

Rancho Seco

Final Status Survey Summary Report

July 16, 2008

Fuel Storage Building (+) 40' El. Upper Walls & Interior Roof

Survey Unit F8121004

Prepared By: J. Anderson Date: 9/9/2008
FSS Engineer

Reviewed By: Robert F. Decker Date: 9/15/08
Lead FSS Engineer

Approved By: E. J. B. Date: 2-6-09
Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8121004, Fuel Storage Building (+) 40' El. 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 cm² and a maximum value of 200,000,000 dpm/100 cm². Direct measurements on the +40' elevation showed a mean gross activity level of 5,942 dpm/100 cm² and a maximum value of 19,357 dpm/100 cm². Direct measurements on the building exterior showed a mean gross activity level of 1,408 dpm/100 cm² and a maximum value of 21,600 dpm/100 cm². 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 576.9 m² were scanned for approximately 68.7% 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. Upper Walls & Interior Roof
Survey Unit:	1004	Structure Surface
Class:	2	LTP Table 5-4
SU Area (m²):	839.9	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm²):	43,000	Gross Activity DCGL
Area Factor:	N/A	Class 2
Design DCGL_{emc} (dpm/100 cm ²):	N/A	Class 2
LBGR (dpm/100 cm²):	29,107	Adjusted
Design Sigma (dpm/100 cm²):	4,631	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m²):	60	Class 2
Scan Area (m²):	576.9	
Scan Coverage (%):	68.7%	Class 2
Z_{1-α} :	1.645	
Z_{1-β} :	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:	7.0	Class 2

Survey Results:

A total of 18 direct measurements were made in F8121004. 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 < 906 dpm/100 cm² Co-60 and < 1,260 dpm/100 cm² to 991 dpm/100 cm² Cs-137. Beta scan activity ranged from 2,910 to 5,112 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)
F8121004-C0001BD	1,727
F8121004-C0002BD	1,561
F8121004-C0003BD	1,644
F8121004-C0004BD	1,509
F8121004-C0005BD	1,541
F8121004-C0006BD	1,592
F8121004-C0007BD	1,681
F8121004-C0008BD	2,697
F8121004-C0009BD	1,961
F8121004-C0010BD	2,033
F8121004-M0011BD	803
F8121004-M0012BD	769
F8121004-M0013BD	831
F8121004-M0014BD	741
F8121004-M0015BD	754
F8121004-M0016BD	877
F8121004-M0017BD	748
F8121004-M0018BD	923
Mean:	1,355
Median:	1,525
Standard Deviation:	572
Range:	741 – 2,697

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm²)
F8121004C0001SM	1.64
F8121004C0002SM	6.8
F8121004C0003SM	4.22
F8121004C0004SM	6.8
F8121004C0005SM	2.93
F8121004C0006SM	9.38
F8121004C0007SM	-0.95
F8121004C0008SM	10.68
F8121004C0009SM	4.22
F8121004C0010SM	15.84
F8121004M0011SM	0.34
F8121004M0012SM	-3.53
F8121004M0013SM	11.97
F8121004M0014SM	-3.53
F8121004M0015SM	-2.24
F8121004M0016SM	15.84
F8121004M0017SM	156.61
F8121004M0018SM	88.16
Mean:	18.07
Median:	5.51
Standard Deviation:	40.18
Range:	-3.53 to 156.61

Survey Unit Data Assessment:

The survey design required 18 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):	18	
Median (dpm/100 cm ²):	1,525	
Mean (dpm/100 cm ²):	1,355	
Direct Measurement Standard Deviation	572	
(dpm/100 cm ²):		
Total Standard Deviation (dpm/100 cm ²):	572	Based on samples and backgrounds.
Maximum (dpm/100 cm ²):	2,697	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	18	
S+ Value:	18	
Critical Value:	12	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGL_{emc}:	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 cm² 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.

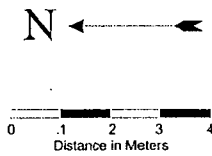
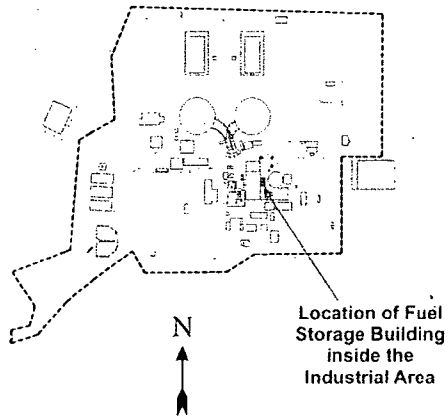
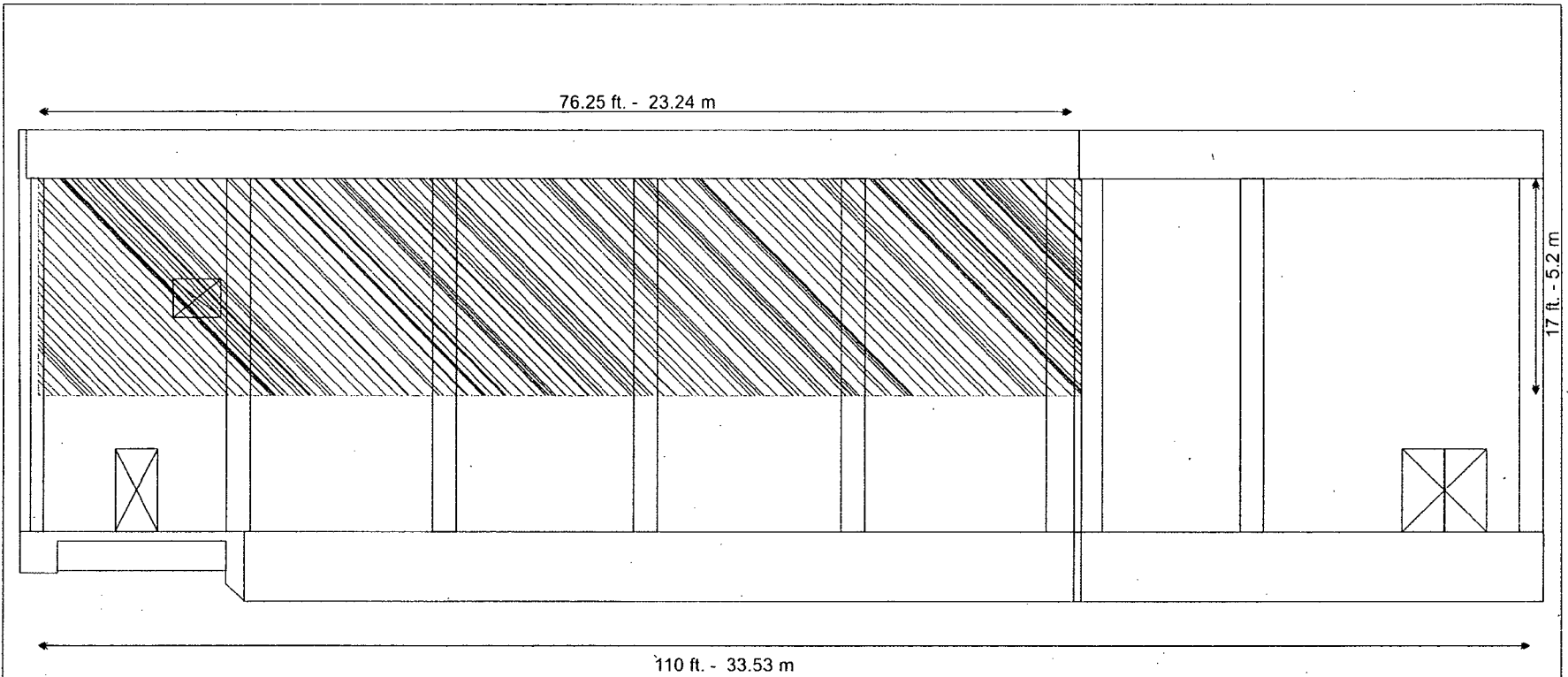
It is concluded that survey unit F8121004 meets the release criteria of 10CFR20.1402.

