Rancho Seco

Final Status Survey Summary Report

October 8, 2008

Spent Fuel Pool Floor, (-) 4' 6" El. to (+) 0' El.

Survey Unit F8120005

Prepared By: D. Anderson **Date:** 10/8/2008

FSS Engineer

Reviewed By: Robert F Daher **Date:** 12/15/08

Lead FSS Engineer

Approved By: E7 **Date:** 2-6-09

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8120005, Spent Fuel Pool Floor, (-) 4' 6" El. to (+) 0' 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 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 175.2 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	Spent Fuel Pool Floor
Survey Unit:	0005	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	175.2	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	43,000	Gross Activity DCGL
Area Factor:	3.6	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	154,800	Class 1
LBGR (dpm/100 cm^2)**:**	21,500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	12,246	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	6.74	Class 1
Scan Area (m^2)**:**	175.2	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.955435	
Calculated Relative Shift:	1.7	
Relative Shift Used:	1.7	Uses 3.0 if Relative Shift is >3
N-Value:	14	
Design N-Value + 20%:	17	NUREG-1575 Table 5-5
Design Min Samples N:	26	Class 1
Grid Spacing L:	2.5	Class 1

Survey Results:

A total of 26 direct measurements were made in F8120005. 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 scan activity ranged from < 1,370 dpm/100 cm^2 to 1,863 dpm/100 cm^2 Co-60 and < 1,260 dpm/100 cm^2 to 14,901 dpm/100 cm^2 Cs-137. Beta scan activity ranged from 3,357 to 11,100 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)
F8120005-C0001BD	2,044
F8120005-C0002BD	2,314
F8120005-C0003BD	2,111
F8120005-C0004BD	2,324
F8120005-C0005BD	2,438
F8120005-C0006BD	2,153
F8120005-C0007BD	3,916
F8120005-C0008BD	2,018
F8120005-C0009BD	2,122
F8120005-C0010BD	2,070
F8120005-C0011BD	2,241
F8120005-C0012BD	4,886
F8120005-C0013BD	2,158
F8120005-C0014BD	2,070
F8120005-C0015BD	2,241
F8120005-C0016BD	19,748
F8120005-C0017BD	2,293
F8120005-C0018BD	2,101
F8120005-C0019BD	2,122
F8120005-C0020BD	2,490
F8120005-C0021BD	1,738
F8120005-C0022BD	2,184
F8120005-C0023BD	2,148
F8120005-C0024BD	2,210
F8120005-C0025BD	2,578
F8120005-C0026BD	2,002
Mean:	3,028
Median:	2,171
Standard Deviation:	3,470
Range:	1,738 – 19,748

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8120005C0001SM	-0.95
F8120005C0002SM	8.09
F8120005C0003SM	-3.53
F8120005C0004SM	0.34
F8120005C0005SM	-0.95
F8120005C0006SM	0.34
F8120005C0007SM	-2.24
F8120005C0008SM	-2.24
F8120005C0009SM	-3.53
F8120005C0010SM	-2.24
F8120005C0011SM	-0.95
F8120005C0012SM	4.22
F8120005C0013SM	-4.82
F8120005C0014SM	-3.53
F8120005C0015SM	0.34
F8120005C0016SM	-0.95
F8120005C0017SM	-4.82
F8120005C0018SM	-2.24
F8120005C0019SM	0.34
F8120005C0020SM	-0.95
F8120005C0021SM	-2.24
F8120005C0022SM	-2.24
F8120005C0023SM	-2.24
F8120005C0024SM	-3.53
F8120005C0025SM	-2.24
F8120005C0026SM	-0.95
Mean:	-1.29
Median:	-2.24
Standard Deviation:	2.7
Range:	-4.82 to 8.09

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):	2,171	
Mean (dpm/100 cm²):	3,028	
Direct Measurement Standard Deviation (dpm/100 cm²):	3,470	
Total Standard Deviation (dpm/100 cm²):	3,470	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	19,748	
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.

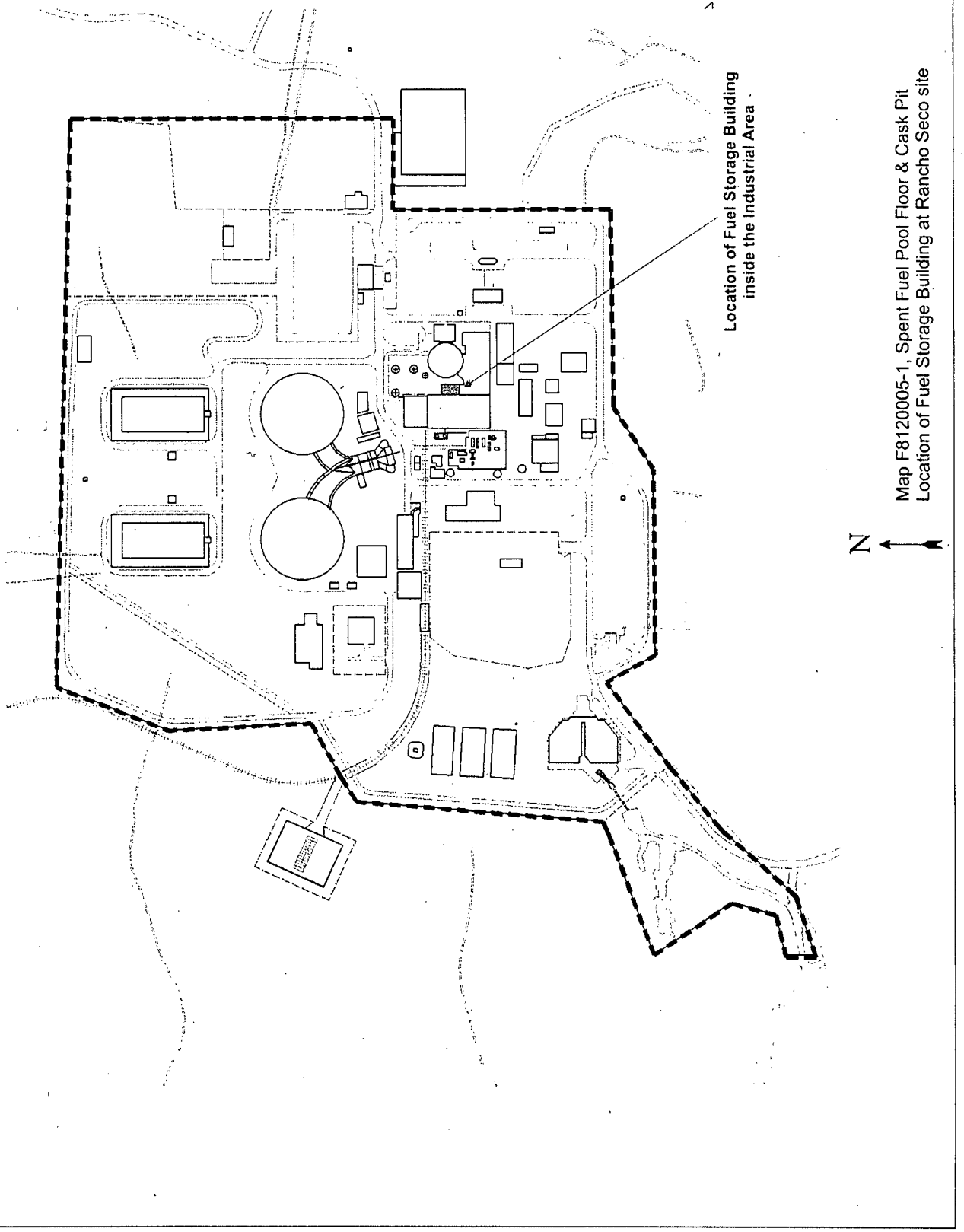
It is concluded that survey unit F8120005 meets the release criteria of 10CFR20.1402.

