Rancho Seco

Final Status Survey Summary Report

July 17, 2008

Turbine Building (+) 0' El., North Floor

Survey Unit F8260161

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Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8260161, Turbine Building (+) 0' El. North Floor

Survey Unit Description:

Operating History: The reinforced concrete and steel structure contained the turbine-generator and supporting systems. The building contained five main elevations. 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.

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 in the condenser pit elevation showed a mean gross activity level of 3,077 dpm/100 cm^2 and a maximum value of 24,900 dpm/100 cm^2. Direct measurements on the grade elevation showed a mean gross activity level of 2,035 dpm/100 cm^2 and a maximum value of 6,980 dpm/100 cm^2. Direct measurements on the mezzanine elevation showed a mean gross activity level of 1,566 dpm/100 cm^2 and a maximum value of 2,626 dpm/100 cm^2. Direct measurements on the +40' elevation showed a mean gross activity level of 2,843 dpm/100 cm^2 and a maximum value of 3,615 dpm/100 cm^2. Direct measurements on the building exterior showed a mean gross activity level of 1,984 dpm/100 cm^2 and a maximum value of 10,312 dpm/100 cm^2. Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the turbine building was determined to be Class 1, 2, & 3 areas and the exterior was a Class 3.

During characterization surveys of F8260131 (Turbine Building (+) 0' El., North Floor, Class 2), beta measurements identified activity within a 2-meter by 3-meter area that exceeded the DCGL of 43,000 dpm/100 cm^2. The area was subsequently remediated and reclassified as a Class 1 structure, based on the classification procedure (DSIP-0020). As a result of the reclassification, a new survey package was initiated as F8260161.

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 11.6 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:	F826	Turbine Building (+) 0' El. North Floor
Survey Unit:	0161	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	11.6	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	43,000	Gross Activity DCGL
Area Factor:	17.7	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	761,100	Class 1
LBGR (dpm/100 cm^2)**:**	25,030	Adjusted
Design Sigma (dpm/100 cm^2)**:**	5,990	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	0.7	Class 1
Scan Area (m^2)**:**	11.6	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	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 1
Grid Spacing L:	0.9	Class 1

Survey Results:

A total of 15 direct measurements were made in F8260161. 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. Scan activity ranged from 3,236 to 20,988 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)
F8260161-C0001BD	1,401
F8260161-C0002BD	2,692
F8260161-C0003BD	1,909
F8260161-C0004BD	1,442
F8260161-C0005BD	1,452
F8260161-C0006BD	1,395
F8260161-C0007BD	1,452
F8260161-C0008BD	7,672
F8260161-C0009BD	1,344
F8260161-C0010BD	2,397
F8260161-C0011BD	3,496
F8260161-C0012BD	2,277
F8260161-C0013BD	6,811
F8260161-C0014BD	1,499
F8260161-C0015BD	1,515
Mean:	2,584
Median:	1,515
Standard Deviation:	1,995
Range:	1,344 – 7,672

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8260161C0001SM	-3.53
F8260161C0002SM	-4.82
F8260161C0003SM	-3.53
F8260161C0004SM	0.34
F8260161C0005SM	-2.24
F8260161C0006SM	-6.11
F8260161C0007SM	-0.95
F8260161C0008SM	-3.53
F8260161C0009SM	-2.24
F8260161C0010SM	-3.53
F8260161C0011SM	-2.24
F8260161C0012SM	-3.53
F8260161C0013SM	-3.53
F8260161C0014SM	-0.95
F8260161C0015SM	0.34
Mean:	-2.67
Median:	-3.53
Standard Deviation:	1.8
Range:	-6.11 to 0.34

Survey Unit Data Assessment:

The survey design required 15 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):	15	
Median (dpm/100 cm²):	1,515	
Mean (dpm/100 cm²):	2,584	
Direct Measurement Standard Deviation (dpm/100 cm²):	1,995	
Total Standard Deviation (dpm/100 cm²):	1,995	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	7,672	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	15	
S+ Value:	15	
Critical Value:	11	
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 F8260161 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