Attachment 1

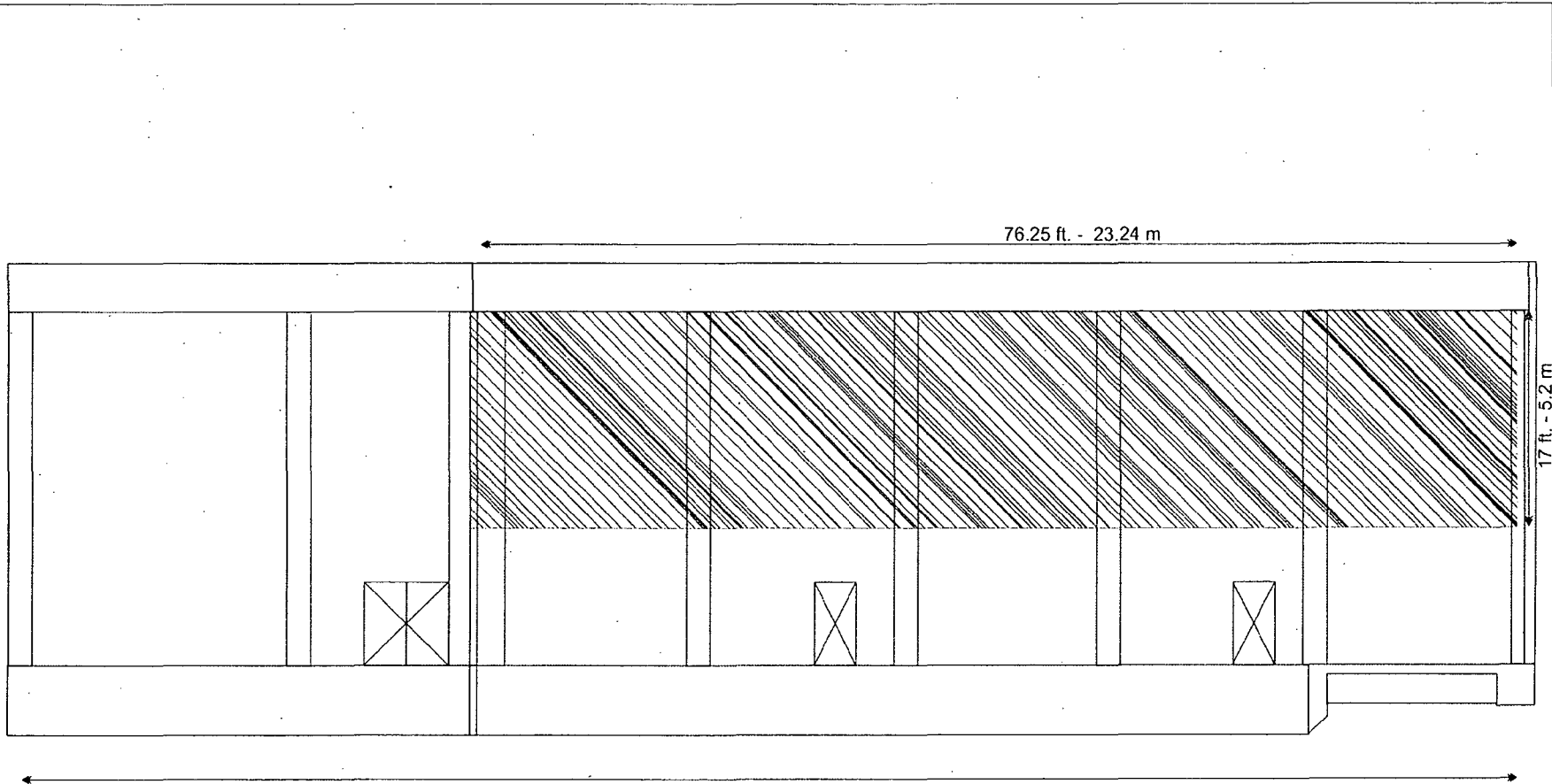
Maps

July 16, 2008

Survey Unit F8121004



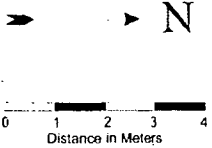
Map F8121004-1, Fuel Storage Building +40' El.
East Wall (Above 10 ft) Area Estimate: 145.6 sq. meters



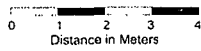
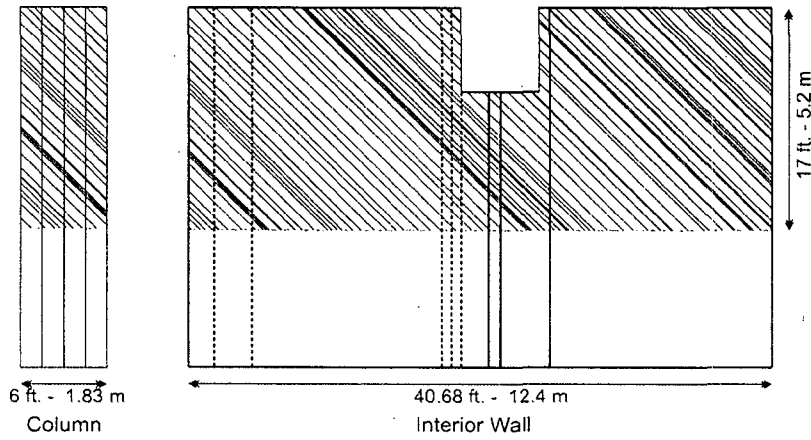
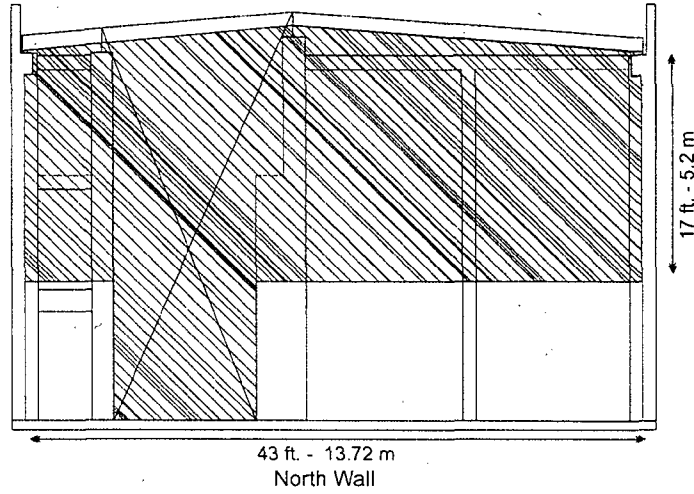
110 ft. - 33.53 m

