Rancho Seco

Final Status Survey Summary Report

July 23, 2008

Fuel Storage Building (+) 40' El., Auxiliary Bldg. End, Upper Walls & Interior Roof

Survey Unit F8121006

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FSS Engineer

Reviewed By: R T Duchac Date: 9/14/08

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Approved By: E-T-S Date: 2-6-09

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8121006, Fuel Storage Building (+) 40' El., Auxiliary Bldg. End, Upper Walls & Interior Roof

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 244 m^2 were scanned for approximately 55% 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 Building (+) 40' El., Auxiliary Bldg. End, Upper Walls & Interior Roof
Survey Unit:	1006	Structure Surface
Class:	2	LTP Table 5-4
SU Area (m^2)**:**	446.1	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	43,000	Gross Activity DCGL
Area Factor:	N/A	Class 2
Design DCGLemc (dpm/100 cm^2)**:**	N/A	Class 2
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)**:**	31.9	Class 2
Scan Area (m^2)**:**	244	
Scan Coverage (%):	55%	Class 2
$Z_{1-\alpha}$ **:**	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 2
Grid Spacing L:	5.6	Class 2

Survey Results:

A total of 14 direct measurements were made in F8121006. 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 < 834 dpm/100 cm^2 Co-60 and < 1,240 dpm/100 cm^2 to 528 dpm/100 cm^2 Cs-137. 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)
F8121006-C0001BD	1,743
F8121006-C0002BD	1,717
F8121006-C0003BD	2,028
F8121006-C0004BD	2,148
F8121006-C0005BD	2,080
F8121006-C0006BD	1,624
F8121006-C0007BD	1,950
F8121006-C0008BD	1,795
F8121006-M0009BD	966
F8121006-M0010BD	797
F8121006-M0011BD	812
F8121006-M0012BD	806
F8121006-M0013BD	815
F8121006-M0014BD	880
Mean:	1,440
Median:	1,670
Standard Deviation:	554
Range:	797 – 2,148

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8121006C0001SM	9.38
F8121006C0002SM	-0.95
F8121006C0003SM	4.22
F8121006C0004SM	9.38
F8121006C0005SM	1.64
F8121006C0006SM	6.8
F8121006C0007SM	8.09
F8121006C0008SM	5.51
F8121006M0009SM	-3.53
F8121006M0010SM	-0.95
F8121006M0011SM	5.51
F8121006M0012SM	-0.95
F8121006M0013SM	-2.24
F8121006M0014SM	-0.95
Mean:	2.93
Median:	2.93
Standard Deviation:	4.56
Range:	-3.53 to 9.38

Survey Unit Data Assessment:

The survey design required 14 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):	14	
Median (dpm/100 cm²):	1,670	
Mean (dpm/100 cm²):	1,440	
Direct Measurement Standard Deviation (dpm/100 cm²):	554	
Total Standard Deviation (dpm/100 cm²):	554	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	2,148	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	14	
S+ Value:	14	
Critical Value:	10	
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 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 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 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.

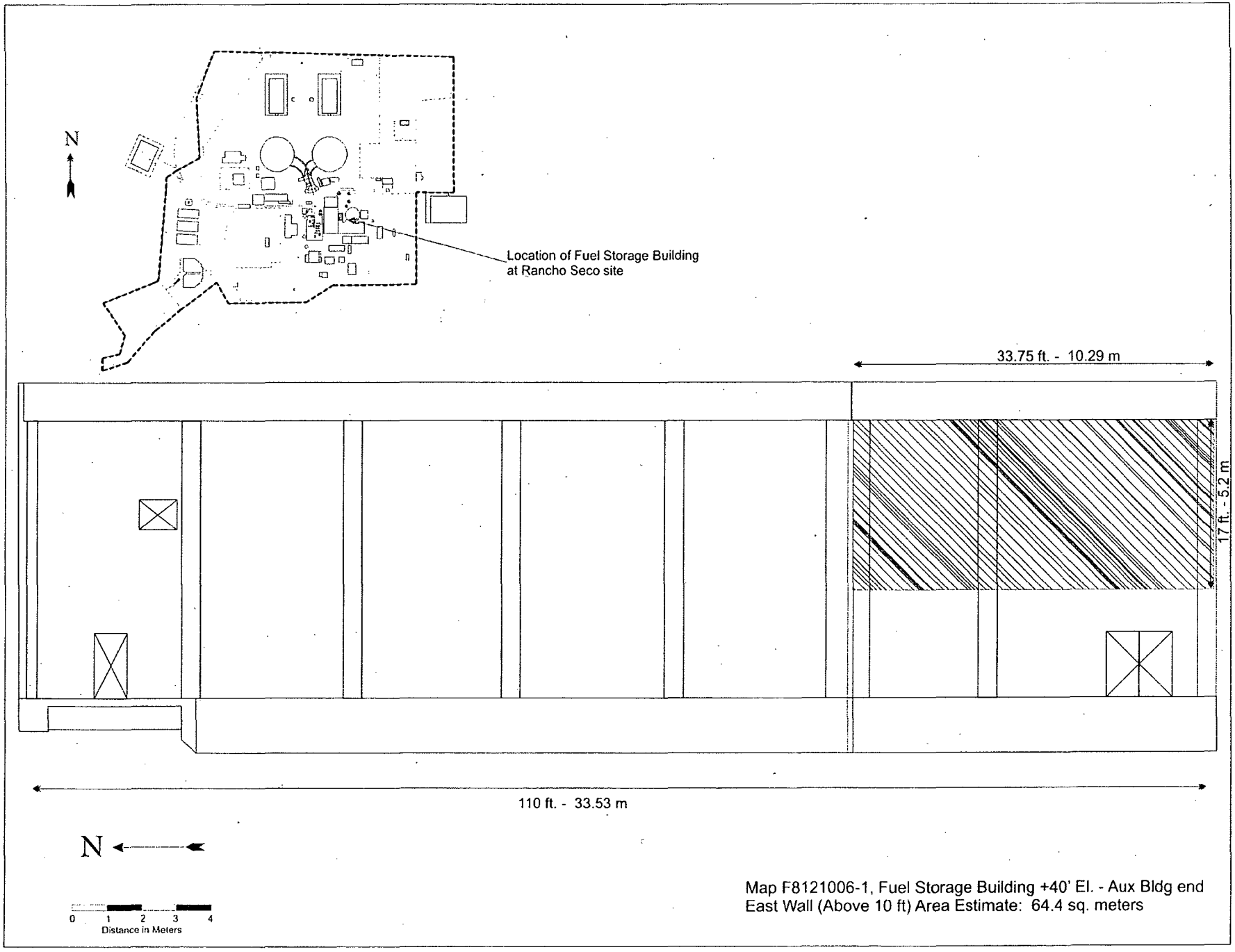
It is concluded that survey unit F8121006 meets the release criteria of 10CFR20.1402.

