

Rancho Seco

Final Status Survey Summary Report

May 14, 2008

Fuel Storage Building East Exterior Wall (-) 6' El. to (+) 20' El.

Survey Unit F8120161

Prepared By: J. Anderson Date: 5/14/2008

FSS Engineer

Reviewed By: [Signature] Date: 5/15/08

Lead FSS Engineer

Approved By: E. J. [Signature] Date: 7-28-08

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8120161, Fuel Storage Building East Exterior Wall (-) 6' El. to (+) 20' El.

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 123 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 East Exterior Wall (-) 6' El. to (+) 20' El.
Survey Unit:	0161	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m²):	123	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm²):	43,000	Gross Activity DCGL
Area Factor:	3.6	Class 1
Design DCGL (dpm/100 cm²):	154,800	Class 1
LBGR (dpm/100 cm²):	40,759	Adjusted
Design Sigma (dpm/100 cm²):	747	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m²):	6.83	Class 1
Scan Area (m²):	123	
Scan Coverage (%):	100%	Class 1
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:	18	Class 1
Grid Spacing L:	2.61	Class 1

Survey Results:

A total of 23 direct measurements were made in F8120161. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. The highest average ISOCS gamma measurements were 13,939 dpm/100 cm² for Cs-137 and 2,081 dpm/100 cm² for Co-60. Soil samples collected from the trench adjacent to the structure identified the highest soil activity as 6.46 pCi/g Cs-137. Co-60 was not identified in soil above the MDA. 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)
F8120161-C0001BD	6,489
F8120161-C0002BD	1,878
F8120161-C0003BD	1,810
F8120161-C0004BD	1,650
F8120161-C0005BD	3,501
F8120161-C0006BD	1,924
F8120161-C0007BD	1,883
F8120161-C0008BD	1,795
F8120161-C0009BD	1,795
F8120161-C0010BD	2,931
F8120161-C0011BD	1,551
F8120161-C0012BD	1,826
F8120161-C0013BD	1,733
F8120161-C0014BD	1,758
F8120161-C0015BD	1,743
F8120161-C0016BD	8,045
F8120161-C0017BD	1,701
F8120161-C0018BD	1,738
F8120161-C0019BD	1,463
F8120161-C0020BD	1,847
F8120161-C0021BD	1,650
F8120161-C0022BD	1,769
F8120161-C0023BD	1,063
Mean:	2,328
Median:	1,795
Standard Deviation:	1,646
Range:	1,063 – 8,045

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm²)
F8120161C0001SM	1.64
F8120161C0002SM	1.64
F8120161C0003SM	-2.24
F8120161C0004SM	-4.82
F8120161C0005SM	-2.24
F8120161C0006SM	-2.24
F8120161C0007SM	-3.53
F8120161C0008SM	-3.53
F8120161C0009SM	-3.53
F8120161C0010SM	4.22
F8120161C0011SM	-3.53
F8120161C0012SM	-2.24
F8120161C0013SM	0.34
F8120161C0014SM	-3.53
F8120161C0015SM	-2.24
F8120161C0016SM	22.3
F8120161C0017SM	-3.53
F8120161C0018SM	-3.53
F8120161C0019SM	-0.95
F8120161C0020SM	-3.53
F8120161C0021SM	-0.95
F8120161C0022SM	-2.24
F8120161C0023SM	-3.53
Mean:	-0.95
Median:	-2.24
Standard Deviation:	5.51
Range:	-4.82 to 22.3

Survey Unit Data Assessment:

The survey design required 23 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 greater than the design standard deviation. Since both values of sigma resulted in a relative shift greater than three (3), no additional samples were required.

Table 4. Data Assessment Results

Survey Results Parameter	Value	Comment
Material Background Used (dpm/100 cm ²):	N/A	Average Ambient BKG = 0
Ambient Background Used (dpm/100 cm ²):	N/A	
Actual Direct Measurements (N):	23	
Median (dpm/100 cm ²):	1,795	
Mean (dpm/100 cm ²):	2,328	
Direct Measurement Standard Deviation	1,646	Based on samples and backgrounds.
(dpm/100 cm ²):		
Total Standard Deviation (dpm/100 cm ²):	1,646	
Maximum (dpm/100 cm ²):	8,045	Background Subtract Not Applied
Material Type:	N/A	
Sign Test Final N Value:	23	
S+ Value:	23	
Critical Value:	15	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	Class 1 All samples < DCGL.
Mean Value < DCGL:	Yes	
Maximum Value < DCGL_{emc}:	Yes	
Total Standard Deviation <= Sigma:	Investigate	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	SU Passes.
Does the Survey Unit Pass All Criteria?	Investigate	

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 greater than the characterization data used for survey design. However, no additional samples were required. 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 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.

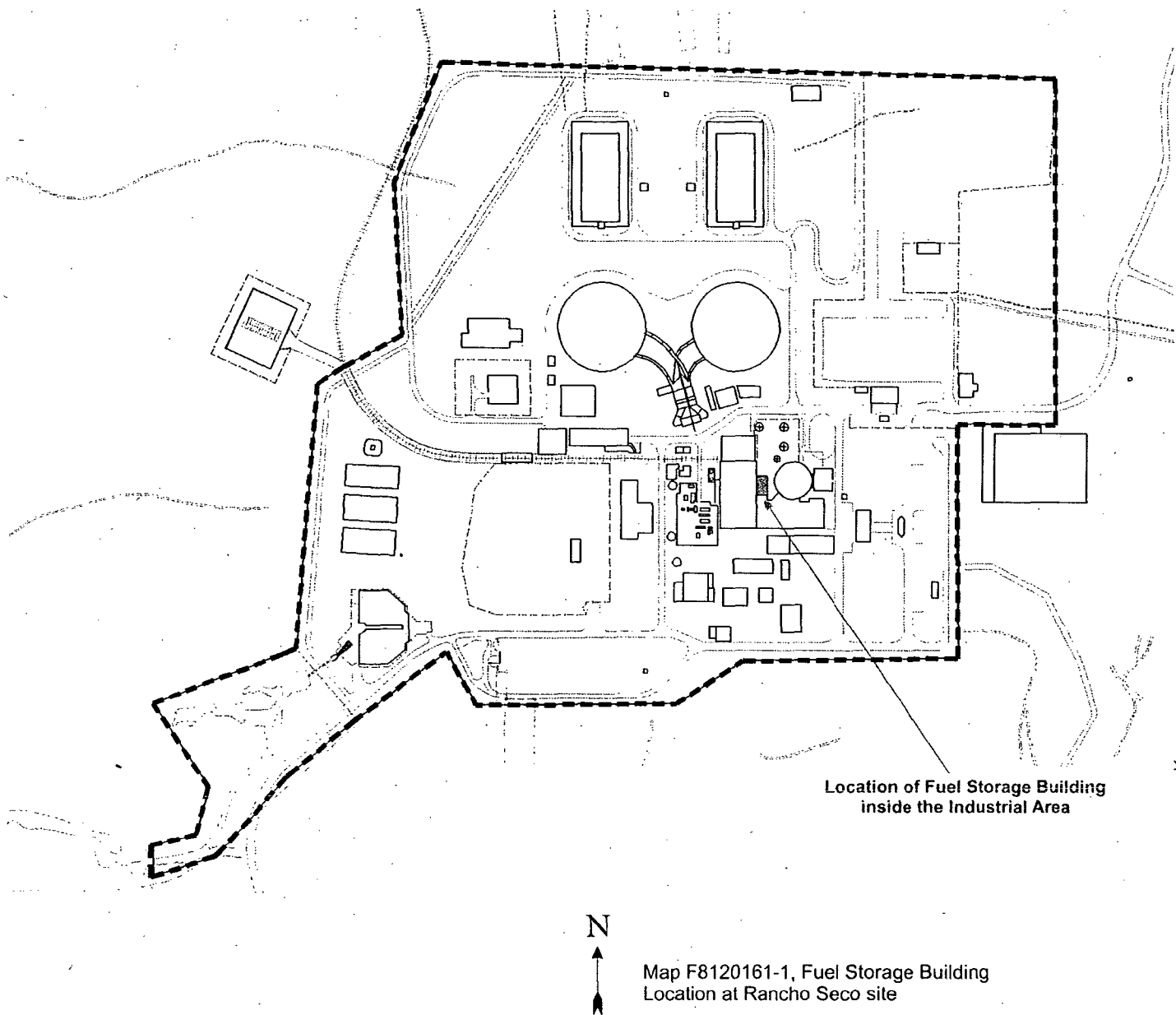
It is concluded that survey unit F8120161 meets the release criteria of 10CFR20.1402.