76.25 ft. - 23.24 m

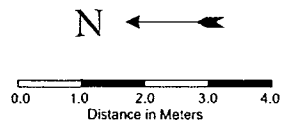
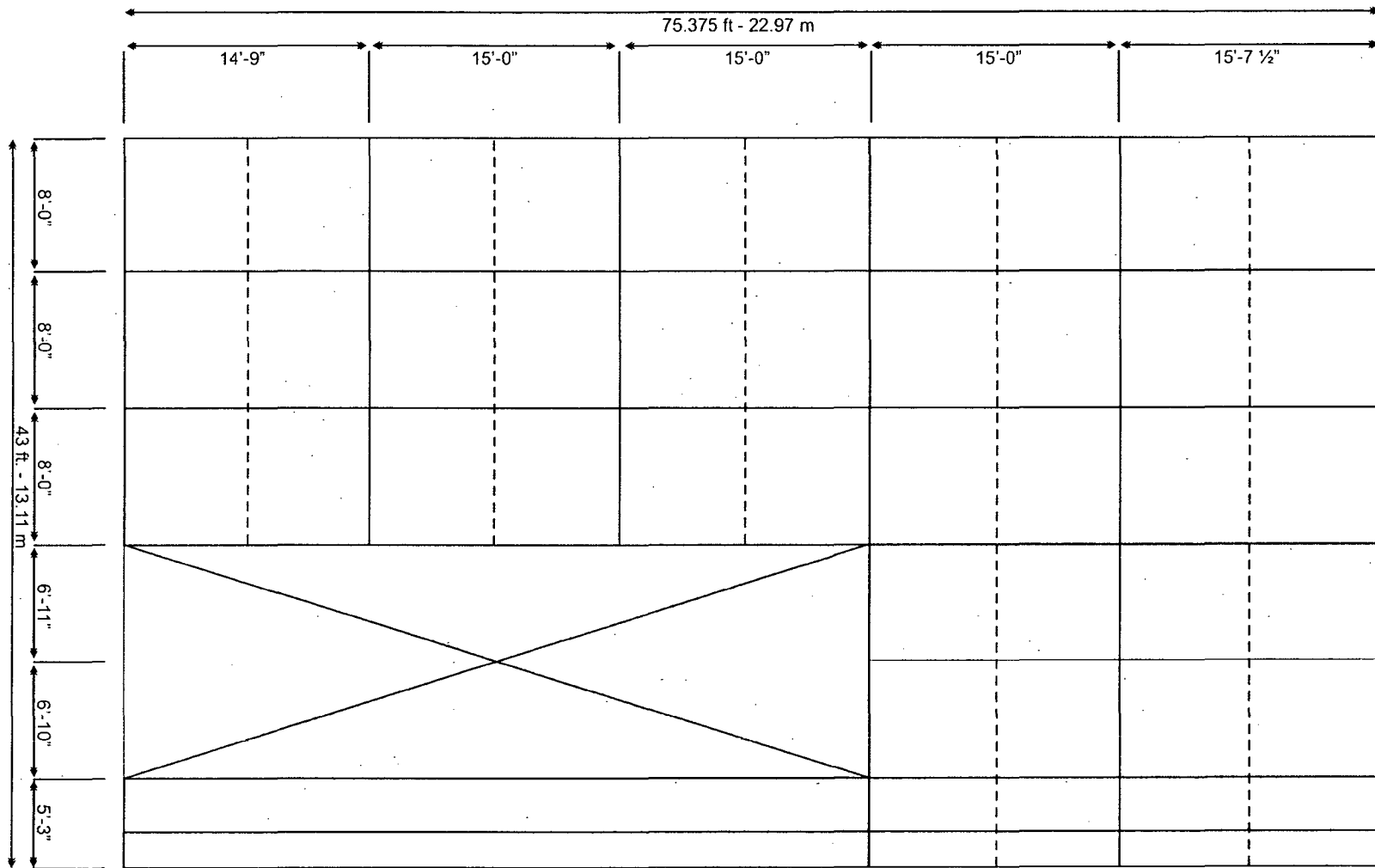
17 ft. - 5.2 m



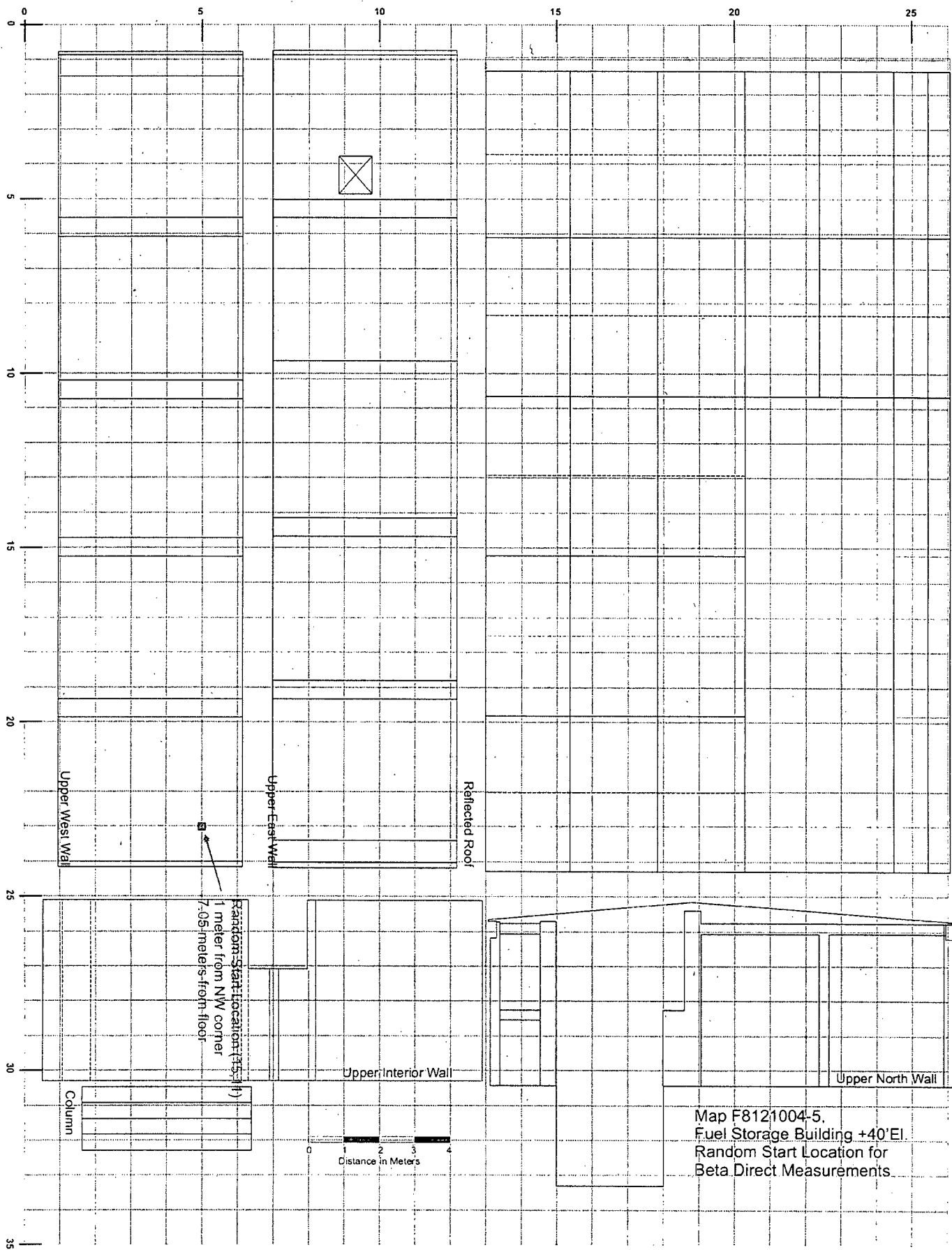
Map F8121004-2, Fuel Storage Building +40' El.
West Wall (Above 10 ft) Area Estimate: 146.3 sq. meters



