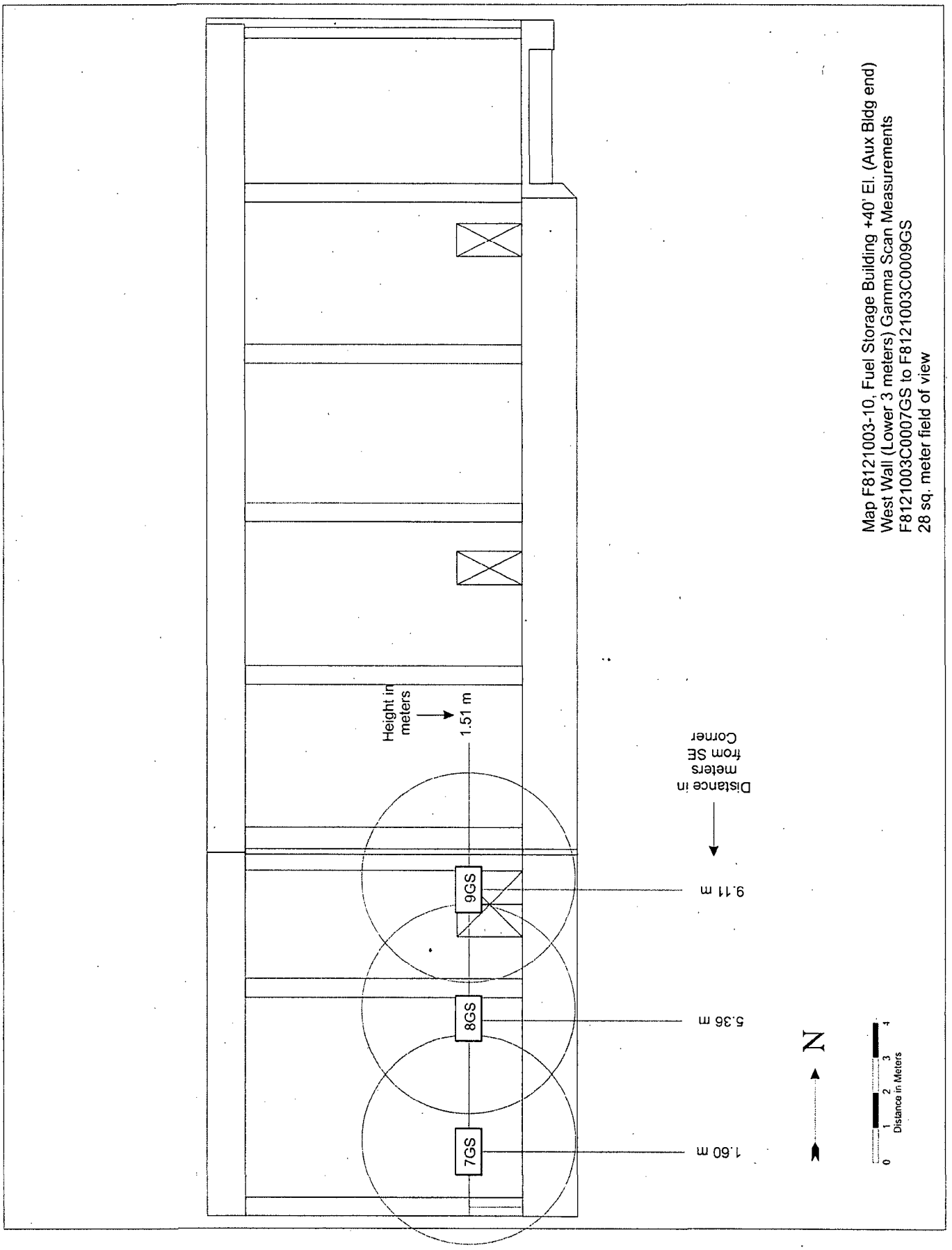


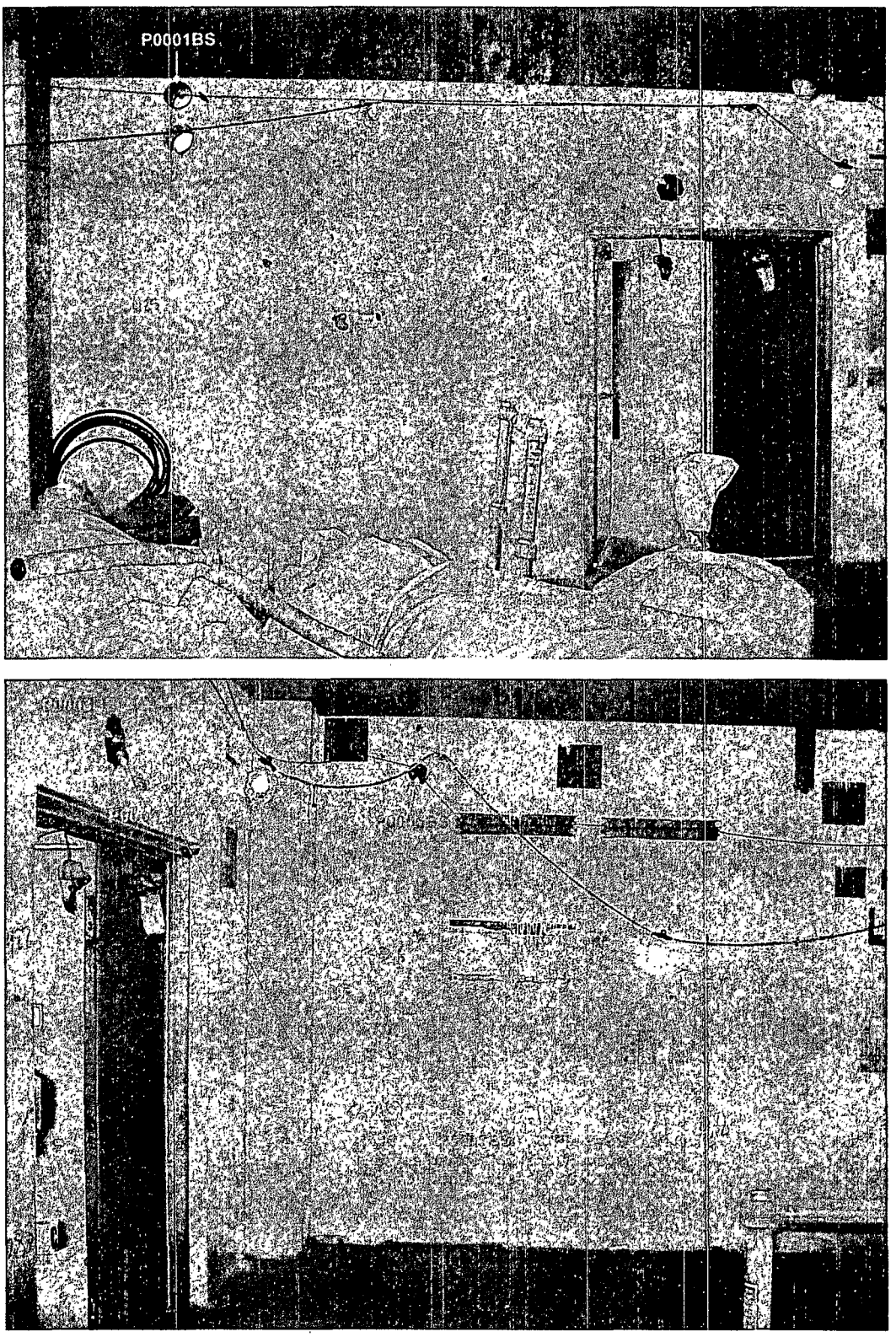
Map F8121003-8, Fuel Storage Building +40' El. (Aux Bldg end)
East Wall (Lower 3 meters) Gamma Scan Measurements
F8121003C0001GS to F8121003C0003GS
28 sq. meter field of view





Map F8121003-9, Fuel Storage Building +40' El. (Aux Bldg end)
South Wall (Lower 3 meters) Gamma Scan Measurements
F8121003C0004GS to F8121003C0006GS
28 sq. meter field of view


Map F8121003-10, Fuel Storage Building +40' El. (Aux Bldg end)
West Wall (Lower 3 meters) Gamma Scan Measurements
F8121003C0007GS to F8121003C0009GS
28 sq. meter field of view
Height in meters
1.51 m
Distance in meters from SE Corner
9GS
8GS
7GS
9.11 m
5.36 m
1.60 m
N
0
1
2
3
4
Distance in Meters



Map F8121003-11, Fuel Storage Building +40' El. - Aux Bldg end Lower Wall (10 ft) Penetration Scan Measurements F8121003P0001BS to F8121003P0005BS