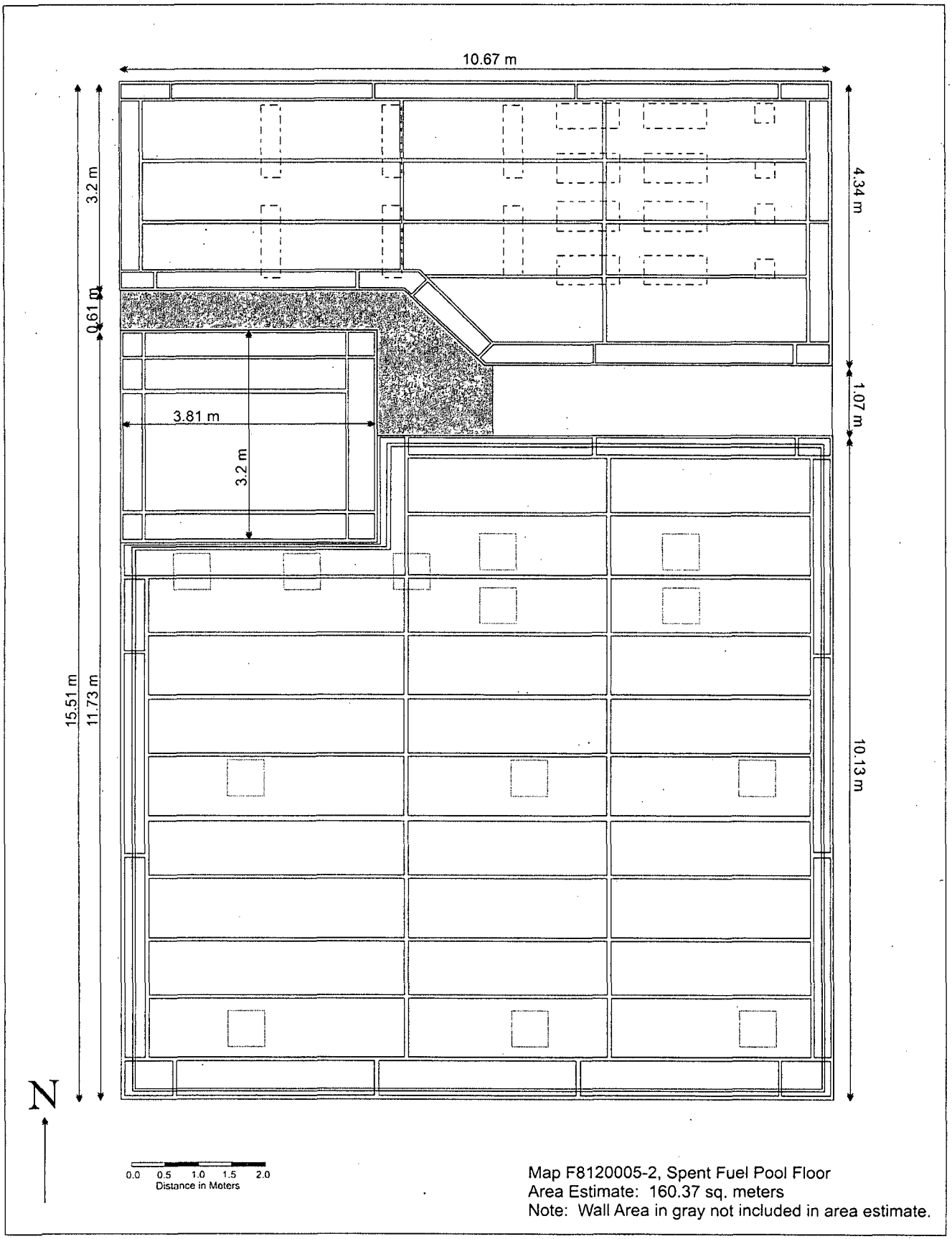
Attachment 1

Maps

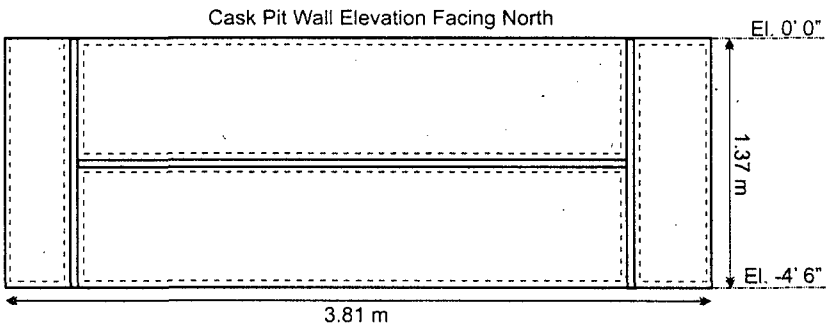
October 8, 2008

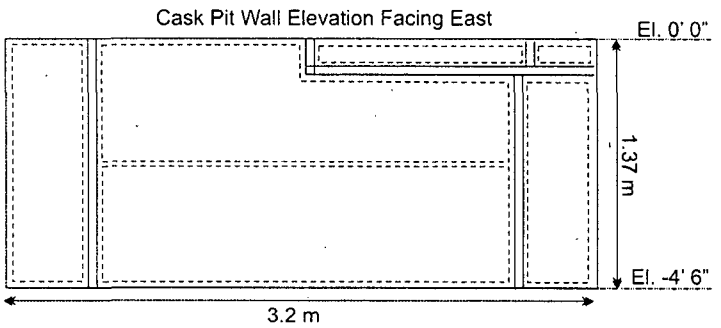
Survey Unit F8120005

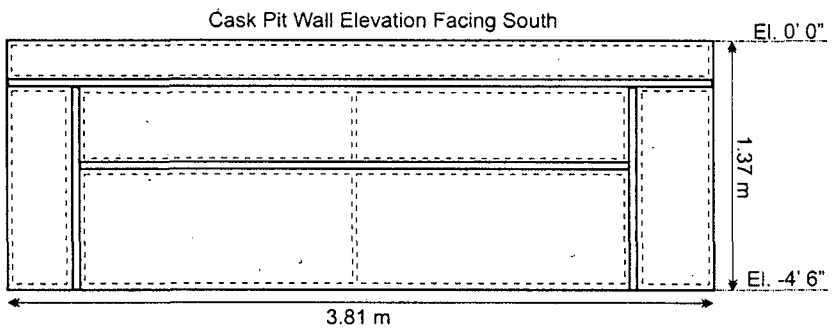

Location of Fuel Storage Building
inside the Industrial Area
N
Map F8120005-1, Spent Fuel Pool Floor & Cask Pit
Location of Fuel Storage Building at Rancho Seco site

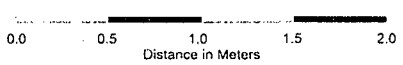


Map F8120005-2, Spent Fuel Pool Floor
Area Estimate: 160.37 sq. meters
Note: Wall Area in gray not included in area estimate.