Attachment 1

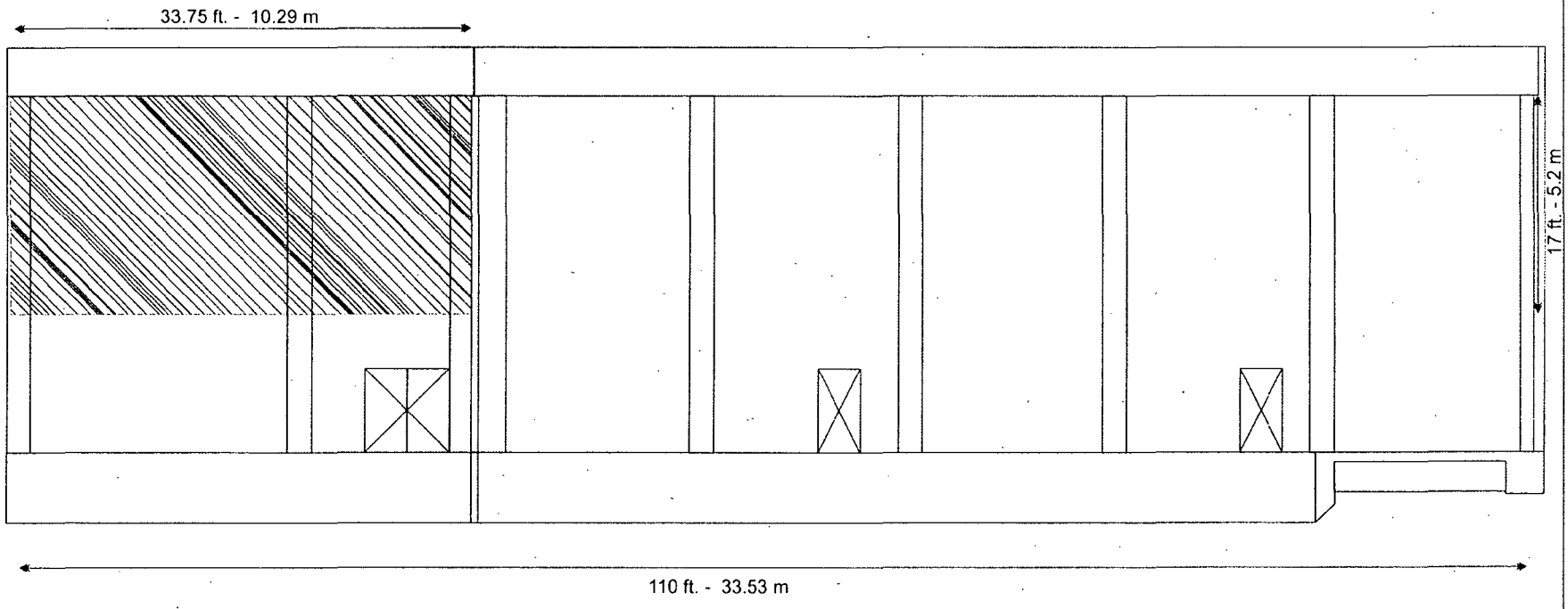
Maps

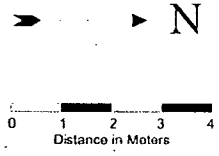
July 23, 2008

Survey Unit F8121006

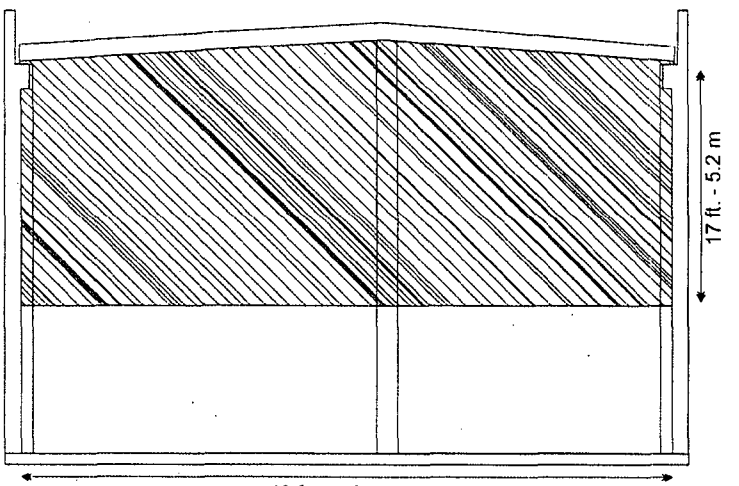


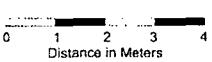
Map F8121006-1, Fuel Storage Building +40' El. - Aux Bldg end
East Wall (Above 10 ft) Area Estimate: 64.4 sq. meters



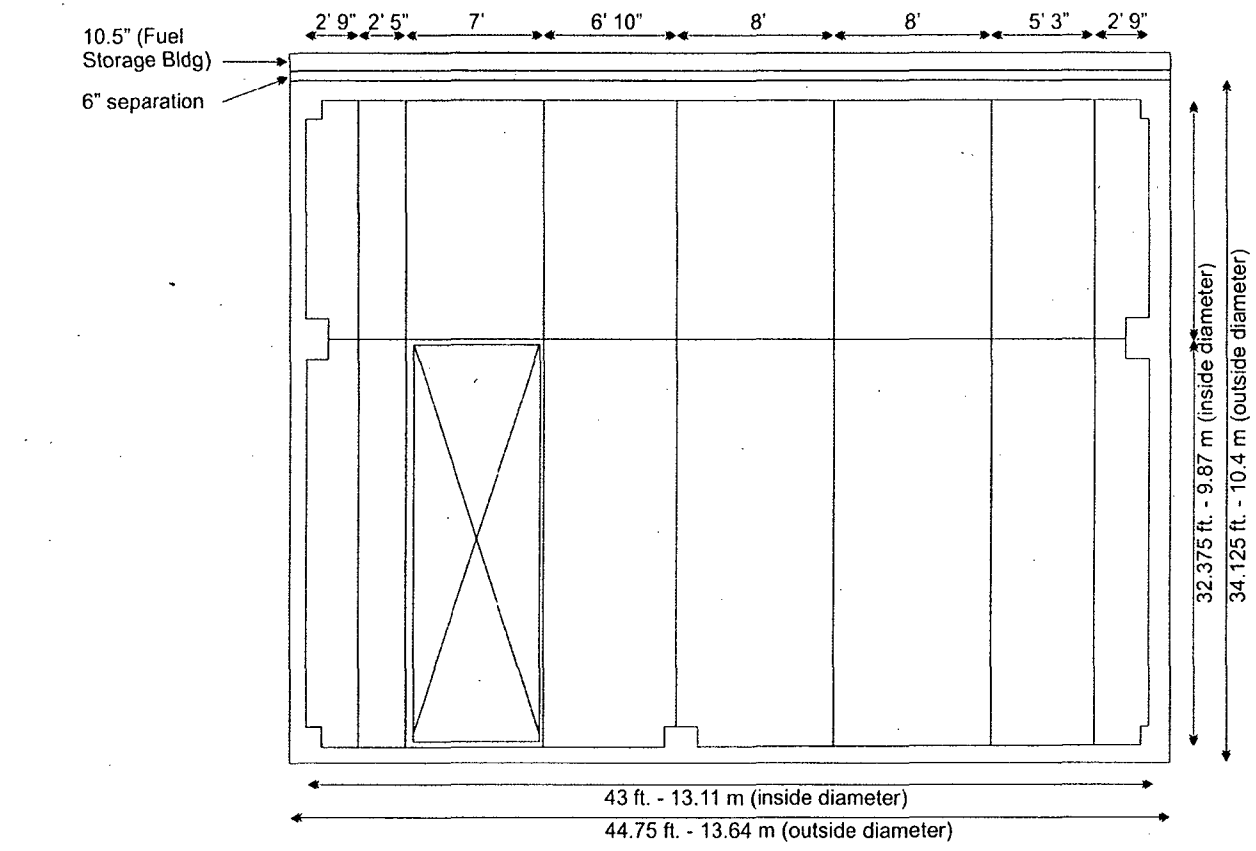


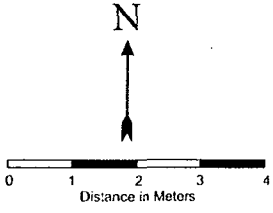
Map F8121006-2, Fuel Storage Building +40' El. - Aux Bldg end
West Wall (Above 10 ft) Area Estimate: 64.7 sq. meters