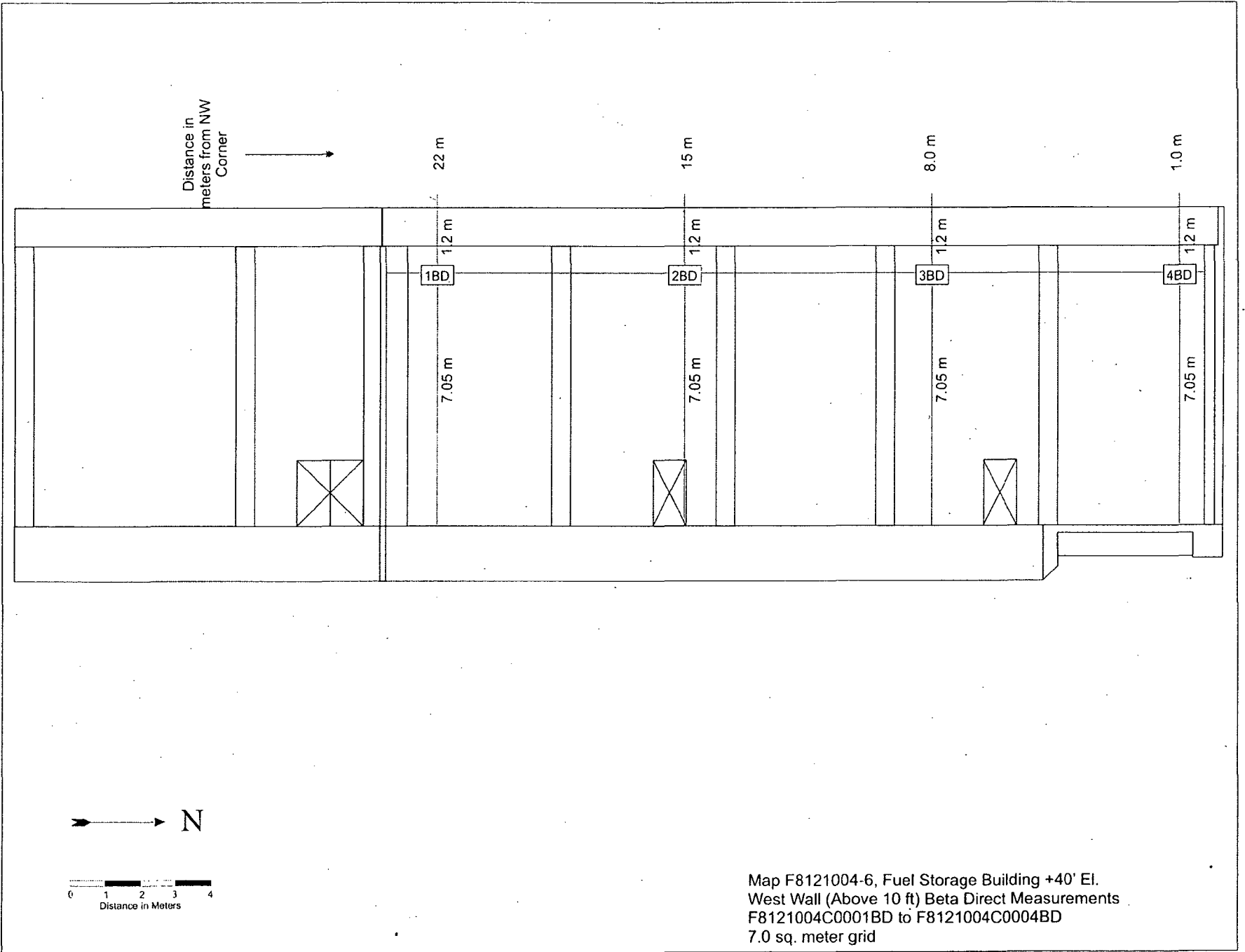
Map F8121004-3, Fuel Storage Building +40' El.
North Wall (Above 10 ft) Area Estimate: 65 sq. meters
Interior Wall and Column Area Estimate: 62 sq. meters



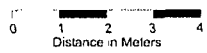
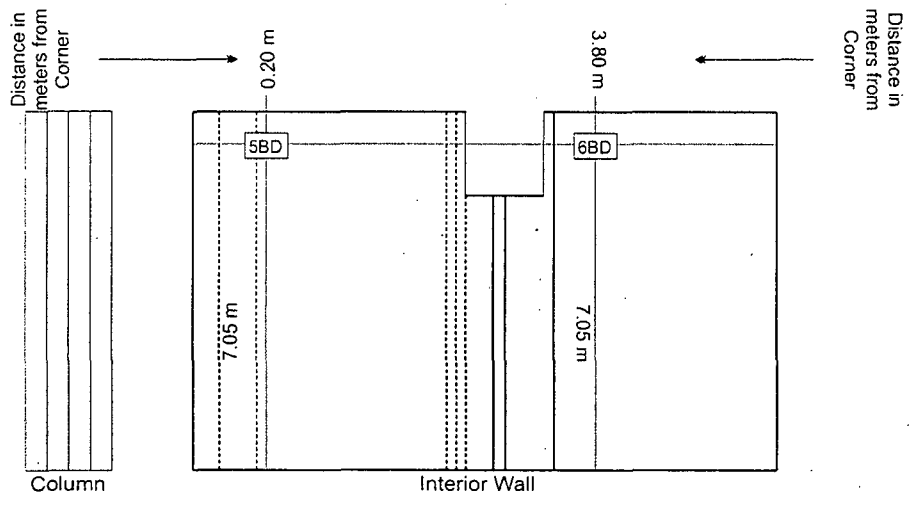
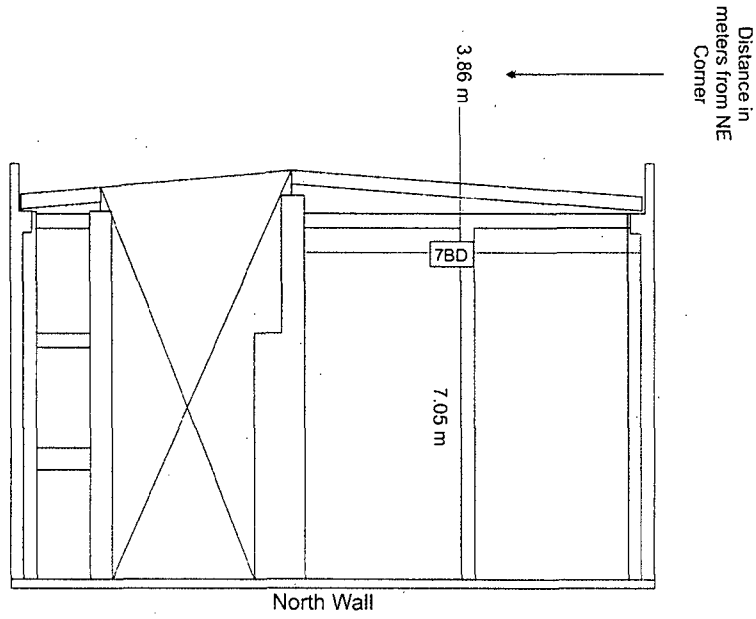
Map F8121004-4, Fuel Storage Building +40' El.
Interior Roof Area Estimate: 421 sq. meters