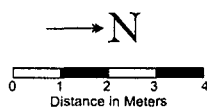
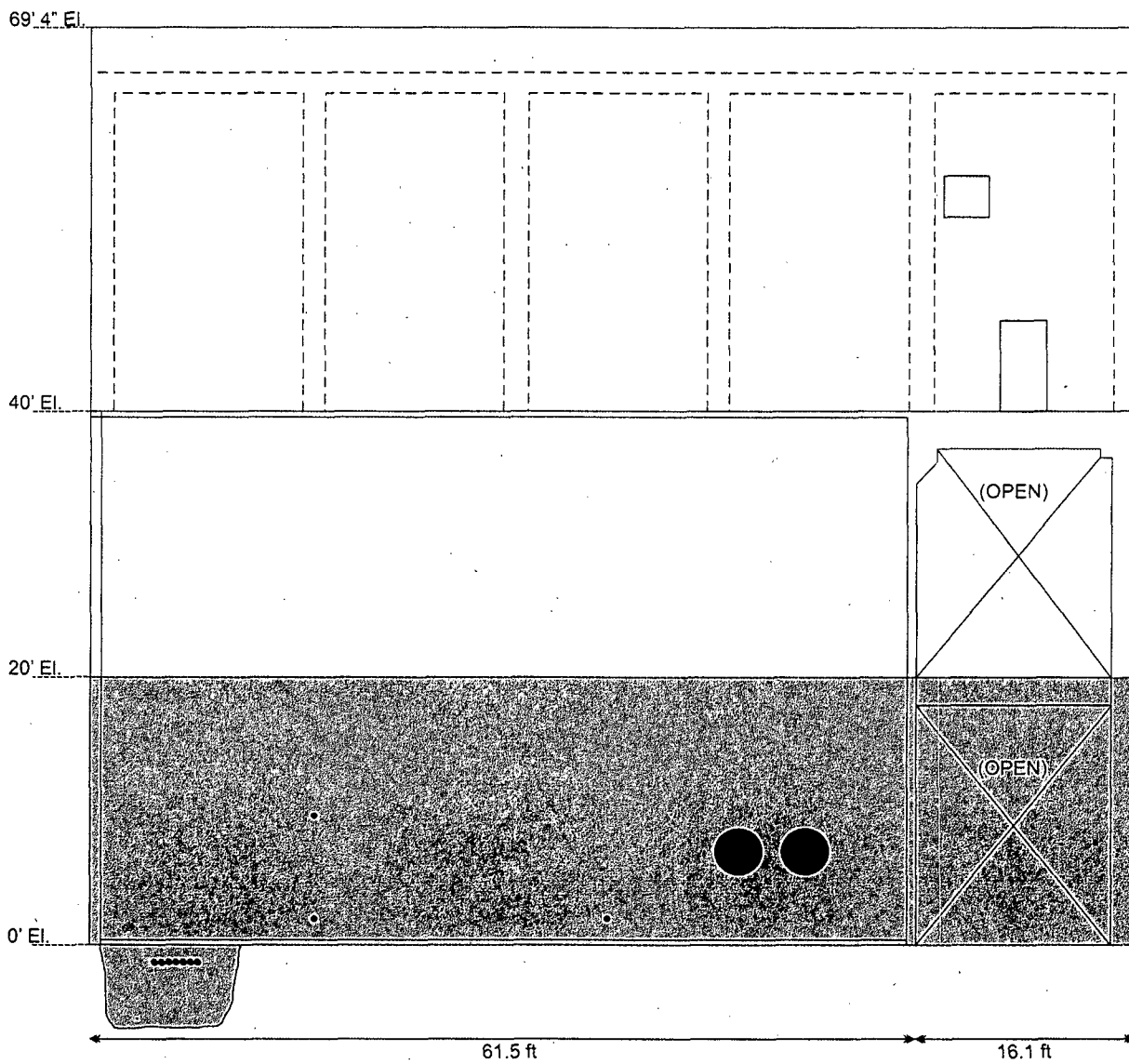
Attachment 1