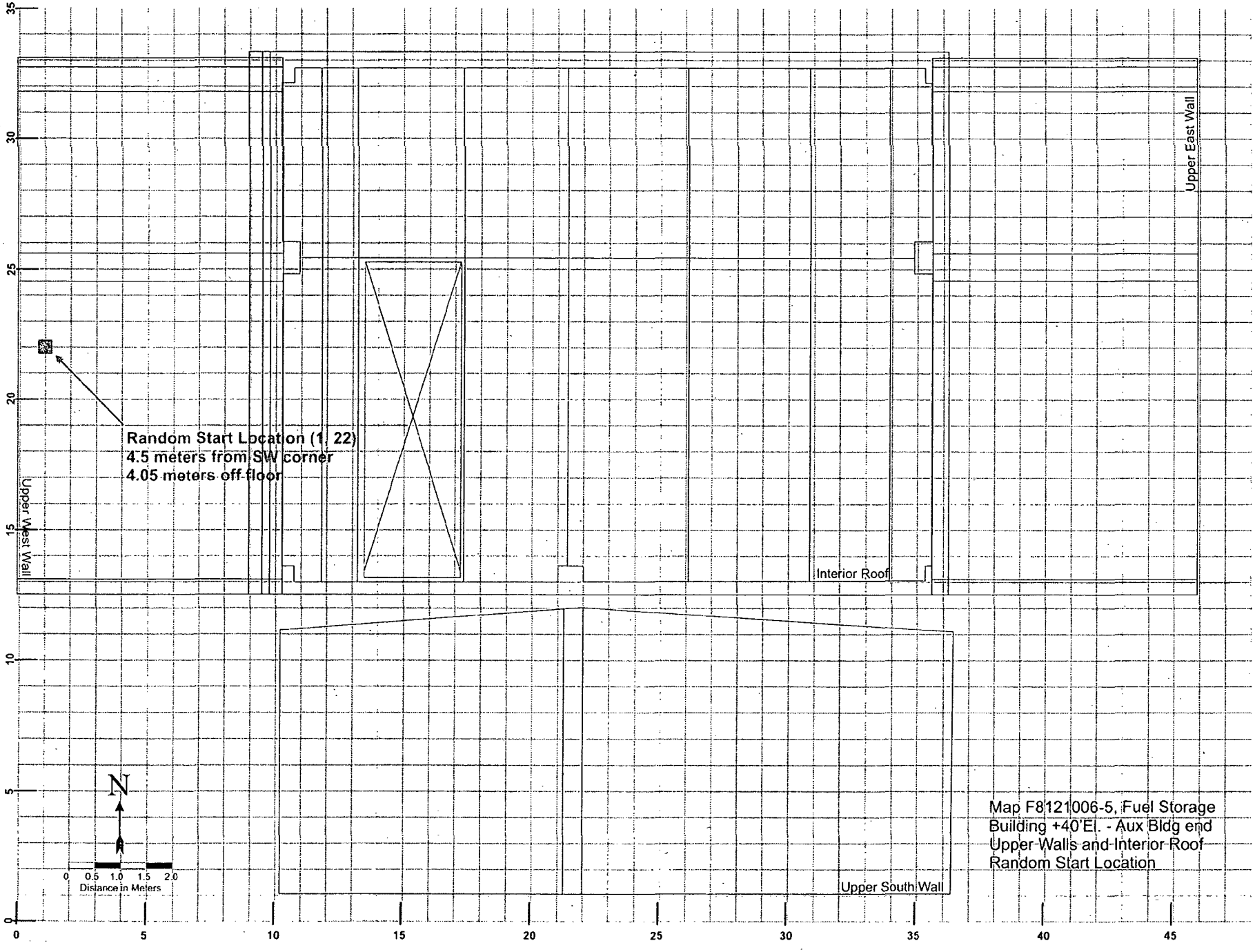


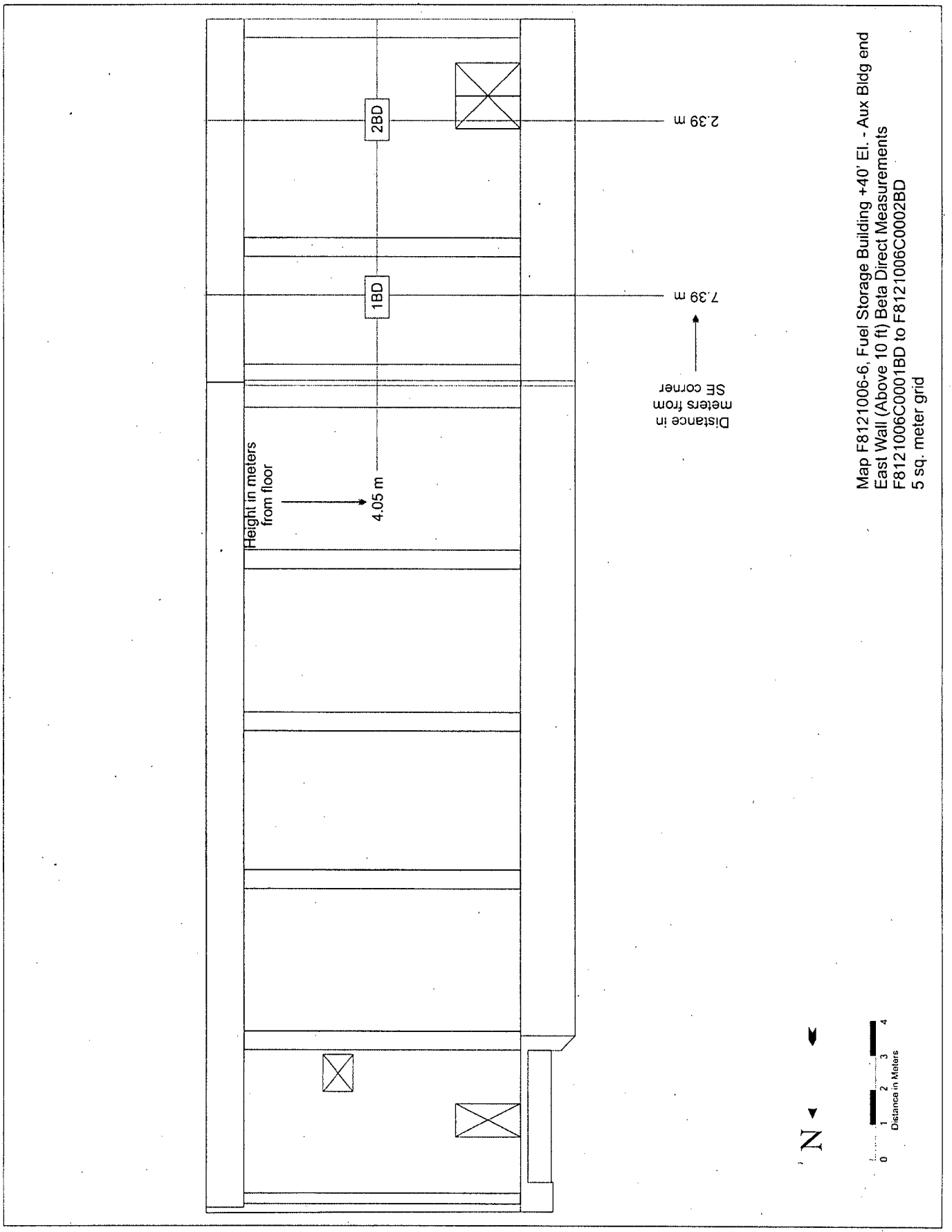
Map F8121006-3, Fuel Storage Building +40' El. (Aux Bldg end)
South Wall (Above 10 ft.) Area Estimate: 76 sq. meters

