MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FB-2000 BAILEY BARN FOOTPRINT
SURVEY UNIT 1

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SURVEY UNIT 1

A. SURVEY UNIT DESCRIPTION

FB-2000 survey unit encompasses the footprint of the former Bailey Barn, an outbuilding that was used as a storage building for farm equipment, chemicals, flammables and environmental monitoring supplies/equipment. The building stood adjacent to the Environmental Services Building along the Back River, outside and to the northeast of the Industrial and Restricted Areas at coordinates 409400N and 625265 E using the Maine State Coordinate System (West Zone) NAD 1927. The building footprint is shown in relation to other major site structures on Map FB 2000 SITE, Attachment 1.

The Bailey Barn was a wood frame structure with a concrete floor. In preparation for decommissioning activities, the building and concrete slab foundation were removed. Following slab excavation, the remaining soil was leveled and spread evenly throughout the survey unit. The building footprint occupied a space of approximately 230 m^2.

B. SURVEY UNIT DESIGN INFORMATION

The Bailey Barn footprint survey area was located outside of the Industrial Area. The only radioactive material stored in the former structure was several sealed NORM-containing luminous temperature detectors. Characterization surveys performed on the barn indicated total and removable beta activity levels were below the minimum detectable activity (MDA) for the instrumentation used to perform the surveys. Removable alpha activity was also found to be less than MDA. Historical site assessment results indicated an absence of radiological events recorded for this area. As an outcome of the characterization surveys and historical knowledge assessment, FB-2000 was established as a Class 3 survey area and Final Status Surveys were performed in accordance with Section 5 of the LTP.

The survey unit design parameters for FB-2000 as a Class 3 land survey are shown in Table 1. To calculate the number of soil samples required for the Sign Test, the sigma value of 0.23 pCi/g (Cs-137) applicable to R1800 Bailey House Land Area (Table 5-1C of the LTP Rev. 3)[1] was used, rather than the sigma of 245 dpm/100 cm^2 from B-2000 Bailey Barn Slab. Following removal of the barn foundation, backfill was not required to bring the footprint to ground level. Therefore, the sigma value from the Bailey House Land Area was determined to be more applicable for this survey unit than that established for the former barn structure.

Given a relative shift of 3.0, it was determined that 14 direct soil sample points were required for the Sign Test. Direct measurement locations were randomly generated and are shown on map FB 2000 DP (Attachment 1). Soil samples were analyzed with laboratory gamma spectroscopy.

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1 Reference 1

In accordance with the LTP, scans covering 1% to 10% of the 230 m^2 area were required for the Class 3 survey unit. This was accomplished by scanning seven approximately 4 m^2 areas (equaling 28 m^2, which is conservatively greater than 10%). Locations of the survey scans are shown on map FB 2000 SS (Attachment 1). The survey instruments used, their MDCs and scan investigation levels are provided in Attachment 2.

Background values were based on local scaler values in the survey unit. These background values were used to establish scan alarm setpoints.

TABLE 1

SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	230 m^2	No limit for Class 3 Area
Number of Direct Measurements Required	14	Based on adjusted LBGR of 3.51 pCi/g, sigma of 0.23 pCi/g, and relative shift of 3.0. Type I = Type II = 0.05
Sample Area	N/A	Class 3 Area
Sample Grid Spacing	N/A	Class 3 Area
Scan Grid Area	4 m^2 (2 m x 2 m)	Class 3 Area
Area Factor	N/A	Class 3 Area
Scan Survey Area	12% (28 m)	Class 3 Area
Background		
SSPA-3 (scan)	Average background $\pm$ 1000 c/m	LTP Revision 3, Section 5.5.2.d
Scan Investigation Level	3 sigma of background See Table 2-2	EC-009-01[2]
DCGL	4.2 pCi/g	LTP Revision 3, Section 6.7
Design $DCGL_{EMC}$	N/A	Class 3 Area

C. SURVEY UNIT RESULTS

As required, 14 direct soil measurements were performed and the results are presented in Table 2. All direct measurements were below the DCGL. No scan alarms occurred within the survey unit scan locations; thus, no investigations were required.

