

Rancho Seco
Final Status Survey Summary Report
January 19, 2009
Fuel Storage Building (+) 40' El. Floor
Survey Unit F8121001

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FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8121001, Fuel Storage Building (+) 40' El. Floor

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 272 m² 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 Building (+)
Survey Unit:	1001	40' El. Floor
Class:	1	Structure Surface
SU Area (m²):	272	LTP Table 5-4
Evaluator:	D. Anderson	
DCGL (dpm/100 cm²):	43,000	Gross Activity DCGL
Area Factor:	3.6	Class 1
Design DCGL_{me} (dpm/100 cm ²):	154,800	Class 1
LBGR (dpm/100 cm²):	21,500	Default = 50% DCGL
Design Sigma (dpm/100 cm²):	4,631	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m²):	6.97	Class 1
Scan Area (m²):	272	
Scan Coverage (%):	100%	Class 1
Z_{1-α}:	1.645	
Z_{1-β}:	1.645	
Sign P:	0.99865	
Calculated Relative Shift:	4.6	
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:	39	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 41 direct measurements were made in F8121001. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. One of the scan measurements indicated an area of elevated activity. The gamma scan activity ranged from $< 1,080$ dpm/100 cm² Co-60 and $< 1,310$ dpm/100 cm² to 9,366 dpm/100 cm² Cs-137. Beta scan activity ranged from 1,633 to 72,374 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 cm²)
F8121001-C0001BD	2,293
F8121001-C0002BD	2,075
F8121001-C0003BD	1,961
F8121001-C0004BD	1,966
F8121001-C0005BD	2,355
F8121001-C0006BD	2,033
F8121001-C0007BD	2,033
F8121001-C0008BD	2,090
F8121001-C0009BD	3,019
F8121001-C0010BD	1,873
F8121001-C0011BD	1,914
F8121001-C0012BD	6,603
F8121001-C0013BD	2,028
F8121001-C0014BD	2,173
F8121001-C0015BD	1,624
F8121001-C0016BD	2,262
F8121001-C0017BD	1,764
F8121001-C0018BD	1,971
F8121001-C0019BD	1,914
F8121001-C0020BD	2,039
F8121001-C0021BD	2,998
F8121001-C0022BD	2,811
F8121001-C0023BD	2,215
F8121001-C0024BD	2,718
F8121001-C0025BD	2,469
F8121001-C0026BD	2,173
F8121001-C0027BD	2,563
F8121001-C0028BD	2,594
F8121001-C0029BD	2,578
F8121001-C0030BD	2,168
F8121001-C0031BD	2,578
F8121001-C0032BD	1,639
F8121001-C0033BD	2,739
F8121001-C0034BD	4,088
F8121001-C0035BD	2,516
F8121001-C0036BD	2,282
F8121001-C0037BD	2,179
F8121001-C0038BD	2,007
F8121001-C0039BD	2,194
F8121001-C0040BD	3,636
F8121001-C0041BD	4,228
Mean:	2,472
Median:	2,194
Standard Deviation:	874
Range:	1,624 – 6,603

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm ²)
F8121001C0001SM	1.64
F8121001C0002SM	4.22
F8121001C0003SM	5.51
F8121001C0004SM	4.22
F8121001C0005SM	8.09
F8121001C0006SM	17.13
F8121001C0007SM	8.09
F8121001C0008SM	13.26
F8121001C0009SM	1.64
F8121001C0010SM	18.42
F8121001C0011SM	5.51
F8121001C0012SM	1.64
F8121001C0013SM	18.42
F8121001C0014SM	17.13
F8121001C0015SM	6.8
F8121001C0016SM	10.68
F8121001C0017SM	13.26
F8121001C0018SM	-2.24
F8121001C0019SM	9.38
F8121001C0020SM	1.64
F8121001C0021SM	30.05
F8121001C0022SM	8.09
F8121001C0023SM	27.46
F8121001C0024SM	4.22
F8121001C0025SM	9.38
F8121001C0026SM	2.93
F8121001C0027SM	21.01
F8121001C0028SM	23.59
F8121001C0029SM	0.34
F8121001C0030SM	5.51
F8121001C0031SM	2.93
F8121001C0032SM	9.38
F8121001C0033SM	10.68
F8121001C0034SM	6.8
F8121001C0035SM	14.55
F8121001C0036SM	11.97
F8121001C0037SM	1.64
F8121001C0038SM	13.26
F8121001C0039SM	-0.95
F8121001C0040SM	6.8
F8121001C0041SM	0.34
Mean:	9.13
Median:	8.09
Standard Deviation:	7.73
Range:	-2.24 to 30.05

Survey Unit Data Assessment:

The survey design required 41 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):	41	
Median (dpm/100 cm ²):	2,194	
Mean (dpm/100 cm ²):	2,472	
Direct Measurement Standard Deviation (dpm/100 cm ²):	874	
Total Standard Deviation (dpm/100 cm ²):	874	Based on samples and backgrounds.
Maximum (dpm/100 cm ²):	6,603	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	41	
S+ Value:	41	
Critical Value:	26	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGL_{emc}:	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:

One investigation (juncture scan 11) was required for the scan measurements and the results are reported 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. One potential area of elevated activity was 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 43,000 dpm/100 cm² and none of the removable surface activity measurements exceeded 10% of the DCGL. One investigation was 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.

