Rancho Seco

Final Status Survey Summary Report

October 9, 2008

Reactor Building, Interior Walls, (+) 75' El. to (+) 115' El.

Survey Unit F8110111

Prepared By: D. Anderson **Date:** 10/28/2008

FSS Engineer

Reviewed By: Robert F Duhen **Date:** 10/29/08

Lead FSS Engineer

Approved By: E. T. [illegible] **Date:** 2-6-09

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8110111, Reactor Building, Interior Walls, (+) 75' El. to (+) 115' El.

Survey Unit Description:

Operating History: The reinforced concrete structure contained the reactor and supporting systems. The building contained four 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. No events documenting exterior contamination were found.

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 (–) 27' elevation showed a mean gross activity level of 1,535,383 dpm/100 cm^2 and a maximum value of 8,134,000 dpm/100 cm^2. Direct measurements on the grade elevation showed a mean gross activity level of 201,670 dpm/100 cm^2 and a maximum value of 370,000 dpm/100 cm^2. Direct measurements on the (+) 40' elevation showed a mean gross activity level of 51,521 dpm/100 cm^2 and a maximum value of 99,150 dpm/100 cm^2. Direct measurements on the (+) 60' elevation showed a mean gross activity level of 20,110 dpm/100 cm^2 and a maximum value of 46,660 dpm/100 cm^2. Direct measurements on the exterior roof showed a mean gross activity level of 1,364 dpm/100 cm^2 and a maximum value of 1,571 dpm/100 cm^2. Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the reactor building was determined to be a Class 1 area and the exterior was a Class 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 fixed grid pattern and 1,966 m^2 were scanned for 100% coverage. Samples of removable contamination were collected. 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:	F811	Reactor Building, Interior Walls, (+) 75' El. to (+) 115' El.
Survey Unit:	0111	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	1,966	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm^2)**:**	43,000	Gross Activity DCGL
Area Factor:	14.9	Class 1 (for $1m^2$)
Design DCGLemc (dpm/100 cm^2)**:**	640,700	Based on 1 m^2 at the edge of the 19.6 m^2 field of view
LBGR (dpm/100 cm^2)**:**	21,500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	33,040	DTBD-06-001, Table 5-4D
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	19.6	Class 1
Scan Area (m^2)**:**	1,966	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.725747	
Calculated Relative Shift:	0.6	
Relative Shift Used:	0.6	Uses 3.0 if Relative Shift is >3
N-Value:	54	
Design N-Value + 20%:	65	NUREG-1575 Table 5-5
Design Min Samples N:	180	Class 1
Grid Spacing L:	N/A	Class 1

Survey Results:

A total of 180 direct measurements were made in F8110111. 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 ISOCS gamma measurements on the interior wall surfaces indicated areas of elevated activity. Co-60 was not identified above the MDC. Beta scan activity on the crane rail supports ranged from 3,564 to 41,945 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)	Uncertainty (dpm/100 cm²)
F8110111-M0001GS	< 954	
F8110111-M0002GS	5,881	1,021
F8110111-M0003GS	10,365	1,575
F8110111-M0004GS	4,195	811
F8110111-M0005GS	4,646	875
F8110111-M0006GS	2,920	652
F8110111-M0007GS	2,356	583
F8110111-M0008GS	7,189	1,185
F8110111-M0009GS	3,701	759
F8110111-M0010GS	< 863	
F8110111-M0011GS	679	325
F8110111-M0012GS	880	367
F8110111-M0013GS	2,151	550
F8110111-M0014GS	< 1,030	
F8110111-M0015GS	1,195	422
F8110111-M0016GS	1,087	397
F8110111-M0017GS	< 904	
F8110111-M0018GS	1,831	497
F8110111-M0019GS	1,081	369
F8110111-M0020GS	< 800	
F8110111-M0021GS	< 710	
F8110111-M0022GS	< 826	
F8110111-M0023GS	1,828	492
F8110111-M0024GS	< 886	
F8110111-M0025GS	1,484	455
F8110111-M0026GS	2,399	569
F8110111-M0027GS	1,365	427
F8110111-M0028GS	1,479	459
F8110111-M0029GS	< 787	
F8110111-M0030GS	< 703	
F8110111-M0031GS	< 794	
F8110111-M0032GS	< 970	
F8110111-M0033GS	2,470	603
F8110111-M0034GS	< 991	
F8110111-M0035GS	1,757	514

Measurement ID	Gross Activity (dpm/100 cm^2)	Uncertainty (dpm/100 cm^2)
F8110111-M0036GS	1,903	529
F8110111-M0037GS	< 975	
F8110111-M0038GS	2,146	539
F8110111-M0039GS	696	327
F8110111-M0040GS	< 767	
F8110111-M0041GS	< 746	
F8110111-M0042GS	< 980	
F8110111-M0043GS	2,406	595
F8110111-M0044GS	< 1,080	
F8110111-M0045GS	< 1,140	
F8110111-M0046GS	4,990	918
F8110111-M0047GS	4,737	879
F8110111-M0048GS	8,115	1,301
F8110111-M0049GS	3,605	732
F8110111-M0050GS	1,784	495
F8110111-M0051GS	1,022	374
F8110111-M0052GS	3,176	683
F8110111-M0053GS	9,660	1,492
F8110111-M0054GS	6,439	1,094
F8110111-M0055GS	7,838	1,265
F8110111-M0056GS	3,410	711
F8110111-M0057GS	1,990	529
F8110111-M0058GS	3,222	679
F8110111-M0059GS	1,220	401
F8110111-M0060GS	< 717	
F8110111-M0061GS	< 845	
F8110111-M0062GS	< 991	
F8110111-M0063GS	4,360	831
F8110111-M0064GS	1,591	469
F8110111-M0065GS	1,536	450
F8110111-M0066GS	5,435	970
F8110111-M0067GS	4,360	845
F8110111-M0068GS	17,259	2,410
F8110111-M0069GS	3,324	714
F8110111-M0070GS	< 1,010	
F8110111-M0071GS	1,536	449
F8110111-M0072GS	3,420	707
F8110111-M0073GS	14,784	2,112
F8110111-M0074GS	5,804	1,018
F8110111-M0075GS	8,278	1,322
F8110111-M0076GS	2,552	593
F8110111-M0077GS	2,432	587
F8110111-M0078GS	4,626	865
F8110111-M0079GS	1,761	487
F8110111-M0080GS	< 832	
F8110111-M0081GS	< 800	
F8110111-M0082GS	2,198	559
F8110111-M0083GS	3,649	735
F8110111-M0084GS	1,960	520
F8110111-M0085GS	1,171	408
F8110111-M0086GS	2,485	580
F8110111-M0087GS	2,591	598