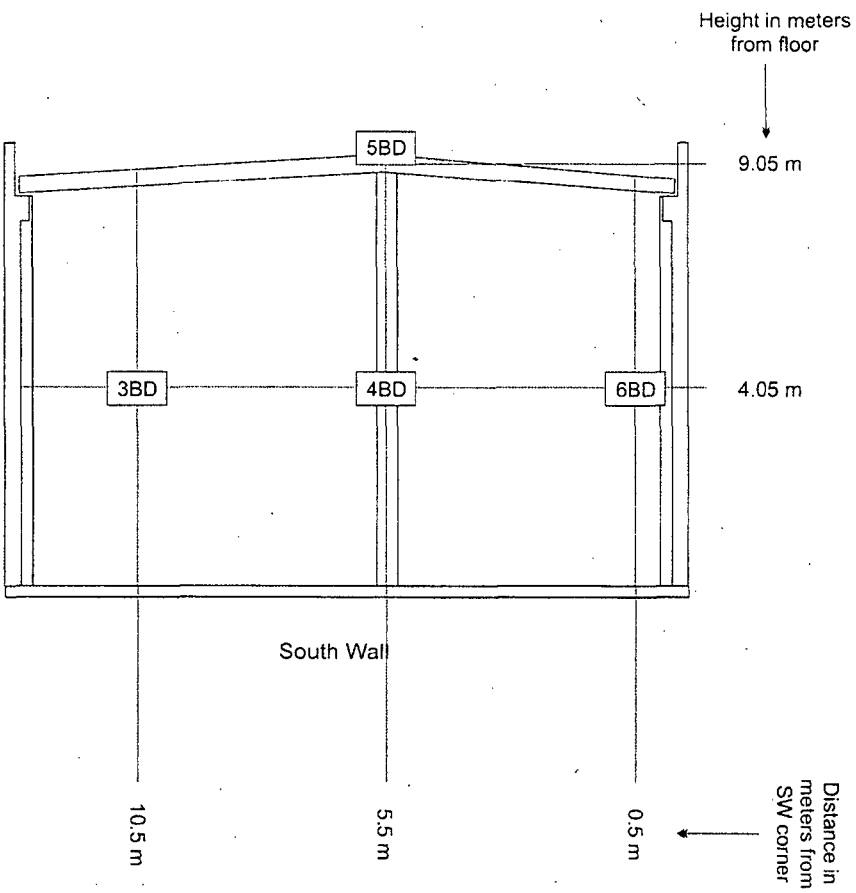


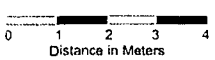


Map F8121006-4, Fuel Storage Building +40' El. (Aux Bldg end)
Interior Roof Area Estimate: 241 sq. meters

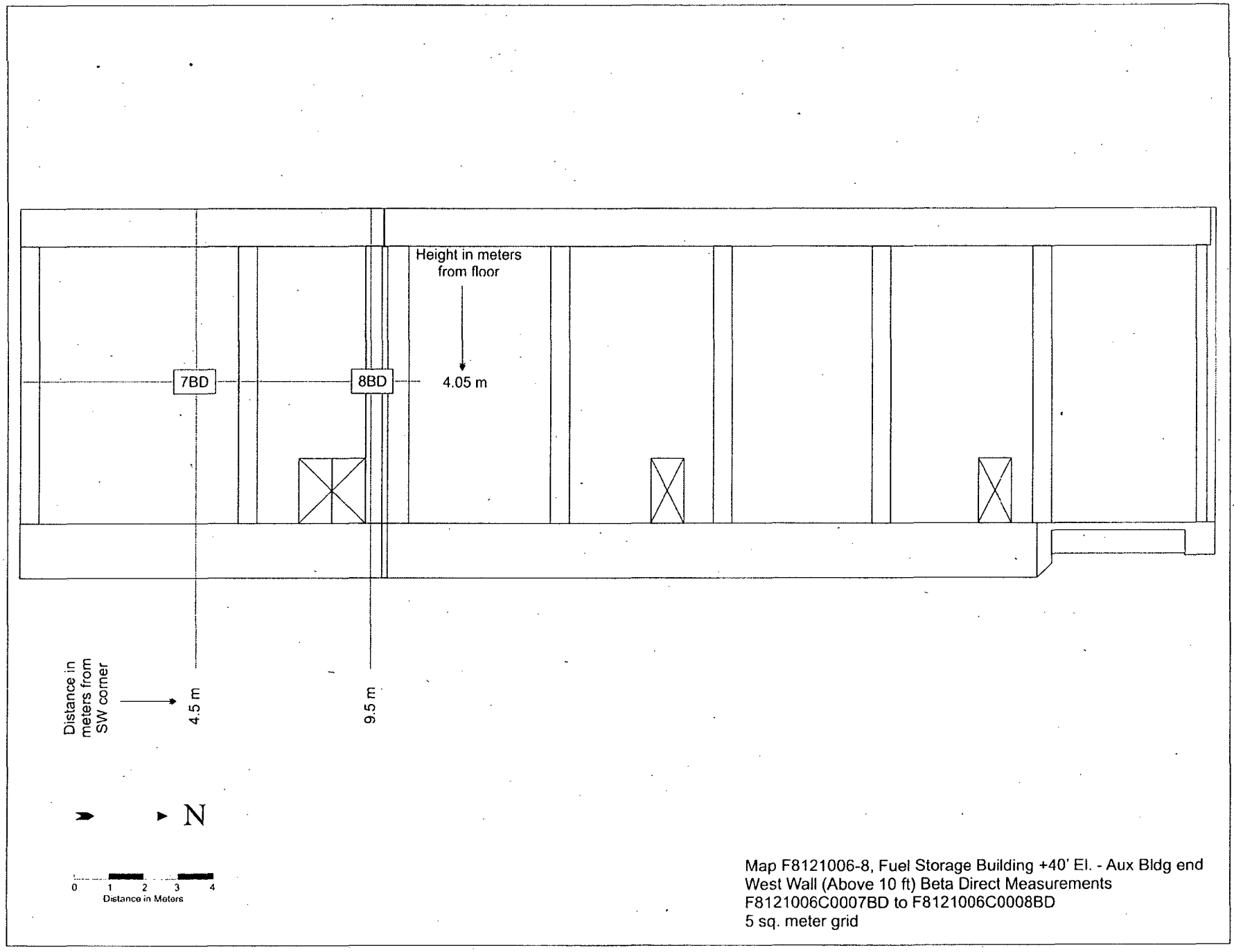

Random Start Location (1, 22)
4.5 meters from SW corner
4.05 meters off-floor
Upper West Wall
Upper East Wall
Interior Roof
Upper South Wall
N
0 0.5 1.0 1.5 2.0
Distance in Meters
Map F8121006-5, Fuel Storage Building +40'El. - Aux Bldg end Upper Walls and Interior Roof Random Start Location


Map F8121006-6, Fuel Storage Building +40' El. - Aux Bldg end East Wall (Above 10 ft) Beta Direct Measurements
F8121006C0001BD to F8121006C0002BD
5 sq. meter grid
2BD
1BD
2.39 m
7.39 m
Distance in meters from SE corner
Height in meters from floor
4.05 m
N
0 1 2 3 4
Distance in Meters