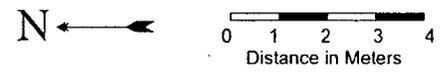
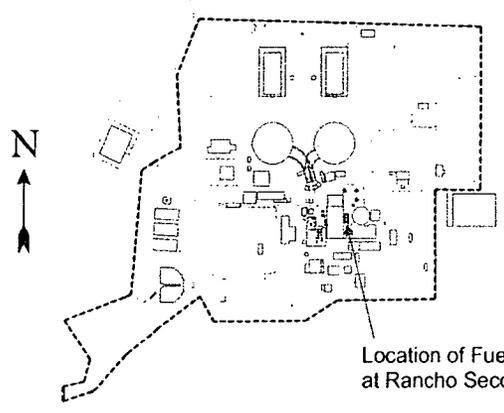
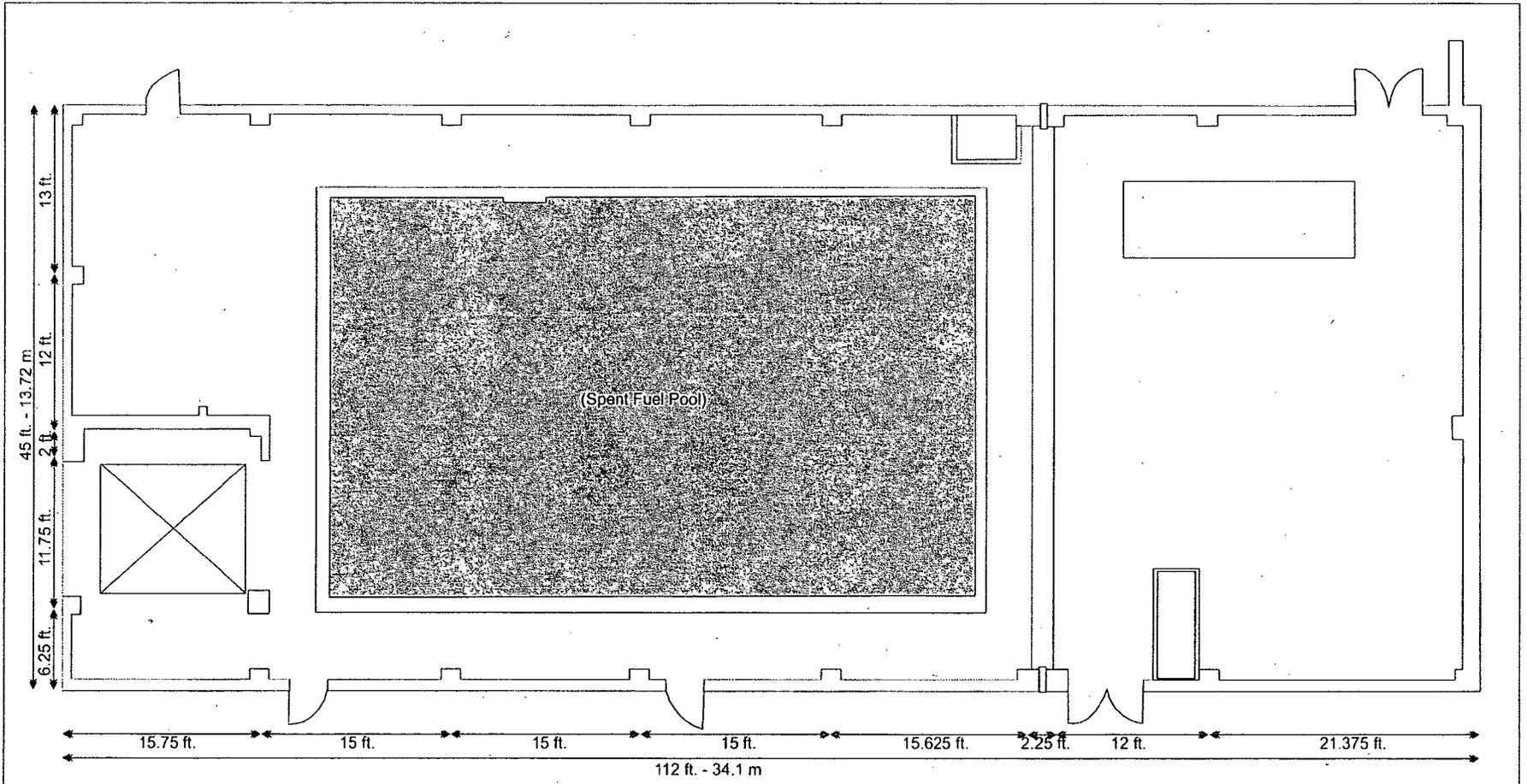
It is concluded that survey unit F8121001 meets the release criteria of 10CFR20.1402.

Attachment 1

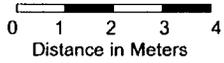
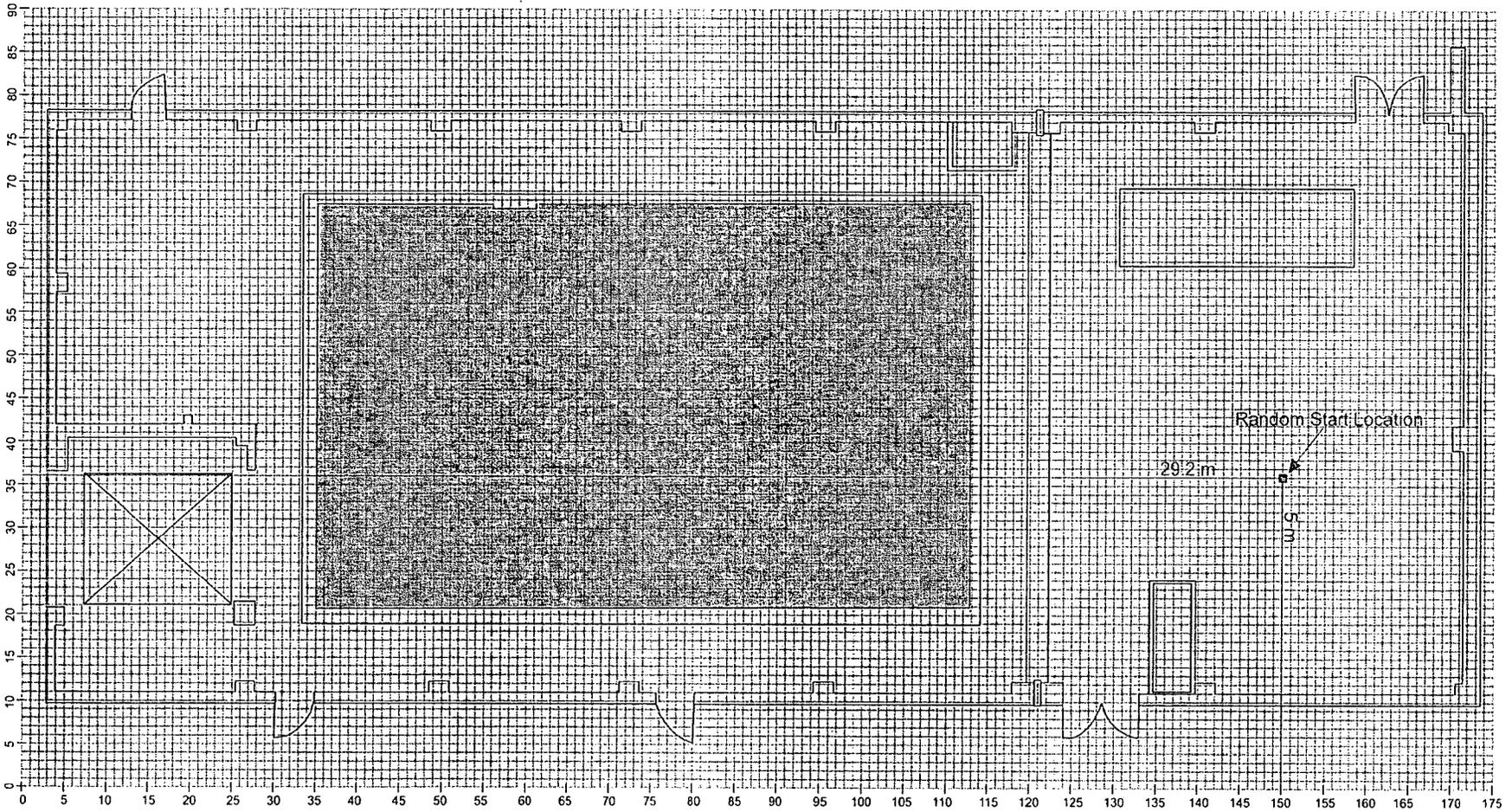
Maps