Maps

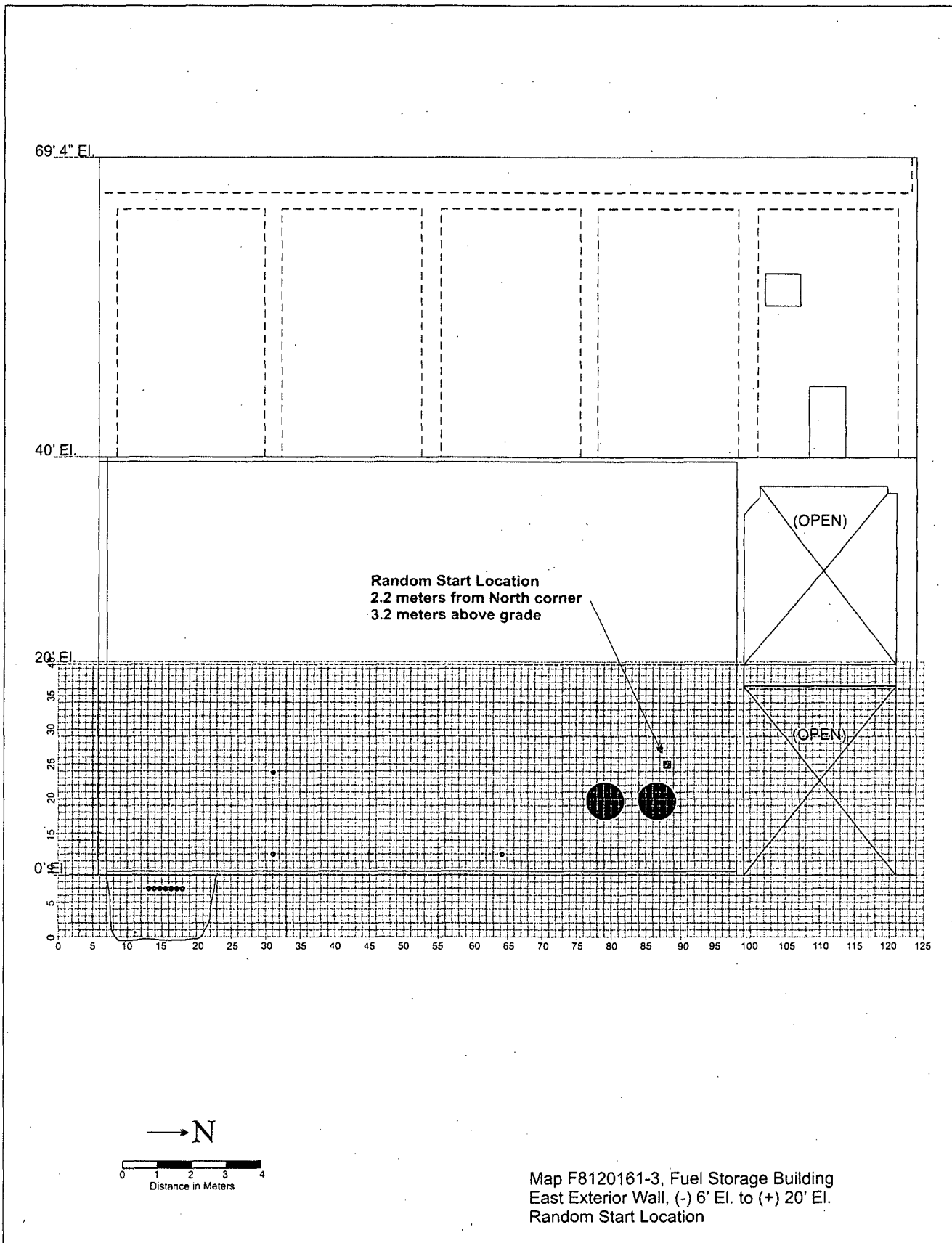
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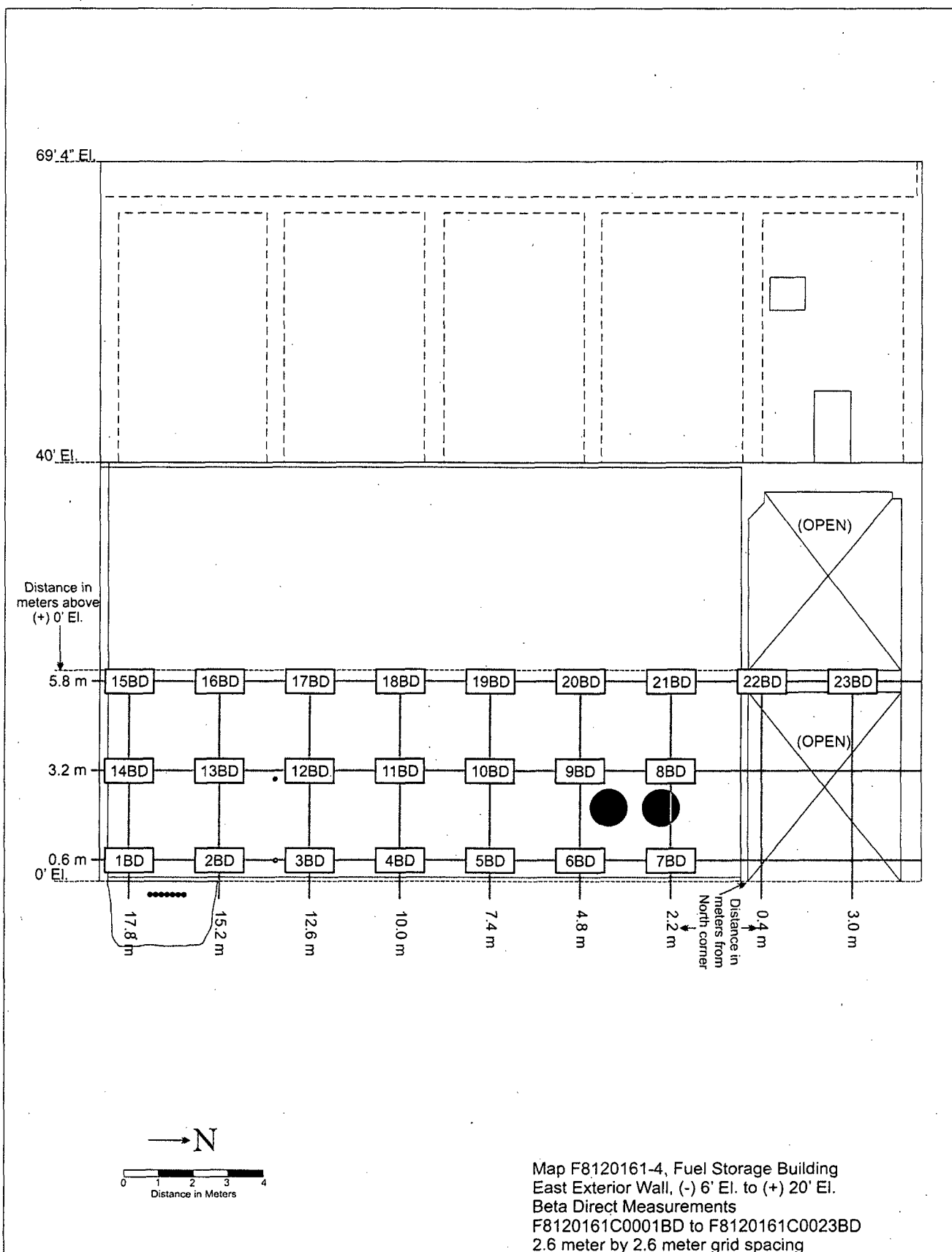
Survey Unit F8120161