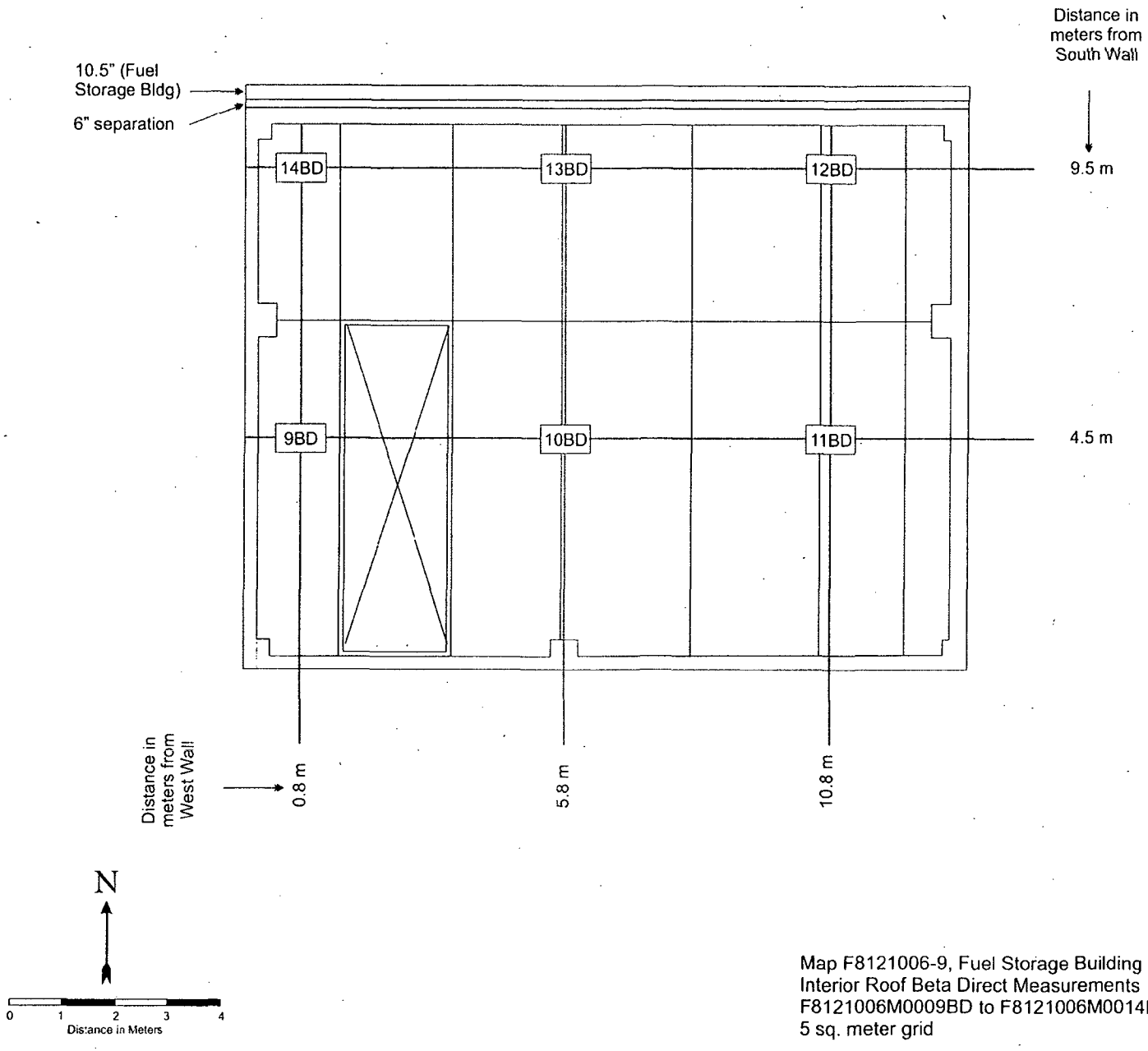




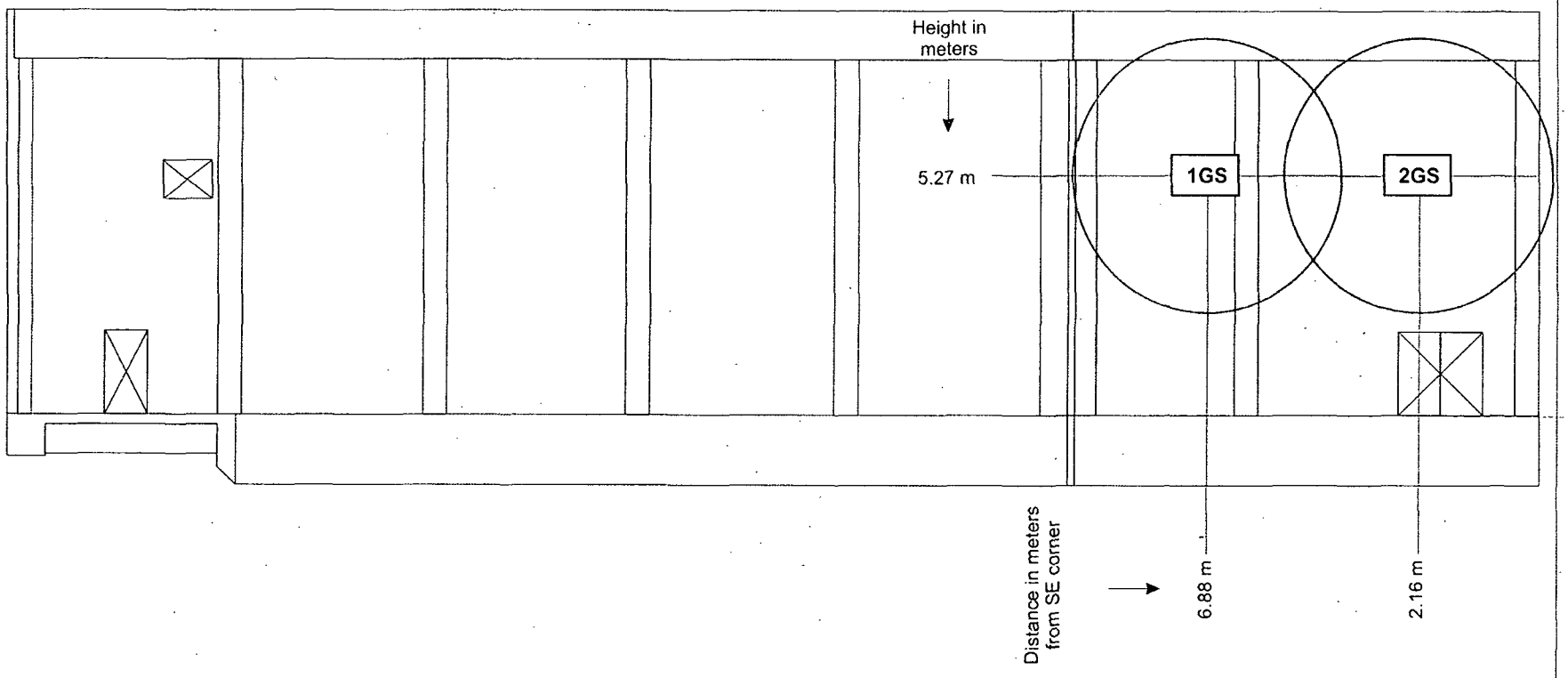
Map F8121006-7, Fuel Storage Building +40' El. - Aux Bldg end South Wall (Above 10 ft) Beta Direct Measurements
F8121006C0003BD to F8121006C0006BD
5 sq. meter grid

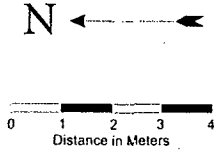


Map F8121006-8, Fuel Storage Building +40' El. - Aux Bldg end West Wall (Above 10 ft) Beta Direct Measurements
F8121006C0007BD to F8121006C0008BD
5 sq. meter grid