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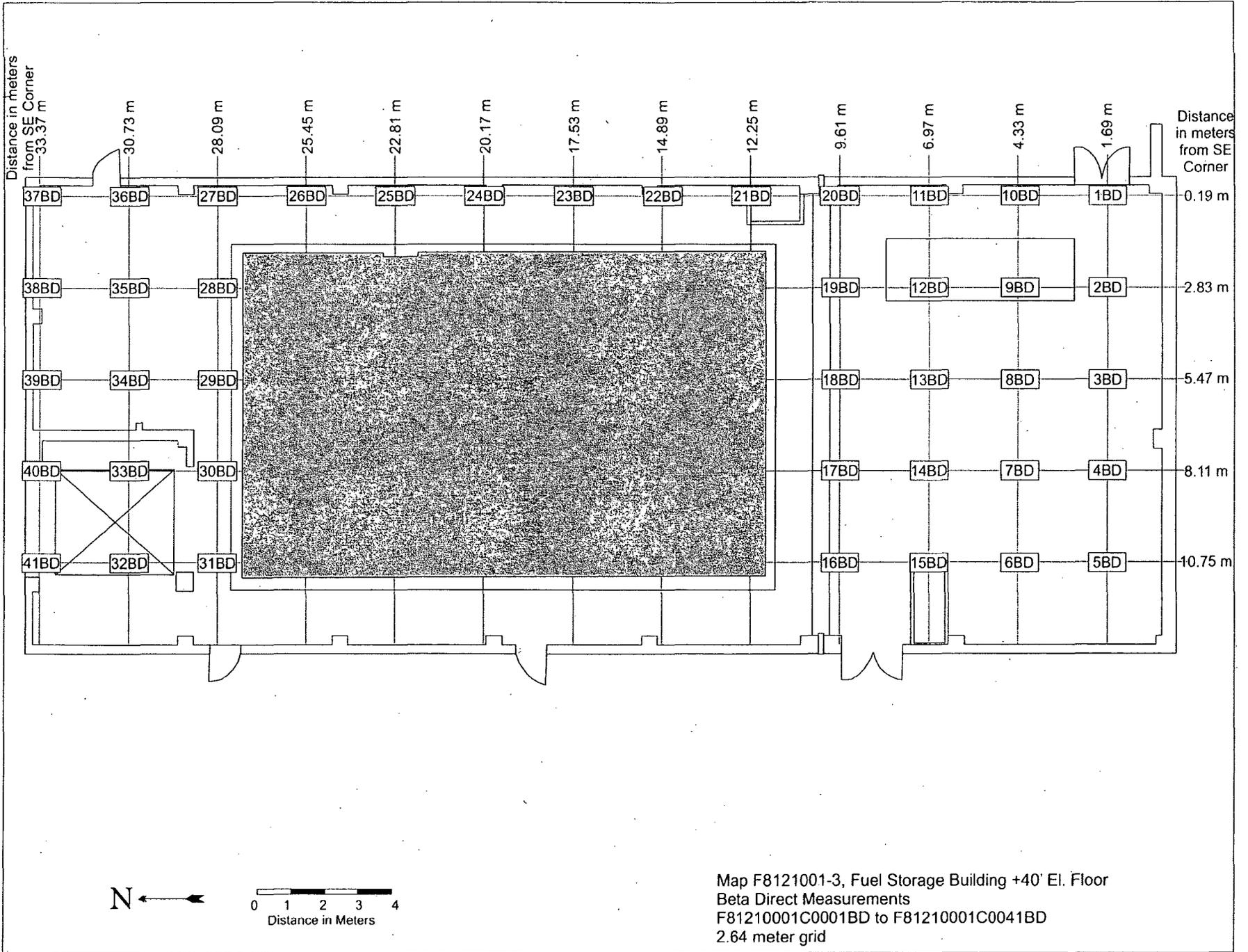
Survey Unit F8121001