Measurement ID	Gross Activity (dpm/100 cm^2)	Uncertainty (dpm/100 cm^2)
F8110111-M0088GS	3,274	692
F8110111-M0089GS	1,366	418
F8110111-M0090GS	< 800	
F8110111-M0091GS	593	306
F8110111-M0092GS	708	350
F8110111-M0093GS	1,946	512
F8110111-M0094GS	1,439	434
F8110111-M0095GS	2,650	615
F8110111-M0096GS	1,732	477
F8110111-M0097GS	1,040	366
F8110111-M0098GS	2,009	526
F8110111-M0099GS	704	313
F8110111-M0100GS	572	324
F8110111-M0101GS	541	314
F8110111-M0102GS	1,012	376
F8110111-M0103GS	2,565	598
F8110111-M0104GS	863	340
F8110111-M0105GS	1,629	475
F8110111-M0106GS	4,494	857
F8110111-M0107GS	3,574	731
F8110111-M0108GS	6,443	1,085
F8110111-M0109GS	1,946	511
F8110111-M0110GS	1,829	500
F8110111-M0111GS	2,703	606
F8110111-M0112GS	3,586	739
F8110111-M0113GS	8,381	1,327
F8110111-M0114GS	5,946	1,036
F8110111-M0115GS	8,597	1,356
F8110111-M0116GS	3,462	715
F8110111-M0117GS	2,989	654
F8110111-M0118GS	6,461	1,092
F8110111-M0119GS	4,481	853
F8110111-M0120GS	1,187	408
F8110111-M0121GS	1,182	409
F8110111-M0122GS	6,754	1,142
F8110111-M0123GS	8,120	1,298
F8110111-M0124GS	4,056	782
F8110111-M0125GS	6,321	1,082
F8110111-M0126GS	5,681	1,000
F8110111-M0127GS	5,169	938
F8110111-M0128GS	10,557	1,597
F8110111-M0129GS	12,871	1,881
F8110111-M0130GS	1,614	483
F8110111-M0131GS	2,056	530
F8110111-M0132GS	14,446	2,071
F8110111-M0133GS	13,344	1,941
F8110111-M0134GS	5,441	978
F8110111-M0135GS	9,072	1,420
F8110111-M0136GS	6,432	1,099
F8110111-M0137GS	5,138	937
F8110111-M0138GS	9,935	1,525
F8110111-M0139GS	5,139	941

Measurement ID	Gross Activity (dpm/100 cm^2)	Uncertainty (dpm/100 cm^2)
F8110111-M0140GS	1,145	406
F8110111-M0141GS	720	331
F8110111-M0142GS	1,553	456
F8110111-M0143GS	2,994	666
F8110111-M0144GS	1,438	450
F8110111-M0145GS	2,502	587
F8110111-M0146GS	1,516	446
F8110111-M0147GS	702	335
F8110111-M0148GS	2,773	618
F8110111-M0149GS	< 857	
F8110111-M0150GS	< 687	
F8110111-M0151GS	< 794	
F8110111-M0152GS	< 910	
F8110111-M0153GS	2,240	536
F8110111-M0154GS	860	368
F8110111-M0155GS	994	390
F8110111-M0156GS	1,418	441
F8110111-M0157GS	1,251	422
F8110111-M0158GS	2,068	511
F8110111-M0159GS	1,076	380
F8110111-M0160GS	608	306
F8110111-M0161GS	< 838	
F8110111-M0162GS	1,004	387
F8110111-M0163GS	3,198	686
F8110111-M0164GS	1,324	410
F8110111-M0165GS	988	392
F8110111-M0166GS	754	317
F8110111-M0167GS	915	360
F8110111-M0168GS	2,234	578
F8110111-M0169GS	< 826	
F8110111-M0170GS	< 826	
F8110111-M0171GS	< 838	
F8110111-M0172GS	1,163	393
F8110111-M0173GS	2,337	571
F8110111-M0174GS	< 857	
F8110111-M0175GS	1,312	414
F8110111-M0176GS	3,031	654
F8110111-M0177GS	3,061	664
F8110111-M0178GS	4,705	875
F8110111-M0179GS	2,667	614
F8110111-M0180GS	1,153	395
Mean:	2,992	
Median:	1,830	
Standard Deviation:	3,012	
Range:	541 to 17,259	