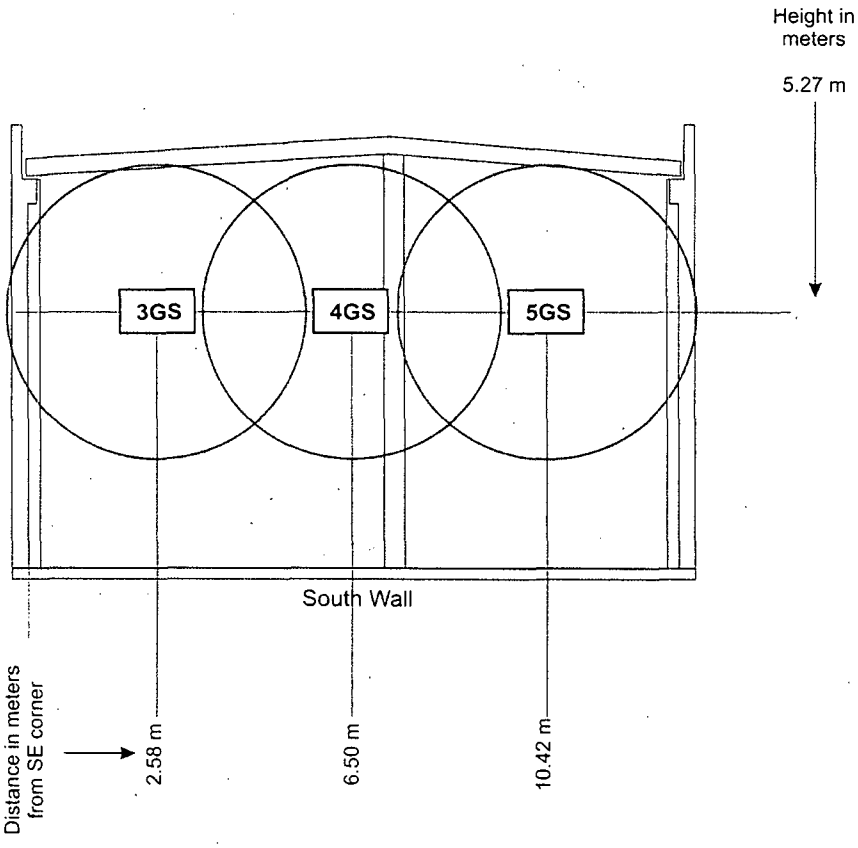


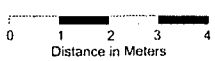
Map F8121006-9, Fuel Storage Building +40' El. - Aux Bldg end
Interior Roof Beta Direct Measurements
F8121006M0009BD to F8121006M0014BD
5 sq. meter grid



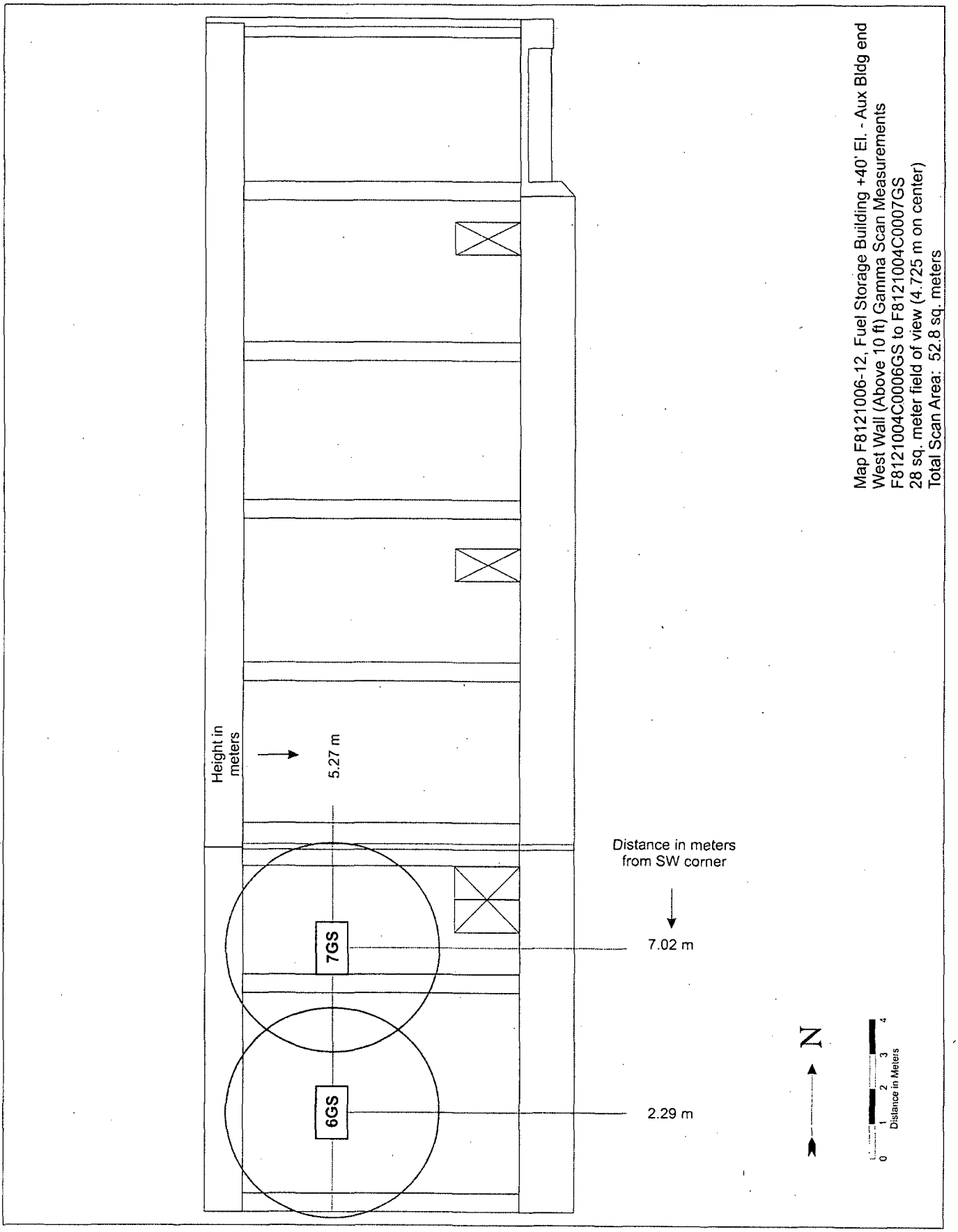


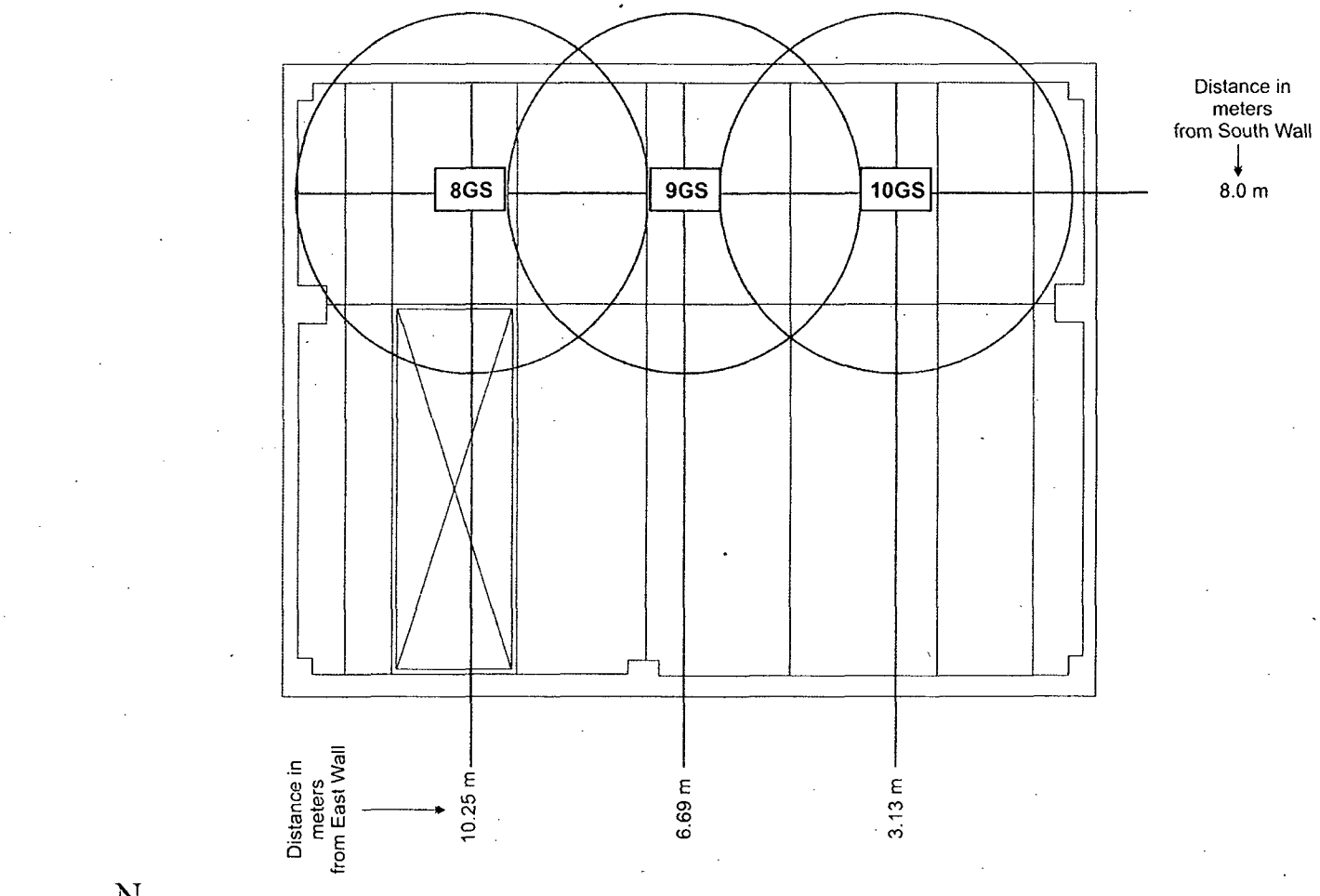
Map F8121006-10, Fuel Storage Building +40' El. - Aux Bldg end
East Wall (Above 10 ft.) Gamma Scan Measurements
F8121004C0001GS to F8121004C0002GS
28 sq. meter field of view (4.725 m on center)
Total Scan Area: 52.8 sq. meters