[2] Reference 6

TABLE 2

DIRECT MEASUREMENTS

Sample Number	Cs-137 (pCi/g)	Uncertainty
FB2000-1-3S001SS	< 2.44E-02	
FB2000-1-3S002SS	**2.06E-02**	± 1.17E-02
FB2000-1-3S003SS	< 2.22E-02	
FB2000-1-3S004SS	**3.83E-02**	± 2.48E-02
FB2000-1-3S005SS	< 2.61E-02	
FB2000-1-3S006SS	< 2.14E-02	
FB2000-1-3S007SS	< 2.31E-02	
FB2000-1-3S008SS	< 2.20E-02	
FB2000-1-3S009SS	< 2.43E-02	
FB2000-1-3S010SS	< 2.32E-02	
FB2000-1-3S011SS	< 2.26E-02	
FB2000-1-3S012SS	< 2.38E-02	
FB2000-1-3S013SS	< 2.16E-02	
FB2000-1-3S014SS	< 2.34E-02	
Mean	**2.41E-02**	
Median	**2.32E-02**	
Standard Deviation	**4.33E-03**	
Range	**2.06E-02 – 3.83E-02**	

NOTE: Samples were also analyzed for Co-60; all were less than the MDA of 0.03 pCi/g.
"<" indicates MDA value

D. SURVEY UNIT INVESTIGATIONS AND RESULTS

No investigations were required.

E. SURVEY UNIT DATA ASSESSMENT

An analysis of the direct sample measurement results, including the mean, median, standard deviation, and sample range, is provided in Table 2. Of the 14 soil samples collected, only 2 samples identified detectable Cs-137 activity, with the reported values less than 1% of the DCGL. The sample activity and Minimum Detectable Activities are listed in Table 2. The mean and median activities were also less than the DCGL. In addition, Co-60 was not identified in any of the 14 samples.

For illustrative purposes, as indicated in LTP Section 5.9.3, a simplified general retrospective dose estimate can be calculated from the average residual contamination level by subtracting the established mean fallout Cs-137 background value (0.19 pCi/g)[3] for disturbed soil from the survey unit sample mean activity (0.0241 pCi/g). The result is a net value of –0.166 pCi/g. This would equate to an annual dose of 0.0 mrem/year. However, for purposes of demonstrating compliance with the radiological criteria for license termination and the enhanced State criteria, background activity was not subtracted from the soil sample analysis activity values and less than detectable activities were assumed to be present at the detection limit.

F. ADDITIONAL DATA EVALUATION

Attachment 4 provides additional data evaluation associated with this Survey Unit, including relevant statistical information. Based on survey unit direct measurement data, this attachment provides the Sign Test Summary, Quantile Plot, Histogram, and Retrospective Power Curve.

1. The Sign Test Summary provides an overall summary of design input (Table 1) and resulting calculated values used to determine the required number (N) of direct measurements (per LTP Section 5.4.2). The Sign Test Summary is a separate statistical analysis that also calculates the mean, median, and standard deviation of the direct measurements.

   The critical value and the result of the Sign Test are provided in the Sign Test Summary table, as well as a listing of the key release criteria. As is shown in the table, all of the key release criteria were clearly satisfied for the FSS of this survey unit.

2. The Quantile Plot was generated from direct measurement data listed in Table 2 and indicates general symmetry about the median. The data set and plot are consistent with expectations for a Class 3 survey unit. All of the measurements are well below the DCGL of 4.2 pCi/g for land outside the restricted area.

3. A Histogram Plot was also developed based on the direct measurement values. This plot shows that the direct data were essentially a log-normal distribution with no significant outliers.

4. A Retrospective Power Curve was constructed, based on FSS results. The curve shows that this survey unit having a mean residual activity at a small fraction of the DCGL has a high probability ("power") of meeting the release criteria. Thus, it can be concluded that 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.

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[3] See Attachment E to Maine Yankee Procedure PMP 6.7.8 (Reference 5).

G. CHANGES IN INITIAL SURVEY UNIT ASSUMPTIONS ON EXTENT OF RESIDUAL ACTIVITY

The survey was designed as a Class 3 area; the FSS results were consistent with that classification. The direct measurement sample standard deviation was less than the design sigma. Thus, a sufficient number of sample measurements were taken and no additional measurements were required.