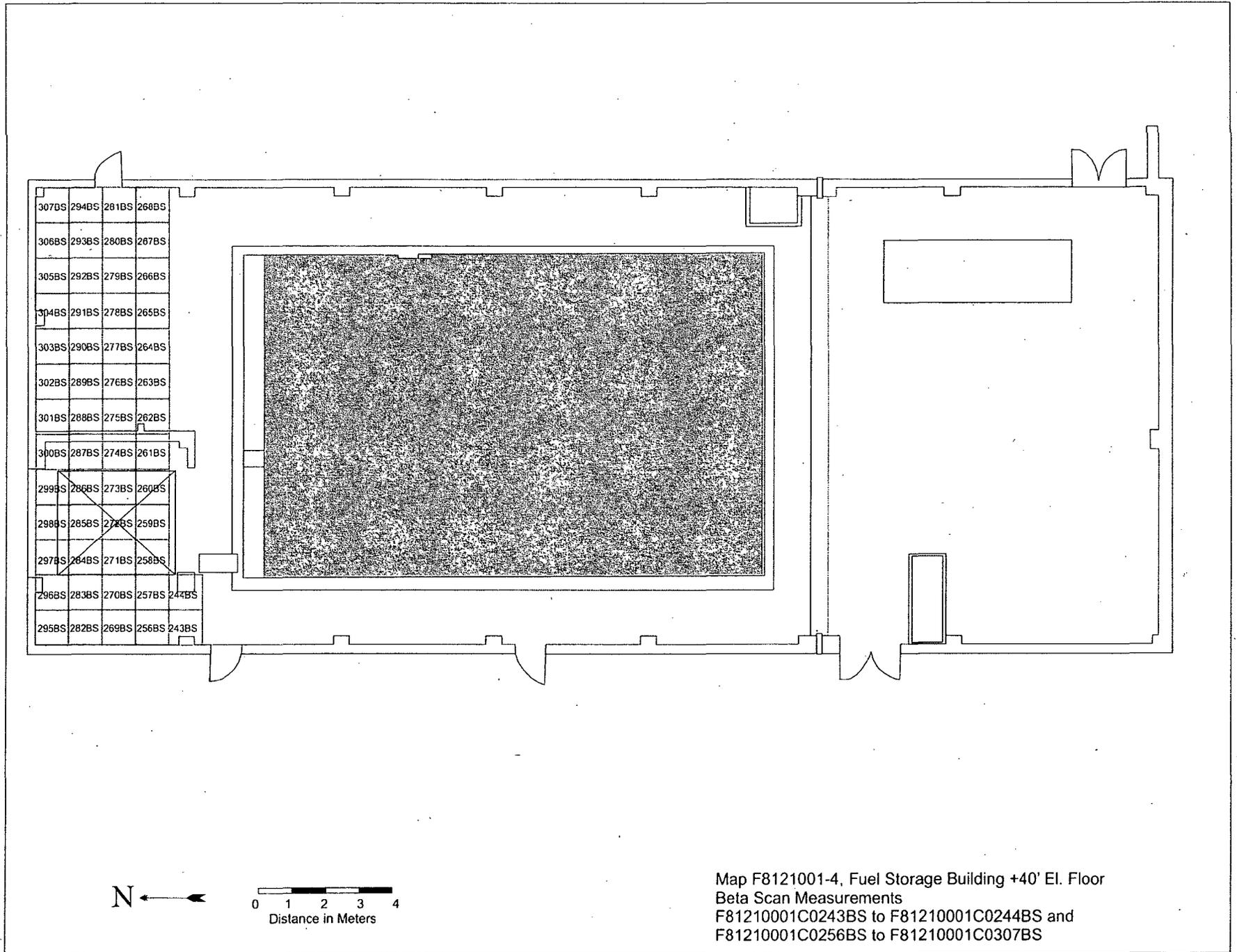


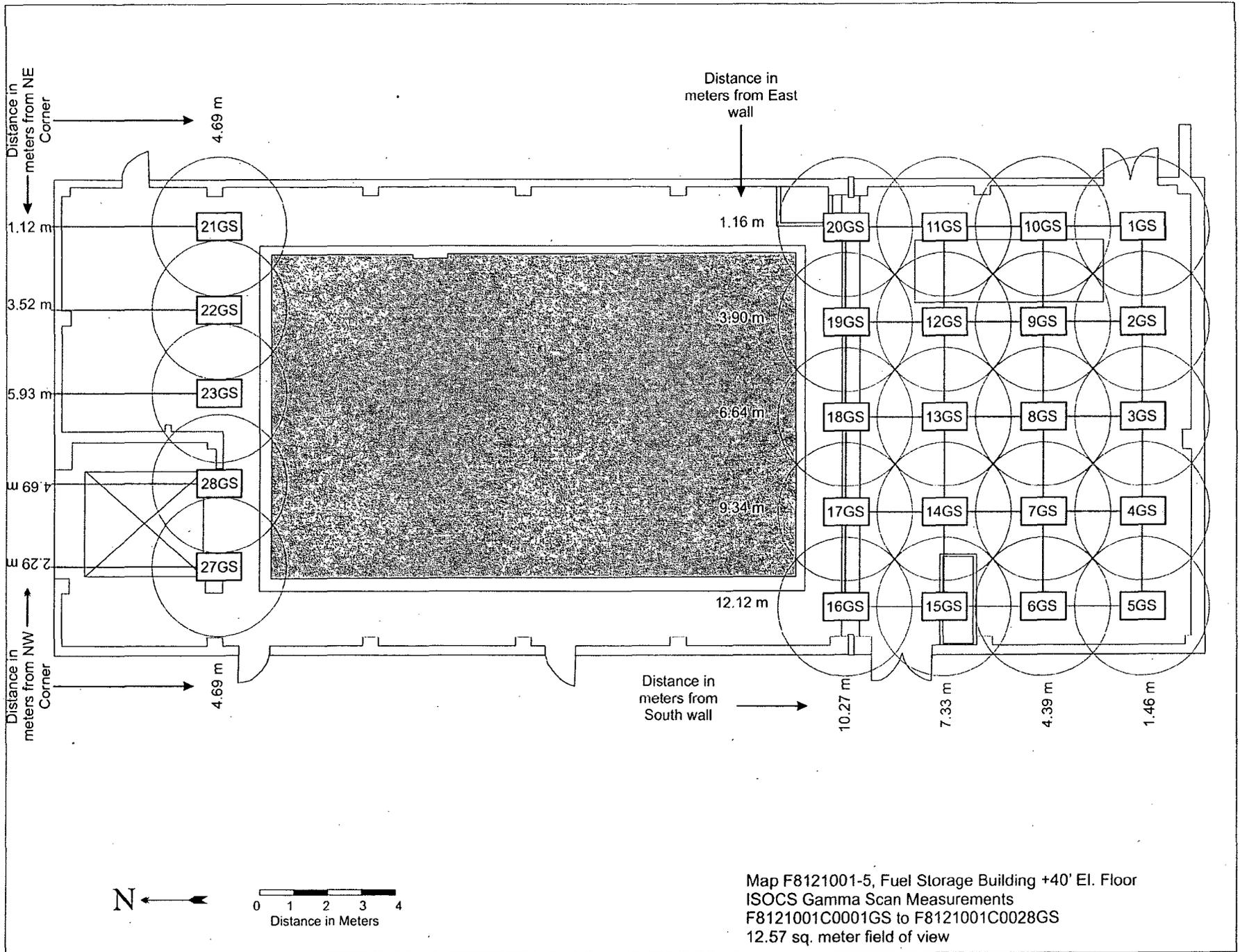
Map F8121001-1, Fuel Storage Building +40' El. Floor
Area Estimate: 272 sq. meters