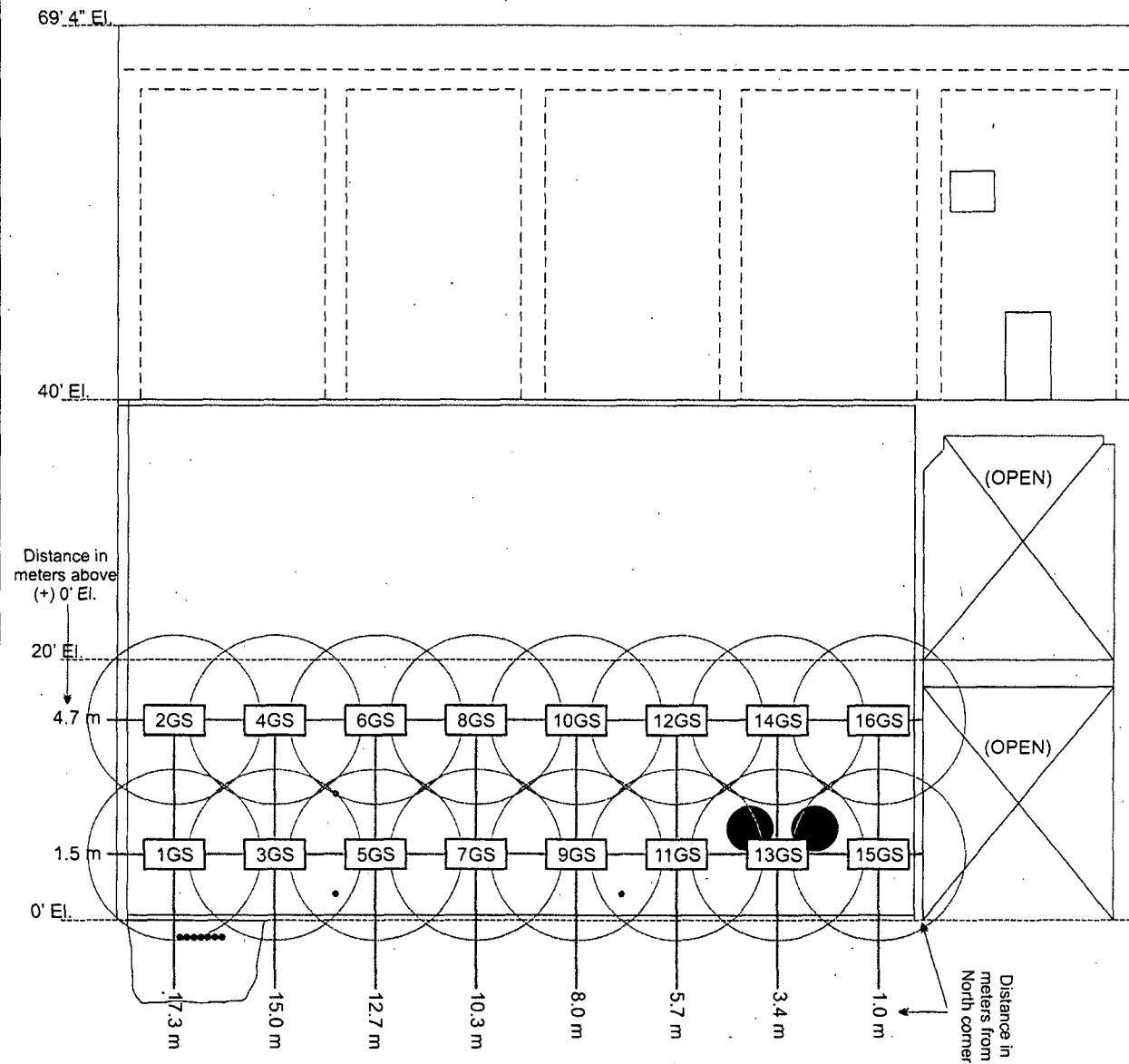




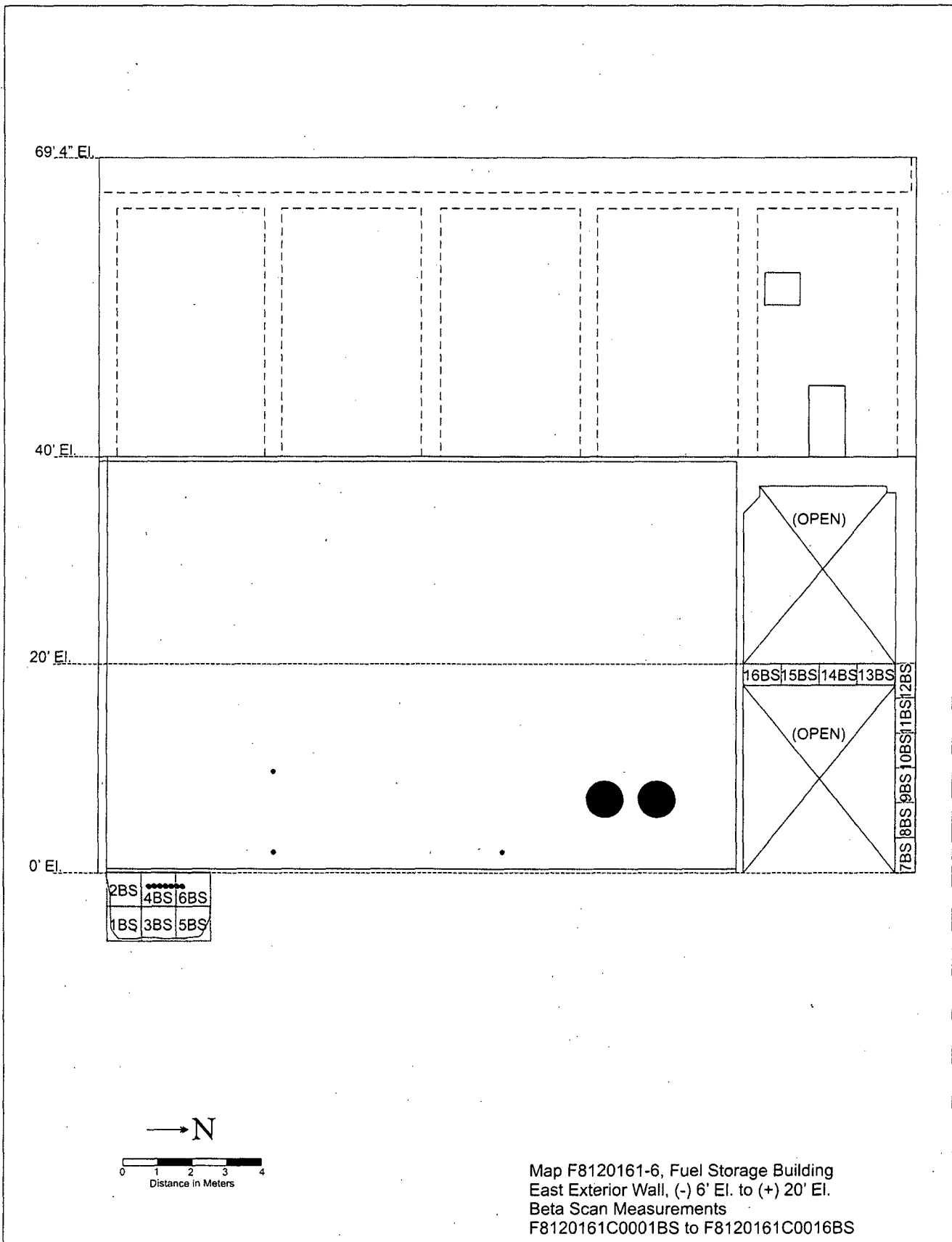
Map F8120161-2, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Area Estimate: 123 sq. meters