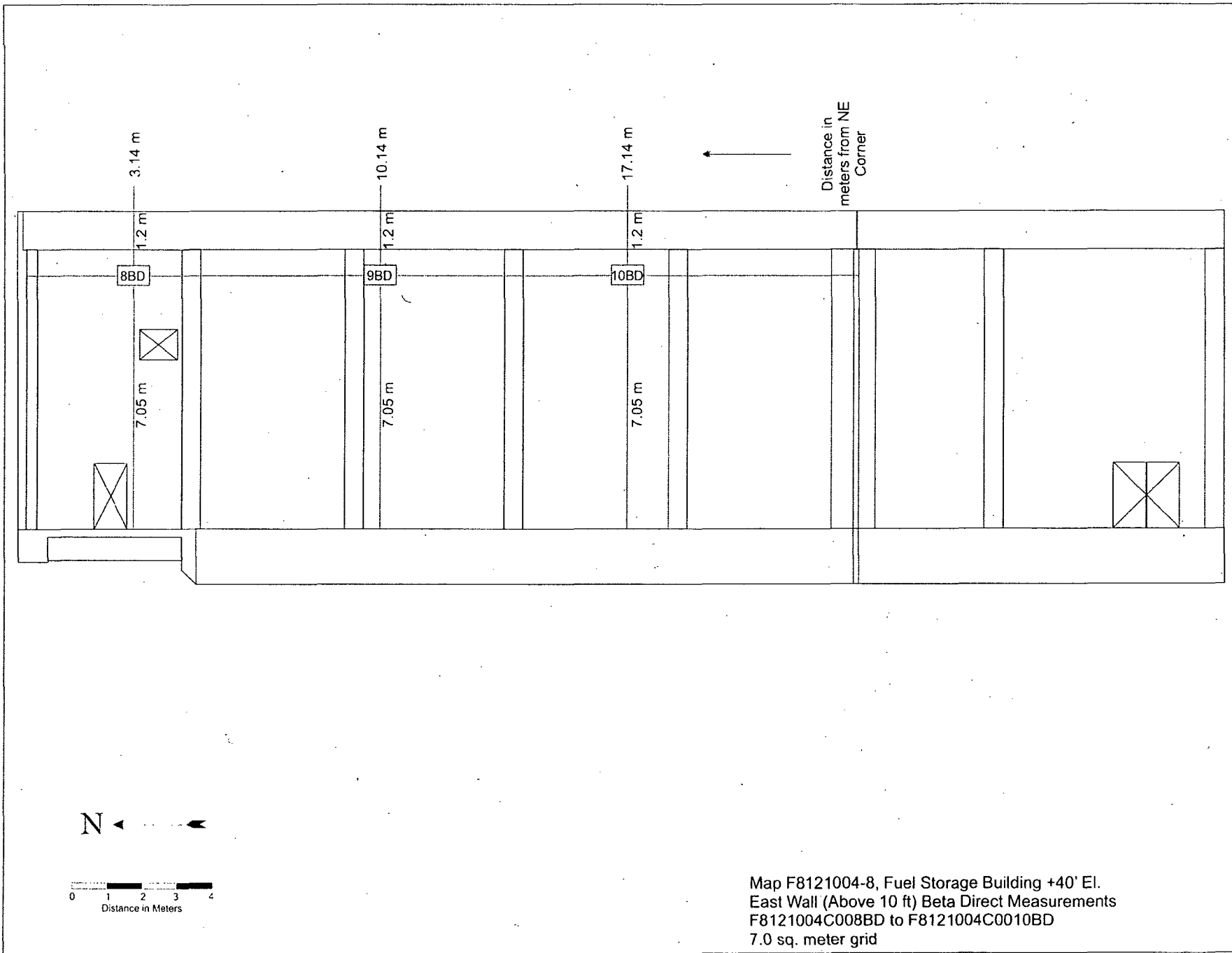
Map F8121004-5.
 Fuel Storage Building +40'E1.
 Random Start Location for
 Beta Direct Measurements



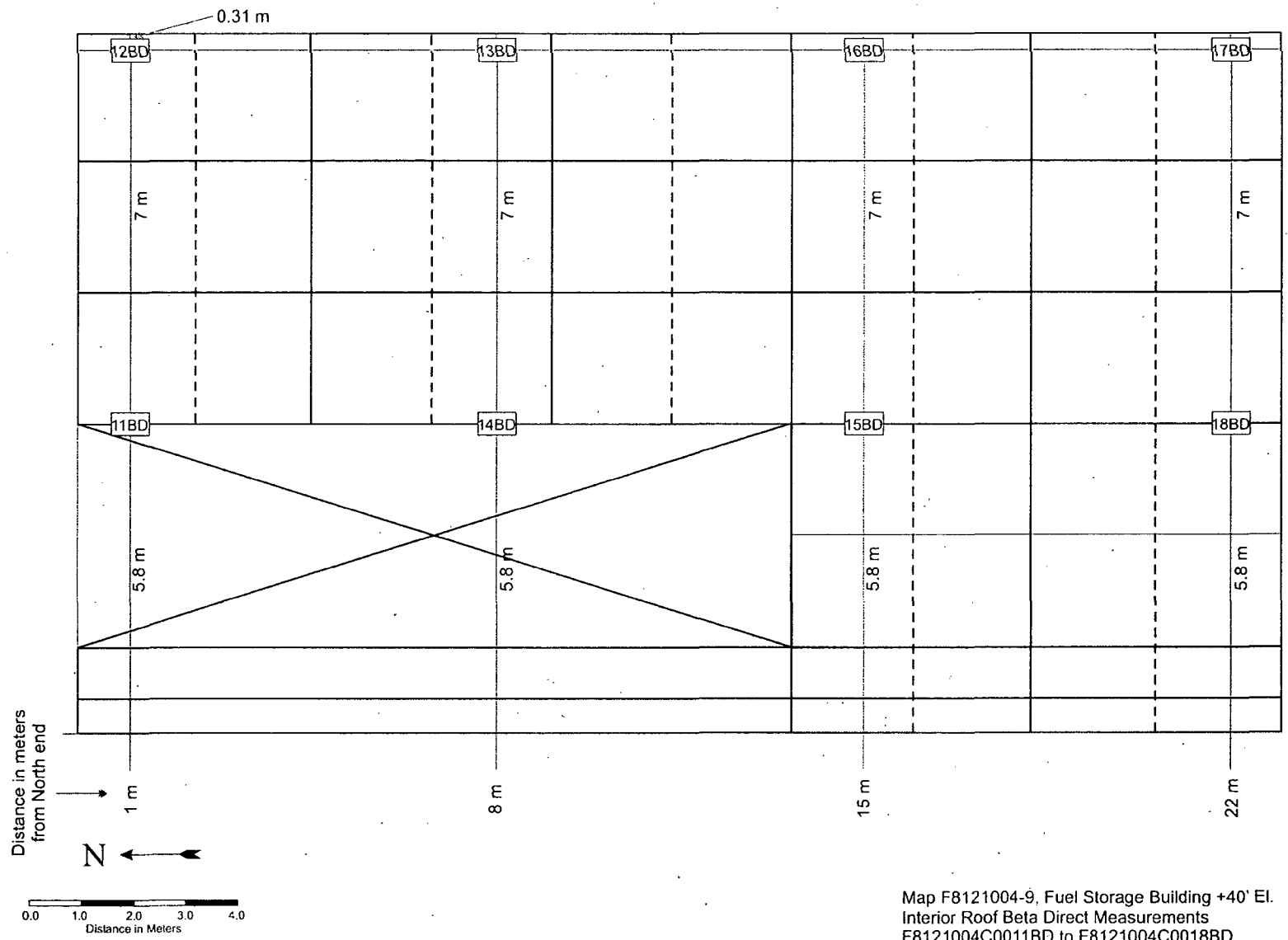
Map F8121004-6, Fuel Storage Building +40' El.
West Wall (Above 10 ft) Beta Direct Measurements
F8121004C0001BD to F8121004C0004BD
7.0 sq. meter grid