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8110111-M0001SM	153.39
F8110111-M0002SM	69.45
F8110111-M0003SM	7.46
F8110111-M0004SM	135.31
F8110111-M0005SM	13.91
F8110111-M0006SM	20.37
F8110111-M0007SM	24.24
F8110111-M0008SM	20.37
F8110111-M0009SM	4.87
F8110111-M0010SM	13.91
F8110111-M0011SM	12.62
F8110111-M0012SM	10.04
F8110111-M0013SM	6.16
F8110111-M0014SM	8.75
F8110111-M0015SM	11.33
F8110111-M0016SM	21.66
F8110111-M0017SM	37.16
F8110111-M0018SM	4.87
F8110111-M0019SM	122.39
F8110111-M0020SM	168.89
F8110111-M0021SM	698.38
F8110111-M0022SM	152.10
F8110111-M0023SM	42.33
F8110111-M0024SM	131.43
F8110111-M0025SM	79.78
F8110111-M0026SM	44.91
F8110111-M0027SM	471.09
F8110111-M0028SM	128.85
F8110111-M0029SM	493.04
F8110111-M0030SM	409.10
F8110111-M0031SM	131.43
F8110111-M0032SM	60.41
F8110111-M0033SM	59.11
F8110111-M0034SM	39.74
F8110111-M0035SM	113.35
F8110111-M0036SM	139.18
F8110111-M0037SM	25.54
F8110111-M0038SM	16.50
F8110111-M0039SM	22.95
F8110111-M0040SM	90.11
F8110111-M0041SM	38.45
F8110111-M0042SM	20.37
F8110111-M0043SM	246.37
F8110111-M0044SM	143.06
F8110111-M0045SM	101.73
F8110111-M0046SM	65.57
F8110111-M0047SM	115.94
F8110111-M0048SM	16.50

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8110111-M0049SM	165.01
F8110111-M0050SM	21.66
F8110111-M0051SM	95.27
F8110111-M0052SM	229.58
F8110111-M0053SM	427.18
F8110111-M0054SM	13.91
F8110111-M0055SM	265.75
F8110111-M0056SM	44.91
F8110111-M0057SM	74.61
F8110111-M0058SM	48.78
F8110111-M0059SM	26.83
F8110111-M0060SM	68.15
F8110111-M0061SM	15.20
F8110111-M0062SM	16.50
F8110111-M0063SM	15.20
F8110111-M0064SM	60.41
F8110111-M0065SM	16.50
F8110111-M0066SM	84.94
F8110111-M0067SM	12.62
F8110111-M0068SM	39.74
F8110111-M0069SM	21.66
F8110111-M0070SM	46.20
F8110111-M0071SM	46.20
F8110111-M0072SM	136.60
Mean:	96.64
Median:	46.2
Standard Deviation:	129.12
Range:	4.87 to 698.38

Survey Unit Data Assessment:

The survey design required 180 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):	180	
Median (dpm/100 cm²):	1,830	
Mean (dpm/100 cm²):	2,992	
Direct Measurement Standard Deviation (dpm/100 cm²):	3,012	
Total Standard Deviation (dpm/100 cm²):	3,012	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	17,259	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	180	
S+ Value:	180	
Critical Value:	101	
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.

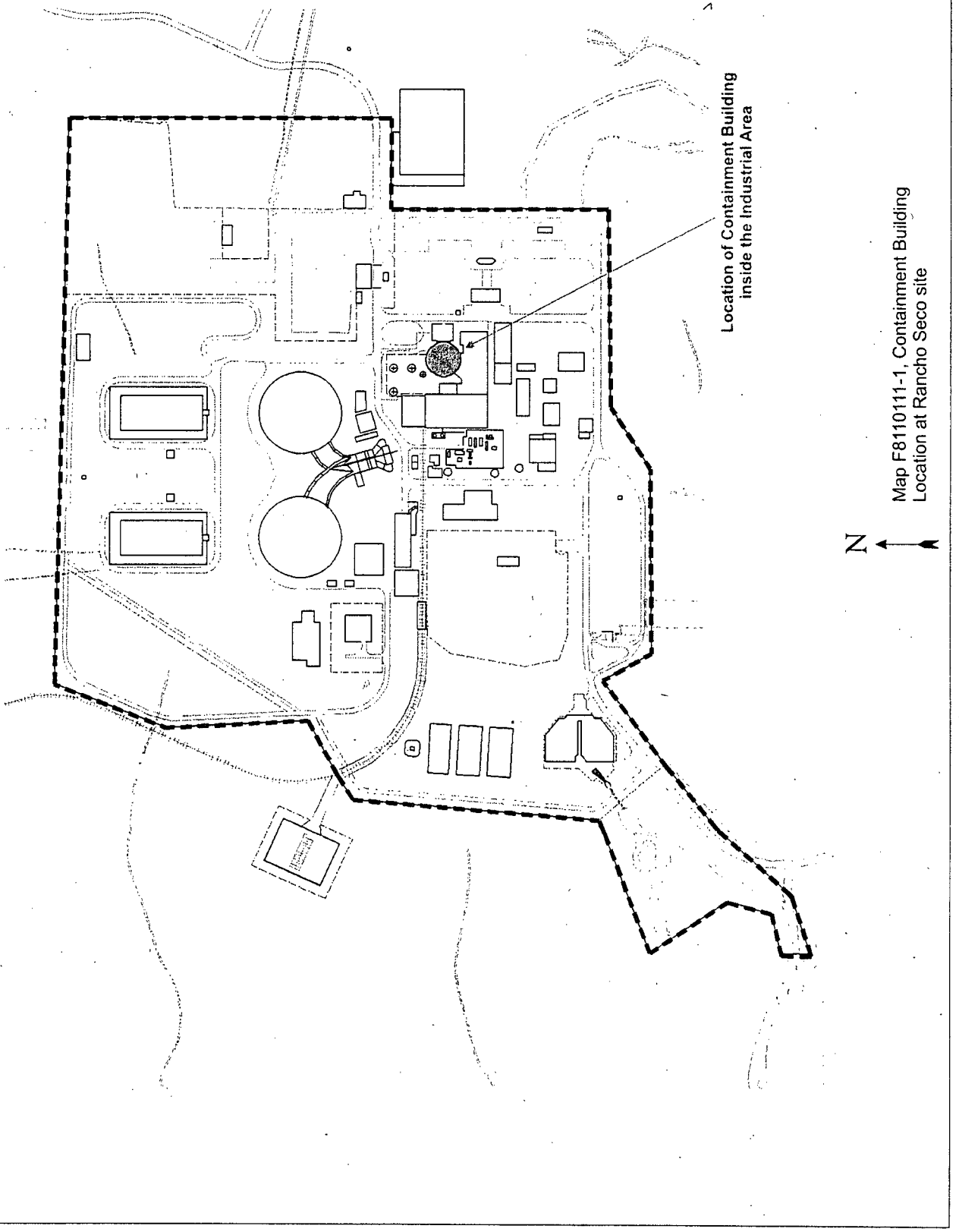
It is concluded that survey unit F8110111 meets the release criteria of 10CFR20.1402.