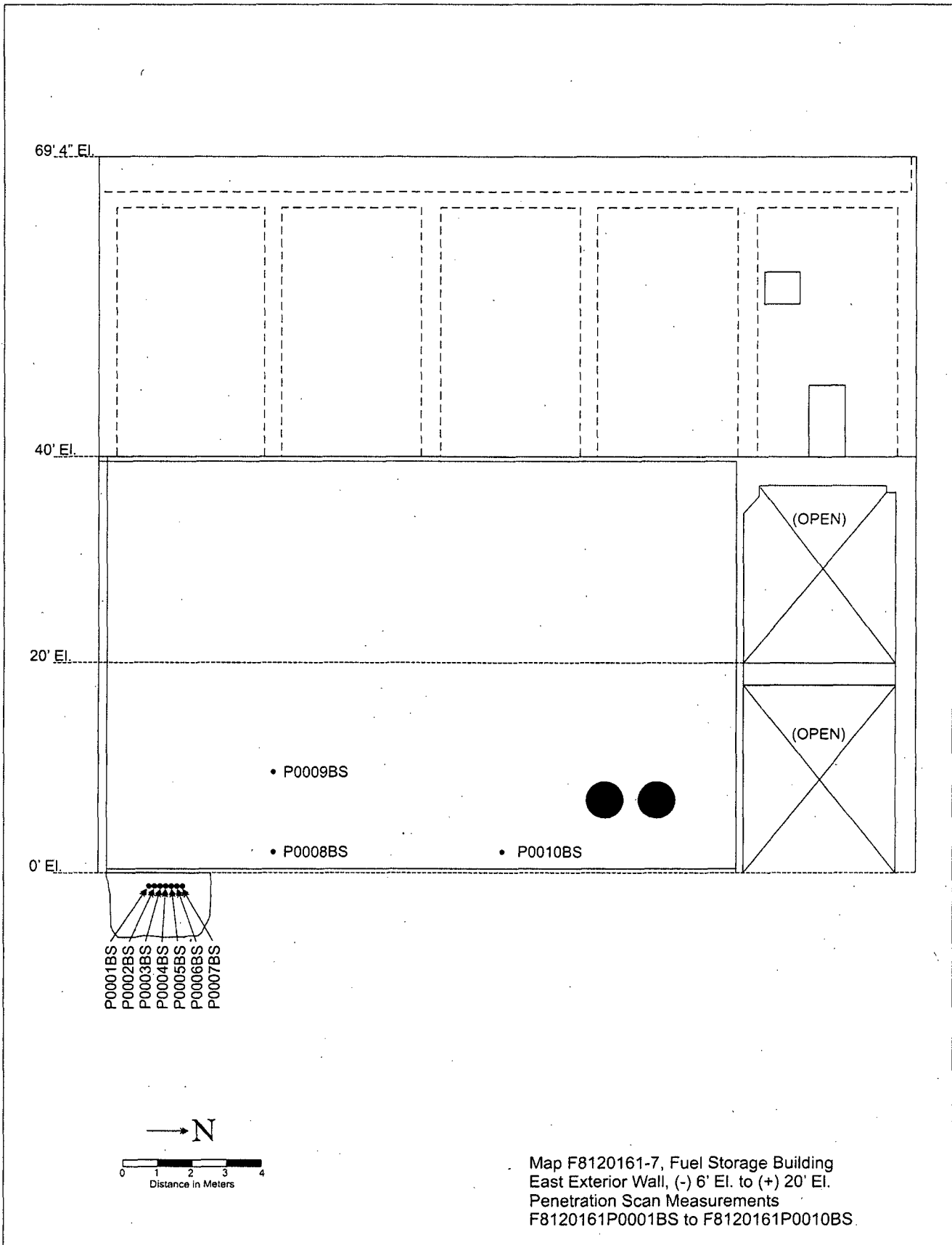


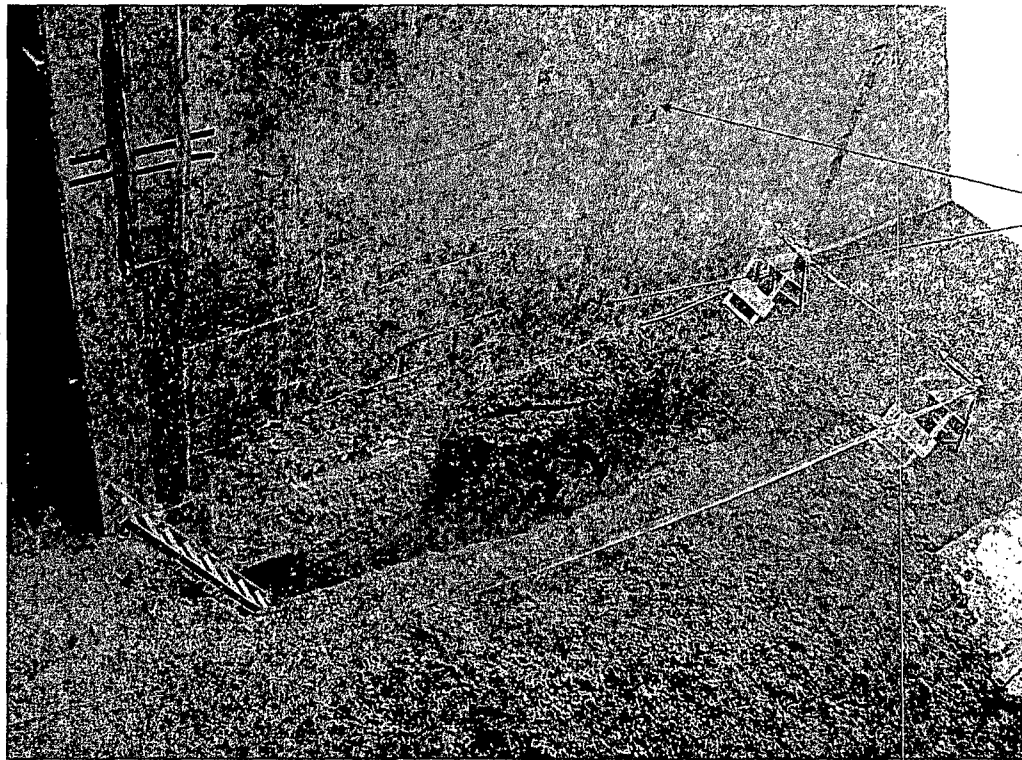




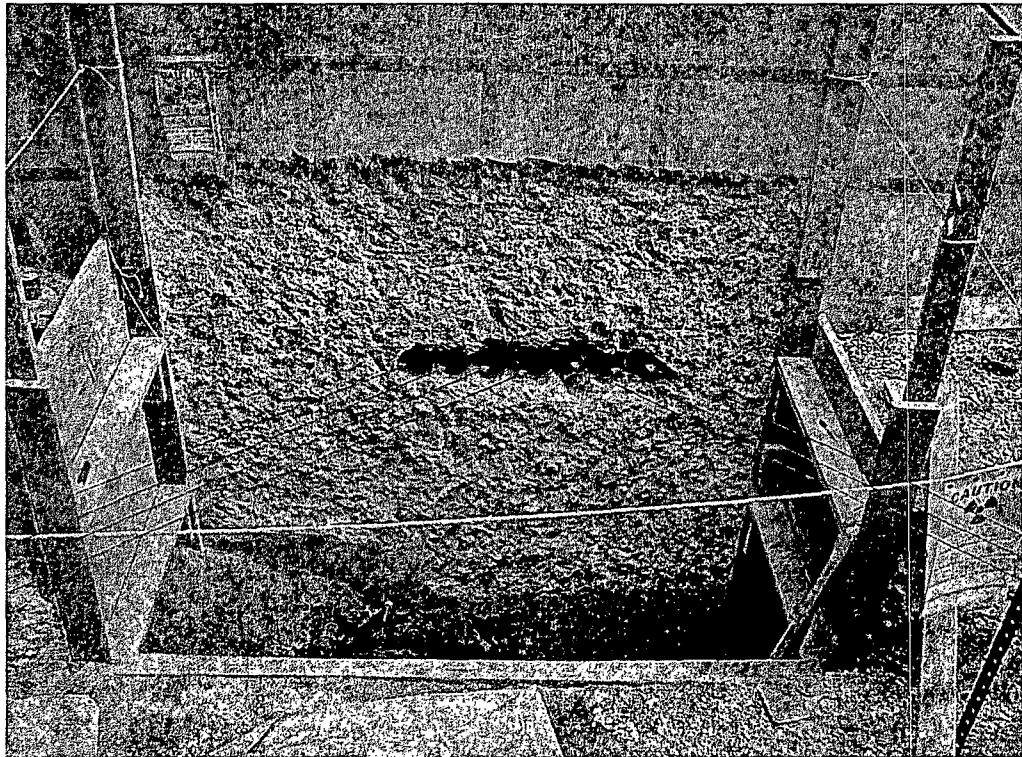
Map F8120161-5, Fuel Storage Building
 East Exterior Wall, (-) 6' El. to (+) 20' El.
 ISOCS Gamma Scan Measurements
 F8120161C0001GS to F8120161C0016GS
 12.57 sq. meter field of view