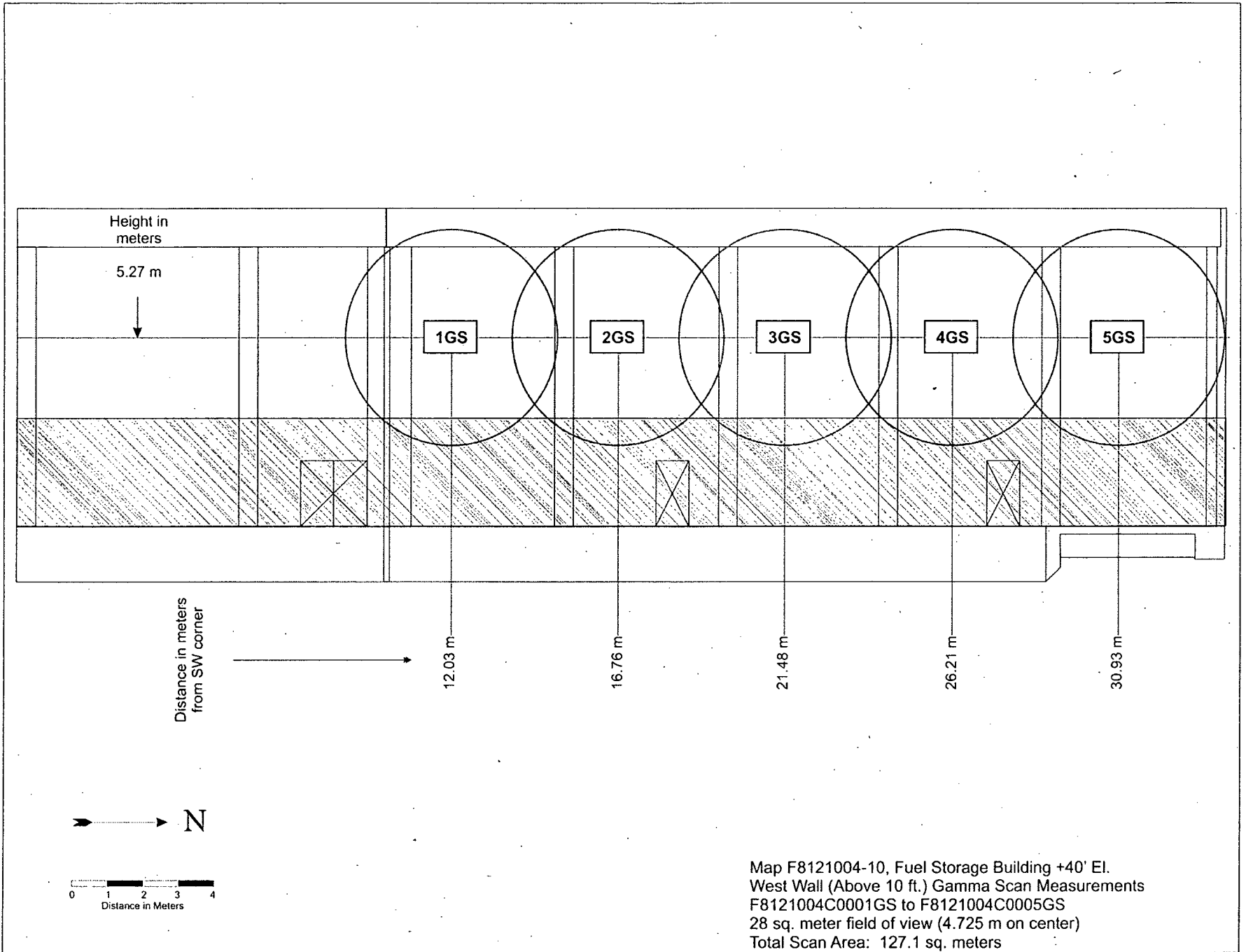
Map F8121004-7, Fuel Storage Building +40' El.
 North Wall (Above 10 ft) Beta Direct Measurements
 F8121004C0005BD to F8121004C0007BD
 7.0 sq. meter grid