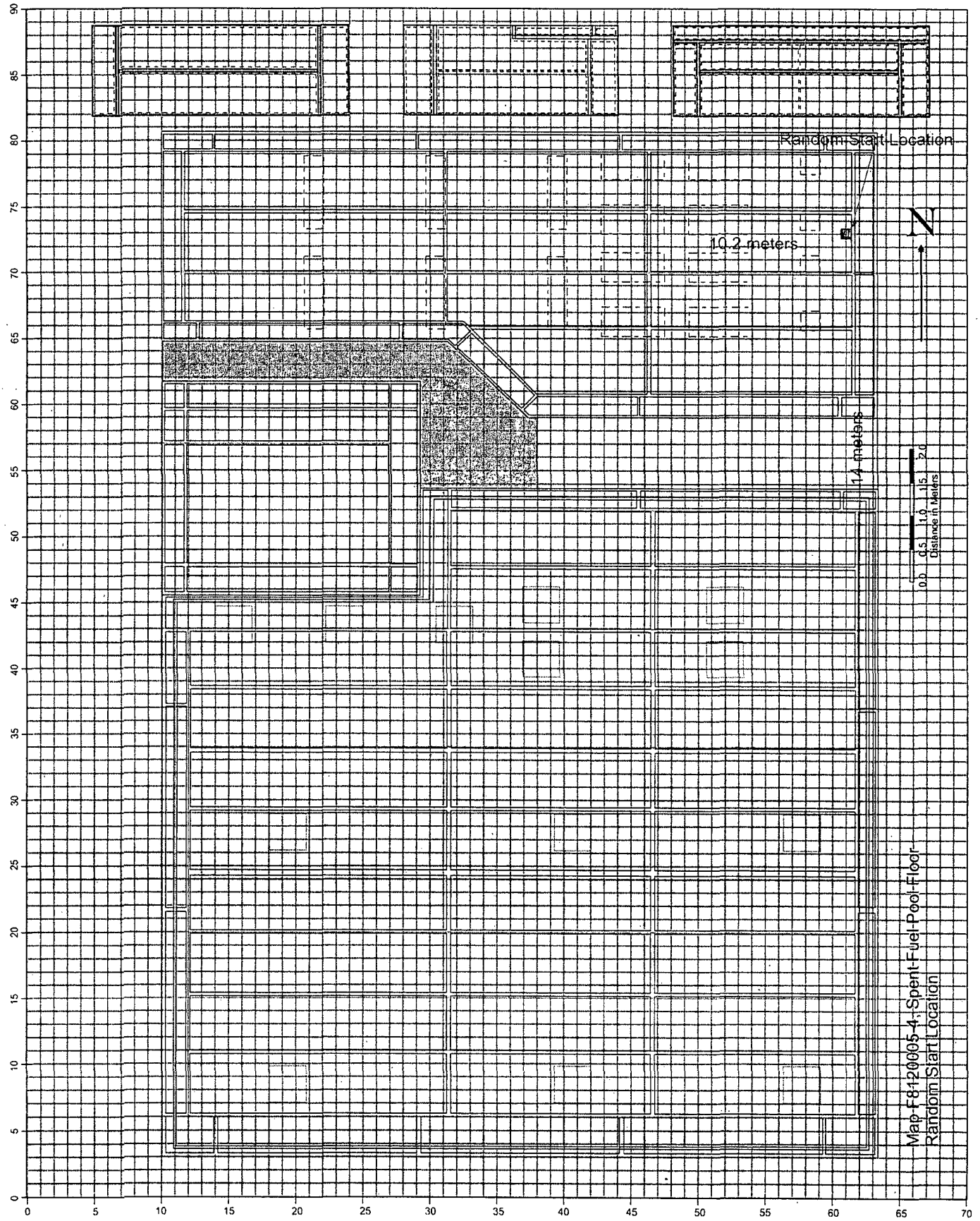


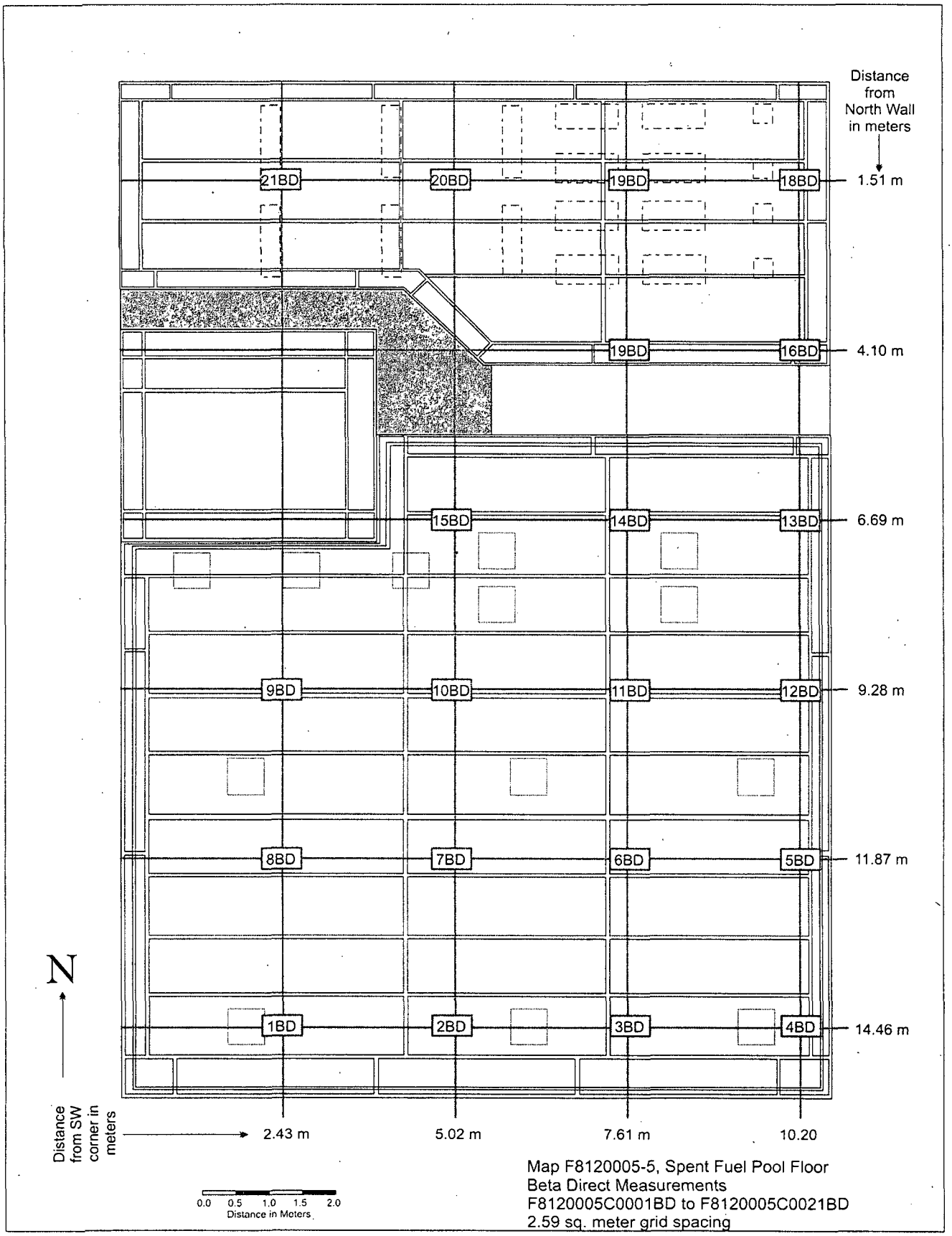


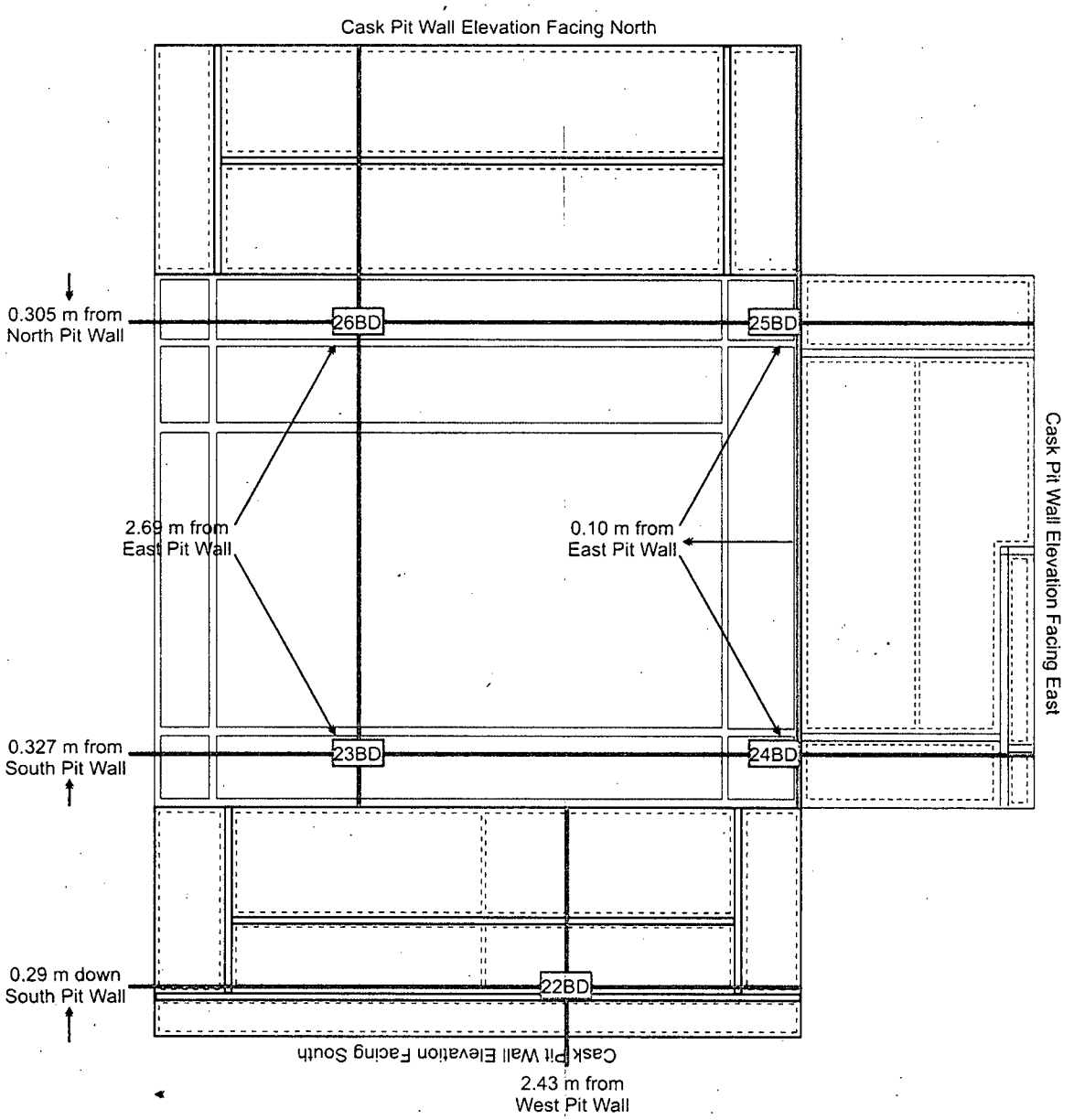




Map F8120005-3, Spent Fuel Pool Floor
Area Estimate: 14.84 sq. meters
Note: Cask Pit West Wall included in
Final Survey Package F8120001.


Random Start Location
10.2 meters
14 meters
N
0.0 0.5 1.0 1.5 2.0
Distance in Meters
Map F8120005-4 Spent Fuel Pool Floor
Random Start Location

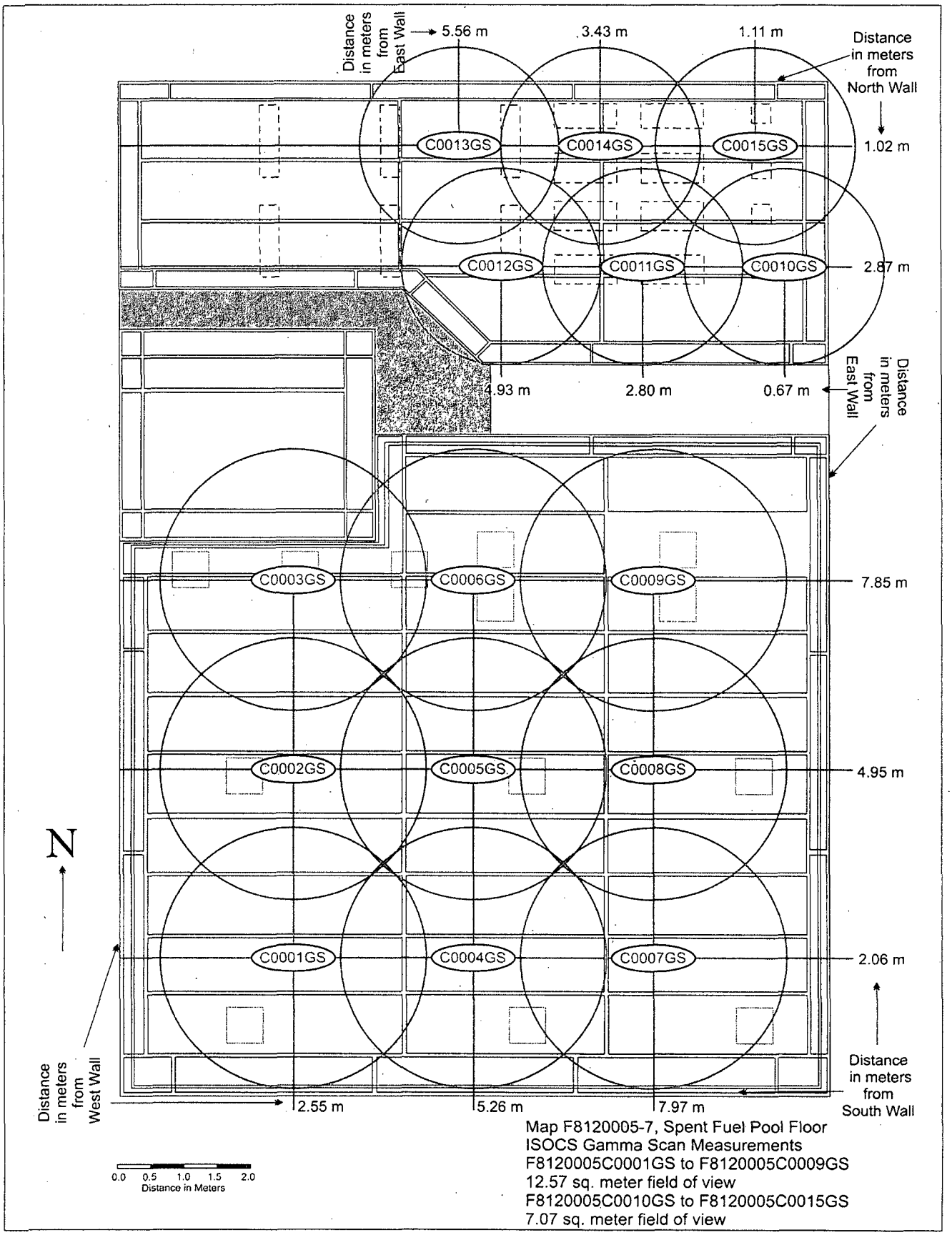

Distance from North Wall in meters
21BD
20BD
19BD
18BD
1.51 m
19BD
16BD
4.10 m
15BD
14BD
13BD
6.69 m
9BD
10BD
11BD
12BD
9.28 m
8BD
7BD
6BD
5BD
11.87 m
1BD
2BD
3BD
4BD
14.46 m
N
Distance from SW corner in meters
2.43 m
5.02 m
7.61 m
10.20
0.0 0.5 1.0 1.5 2.0
Distance in Meters
Map F8120005-5, Spent Fuel Pool Floor
Beta Direct Measurements
F8120005C0001BD to F8120005C0021BD
2.59 sq. meter grid spacing