H. CHANGES IN INITIAL SURVEY UNIT ASSUMPTIONS ON EXTENT OF RESIDUAL ACTIVITY

The FSS of Survey Unit 1 was designed and performed using the criteria of the approved LTP Revision 3 Addenda[4]. The only subsequent LTP changes (with potential impact to this FSS) included the proposed license amendment related to modifications of the activated concrete remediation plan, submitted September 11, 2003[5] and approved by the NRC[6]. The license amendment lowered the surface soil DCGL to 2.39 pCi/g for areas inside the Restricted Area. However, the changes do not apply to this survey unit as the surface soil DCGL for areas outside the restricted area remain unchanged.

I. CONCLUSION

The FSS of this survey unit was designed based on the LTP designation as a Class 3 area. The survey design parameters are presented in Table 1. The required number of direct measurements was determined for the Sign Test in accordance with the LTP. As presented in Table 2, all direct measurements were less than the DCGL of 4.2 pCi/g Cs-137.

A Sign Test Summary analysis demonstrated that the Sign Test criteria were satisfied. The direct measurement sigma was determined to be less than that used for design, thus indicating that a sufficient number of samples was taken.

The Retrospective Power Curve shown in Attachment 4 confirmed that sufficient samples were taken to support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and the data quality objectives were met. Attachment 4 also revealed that direct measurement data represented essentially a log-normal distribution with no significant outliers.

The scan survey design for this survey unit was developed in accordance with the LTP with significant aspects of the design discussed in Section B and Table 1. Scanning resulted in no verified alarms; therefore, no investigations were required.

It is concluded that FB2000 Survey Unit 1 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

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4 Reference 1

5 Reference 3

6 Reference 4

J. REFERENCES

1. Maine Yankee License Termination Plan, Revision 3, October 15, 2002 and Addenda, Maine Yankee letter to the NRC, MN-02-061, dated November 26, 2002

2. NRC letter to Maine Yankee, dated February 28, 2003

3. Maine Yankee letter to the NRC, MN-03-049, dated September 11, 2003

4. Issuance of License Amendment No. 170, NRC letter to Maine Yankee, dated February 18, 2004

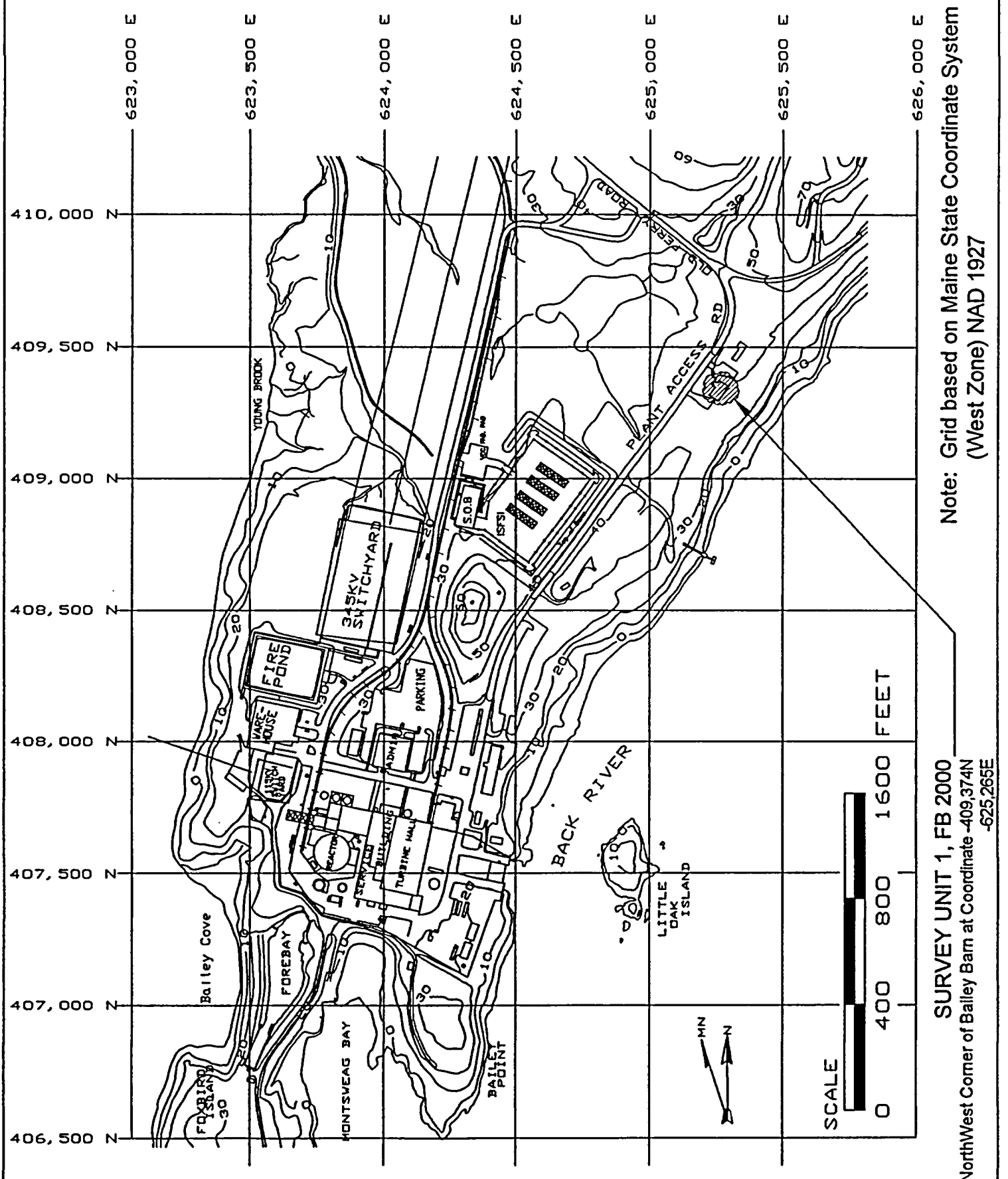
5. Maine Yankee PMP 6.7.8, FSS Data Processing and Reporting, Attachment E, Approach for Dealing with Background Radioactivity for Maine Yankee Final Status Surveys