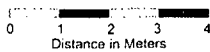
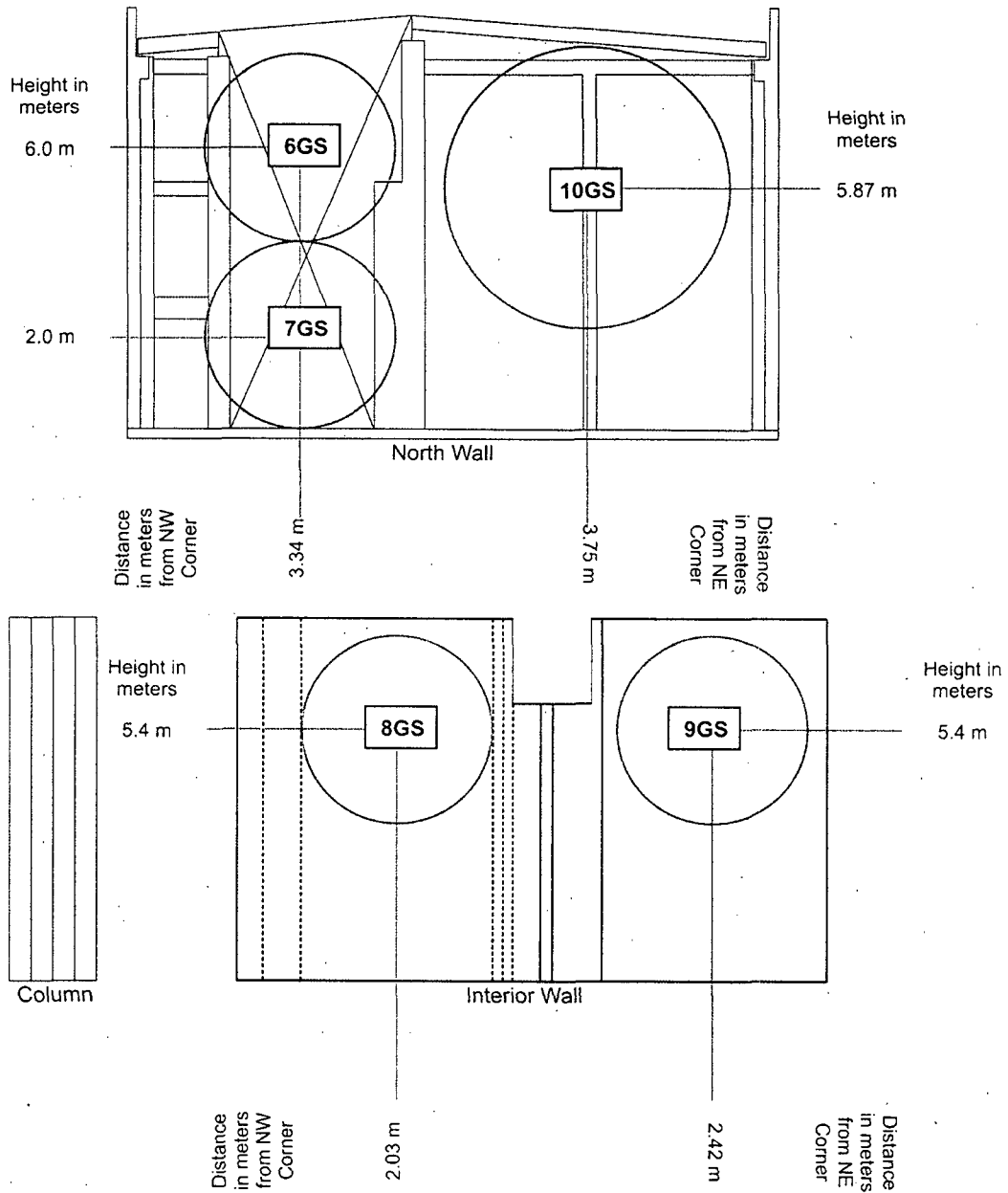


Map F8121004-8, Fuel Storage Building +40' El.
East Wall (Above 10 ft) Beta Direct Measurements
F8121004C008BD to F8121004C0010BD
7.0 sq. meter grid

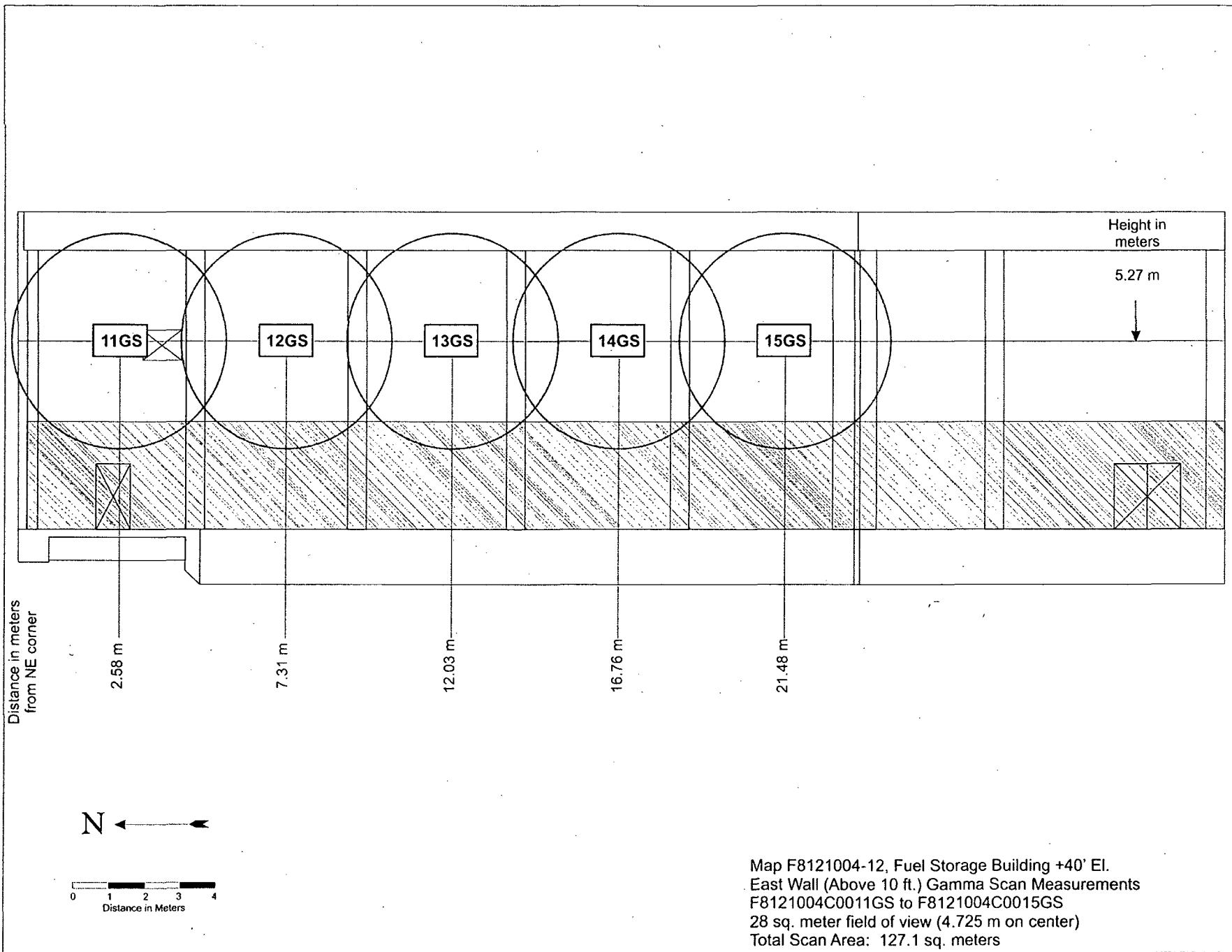


Map F8121004-9, Fuel Storage Building +40' El.
Interior Roof Beta Direct Measurements
F8121004C0011BD to F8121004C0018BD
7.0 sq. meter grid