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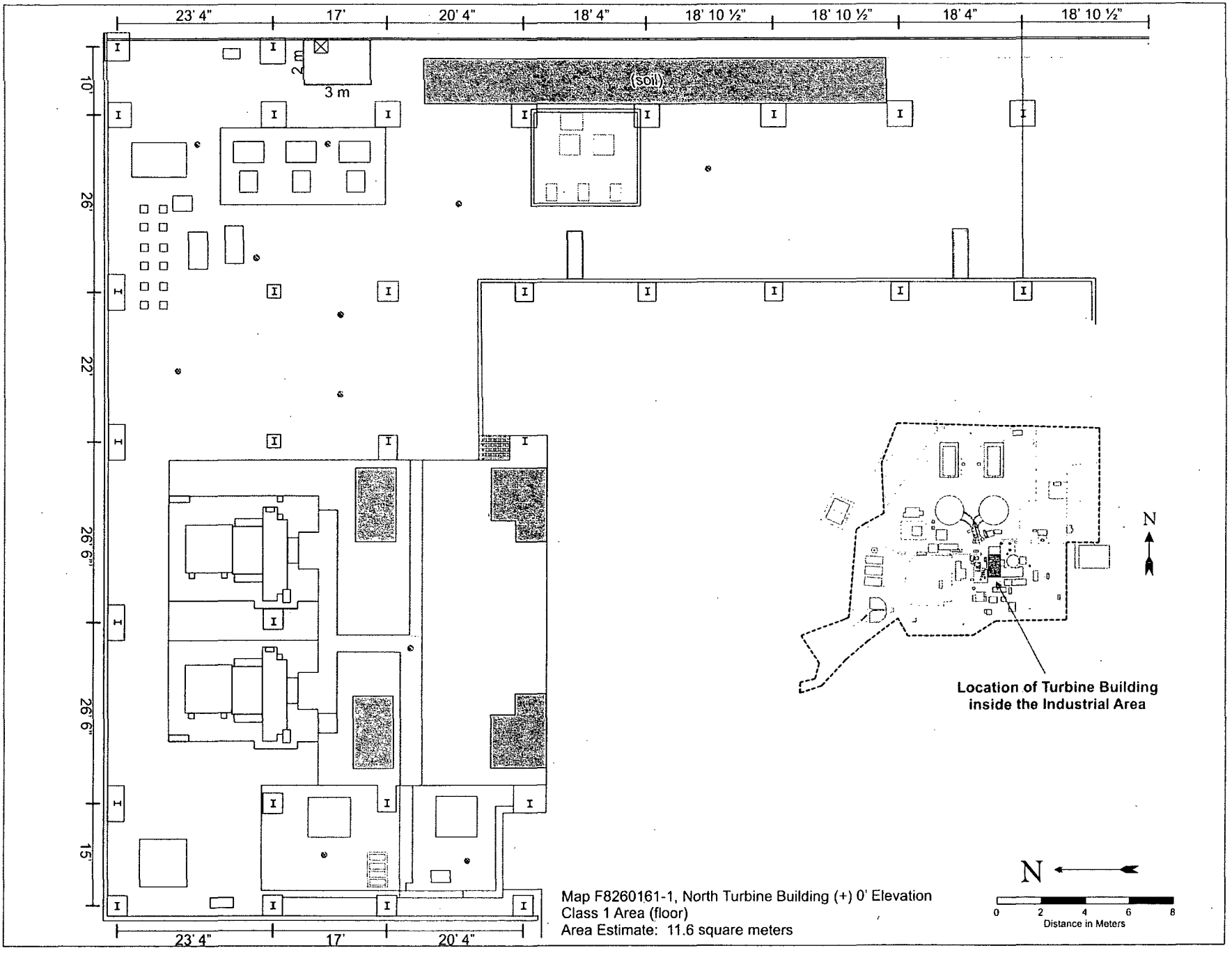
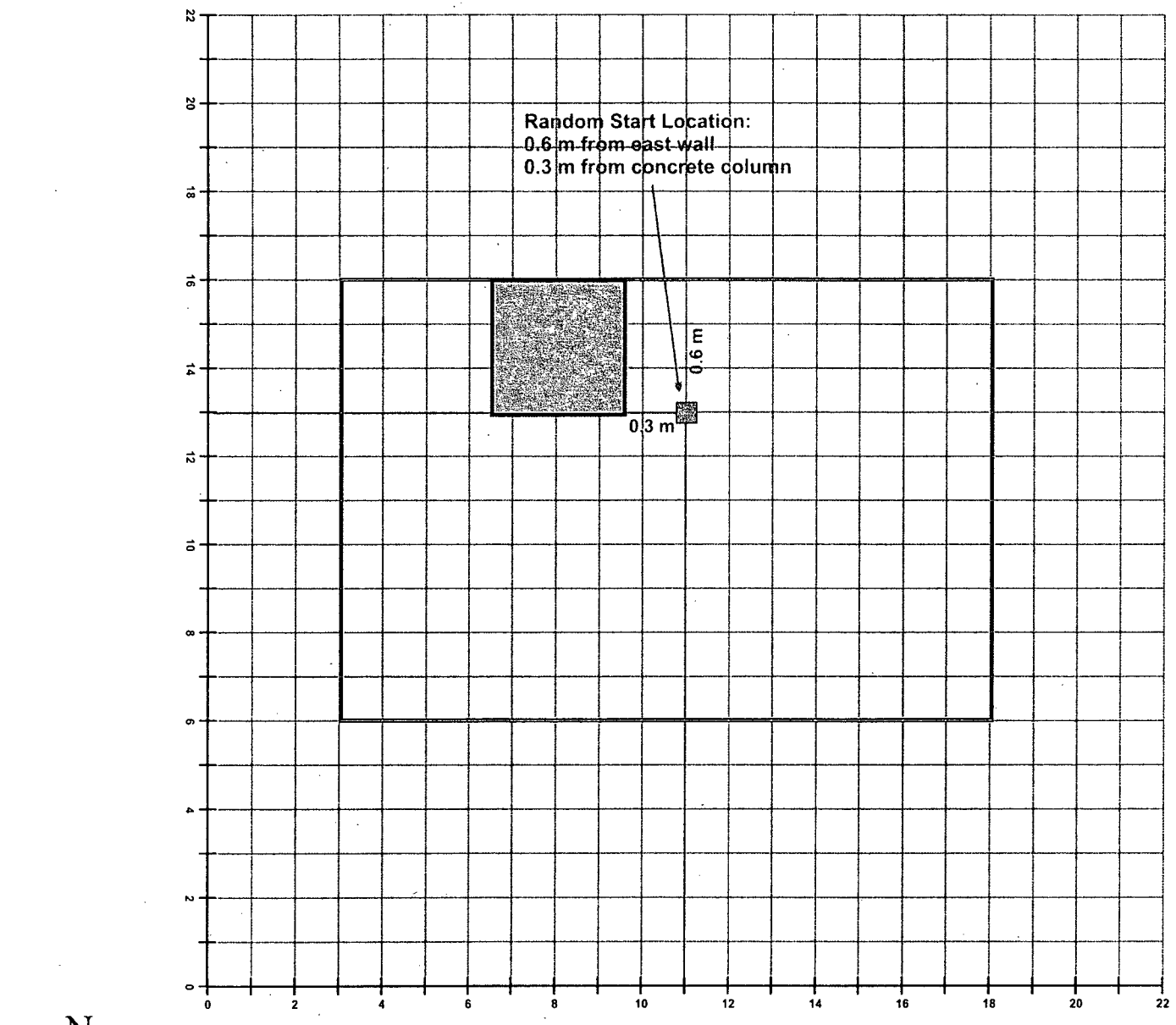