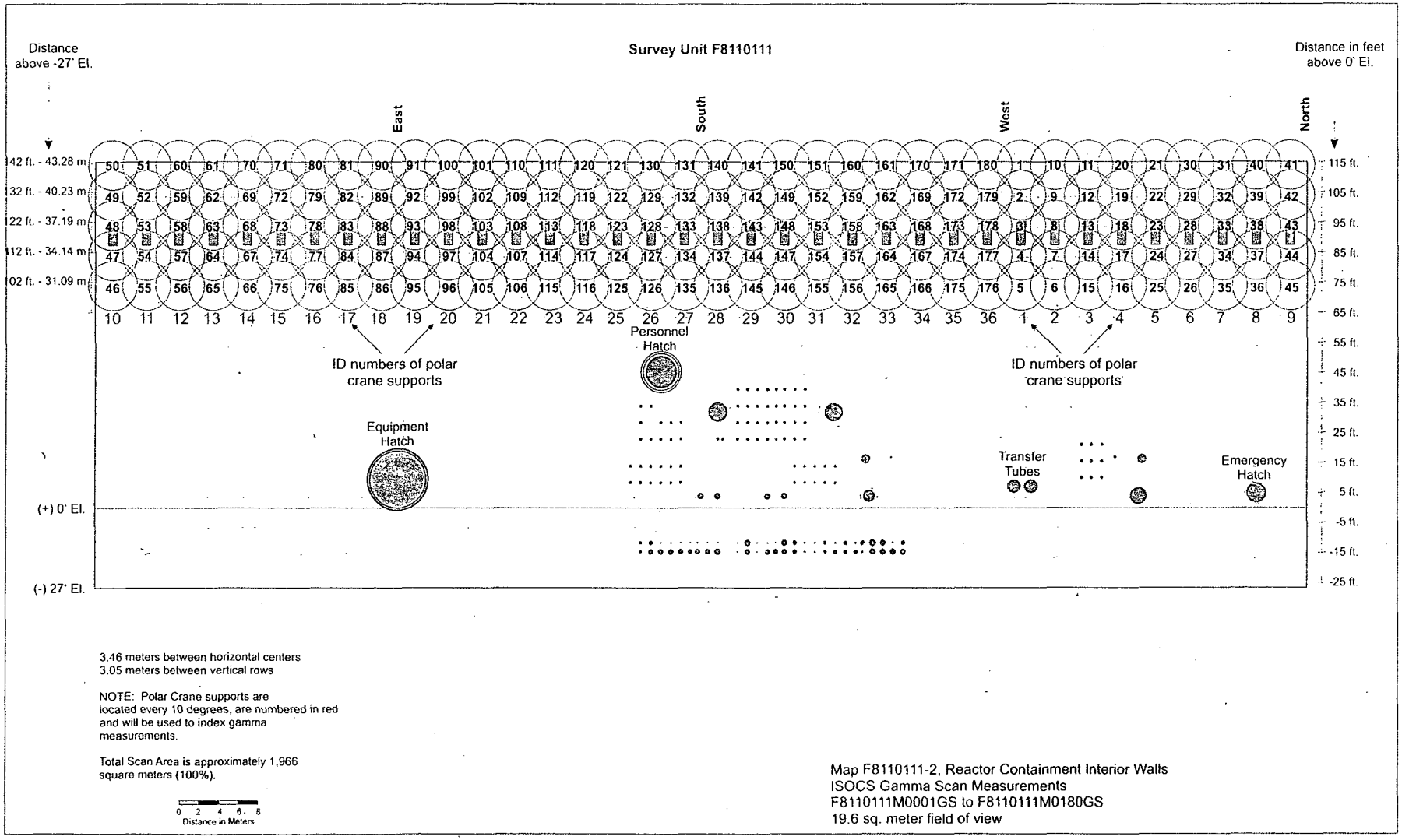
Attachment 1

Maps

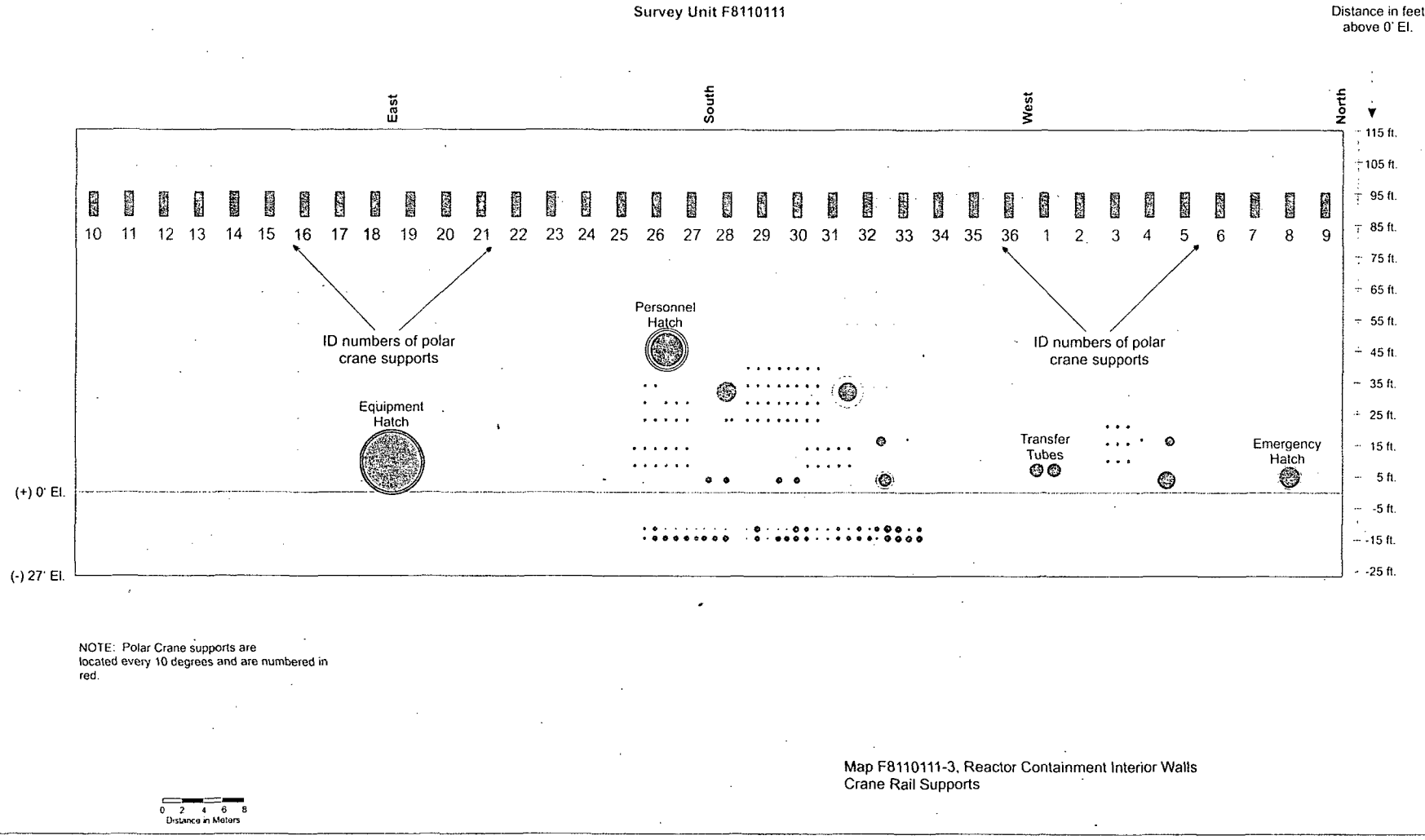
October 9, 2008

Survey Unit F8110111