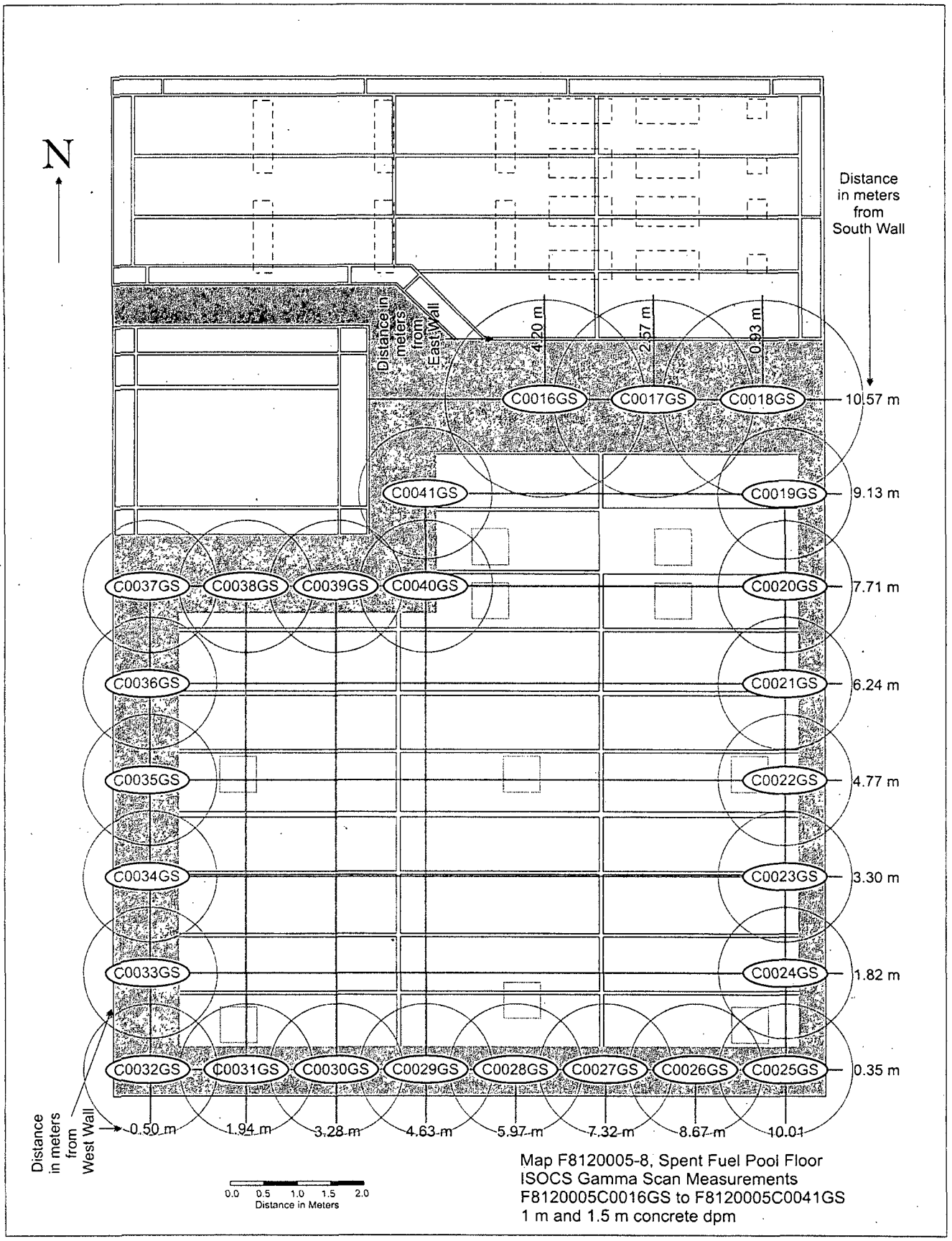


N

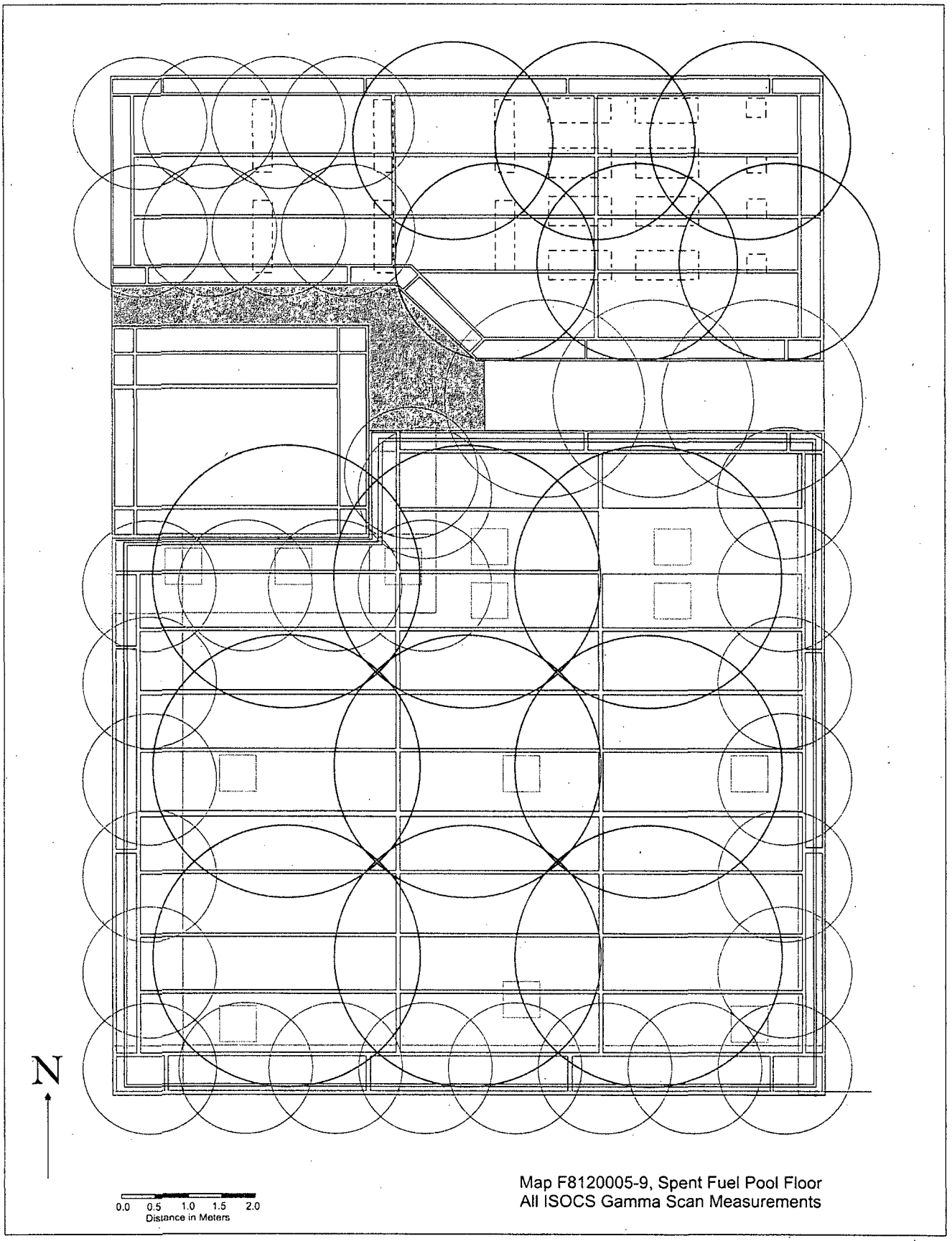
0.0 0.5 1.0 1.5 2.0
Distance in Meters

Map F8120005-6, Spent Fuel Pool Floor
Beta Direct Measurements
F8120005C0022BD to F8120005C0026BD
2.59 sq. meter grid spacing