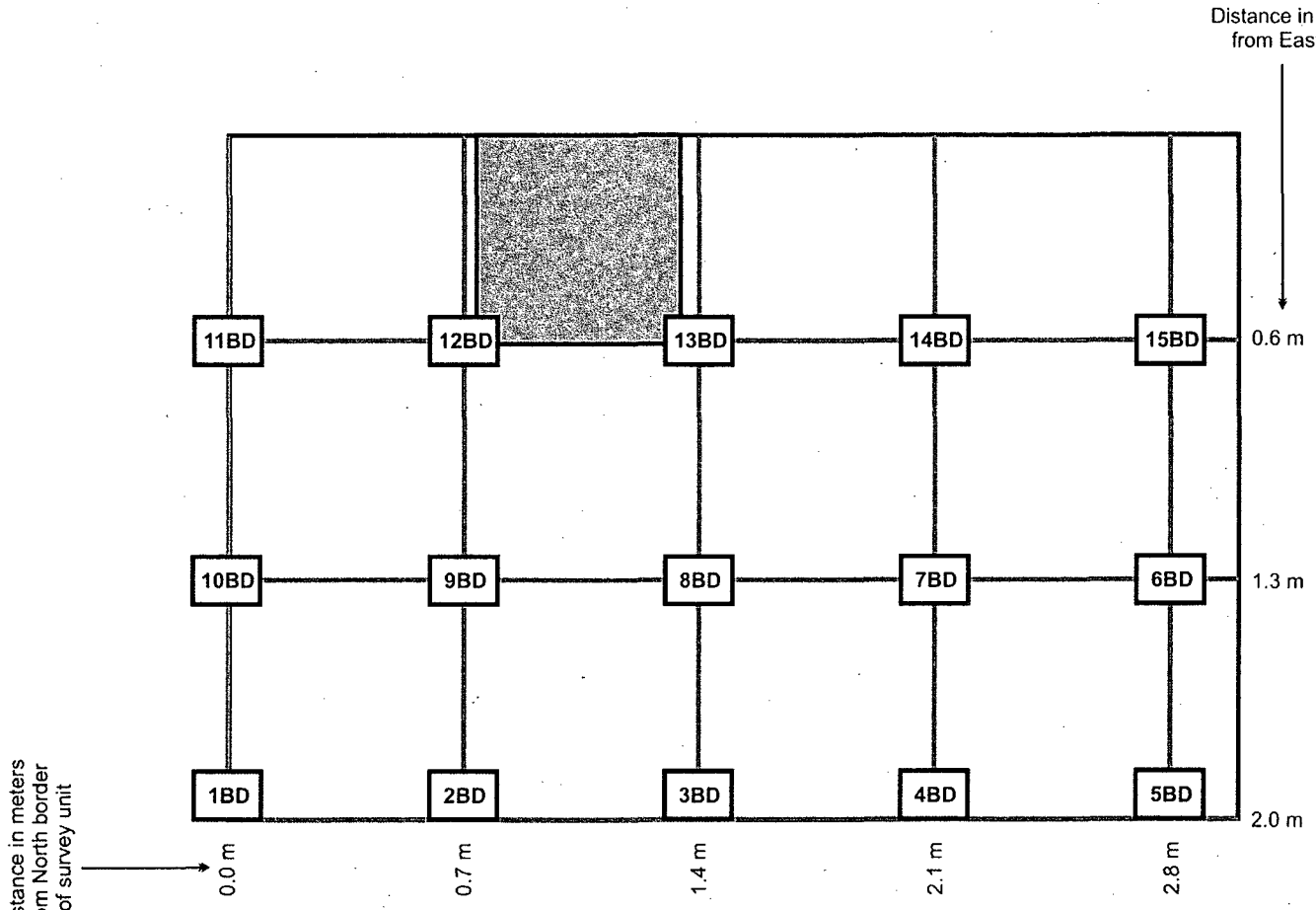
Survey Unit F8260161