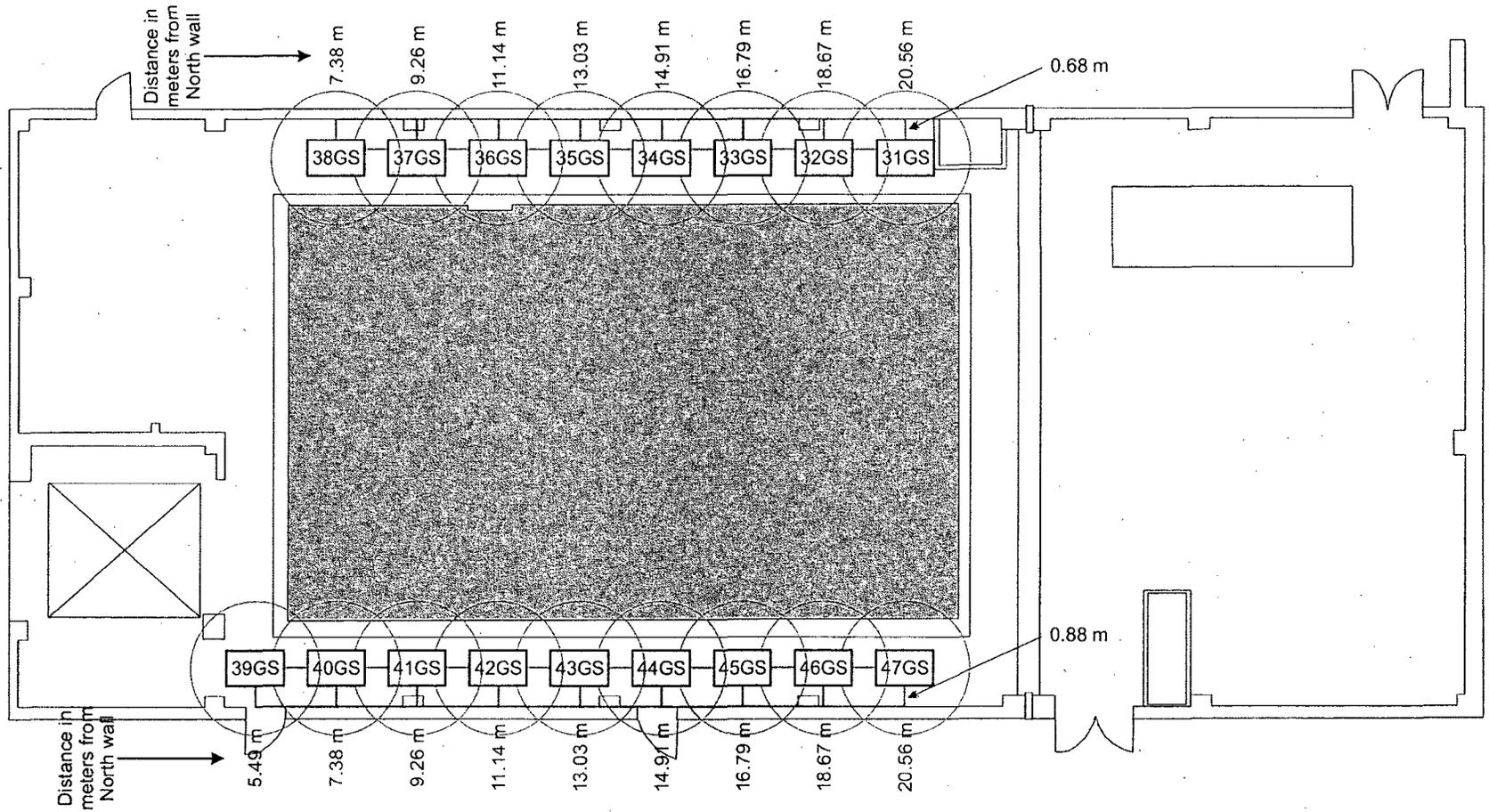


Map F8121001-2, Fuel Storage Building +40' El. Floor
Random Start Location

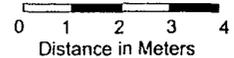
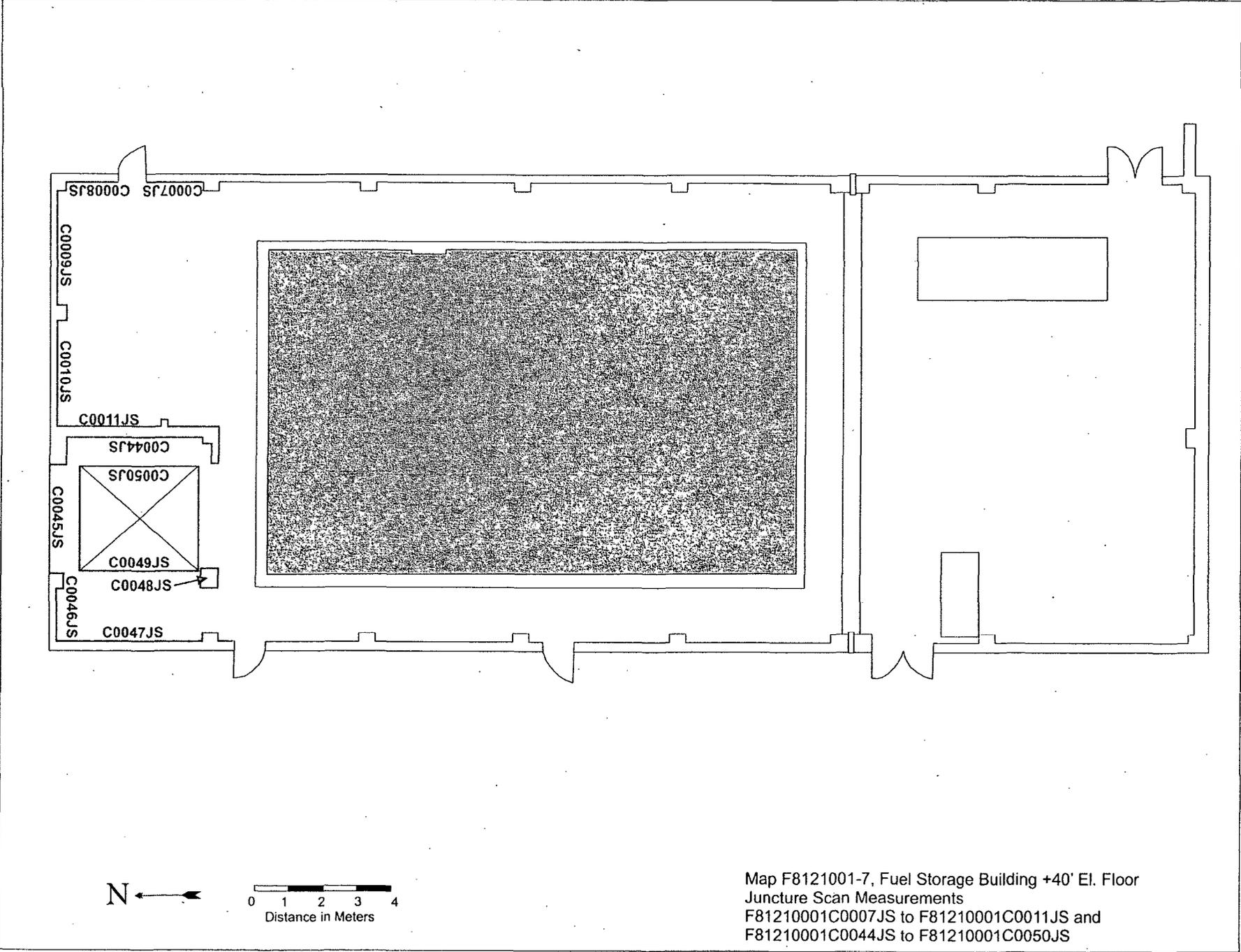