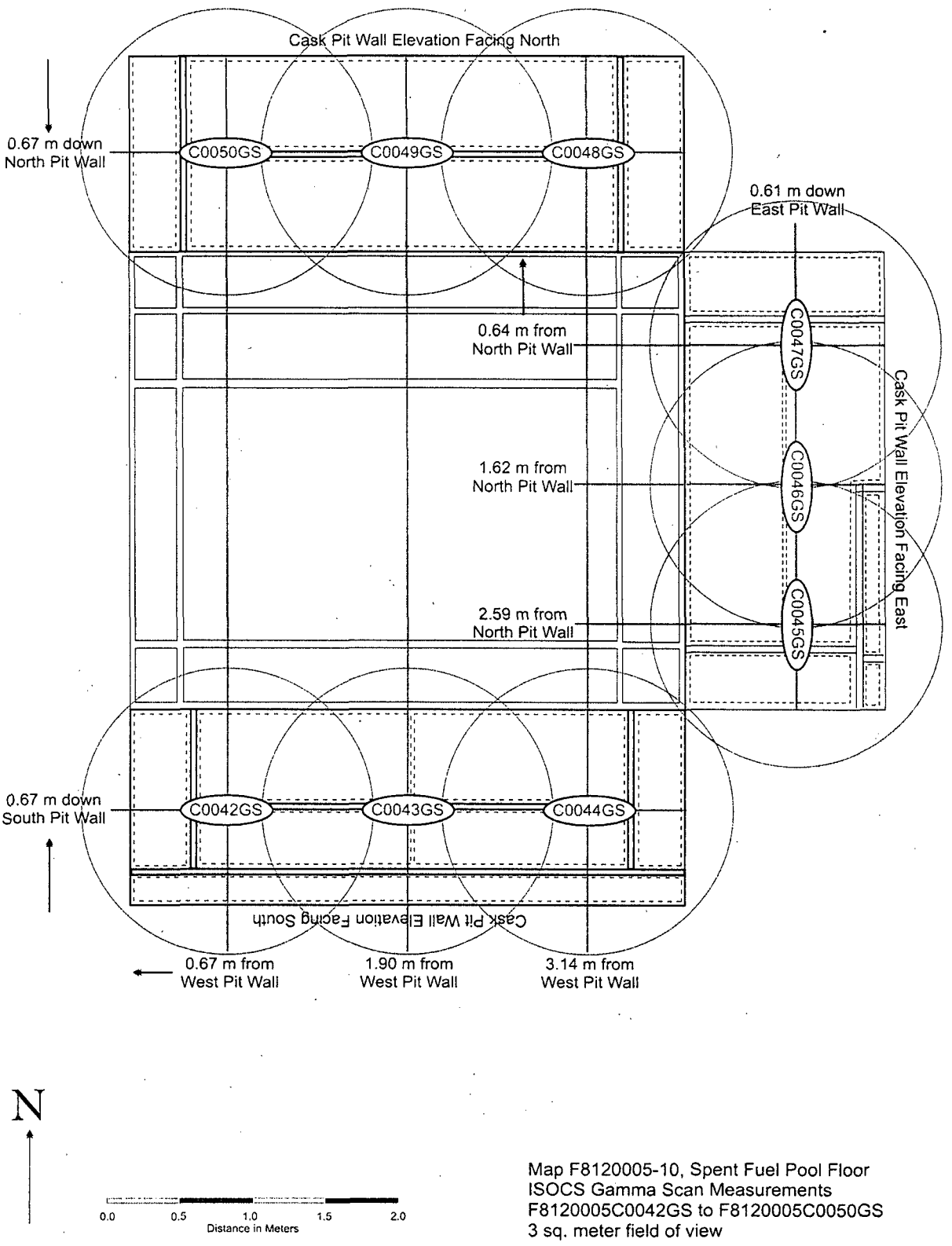

Distance in meters from East Wall
5.56 m
3.43 m
1.11 m
Distance in meters from North Wall
C0013GS
C0014GS
C0015GS
1.02 m
C0012GS
C0011GS
C0010GS
2.87 m
4.93 m
2.80 m
0.67 m
Distance in meters from East Wall
C0003GS
C0006GS
C0009GS
7.85 m
C0002GS
C0005GS
C0008GS
4.95 m
N
C0001GS
C0004GS
C0007GS
2.06 m
Distance in meters from West Wall
2.55 m
5.26 m
7.97 m
Distance in meters from South Wall
0.0 0.5 1.0 1.5 2.0
Distance in Meters
Map F8120005-7, Spent Fuel Pool Floor
ISOCS Gamma Scan Measurements
F8120005C0001GS to F8120005C0009GS
12.57 sq. meter field of view
F8120005C0010GS to F8120005C0015GS
7.07 sq. meter field of view



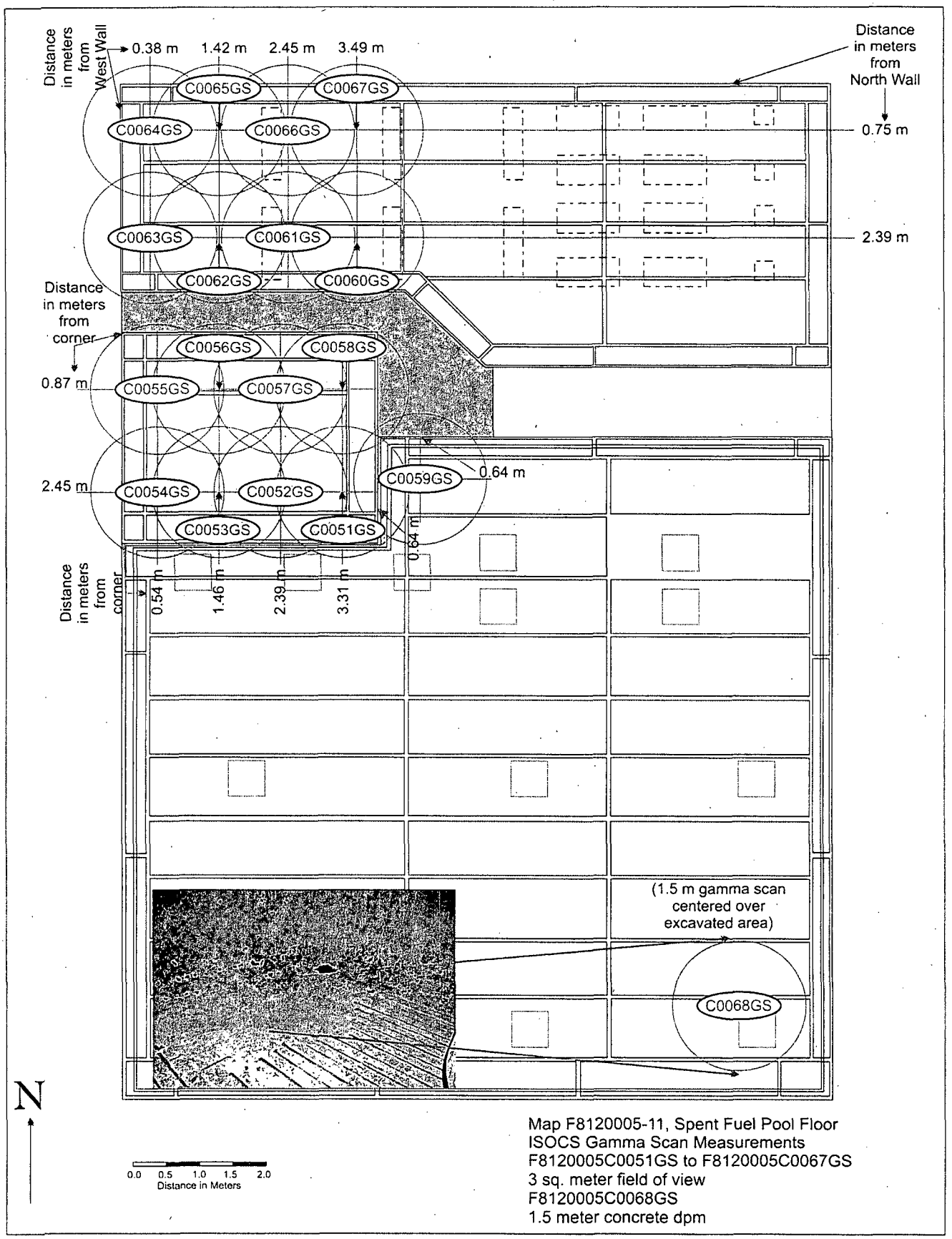
Map F8120005-8, Spent Fuel Pool Floor
ISOCS Gamma Scan Measurements
F8120005C0016GS to F8120005C0041GS
1 m and 1.5 m concrete dpm



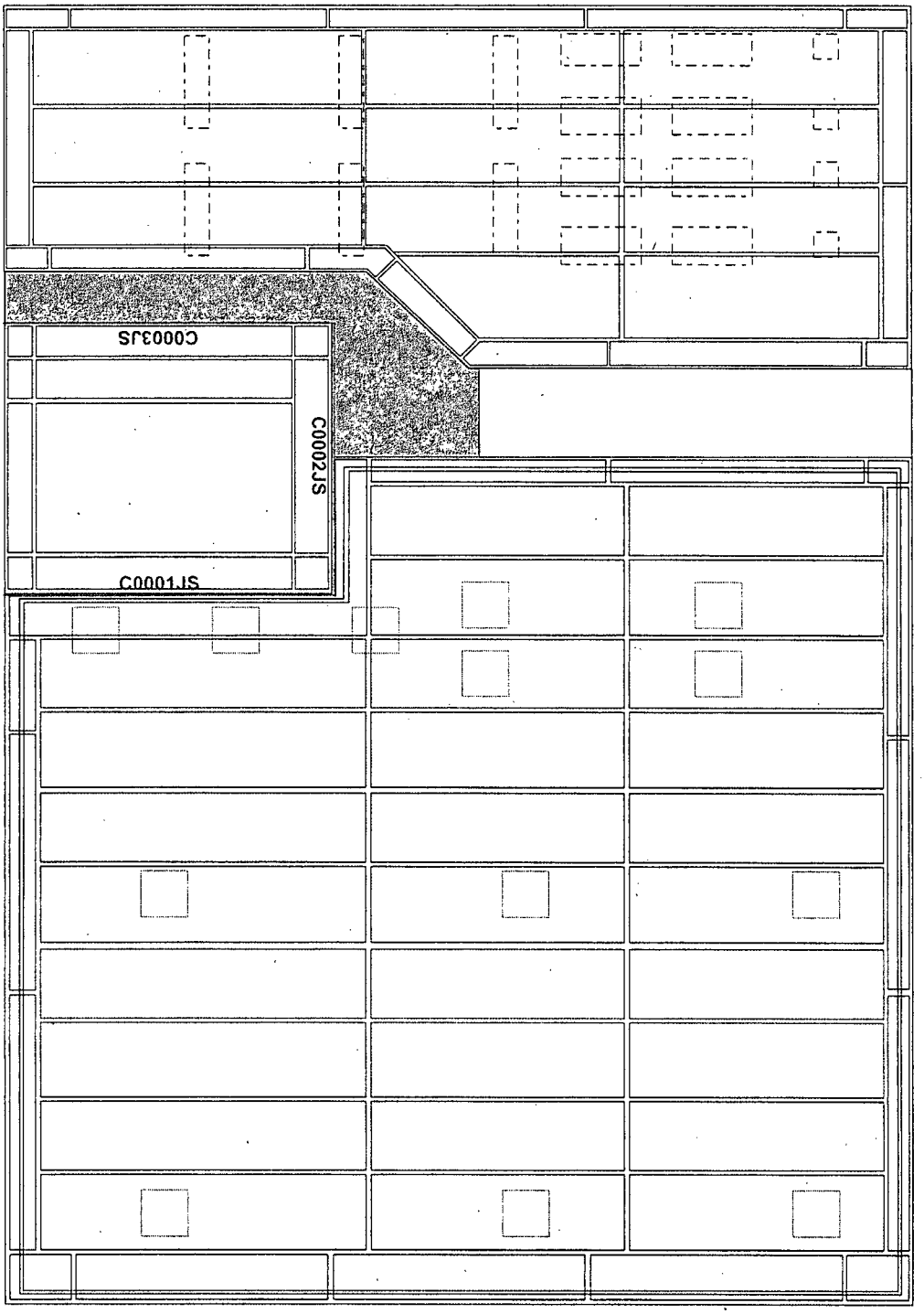
Map F8120005-9, Spent Fuel Pool Floor
All ISOCS Gamma Scan Measurements



Map F8120005-10, Spent Fuel Pool Floor
ISOCS Gamma Scan Measurements
F8120005C0042GS to F8120005C0050GS
3 sq. meter field of view