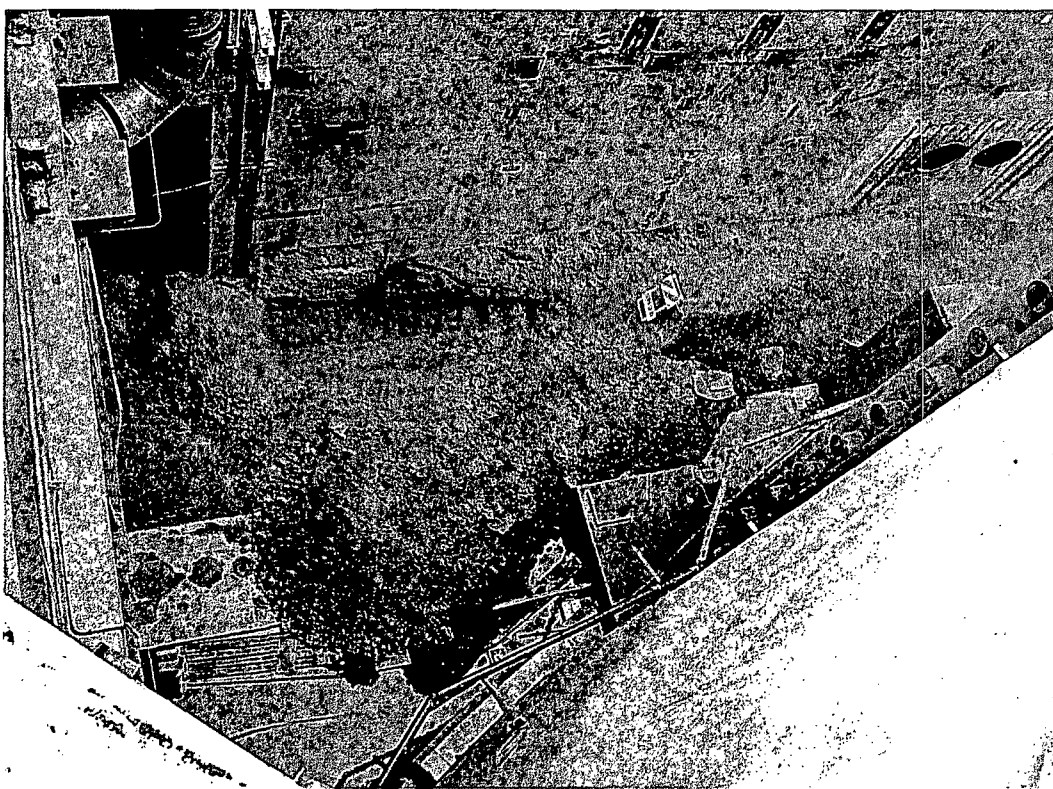
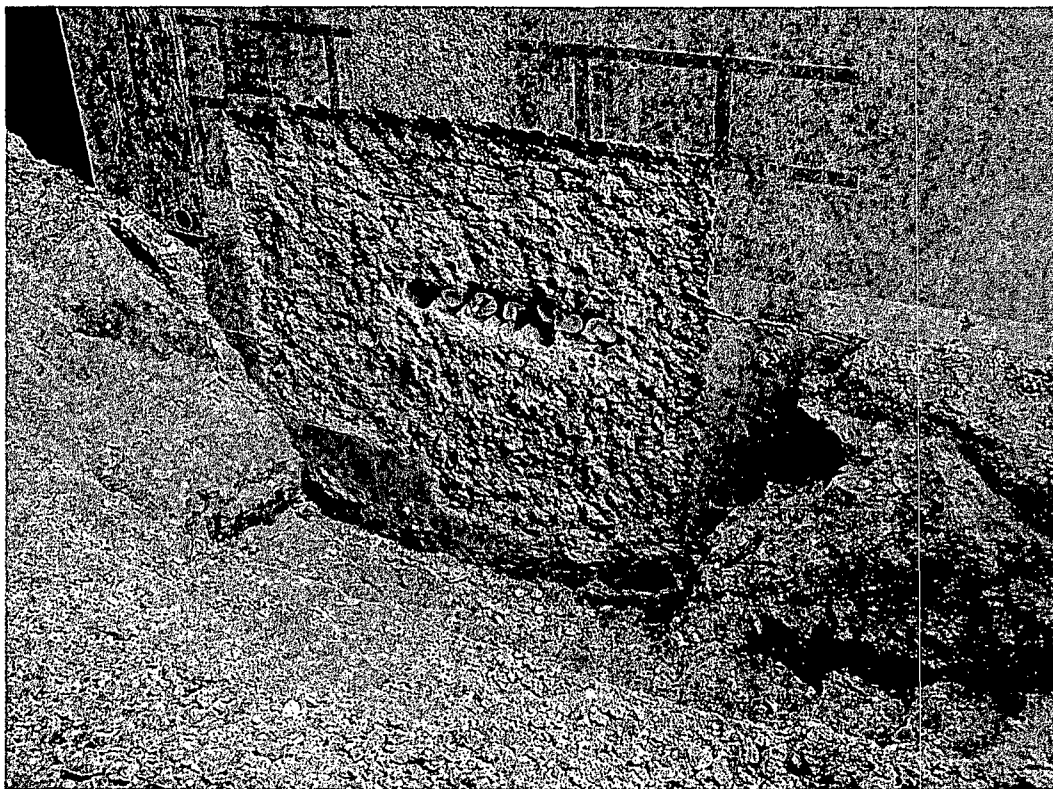
P0009BS
P0008BS



P0001BS
P0002BS
P0003BS
P0004BS

P0007BS
P0006BS
P0005BS

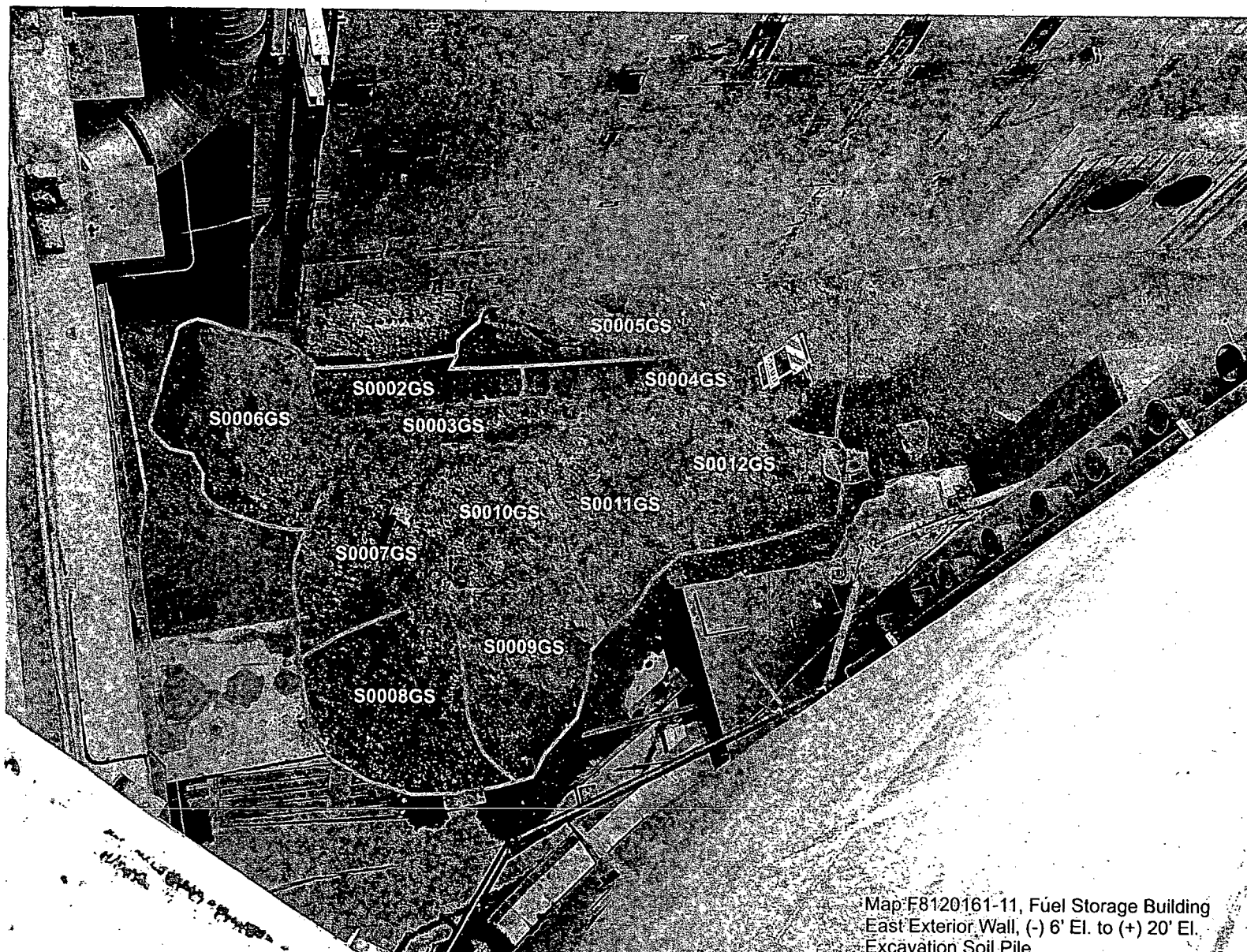
Map F8120161-8, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Penetration Scan Measurements
F8120161P0001BS to F8120161P0009BS