6. EC-009-01 (MY), Instrumentation Selection and MDC Calculation

Attachment 1

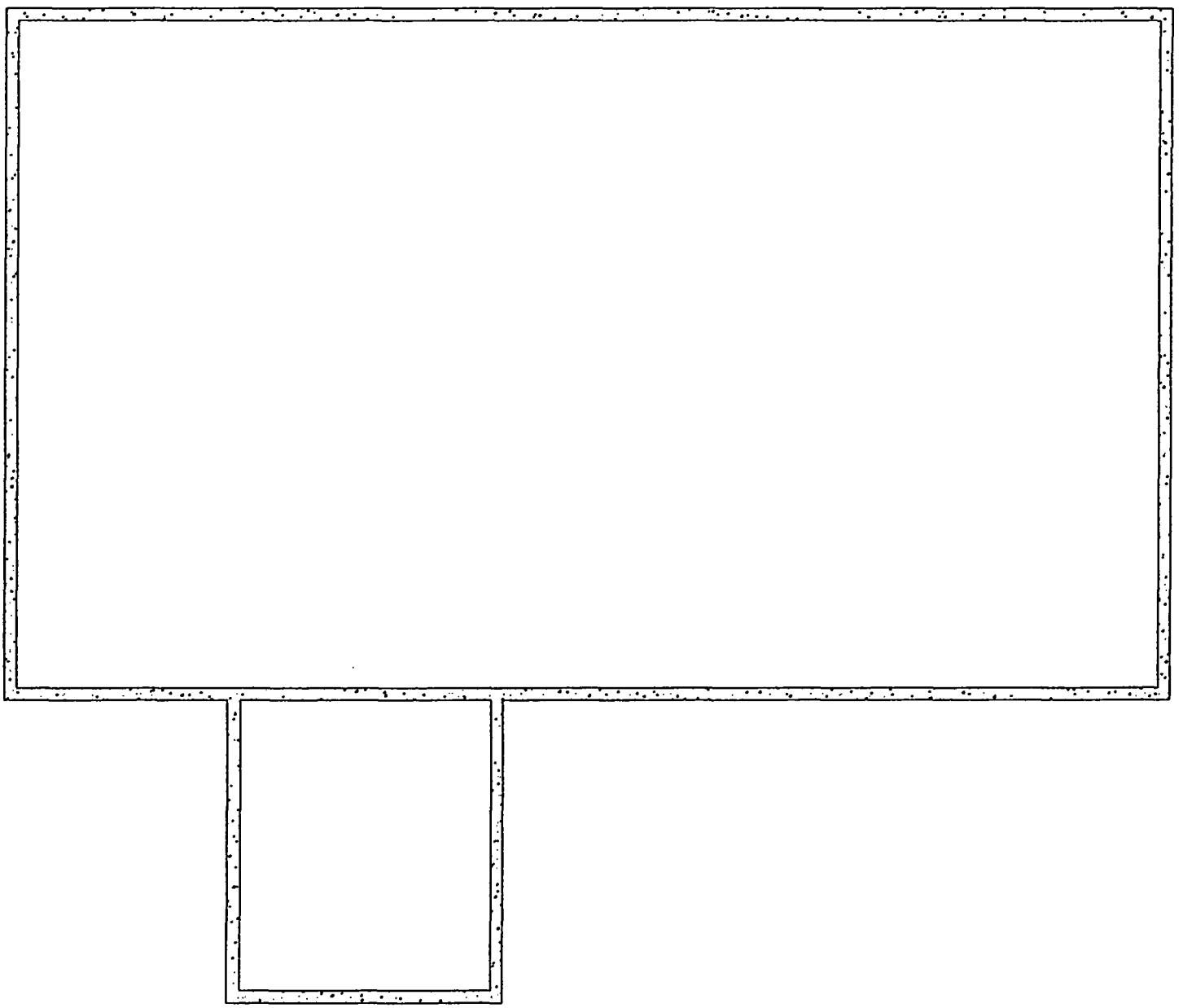
Survey Unit Maps

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FB 2000 SITE Revised: 5-3-04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Barn	



Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FB 2000-BKG Revised: 5-3-04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Barn	

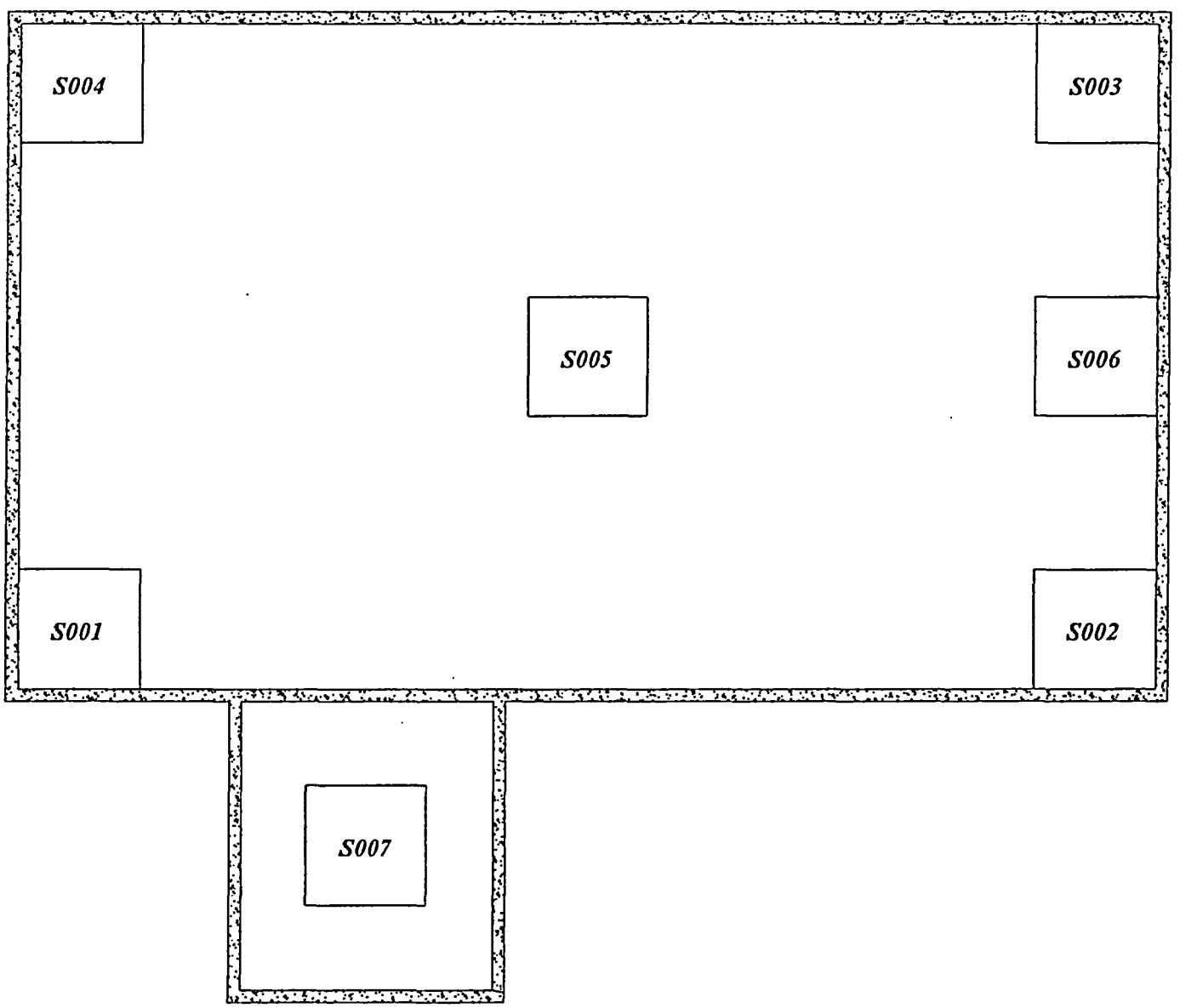
Bailey Barn
Final Status Survey
Background Map