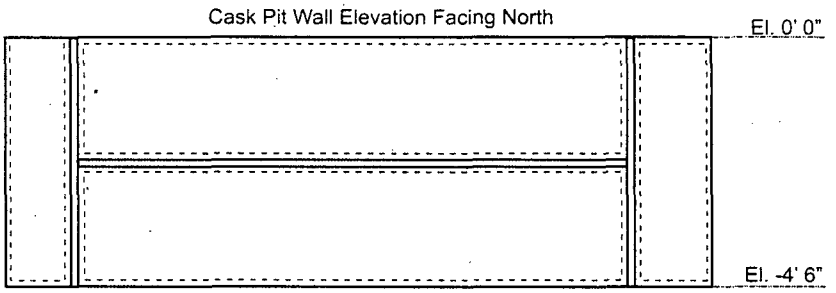
Map F8120005-11, Spent Fuel Pool Floor
ISOCS Gamma Scan Measurements
F8120005C0051GS to F8120005C0067GS
3 sq. meter field of view
F8120005C0068GS
1.5 meter concrete dpm

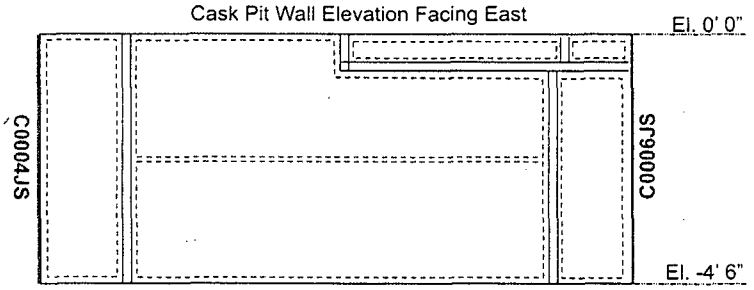


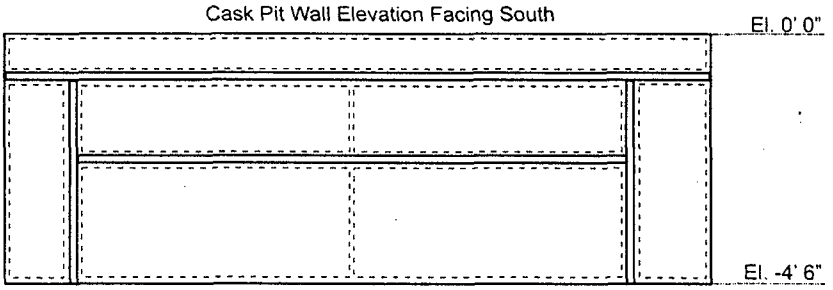
N

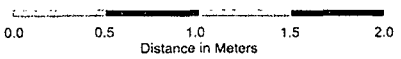
0.0 0.5 1.0 1.5 2.0
Distance in Meters

Map F8120005-12, Spent Fuel Pool Floor
Juncture Scan Measurements
F8120005C0001JS to F8120005C0003JS

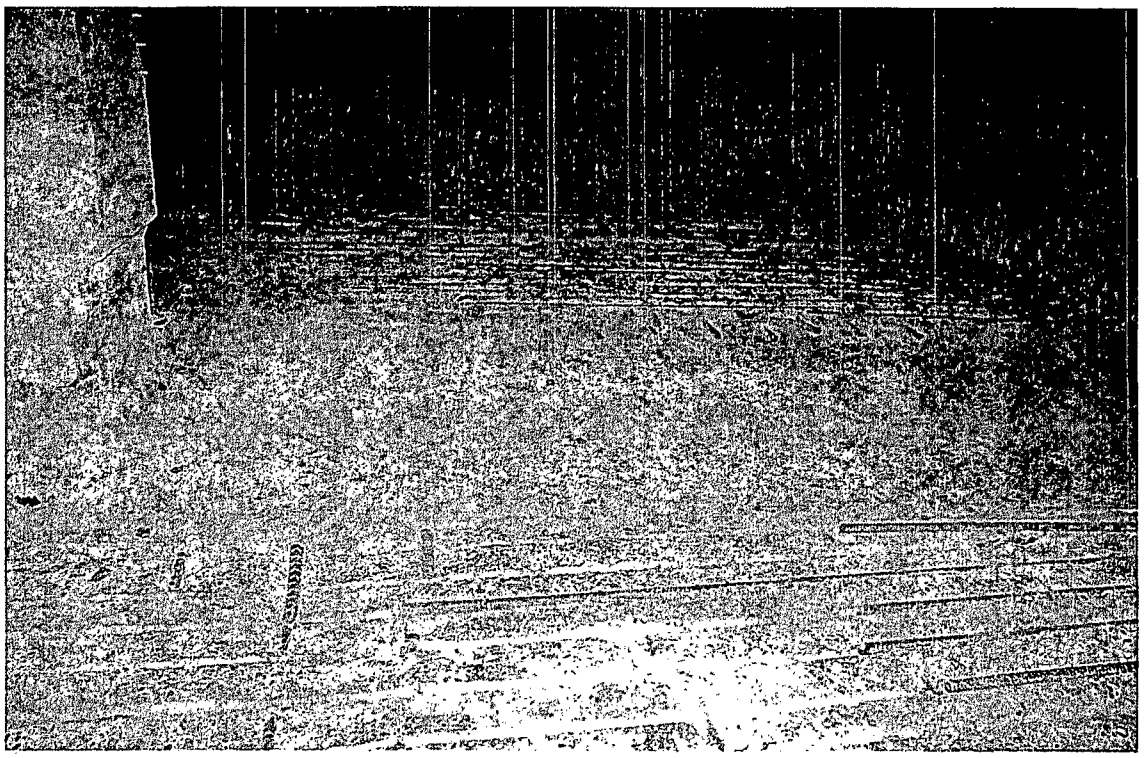


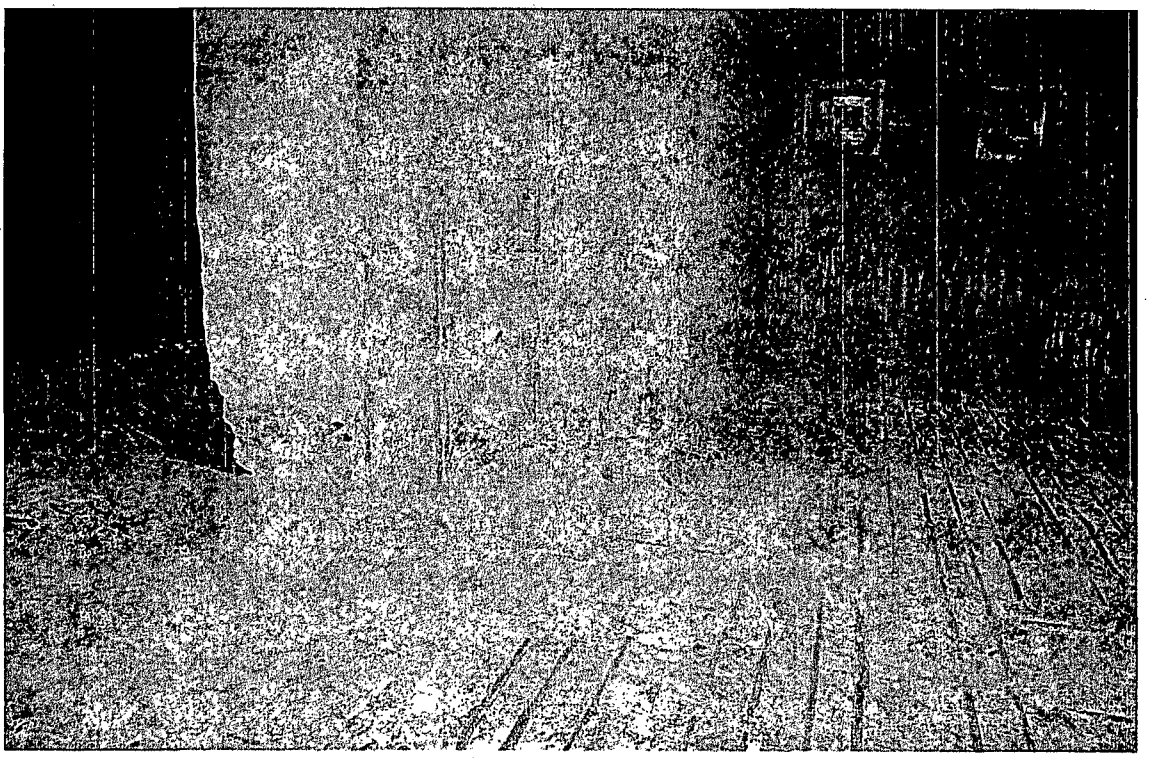




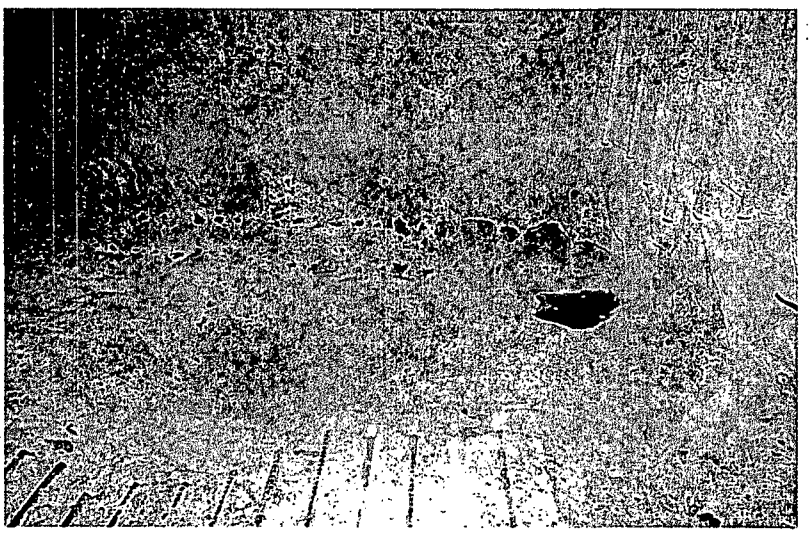


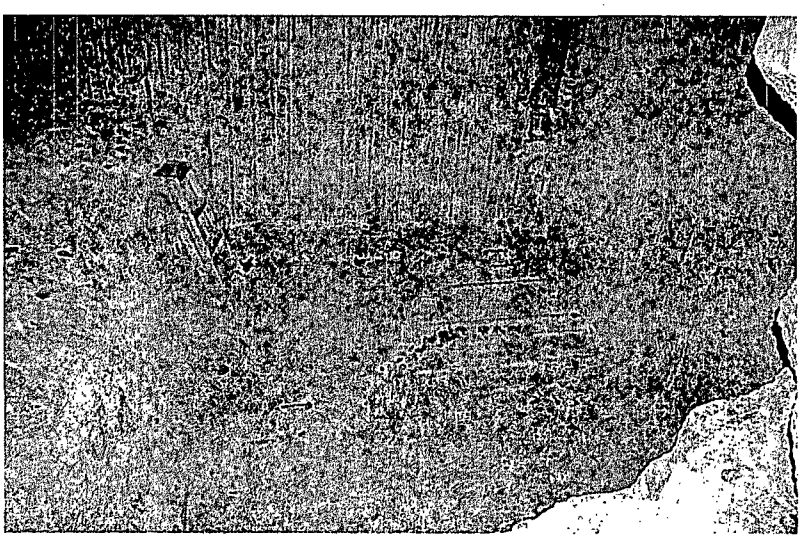
Map F8120005-13, Spent Fuel Pool Floor
Juncture Scan Measurements
F8120005C0004JS and F8120005C0006JS