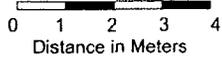
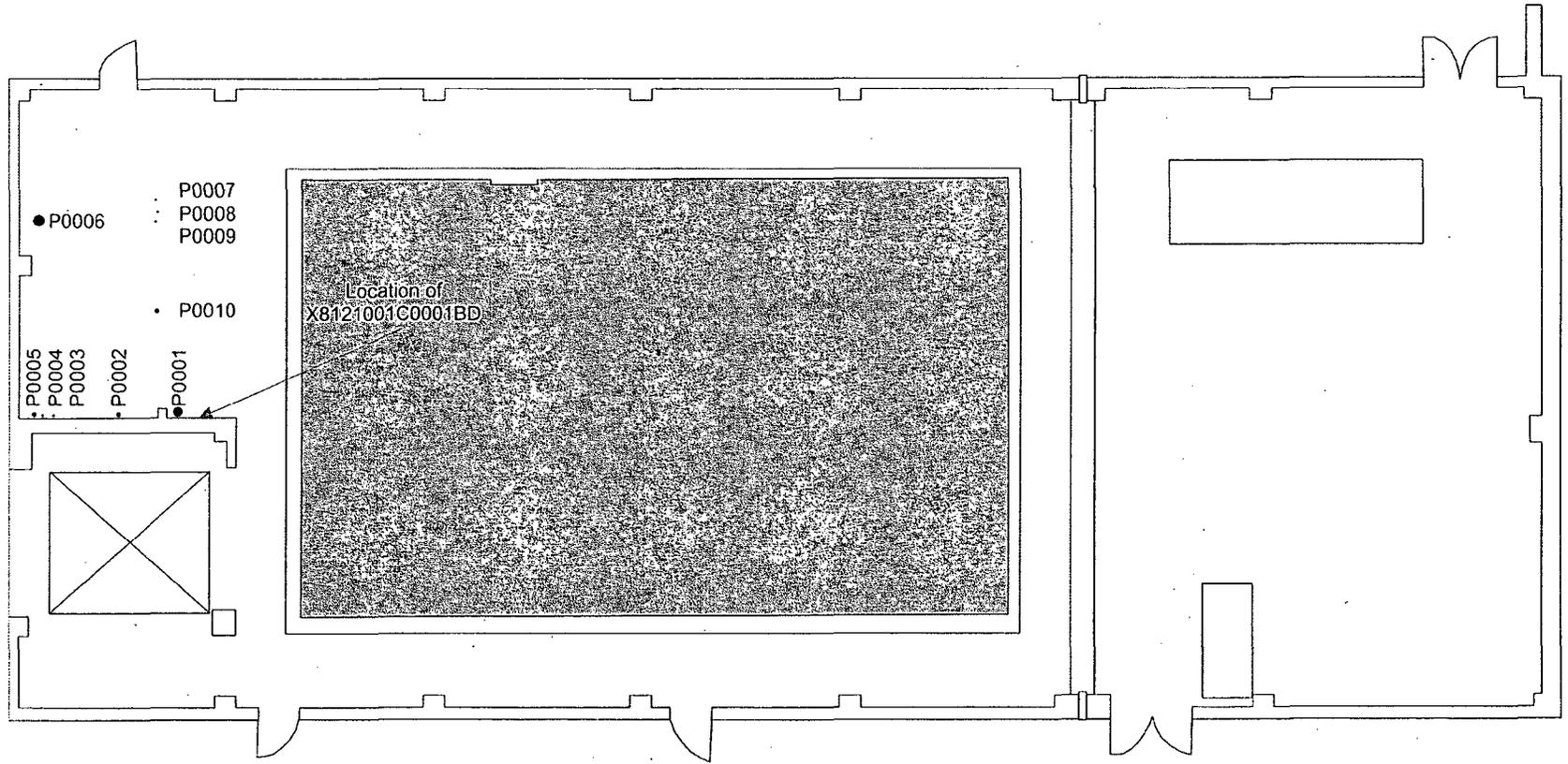