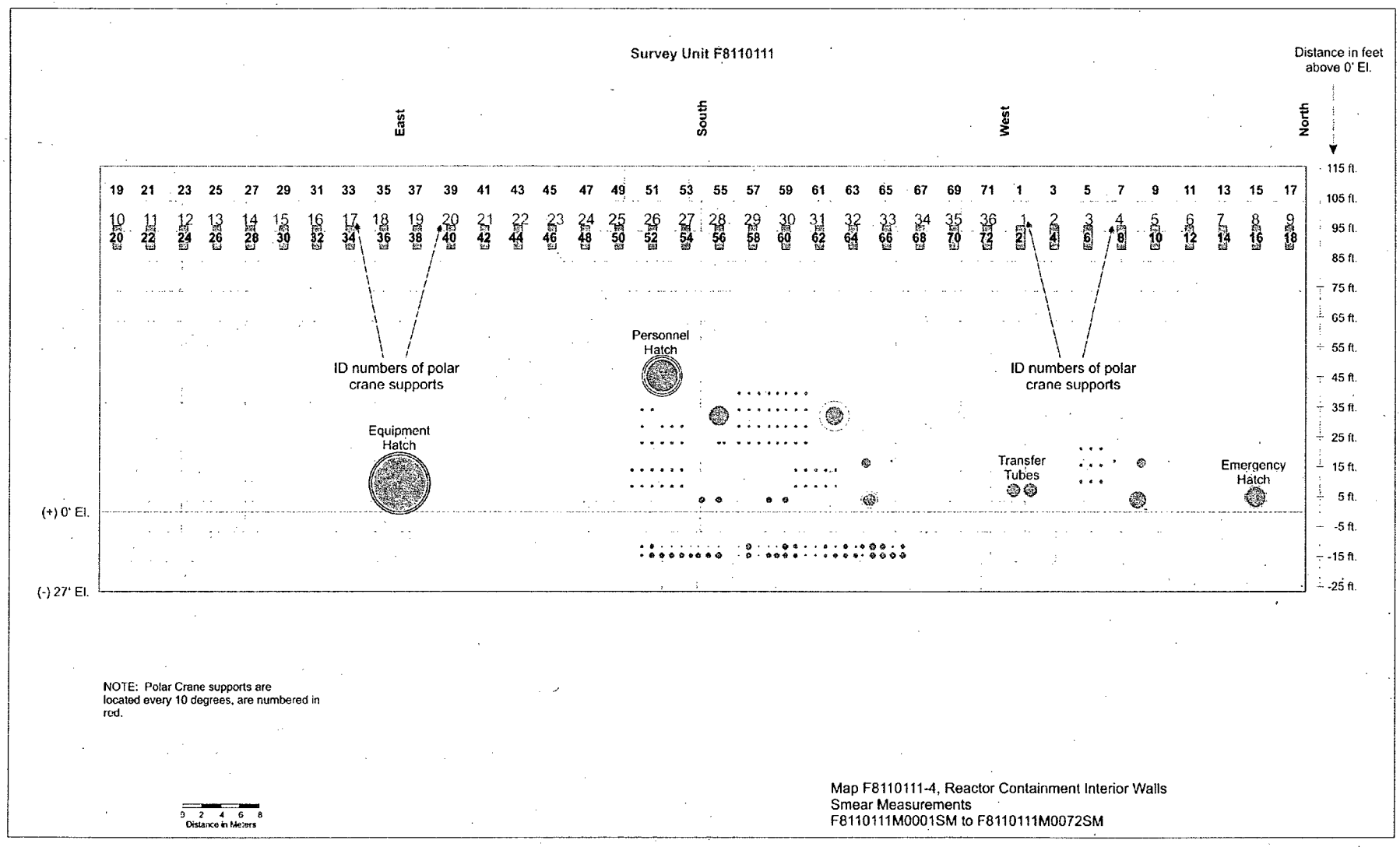

Location of Containment Building
inside the Industrial Area
Map F8110111-1, Containment Building
Location at Rancho Seco site
N