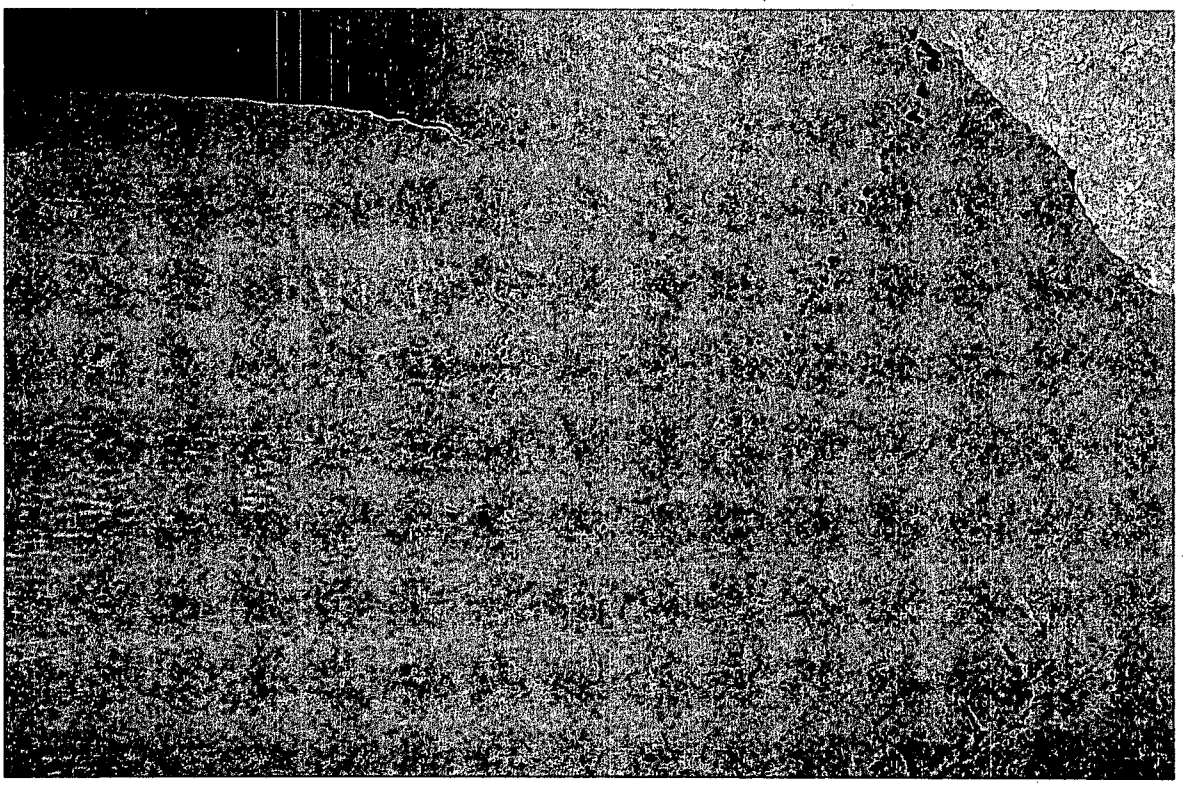


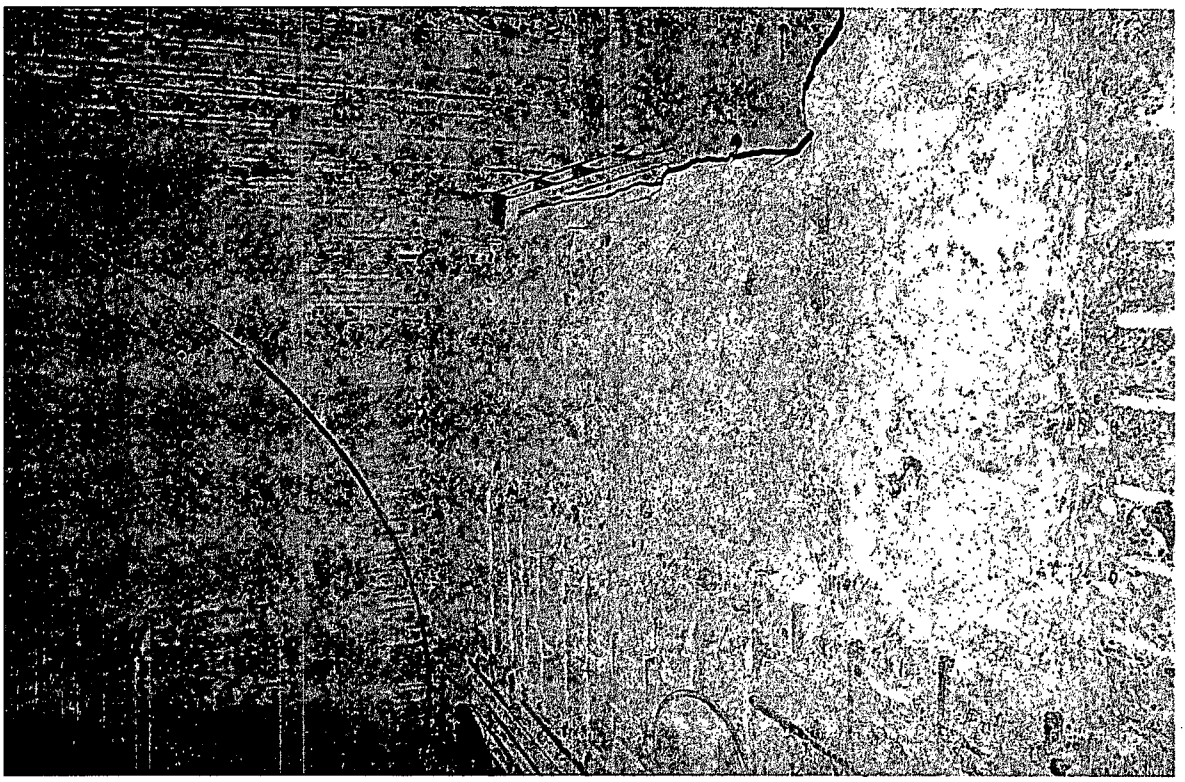
Spent Fuel Pool floor
Photos-1





Spent Fuel Pool floor
Photos-2





Spent Fuel Pool floor
Photos-3

Attachment 2

Instrumentation

October 8, 2008

Survey Unit F8120005

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; 175834	43-68B; 148634	433	1,033
M2350; 175834	43-116-1B; 190642	491	739
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 – 783 dpm/100 cm^2 Co-60
ISOCS	N/A	2983947	Concrete – 1,260 dpm/100 cm^2 Cs-137, Concrete – 1,370 dpm/100 cm^2 Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
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 20,000 Co-60
Investigation Criteria – Scan (ISOCS average activity – 7.0 sq. meter field of view)	115,000 Cs-137 40,000 Co-60
Investigation Criteria – Scan (ISOCS average activity – 3.1 sq. meter field of view)	180,000 Cs-137 60,000 Co-60
$DCGL_W$	43,000
$DCGL_{EMC}$	154,800

Attachment 3

Investigation

October 8, 2008

Survey Unit F8120005

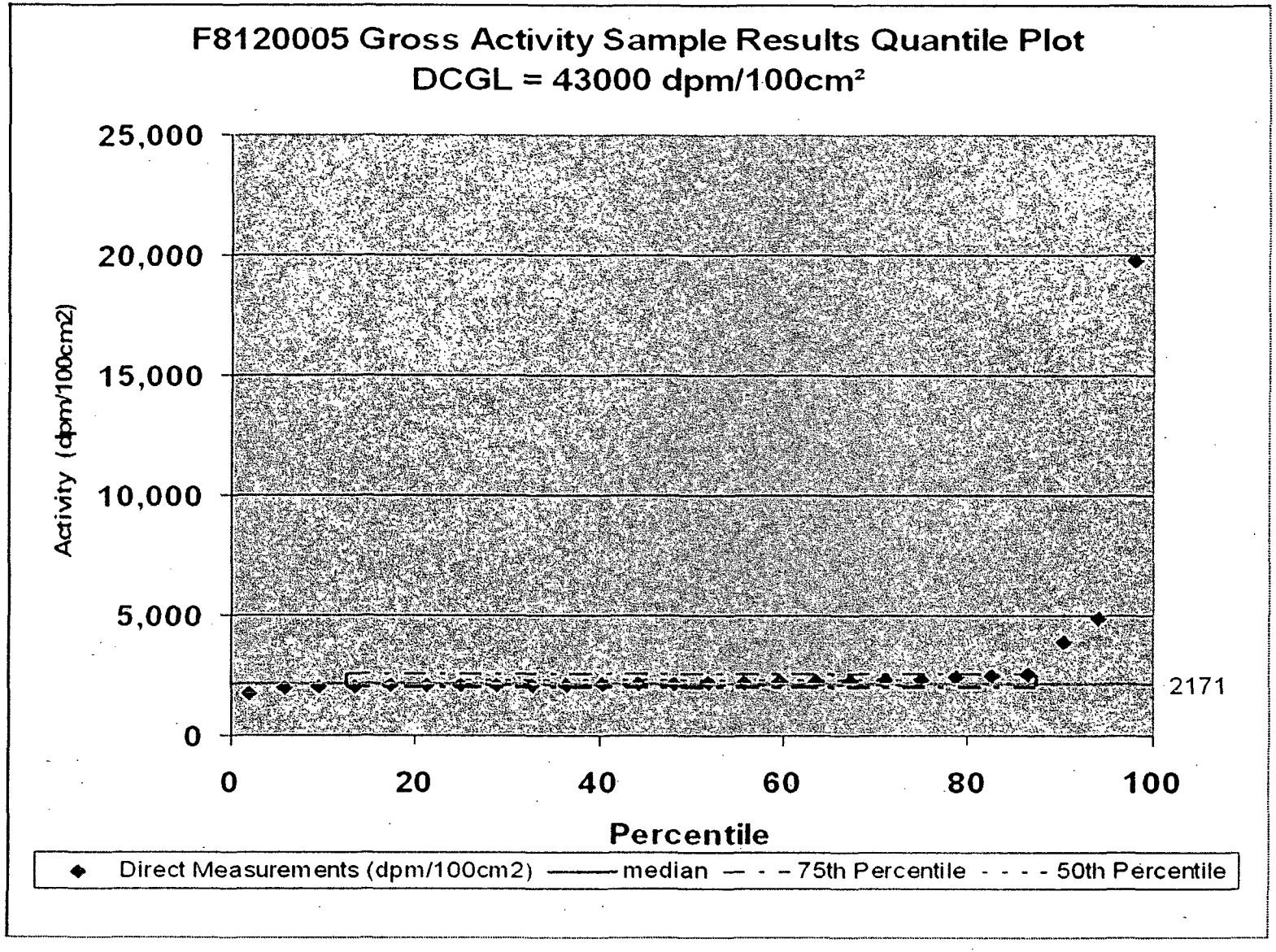
(none required)