Soil Footprint Total Area - 230 sq-m

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FB 2000 SS Revised: 5-3-04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Barn	

Bailey Barn
Final Status Survey
Survey Scans S001 - S007

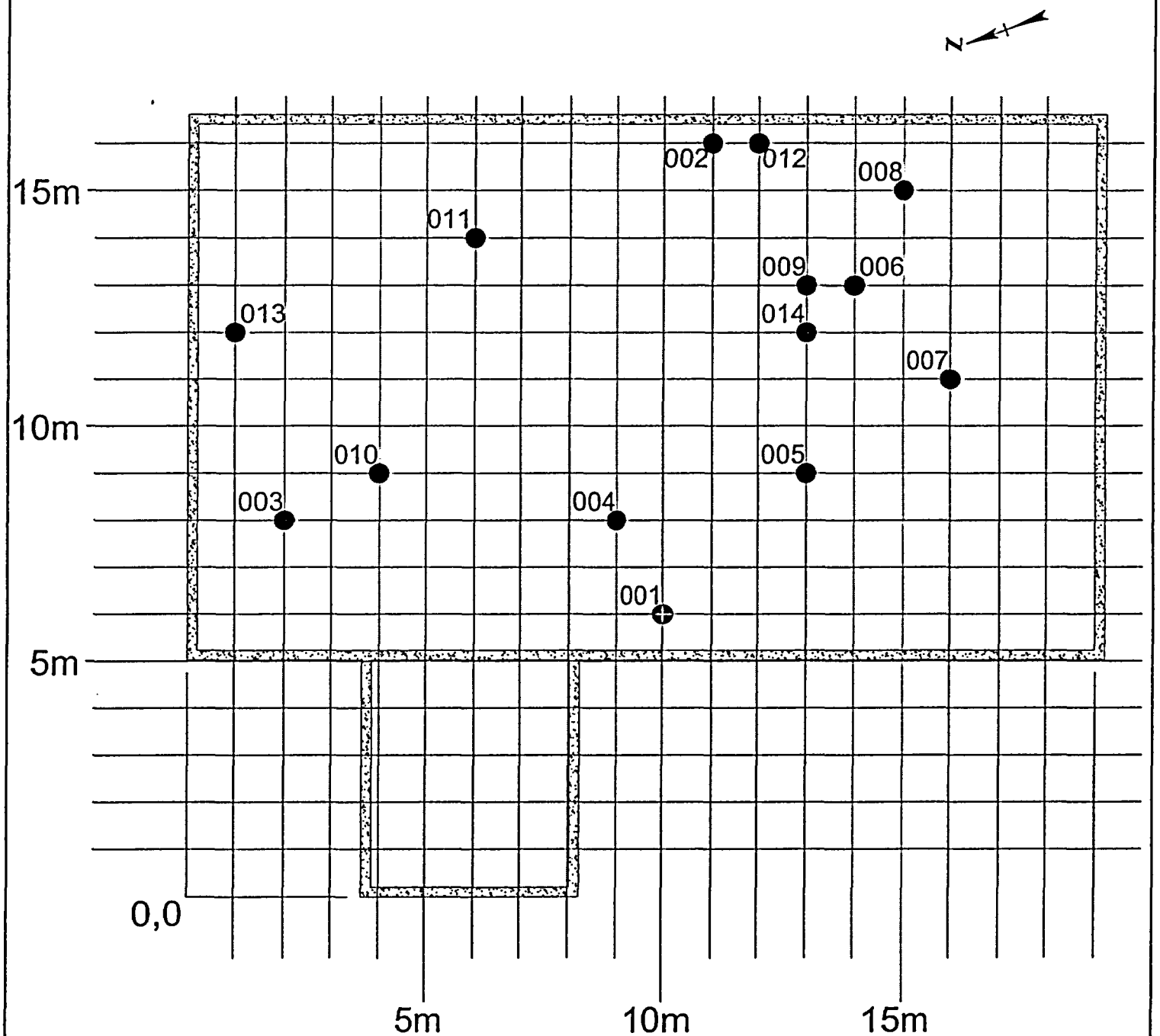


Grids are approximately 2m x 2m

Soil Footprint Total Area - 230 sq-m

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FB 2000 DP Revised: 3-24-04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Barn	

Bailey Barn
Final Status Survey
Direct Points 001 - 014



N = 14

Soil Footprint Total Area - 230 sq-m

Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