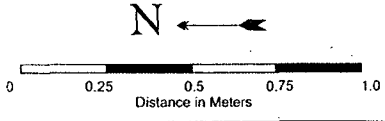


Map F8260161-1, North Turbine Building (+) 0' Elevation
Class 1 Area (floor)
Area Estimate: 11.6 square meters

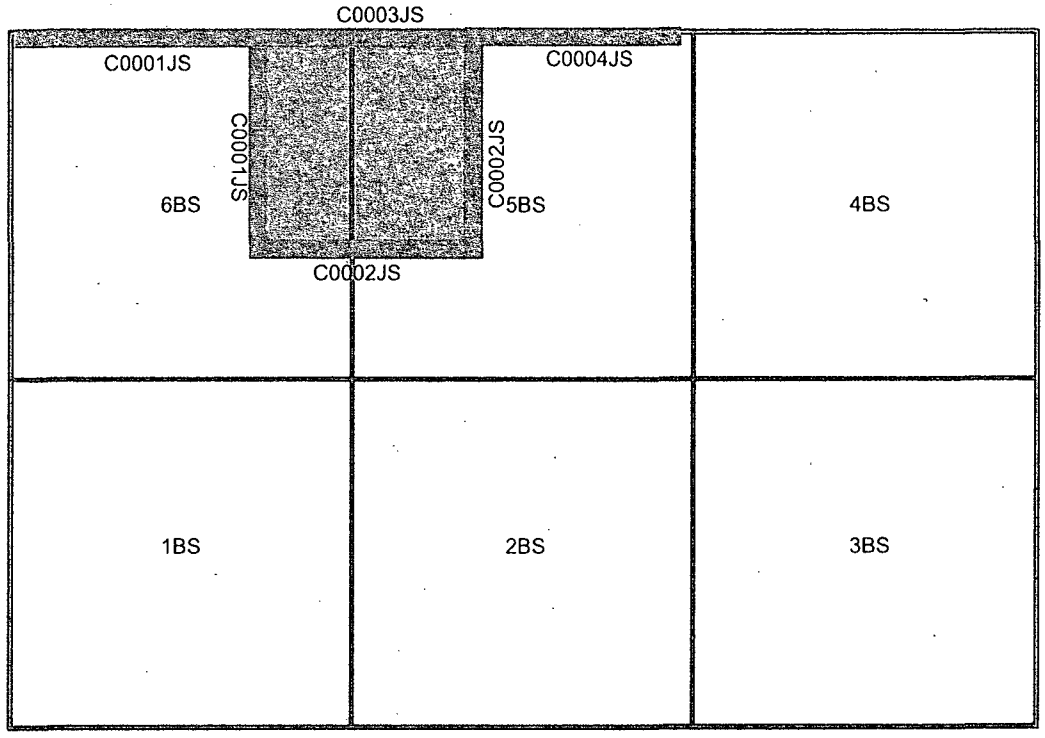


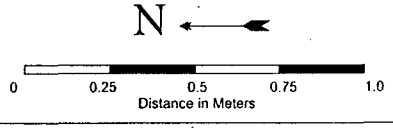
Map F8260161-2, North Turbine Building (+) 0' Elevation
Class 1 Area
Random Start Location





Map F8260161-3, North Turbine Building (+) 0' Elevation
Class 1 Area
Beta Direct Measurements
F8260161C0001BD to F8260161C0015BD
0.7 m by 0.7 m grid spacing





Map F8260161-4, North Turbine Building (+) 0' Elevation
Class 1 Area
Beta Scan Measurements
F8260161C0001BS to F8260161C0006BS
Juncture Scan Measurements
F8260161C0001JS to F8260161C0004JS

Attachment 2

Instrumentation

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Survey Unit F8260161

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; 193715	43-68B; 148630	433	1,033
M2350; 193715	43-116-1B; 190643	491	739
Tennelec; 0401171	N/A	5.88 dpm α, 11.71 dpm β	N/A

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
Investigation Criteria - Direct	761,100
Investigation Criteria – Scan	761,100
$DCGL_W$	43,000
$DCGL_{EMC}$	761,100

Attachment 3

Investigation

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(none required)