Attachment 2

Instrumentation

July 22, 2008

Survey Unit F8121003

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; 189089	43-68B; 161406	433	1,033
M2350; 175834	43-116-1B; 190642	796	3,258
Tennelec; 0401171	N/A	5.88 dpm α, 11.71 dpm β	N/A

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Concrete – 1,310 dpm/100 cm^2 Cs-137, Concrete – 943 dpm/100 cm^2 Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
Investigation Criteria - Direct	146,200
Investigation Criteria – Scan	146,200
Investigation Criteria – Scan (ISOCS average activity - 28 sq. meter field of view)	23,900
$DCGL_W$	43,000
$DCGL_{EMC}$	146,200

Attachment 3

Investigation

July 22, 2008

Survey Unit F8121003

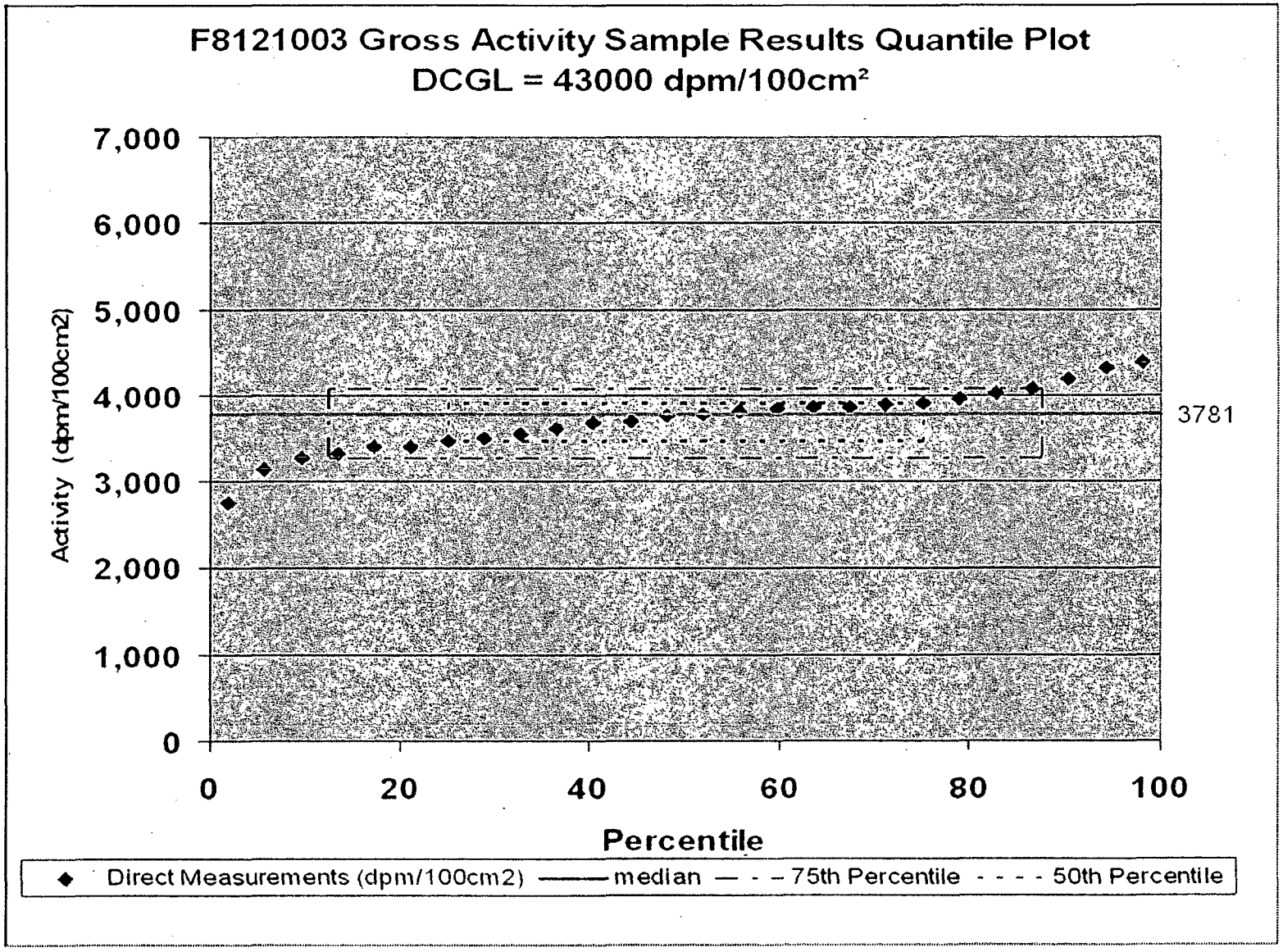
(none required)