2491	2254 (SSPA-3)
2620	726554 (SSPA-3)

HPGe Detectors for Lab Analysis of Volumetric Samples

Detector Number	MDC (pCi/g)
FSS-1	0.015 to 0.03
FSS-2	0.015 to 0.03

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Detector	SSPA-3	Comments
Scan MDC	5.9 pCi/g Cs-137	Design Scan MDC, LTP Table 5-6 (Reference 1)
DCGL	4.2 pCi/g Cs-137	Approved DCGL for land areas outside the Restricted Area, LTP Section 6.7 (Reference 1)
Investigation Level (Alarm Setpoint)	13,215 cpm	3 sigma of Background, EC-009-01 (MY) (Reference 6)

Attachment 3

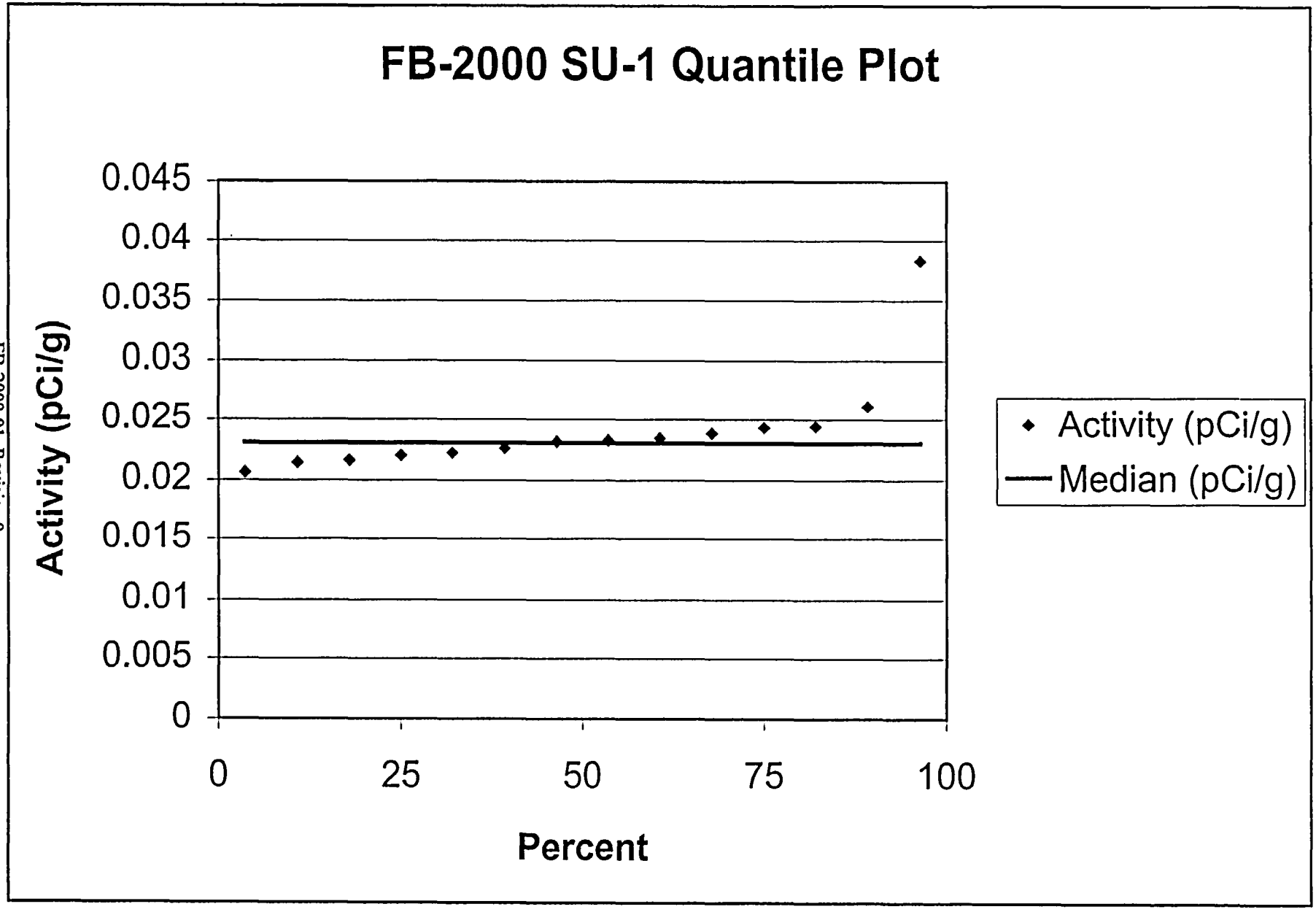
Investigation Tables
(None Required)