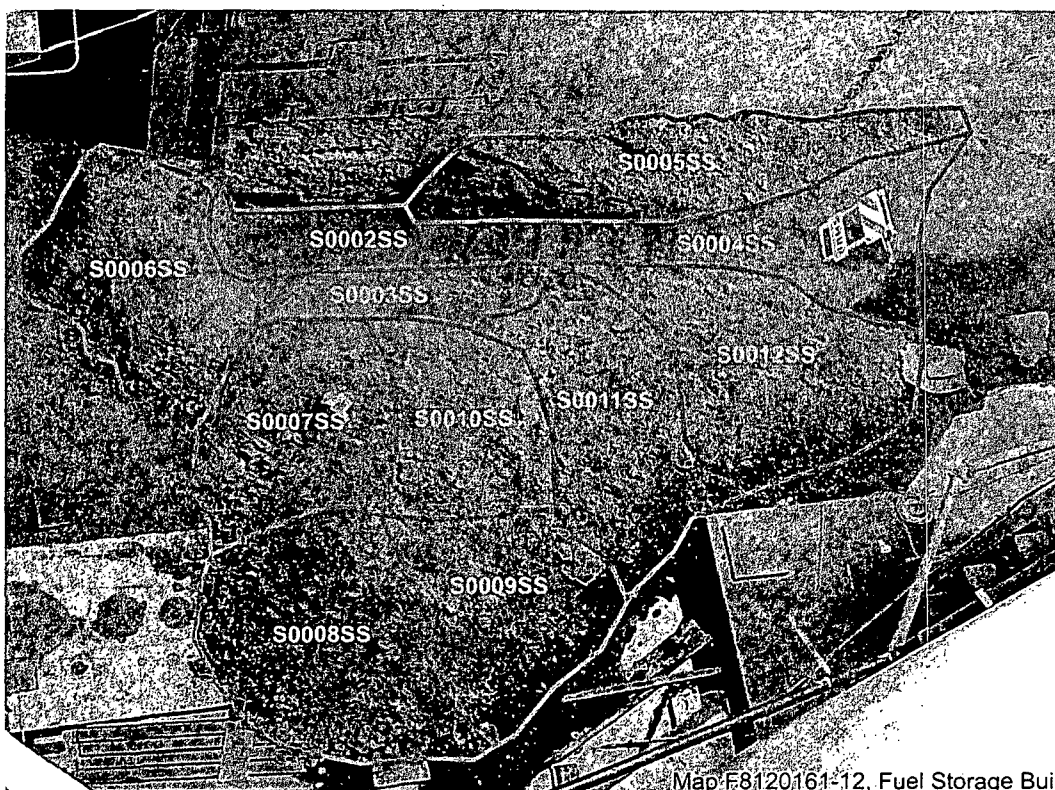
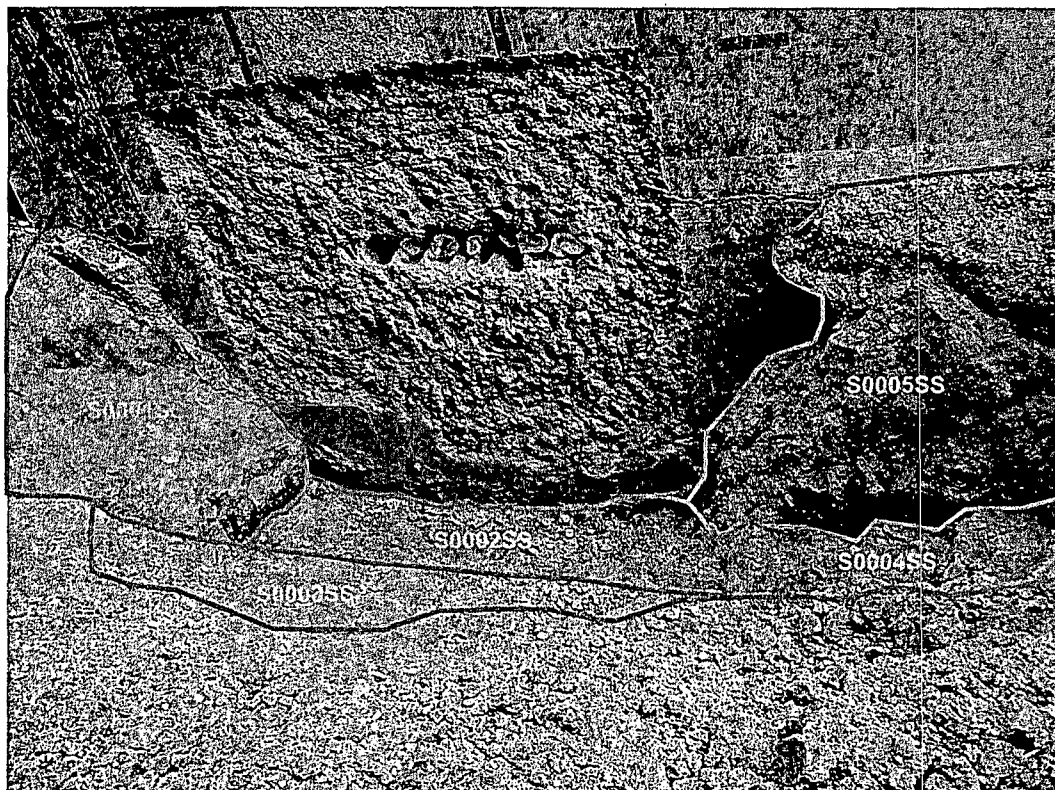
Map F8120161-9, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Sump Excavation and Spoils Pile



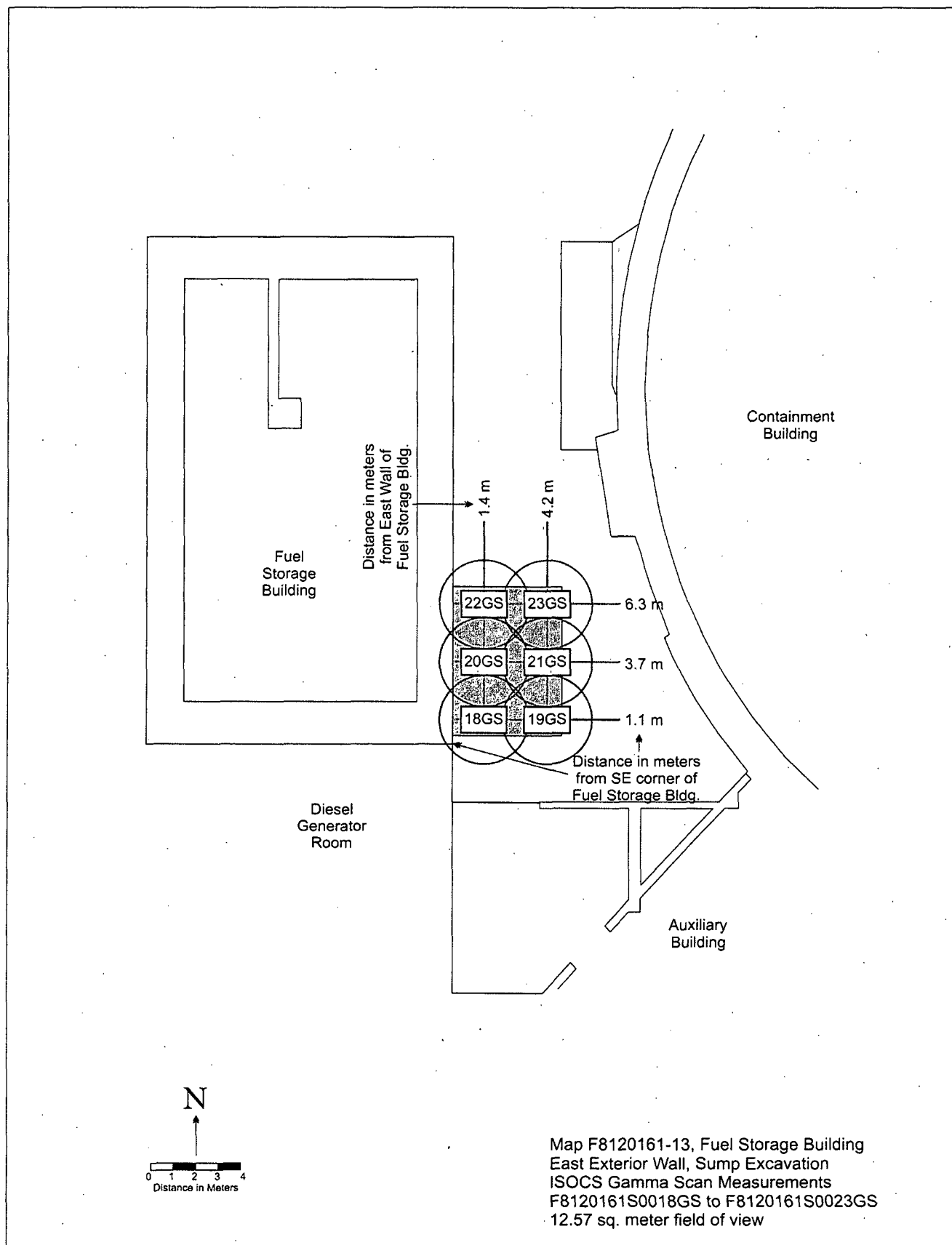
Map F8120161-10, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Sump Excavation
Nal Gamma Scan Measurements
F8120161S0001GS to F8120161S0005GS