Attachment 4

Data Assessment

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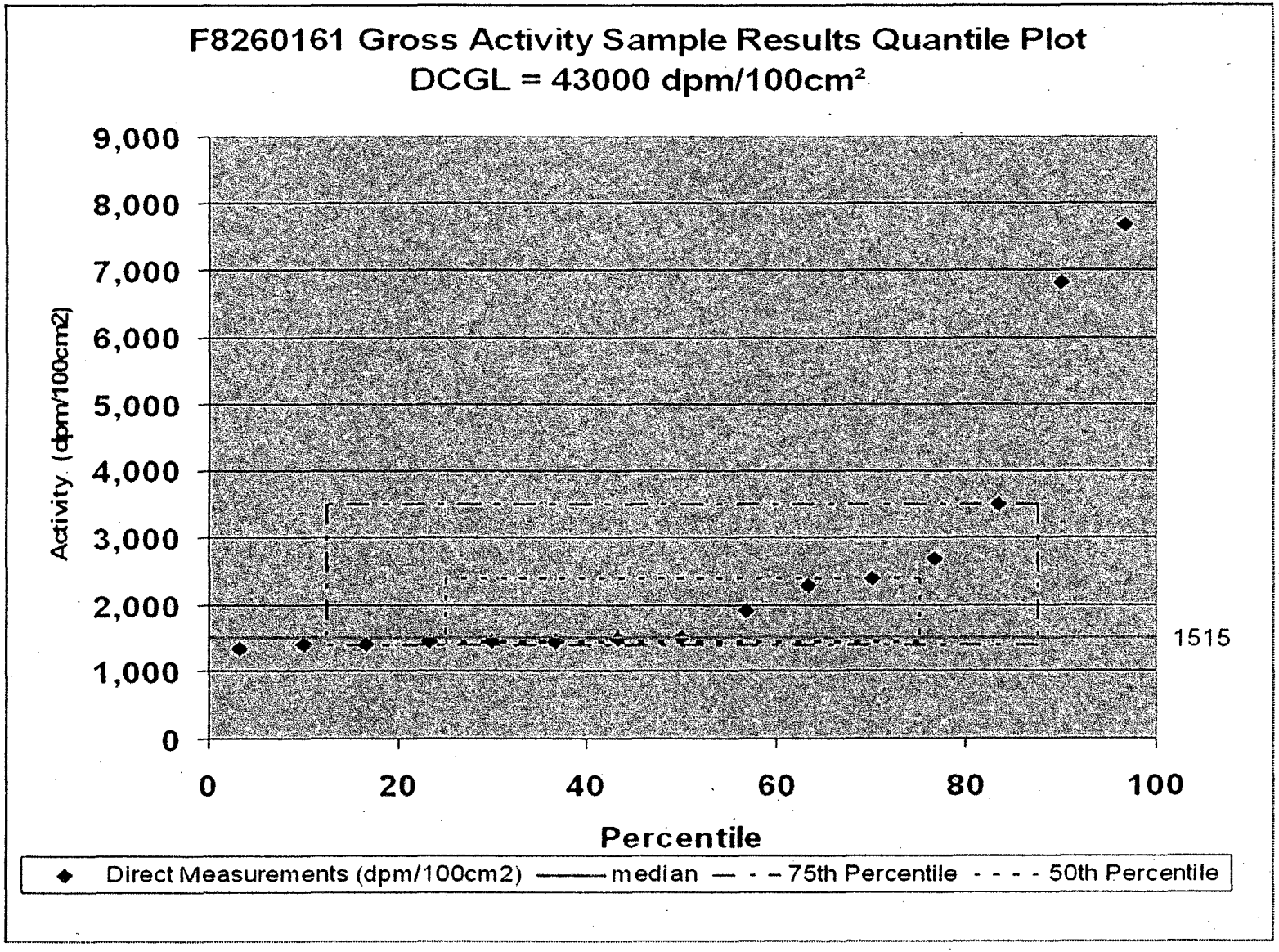
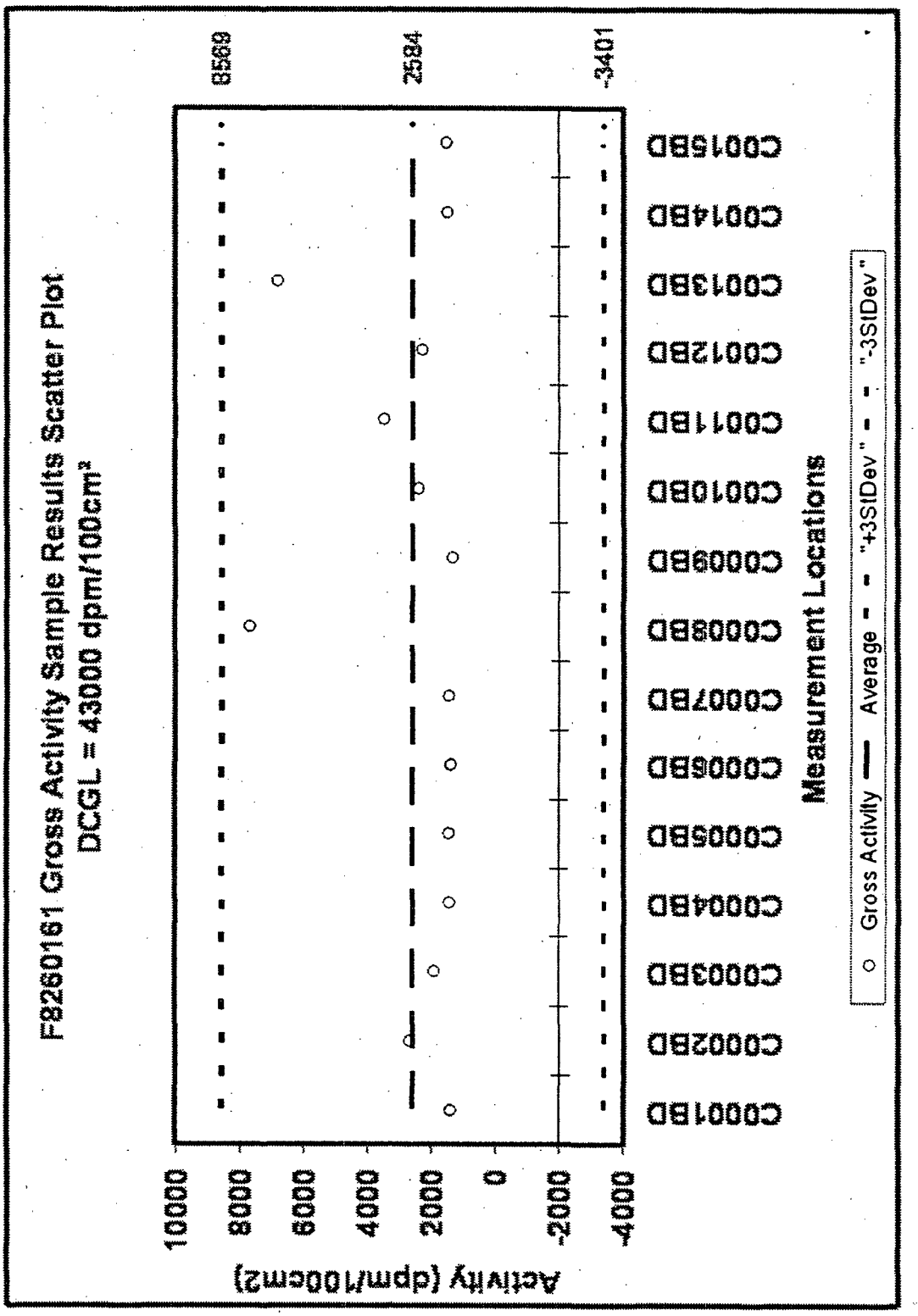
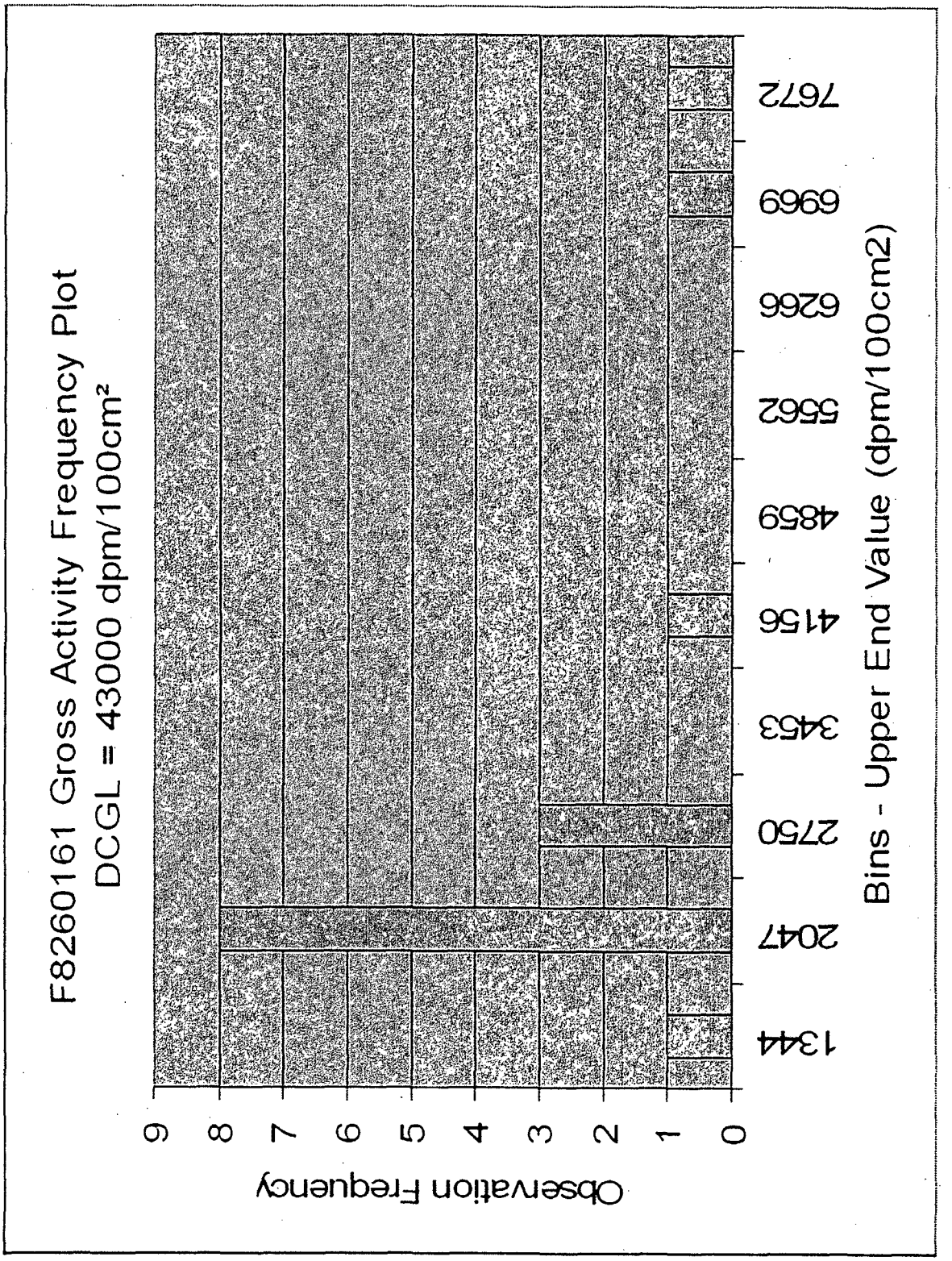

F8260161 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0
20
40
60
80
100
Percentile
1515
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8260161 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
8569
2584
-3401
C00015BD
C00014BD
C00013BD
C00012BD
C00011BD
C00010BD
C00009BD
C00008BD
C00007BD
C00006BD
C00005BD
C00004BD
C00003BD
C00002BD
C00001BD
Measurement Locations
10000
8000
6000
4000
2000
0
-2000
-4000
Activity (dpm/100cm2)
Gross Activity
Average
"+3SIDev"
"-3SIDev"


F8260161 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
6
7
8
9
1344
2047
2750
3453
4156
4859
5562
6266
6969
7672
Bins - Upper End Value (dpm/100cm2)