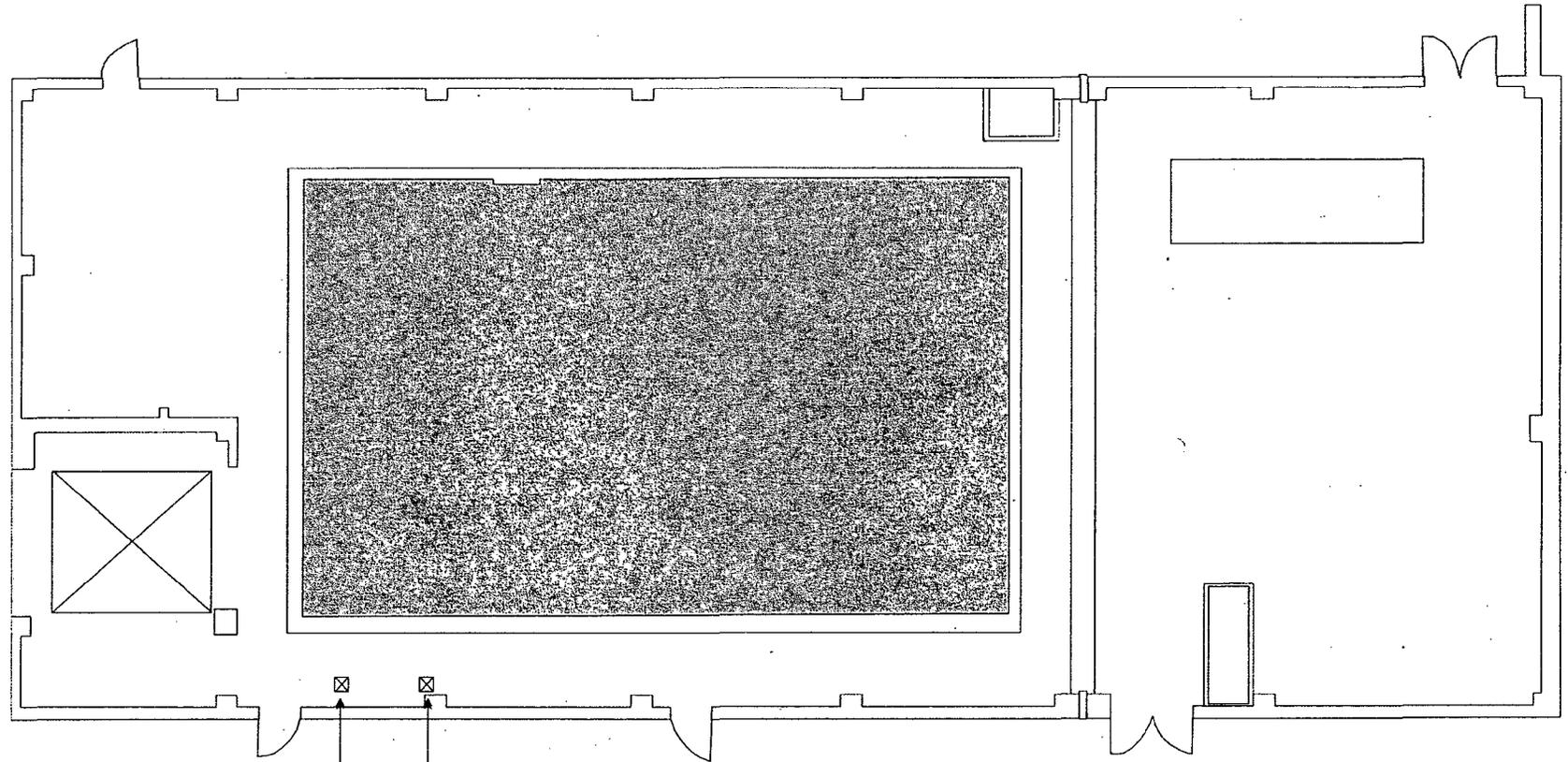
Map F8121001-6, Fuel Storage Building +40' El. Floor
ISOCS Gamma Scan Measurements
F8121001C0031GS to F8121001C0047GS
7.1 sq. meter field of view



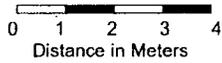
Map F8121001-7, Fuel Storage Building +40' El. Floor
Juncture Scan Measurements
F81210001C0007JS to F81210001C0011JS and
F81210001C0044JS to F81210001C0050JS



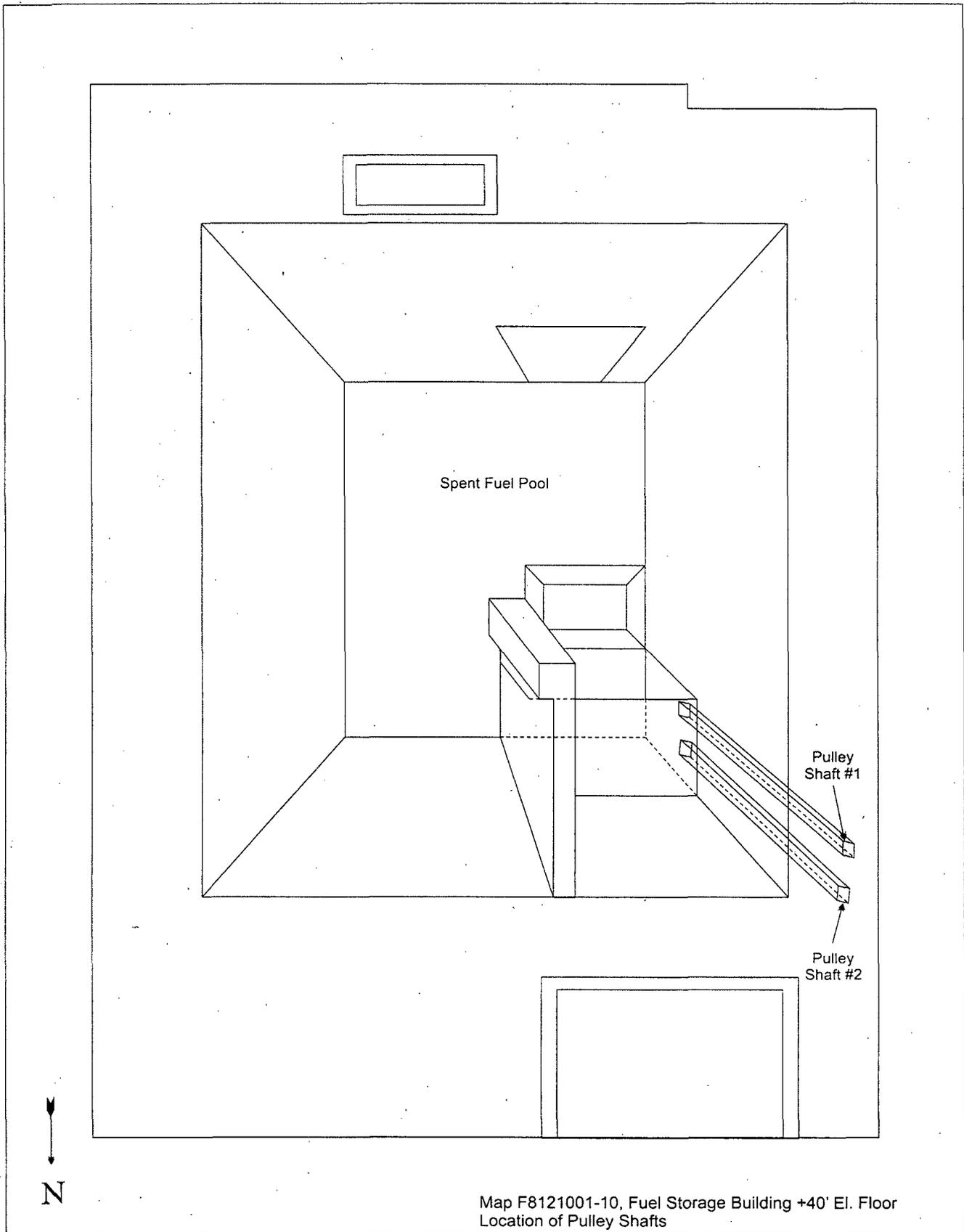
Map F8121001-8, Fuel Storage Building +40' El. Floor
Investigation Measurement X8121001C0001BD
Penetration Scan Measurements
F8121001P0001BS to F8121001P0010BS