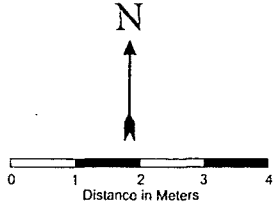




Map F8121006-11, Fuel Storage Building +40' El. - Aux Bldg end South Wall (Above 10 ft) Gamma Scan Measurements
F8121004C0003GS to F8121004C005GS
28 sq. meter field of view, (3.92 m on center)
Total Scan Area: 70.9 sq. meters


Map F8121006-12, Fuel Storage Building +40' El. - Aux Bldg end
West Wall (Above 10 ft) Gamma Scan Measurements
F81210004C0006GS to F8121004C0007GS
28 sq. meter field of view (4.725 m on center)
Total Scan Area: 52.8 sq. meters
Height in meters
5.27 m
Distance in meters from SW corner
7.02 m
2.29 m
7GS
6GS
N
0 1 2 3 4
Distance in Meters





Map F8121006-13, Fuel Storage Building +40' El. - Aux Bldg end
Interior Roof Gamma Scan Measurements
F8120006M0008GS to F8120006M0010GS
28 sq. meter field of view (3.56 m on center)
Total Scan Area: 67.5 sq. meters

Attachment 2

Instrumentation

July 23, 2008

Survey Unit F8121006

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; 161415[1]	433	1,033
M2350; 149789	43-68B; 161415[2]	257	612
Tennelec; 0401171	N/A	5.88 dpm α, 11.71 dpm β	N/A

[1]Concrete Surfaces
[2]Metal Surfaces

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Concrete – 1,240 dpm/100 cm^2 Cs-137, Concrete – 834 dpm/100 cm^2 Co-60
ISOCS	N/A	1983920	Metal – 850 dpm/100 cm^2 Cs-137, Metal – 652 dpm/100 cm^2 Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
Investigation Criteria - Direct	43,000
Investigation Criteria – Scan (ISOCS average activity – 28 sq. meter field of view)	1,600 Cs-137
$DCGL_W$	43,000
$DCGL_{EMC}$	N/A

Attachment 3

Investigation

July 23, 2008

Survey Unit F8121006

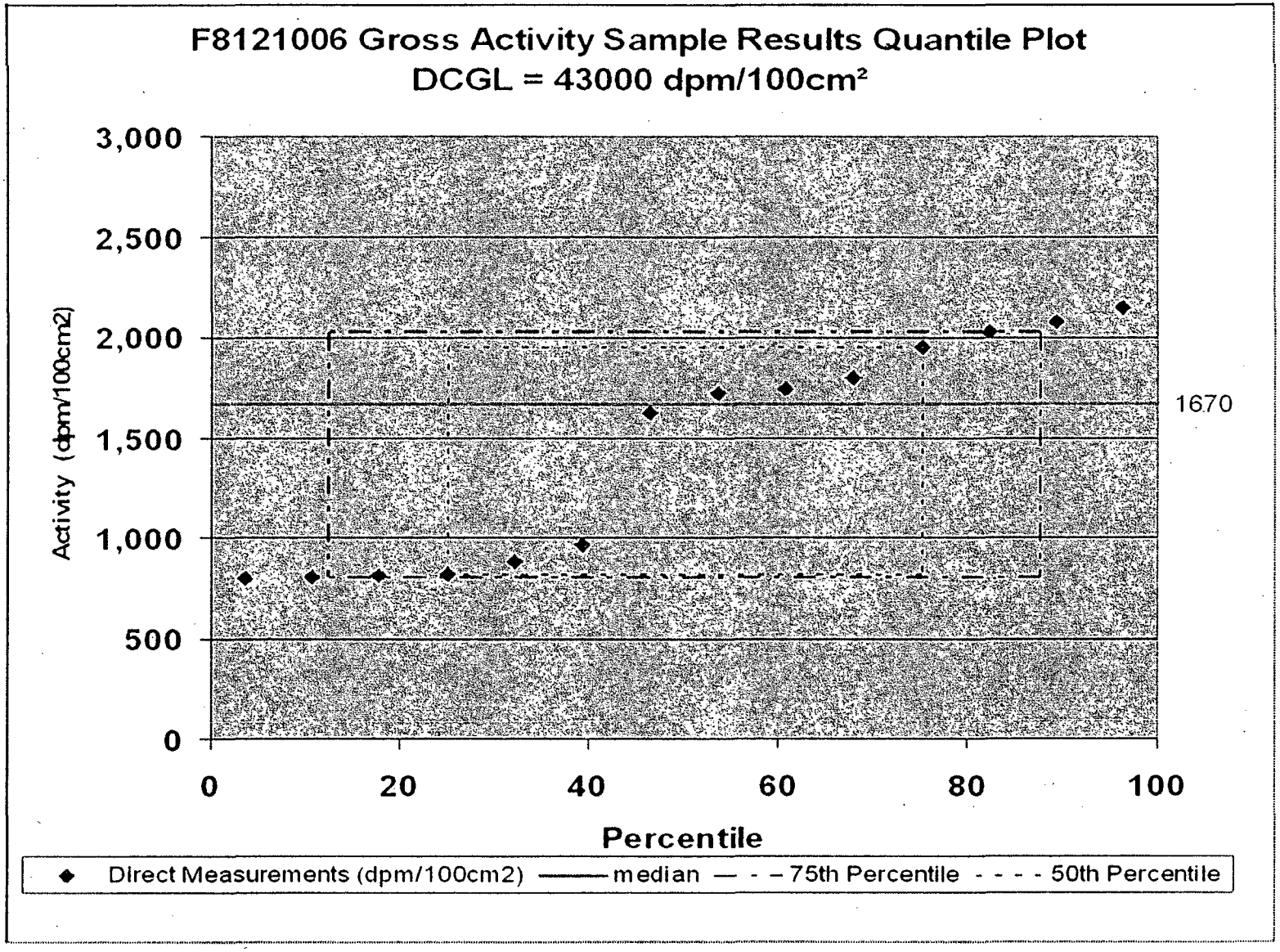
(none required)