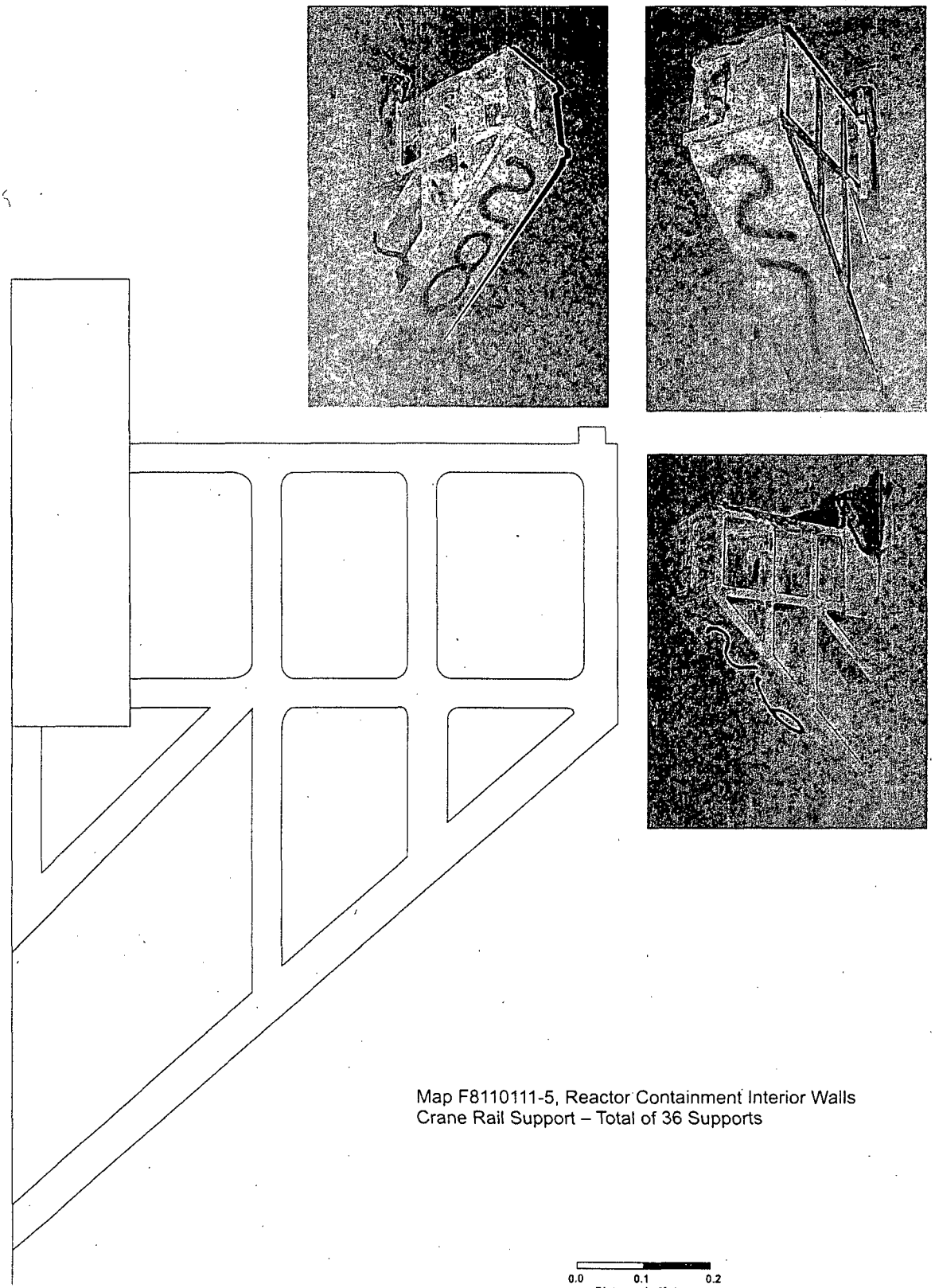
Map F8110111-2, Reactor Containment Interior Walls
ISOCS Gamma Scan Measurements
F8110111M0001GS to F8110111M0180GS
19.6 sq. meter field of view



Map F8110111-3, Reactor Containment Interior Walls
Crane Rail Supports



Map F8110111-4, Reactor Containment Interior Walls
Smear Measurements
F8110111M0001SM to F8110111M0072SM



Map F8110111-5, Reactor Containment Interior Walls
Crane Rail Support – Total of 36 Supports

Attachment 2

Instrumentation

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Survey Unit F8110111

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; 142509	44-116; 193992	343	884
M2350; 142507	44-116; 153352	343	884
M2350; 189089	44-116; 192946	343	884
M2350; 149794	44-116; 193562	343	884
M2350; 142509	43-51B; 190667	788	2,675
M2350; 180738	43-51B; 190666	788	2,675
Tennelec; 0401171	N/A	4.93 dpm α, 8.21 dpm β	N/A

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	2983947	Metal – 1,140 dpm/100 cm^2 Cs-137, Metal – 652 dpm/100 cm^2 Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
Investigation Criteria - Direct	640,700
Investigation Criteria – Scan (ISOCS average activity – 19.6 sq. meter field of view)	34,000 Cs-137 11,000 Co-60
$DCGL_W$	43,000
$DCGL_{EMC}$	640,700