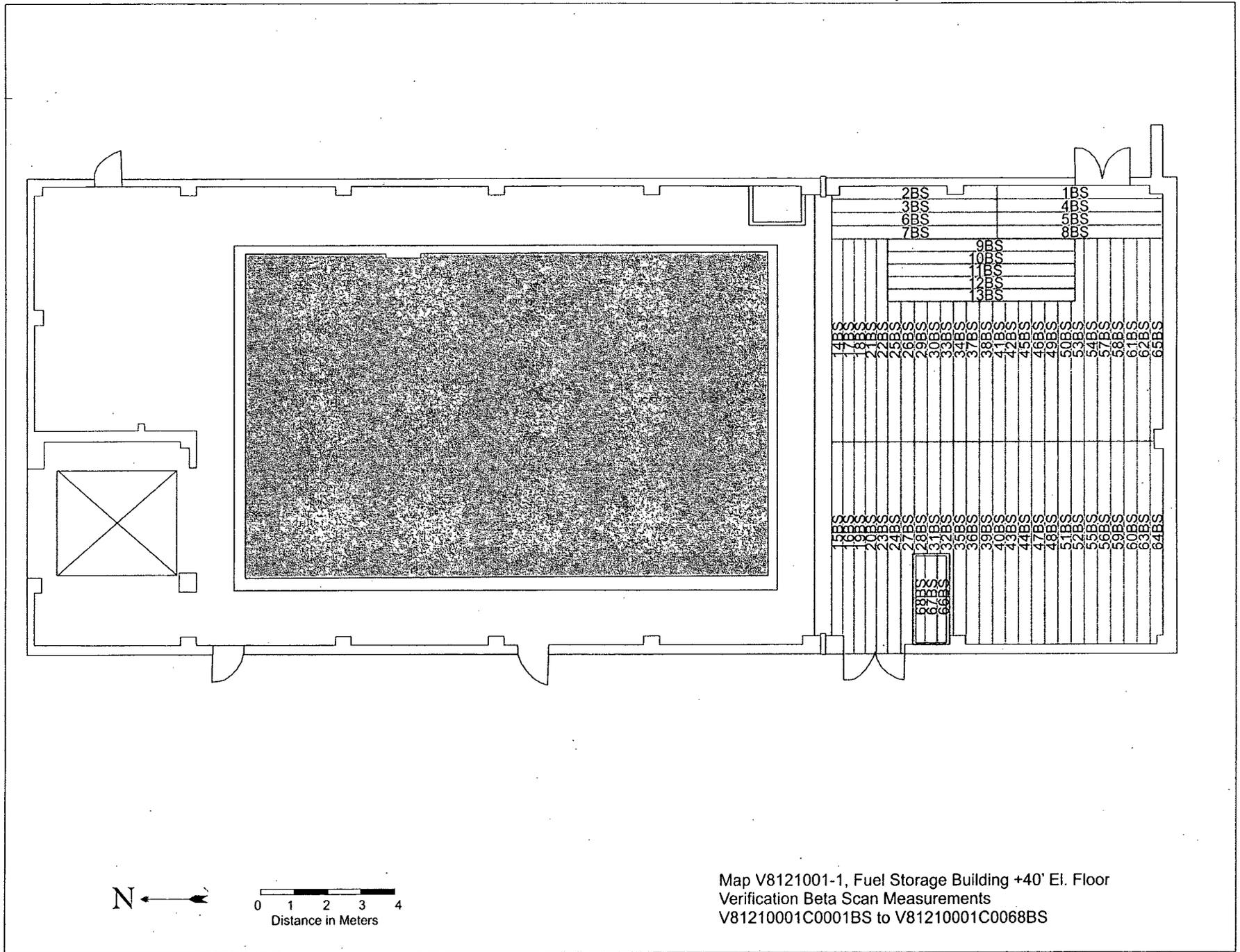
Pulley Shaft #2
Pulley Shaft #1



Map F8121001-9, Fuel Storage Building +40' El. Floor
Location of Pulley Shafts



Map F8121001-10, Fuel Storage Building +40' El. Floor
Location of Pulley Shafts



Attachment 2
Instrumentation
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Survey Unit F8121001

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; 142499	43-37B; 148502	198	616
M2350; 180733	43-94B; 148620 ¹	590	1,030
M2350; 180733	43-94B; 148620 ²	1,610	2,800
M2350; 180733	43-94B; 148620 ³	350	610
M2350; 180733	43-94B; 148620 ⁴	950	1,660
M2350; 203486	43-68B; 161400	433	1,033
M2350; 175834	43-68B; 148634	433	1,033
M2350; 175834	43-116-1B; 190642 ⁵	796	3,258
M2350; 175834	43-116-1B; 190642 ⁶	491	739
M2350; 175834	43-116-1B; 190642 ⁷	472	1,930
Tennelec; 0401171	N/A	5.88 dpm α, 11.71 dpm β	N/A

¹1-inch concrete pipe

²2-inch concrete pipe

³1-inch metal pipe

⁴2-inch metal pipe

⁵Concrete surfaces

⁶Concrete junctures

⁷Metal surfaces

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Concrete – 1,310 dpm/100 cm ² Cs-137, Concrete –1,080 dpm/100 cm ² Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	154,800
Investigation Criteria – Scan	154,800
Investigation Criteria – Scan (ISOCS average activity – 12.6 sq. meter field of view)	63,300 Cs-137
Investigation Criteria – Scan (ISOCS average activity – 7.1 sq. meter field of view)	115,000 Cs-137
DCGL _W	43,000
DCGL _{EMC}	154,800

Attachment 3

Investigation

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Table 3-1 Survey Unit Investigation

<i>Grid</i>	<i>Investigation Level (cpm)</i>	<i>Initial Value (cpm)</i>	<i>Investigation Result (cpm)</i>	<i>Elevated Area (m²)</i>	<i>Area Factor</i>	<i>DCGL_{emc}</i>	<i>Investigation Result (dpm/100cm²)</i>	<i>DCGL_{emc} Unity Fraction</i>
11JS	7,100	7,179	7,087	0.0116	1,116.5	48,009,355	82,073	0.002
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2,472	0.057
EMC Unity Sum								0.059

Attachment 4

Data Assessment

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