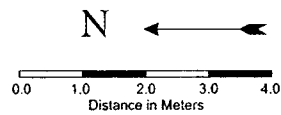
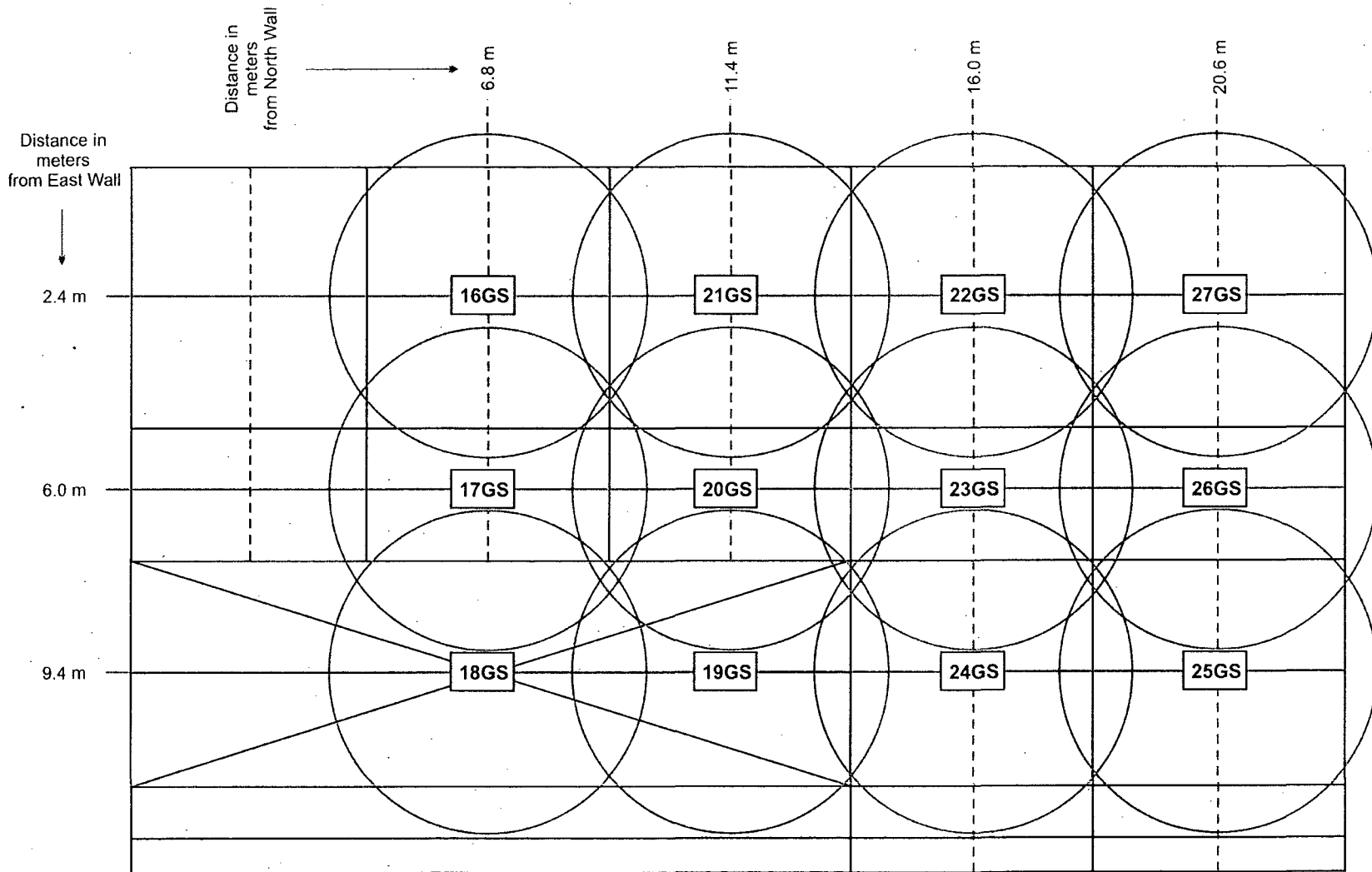




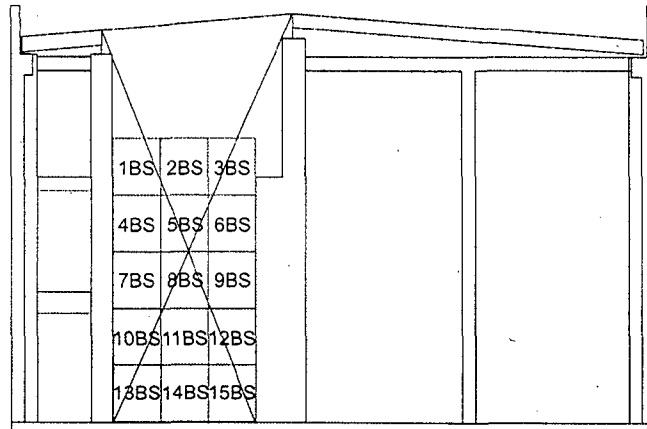
Map F8121004-11, Fuel Storage Building +40' El.
 North Wall (Above 10 ft.) Gamma Direct Measurements
 F8121004C0006GS to F8121004C0009GS
 12.57 sq. meter field of view
 F8121004C0010GS (28 sq. meter field of view)
 Total Scan Area: 65.7 sq. meters



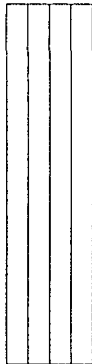
Map F8121004-12, Fuel Storage Building +40' El.
East Wall (Above 10 ft.) Gamma Scan Measurements
F8121004C0011GS to F8121004C0015GS
28 sq. meter field of view (4.725 m on center)
Total Scan Area: 127.1 sq. meters



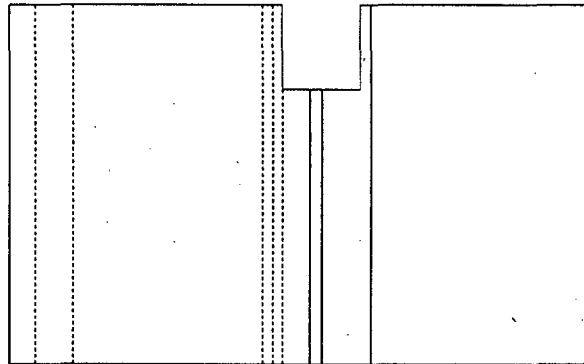
Map F8121004-13, Fuel Storage Building +40' El.
Interior Roof Gamma Scan Measurements
F8121004M0018GS to F8121004M0027GS
28 sq. meter field of view
Total Scan Area: 238.4 sq. meters



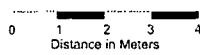
North Wall



Column



Interior Wall



Map F8121004-14, Fuel Storage Building +40' El.
 North Wall (Above 10 ft.) Beta Scan Measurements
 F8121004M0001BS to F8121004C0015BS
 Total Scan Area: 18.6 sq. meters

Attachment 2

Instrumentation

July 16, 2008

Survey Unit F8121004

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; 203486	43-68B; 161400 ¹	433	1,033
M2350; 203481	43-68B; 161405 ²	257	612
M2350; 203486	43-68B; 161400 ²	257	612
Tennelec; 0401171	N/A	5.88 dpm α, 11.71 dpm β	N/A

¹Concrete Surfaces

²Metal Surfaces.

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Concrete – 1,260 dpm/100 cm ² Cs-137, Concrete – 906 dpm/100 cm ² Co-60 Metal – 719 dpm/100 cm ² Cs-137, Metal – 658 dpm/100 cm ² Co-60
ISOCS	N/A	2983947	Metal – 758 dpm/100 cm ² Cs-137, Metal – 452 dpm/100 cm ² Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	43,000
Investigation Criteria – Scan	43,000
Investigation Criteria – Scan (ISOCS average activity – 28 sq. meter field of view)	1,600 Cs-137
Investigation Criteria – Scan (ISOCS average activity – 12.57 sq. meter field of view)	4,300 Cs-137
DCGL _w	43,000
DCGL _{EMC}	N/A

Attachment 3

Investigation

July 16, 2008

Survey Unit F8121004

(none required)

Attachment 4

Data Assessment

July 16, 2008

Survey Unit F8121004