Attachment 3

Investigation

October 9, 2008

Survey Unit F8110111

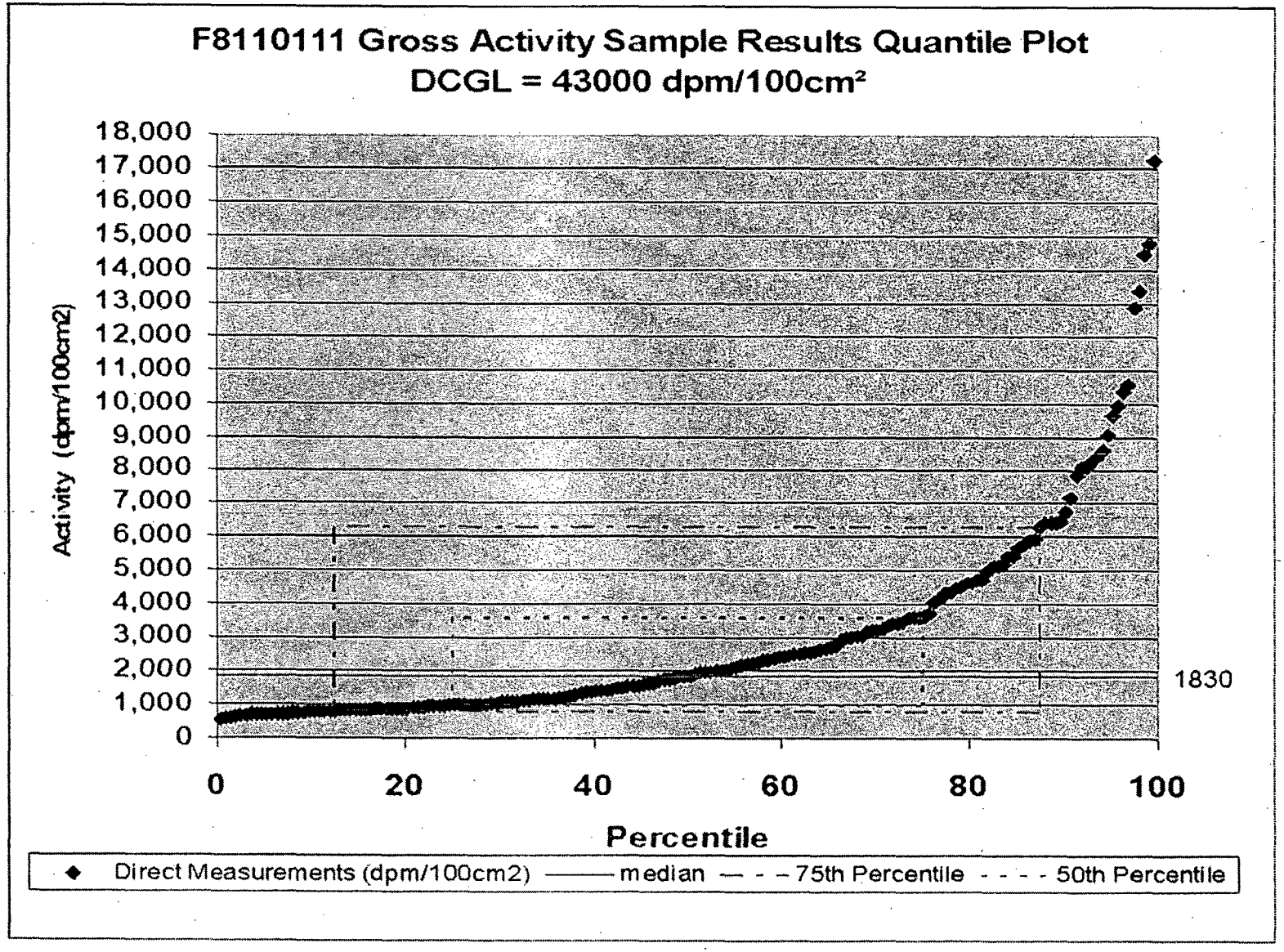
(none required)