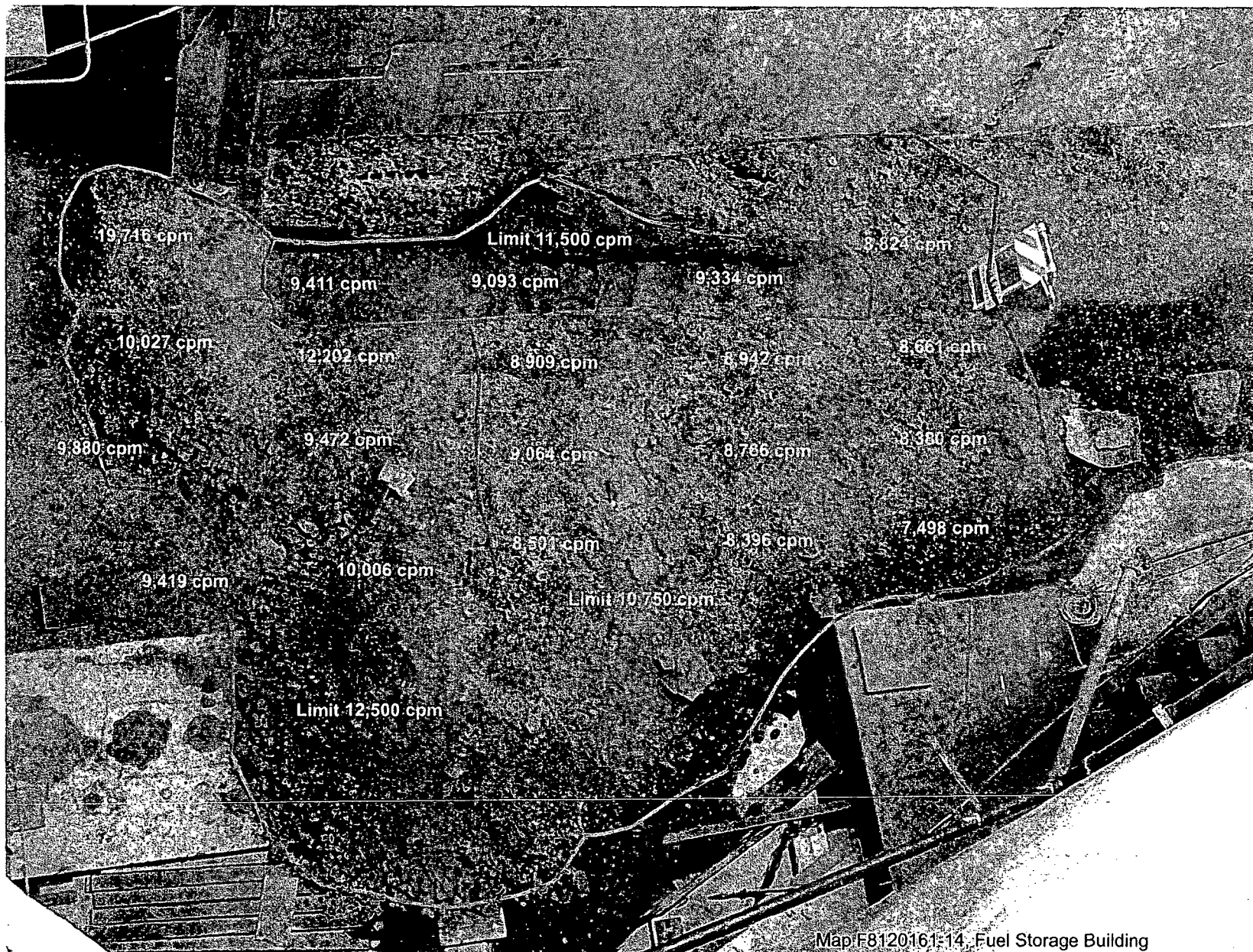


Map F8120161-11, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Excavation Soil Pile
Nal Gamma Scan Measurements
F8120161S0002GS to F8120161S0012GS



Map F8120161-12, Fuel Storage Building
 East Exterior Wall, (-) 6' El. to (+) 20' El.
 Excavation and Soil Pile Soil Sample Locations
 F8120161S0001SS to F8120161S0012SS





Map F8120161-14, Fuel Storage Building
East Exterior Wall Excavation and Soil Piles
NaI Scan Background Measurements & Alarm Setpoints
F8120161S0001SB to F8120161S0020SB



Map F8120161-15, Fuel Storage Building
East Exterior Wall, (-) 6' El. to (+) 20' El.
Excavation and Soil Pile Nal Scan Measurements
F8120161S0001GS to F8120161S0012GS



Map F8120161-16, Fuel Storage Building
East Exterior Wall Excavation and Soil Piles
Verification Nal Scan Measurements
F8120161S0013GS to F8120161S0019GS

Attachment 2

Instrumentation

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Survey Unit F8120161

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; 142514	43-98B; 148639	1,400	2,520
M2350; 180733	43-98B; 148638	1,400	2,520
M2350; 193700	43-68B; 160691	433	1,033
M2350; 193715	43-68B; 148630	433	1,033
M2350; 193715	43-116-1B; 190643	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 – 1,240 dpm/100 cm ² Cs-137, Concrete – 995 dpm/100 cm ² Co-60

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (pCi/g)	MDC Scan (pCi/g)
M2350; 203482	44-10; 211672	N/A	5.2
M2350; 193715	44-10; 171374	N/A	5.2

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Soil – 0.39 pCi/g Cs-137, Soil – 0.23 pCi/g Co-60
HPGe	N/A	05069128	Soil – 0.09 pCi/g Cs-137, Soil – 0.07 pCi/g Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	154,800
Investigation Criteria – Scan (ISOCS average activity)	63,300
DCGL _W	43,000
DCGL _{EMC}	154,800

Attachment 3

Investigation

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Survey Unit F8120161

(none required)

Attachment 4

Data Assessment

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