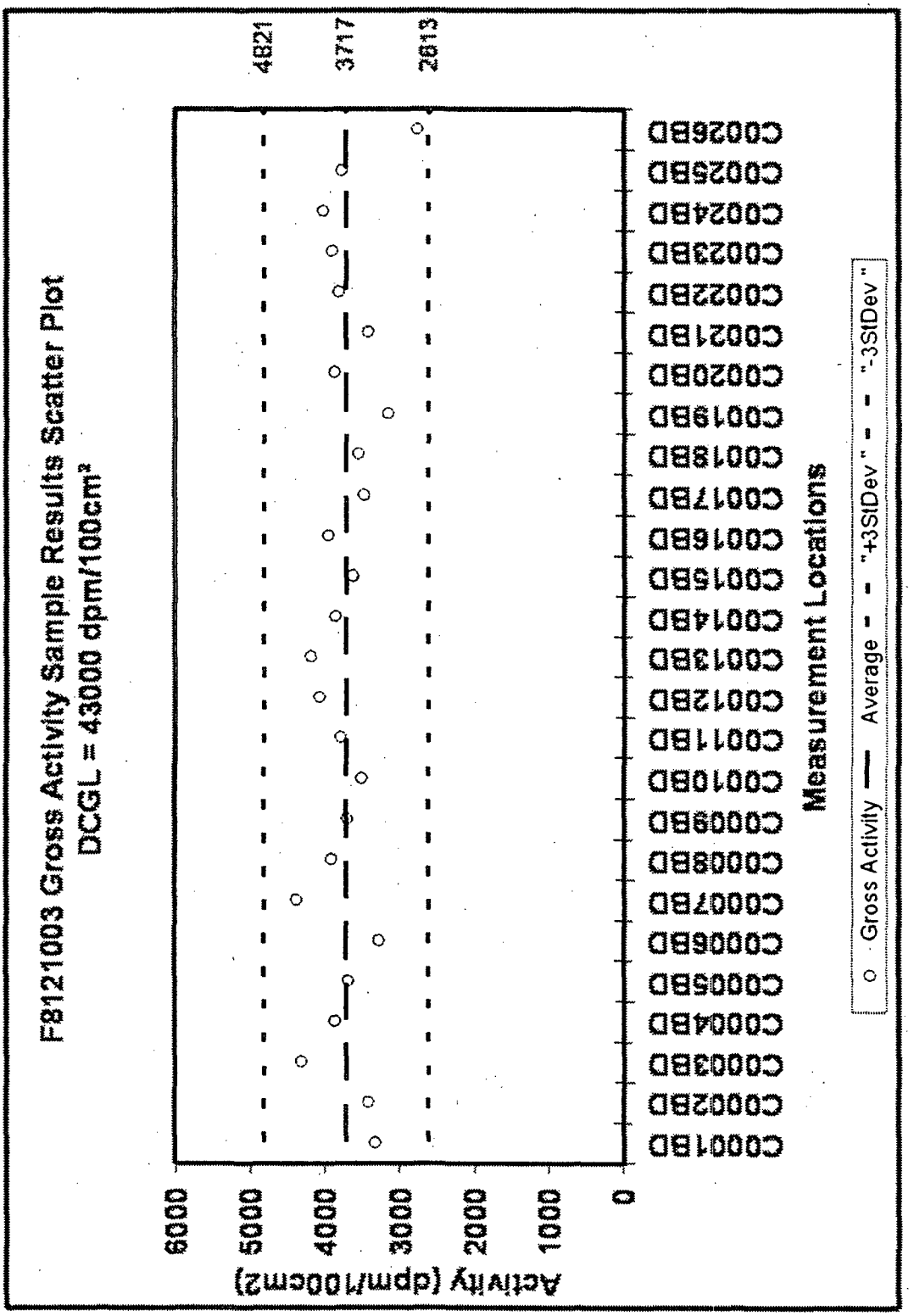
Attachment 4

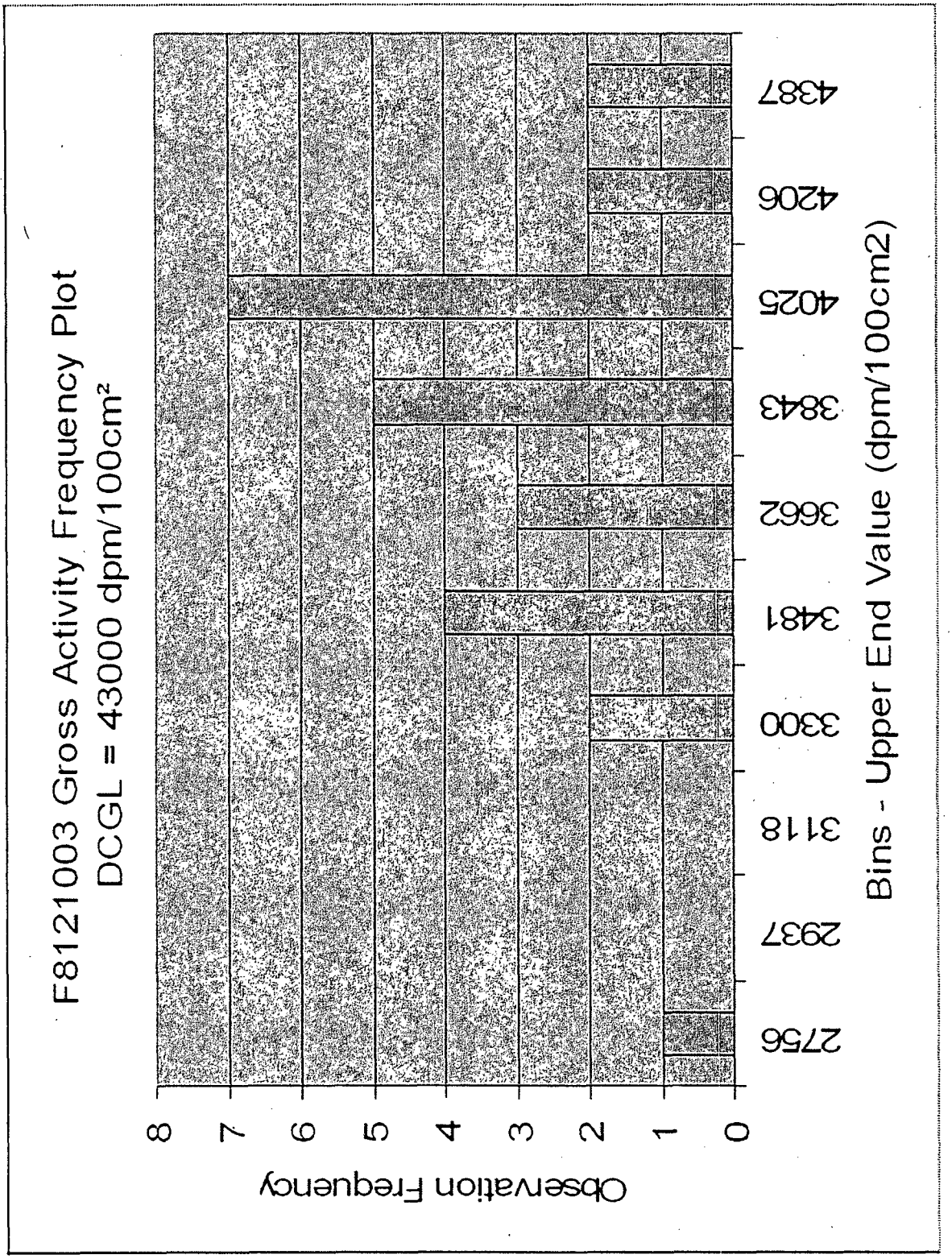
Data Assessment

July 22, 2008

Survey Unit F8121003


F8121003 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0
20
40
60
80
100
Percentile
3781
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8121003 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
4821
3717
2613
Activity (dpm/100cm2)
6000
5000
4000
3000
2000
1000
0
C00026BD
C00025BD
C00024BD
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"


F8121003 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
6
7
8
2756
2937
3118
3300
3481
3662
3843
4025
4206
4387
Bins - Upper End Value (dpm/100cm2)