Attachment 4

Statistical Data

Survey Package FB-2000 Unit 1 Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FB-2000	
Survey Unit:	01	
Evaluator:	Anderson	
$DCGL_w$:	4.20E+00	
$DCGL_{emc}$:	N/A	
LBGR:	3.51E+00	
Sigma:	2.30E-01	
Type I error:	0.05	
Type II error:	0.05	
Nuclide:	CS-137	
Soil Type:	N/A	
Calculated Values		**Comments**
$Z_{1-\alpha}$:	1.645	
$Z_{1-\beta}$:	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	3.0	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift is >3
N-Value:	11	
N-Value+20%:	14	
Sample Data Values		**Comments**
Number of Samples:	14	
Median:	2.32E-02	
Mean:	2.41E-02	
Net Sample Standard Deviation:	4.33E-03	
Total Standard Deviation:	4.33E-03	SRSS
Maximum:	3.83E-02	
Sign Test Results		**Comments**
Adjusted N Value:	14	
S+ Value:	14	
Critical Value:	10	
Sign test results:	Pass	
Criteria Satisfaction		**Comments**
Sufficient samples collected:	Pass	
Maximum value <$DCGL_w$:	Pass	
Median value <$DCGL_w$:	Pass	
Mean value <$DCGL_w$:	Pass	
Maximum value <$DCGL_{emc}$:	Pass	
Total Standard Deviation <=Sigma:	Pass	
Criteria comparison results:	Pass	
Final Status		**Comments**
The survey unit passes all conditions:	Pass	


FB-2000 SU-1 Quantile Plot
Activity (pCi/g)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
25
50
75
100
Percent
Activity (pCi/g)
Median (pCi/g)

One-Sample T-Test Report

Page/Date/Time 2 7/22/04 9:02:54 AM
Database
Variable C2

Plots Section

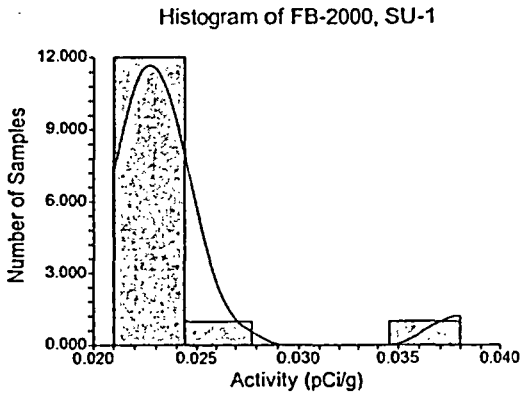


Chart Section