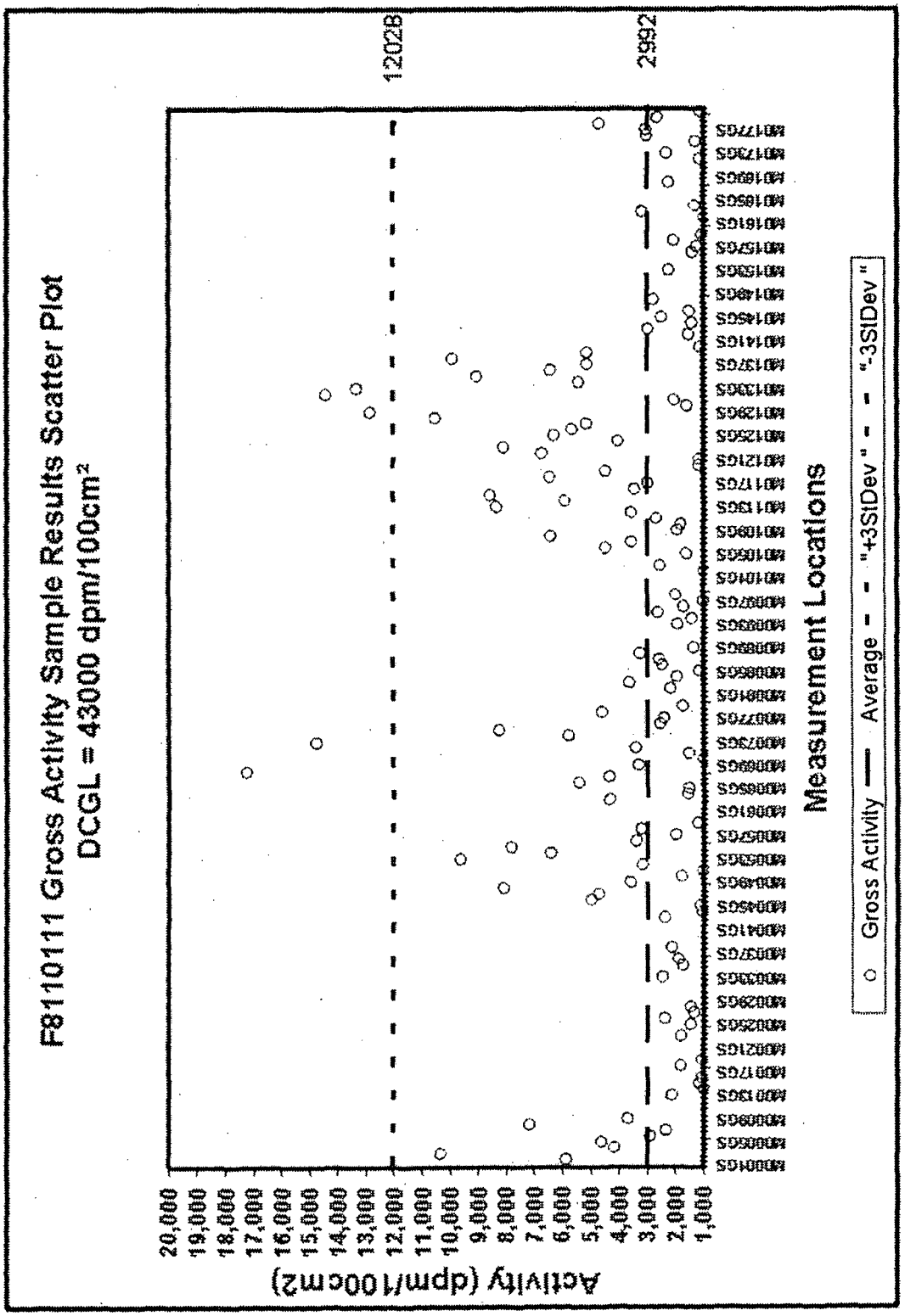
Attachment 4

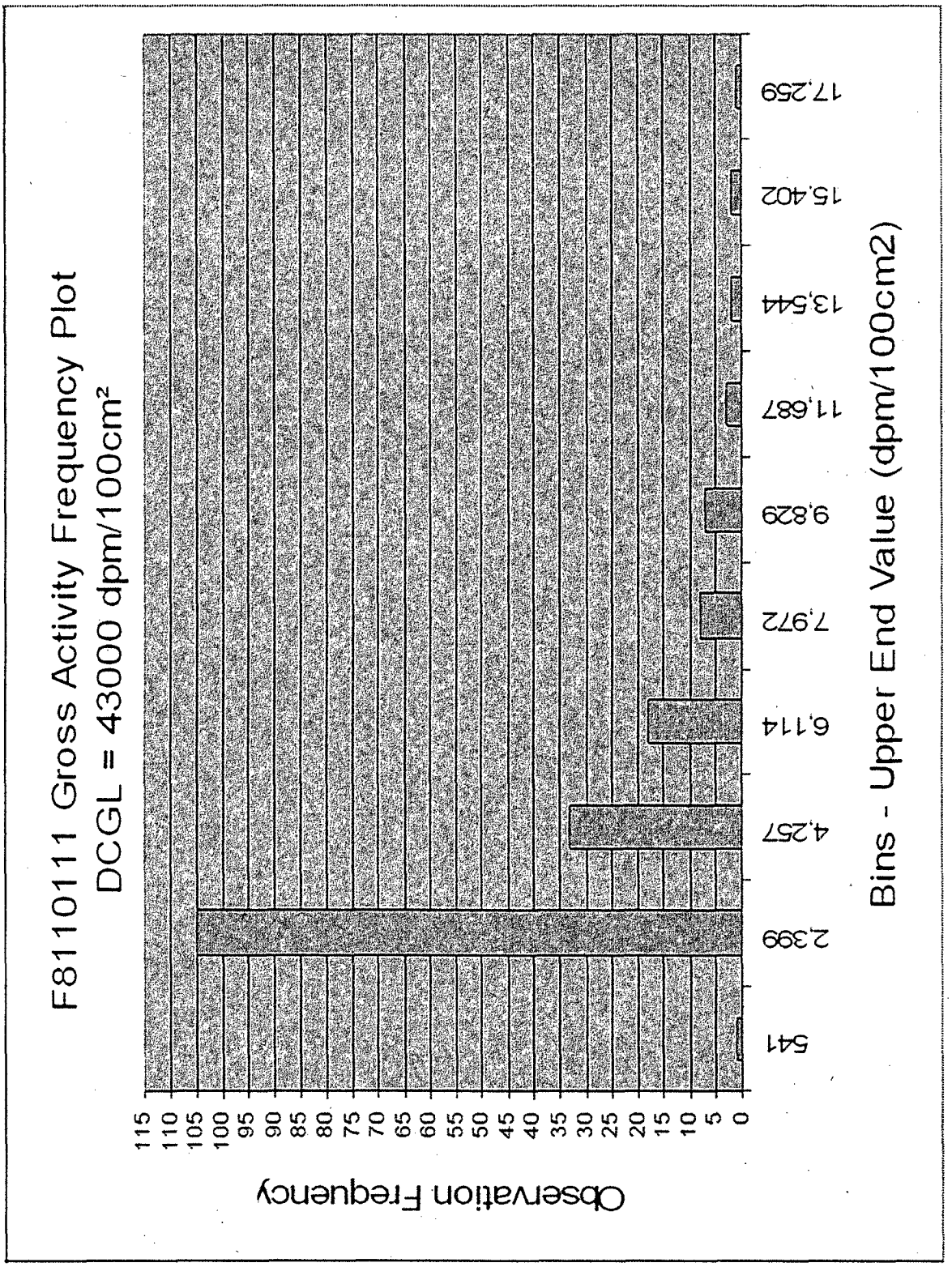
Data Assessment

October 9, 2008

Survey Unit F8110111


F8110111 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1830
0
20
40
60
80
100
Percentile
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8110111 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
12028
2992
Activity (dpm/100cm2)
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8110111 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
541
2,399
4,257
6,114
7,972
9,829
11,687
13,544
15,402
17,259
Bins - Upper End Value (dpm/100cm2)