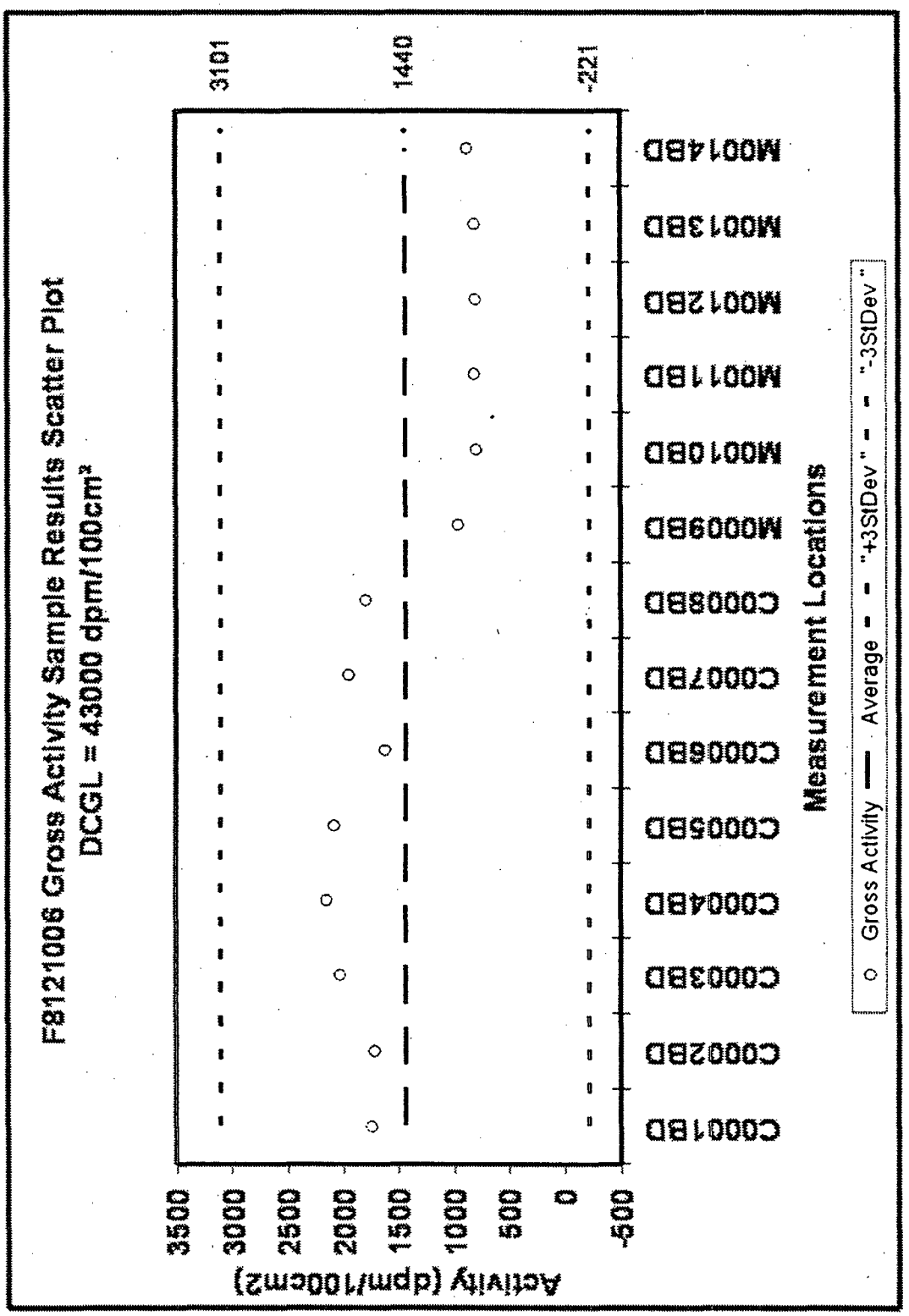
Attachment 4

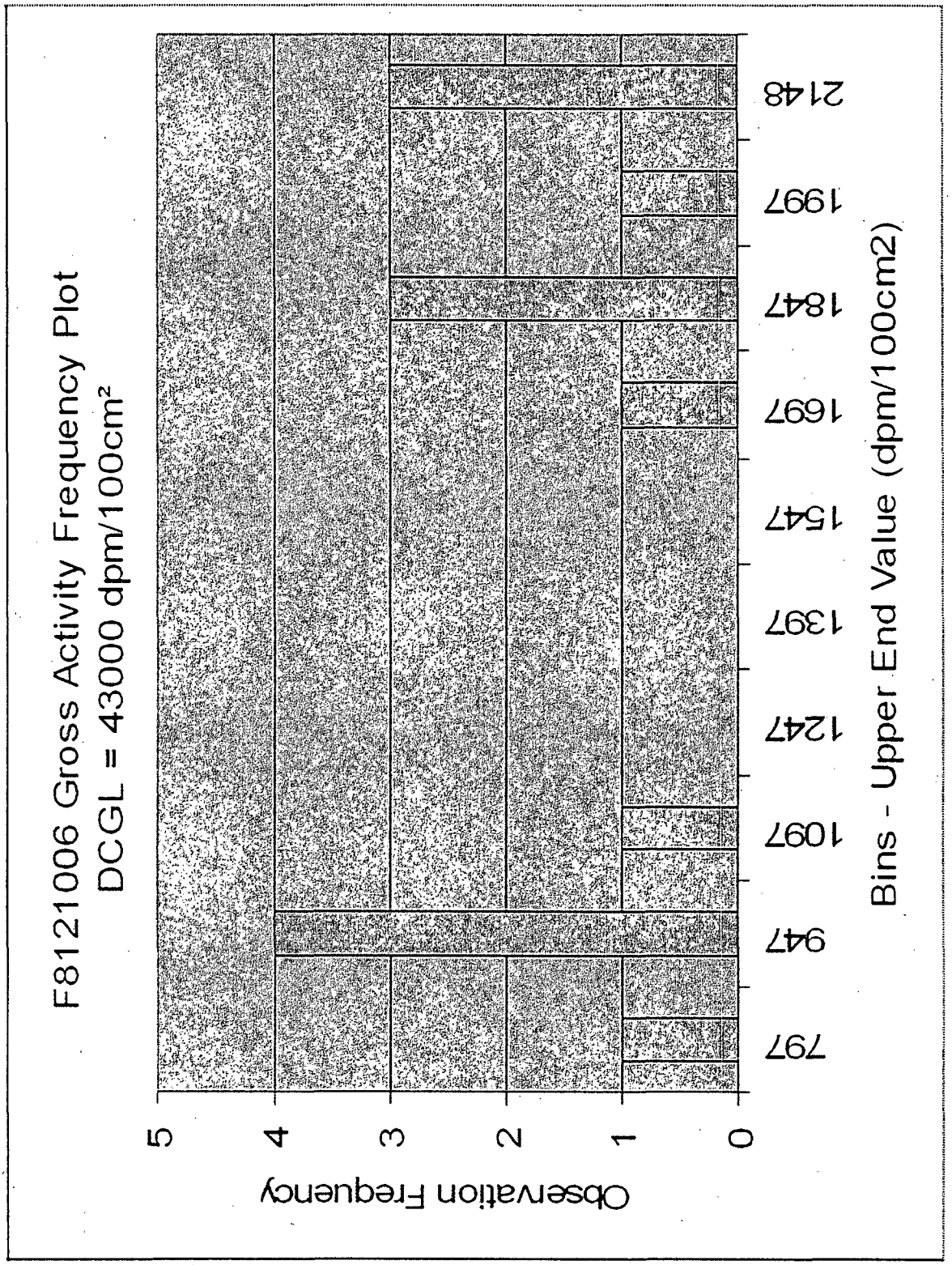
Data Assessment

July 23, 2008

Survey Unit F8121006


F8121006 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
3,000
2,500
2,000
1,500
1,000
500
0
0
20
40
60
80
100
Percentile
1670
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8121006 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
3101
1440
-221
C0001BD
C0002BD
C0003BD
C0004BD
C0005BD
C0006BD
C0007BD
C0008BD
M0009BD
M0010BD
M0011BD
M0012BD
M0013BD
M0014BD
Measurement Locations
Activity (dpm/100cm2)
3500
3000
2500
2000
1500
1000
500
0
-500
Gross Activity
Average
"+3StDev"
"-3StDev"


F8121006 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
797
947
1097
1247
1397
1547
1697
1847
1997
2148
Bins - Upper End Value (dpm/100cm2)