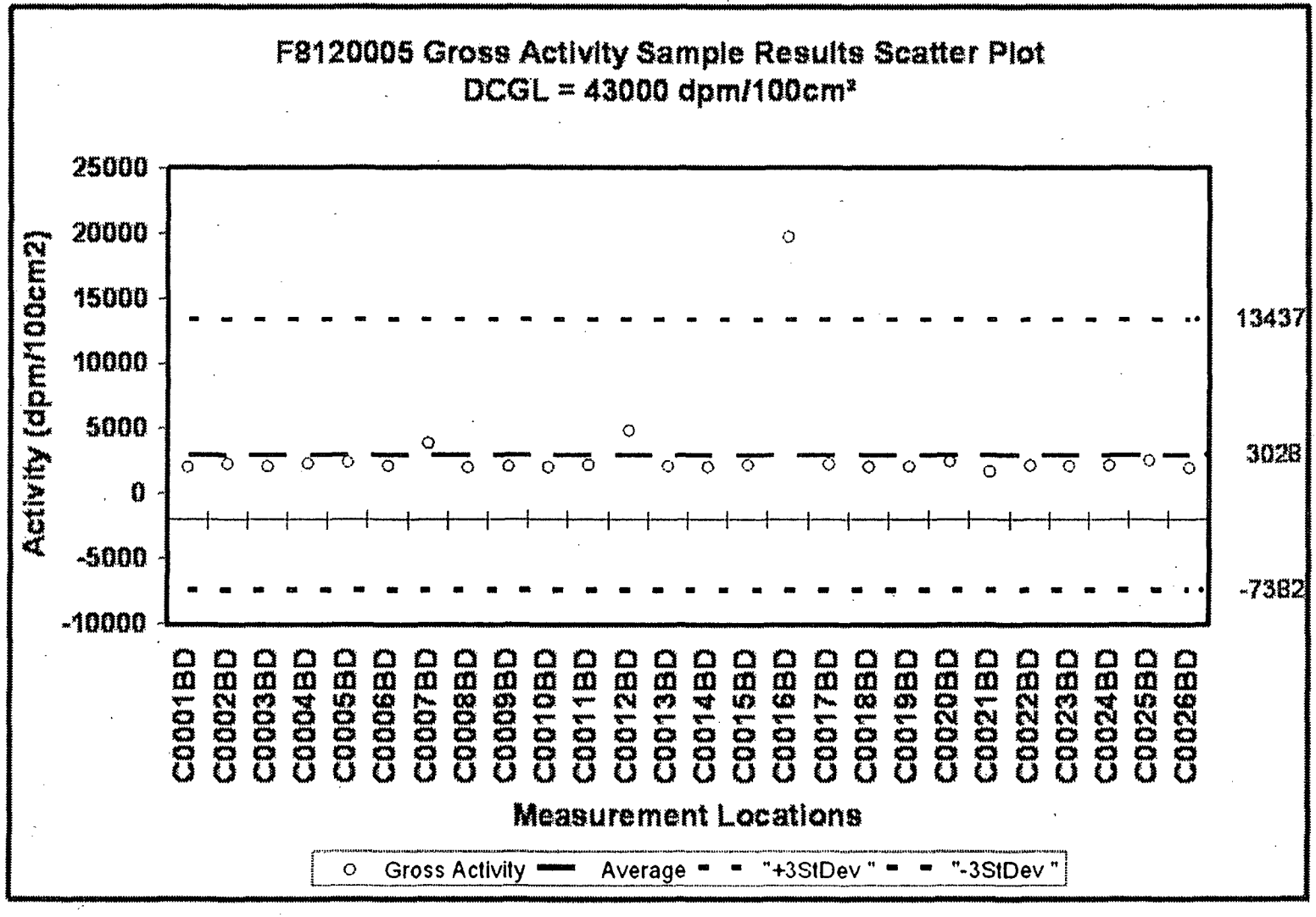
Attachment 4

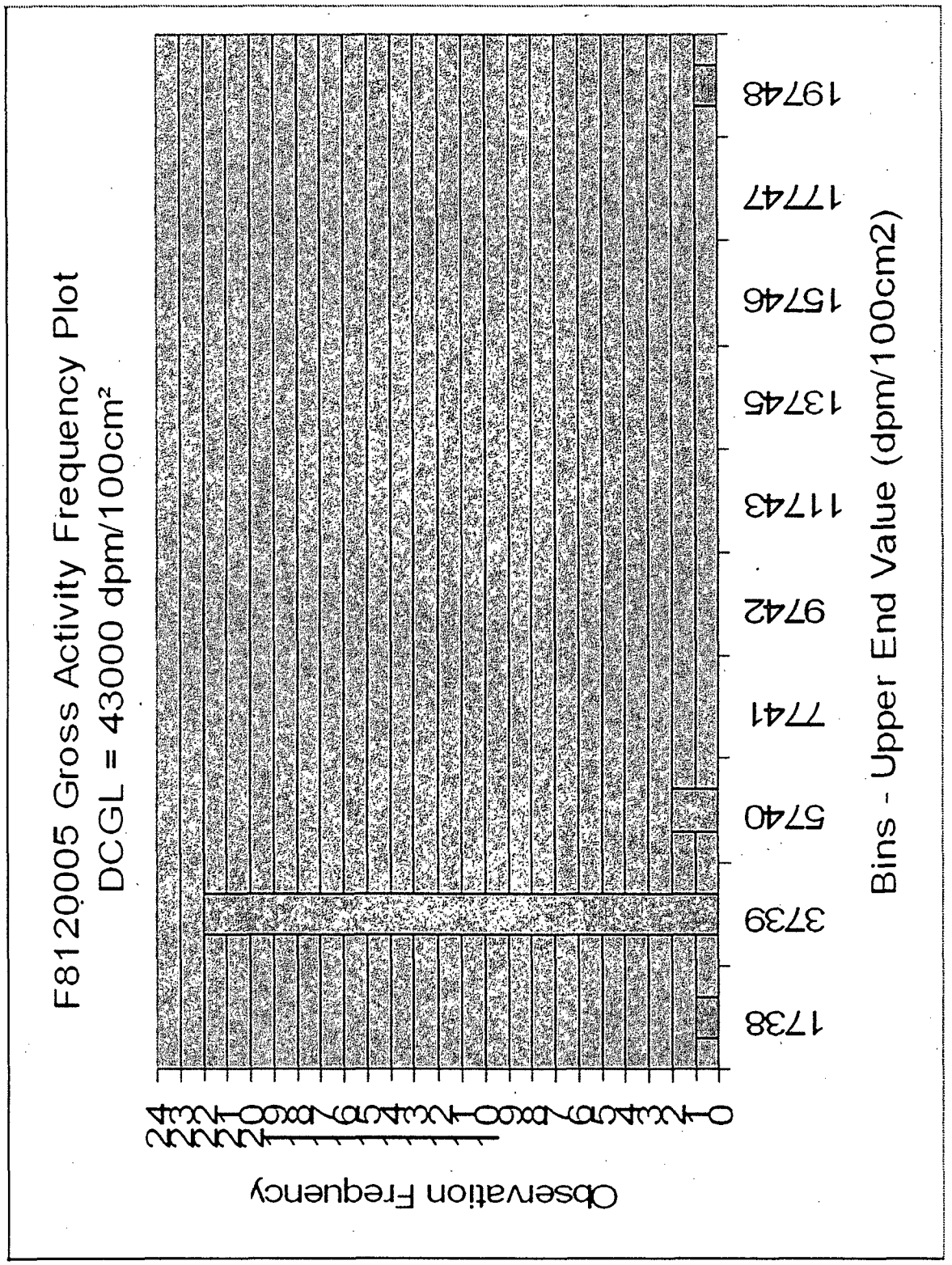
Data Assessment

October 8, 2008

Survey Unit F8120005


F8120005 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
25,000
20,000
15,000
10,000
5,000
0
0
20
40
60
80
100
Percentile
2171
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8120005 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
25000
20000
15000
10000
5000
0
-5000
-10000
13437
3028
-7382
C0001BD
C0002BD
C0003BD
C0004BD
C0005BD
C0006BD
C0007BD
C0008BD
C0009BD
C0010BD
C0011BD
C0012BD
C0013BD
C0014BD
C0015BD
C0016BD
C0017BD
C0018BD
C0019BD
C0020BD
C0021BD
C0022BD
C0023BD
C0024BD
C0025BD
C0026BD
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8120005 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
Bins - Upper End Value (dpm/100cm2)
1738
3739
5740
7741
9742
11743
13745
15746
17747
19748