MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0500 BAILEY POINT
SURVEY UNIT 1

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A. SURVEY UNIT DESCRIPTION

FR-0500 Survey Unit 1, Bailey Point, consists of the location in which a small volume of contaminated soil, gravel and/or asphalt media, originating from inside the Restricted Area, was temporarily placed. This area was determined to have elevated activity based on the results of the characterization survey and is believed to have been remediated as part of the characterization effort. In accordance with the License Termination Plan (LTP), (Reference 3) the subject area was reclassified into a Class 1 survey unit.

The area requiring remediation measured approximately 1.2 m by 0.75 m (4 foot by 2.5 foot). The initial design for Bailey Point was intended to be a Class 1 survey unit that was completely surrounded by a Class 2 buffer survey unit. Alternately, it was deemed to be more efficient to combine both of these small survey units into one Class 1 unit. This was done, producing the 8 m by 8 m area that is now designated FR-0500 Survey Unit 1.

The survey unit area located at approximately grid coordinates 407,000 N and 624,200 E is shown in relation to other major site structures in map FR 0500 SITE. All maps referenced in this release record are provided in Attachment 1, unless otherwise noted. The survey unit total area including suitable buffer zone is approximately 64 m^2.

B. SURVEY UNIT DESIGN INFORMATION

FR-0500 Survey Unit 1 was designated a Class 1 survey unit. The survey unit design parameters are summarized in Table 1. Given a relative shift of 3.0, it was determined that 14 direct measurements were required for the Sign Test. Measurement locations were determined using the fixed grid with a random start point method and are illustrated on the map FR 0500-01c. All direct measurements consisted of soil samples obtained at the required location. The samples were analyzed with laboratory gamma spectroscopy.

For a Class 1 area, 100% scan coverage was required.[1] Scan areas are indicated on map FR 0500-01a. Twenty-five scan grids of varying sizes were made to provide a total of 64 m^2 scan coverage. The survey instruments used, their MDC, and alarm setpoints are provided in Attachment 2.

Background values were established for the scan measurements based on local scaler values in survey area. These background values were used to establish scan alarm setpoints and to confirm scan MDCs were appropriate.

[1] LTP Table 5-3

TABLE 1

SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	64 m^2	See discussion (< 2000 m^2)
Number of Direct Measurements Required	14	LTP (Based on LBGR of 3.36 pCi/g, sigma[2] of 0.28 pCi/g, and a relative shift of 3.0. Type I = Type II= 0.05)
Sample Area	4.57 m^2	64 m^2 / 14 = 4.57 m^2
Sample Grid Spacing	2.1 m	
Scan Grid Area	Approximately 2m x 2m (some are smaller as is indicated on SU maps)	Grid size < 10 m^2 in accordance with Reference 4
Area Factor	3.8	LTP Table 6-12
Scan Survey Area	64 m^2	Class 1 area-100%
Background		
SPA-3 (scan)	Average Background ± 1000 cpm	DI 6-150, EC-009-01, LTP Section 5
Scan Investigation Level	3 sigma of Background plus Background	EC 009-01(Reference 1) See Table 2-2
DCGL	4.2 pCi/g	LTP Revision 3 Table 5-6 (Reference 2)
Design $DCGL_{EMC}$	16.0 pCi/g	DCGL x AF

C. SURVEY RESULTS

Fourteen direct measurements were required, 16 direct soil samples were actually obtained. The results are presented in Table 2. All direct measurements were below the DCGL. No verified alarms resulted from scanning; therefore, no investigations needed to be performed.

[2] Design sigma based on LTP Revision 3, Table 5-1C, Bailey Point, FR-0500.

TABLE 2

DIRECT MEASUREMENTS

Sample Number	Cs-137 (pCi/g)
FR-0500-01-S001	**1.50E-01 ± 4.59E-02**
FR-0500-01-S002	**9.17E-02 ± 3.21E-02**
FR-0500-01-S003	< 5.88E-02
FR-0500-01-S004	< 5.46E-02
FR-0500-01-S005	< 7.23E-02
FR-0500-01-S006	< 6.90E-02
FR-0500-01-S007	< 5.17E-02
FR-0500-01-S008	**9.44E-02 ± 3.23E-02**
FR-0500-01-S009	**5.54E-02 ± 2.79E-02**
FR-0500-01-S010	< 5.81E-02
FR-0500-01-S011	< 4.44E-02
FR-0500-01-S012	< 4.94E-02
FR-0500-01-S013	< 5.65E-02
FR-0500-01-S014	< 4.42E-02
FR-0500-01-S015	< 5.15E-02
FR-0500-01-S016	< 4.73E-02
Mean	**6.56E-02**
Median	**5.60E-02**
Standard Deviation	**2.71E-02**
Range	**4.42E-02 – 1.50E-01**

NOTES

1. The samples were also evaluated for Co-60, all were below the nominal MDA of 0.1 pCi/g.
2. "<" indicates values less than MDA, the MDA value is reported.

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

No investigations were required.

E. SURVEY UNIT DATA ASSESSMENT

An analysis of the direct sample results, including the mean, median, standard deviation, and sample result range, are provided in Table 2. Both the mean and the median activities were less than the DCGL. Four of the samples had positive indications of Cs-137 at environmental levels. The maximum direct measurement result was less than 3.6 percent of the DCGL.

One background location sample contained a trace level of colbalt-60. This was corrected by subtracting the activity equivalent in cpm from the background value used to calculate the scan setpoint. This amounted to a 15 cpm reduction in background.

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) for disturbed soil from the survey unit sample mean activity (0.07 pCi/g). The result is a net activity value of –0.12 pCi/g. This would equate to an annual dose rate of 0.0 mrem/y.[3] However, for purposes of demonstrating compliance with the radiological criteria for license termination and the enhanced State criteria, background activity is not subtracted from the soil sample analysis activity values.

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. The data set and plot are consistent with expectations for a Class 1 survey unit. All of the measurements are well below the DCGL of 4.2 pCi/g.

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

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 one outlier.

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 the data quality objectives were met.

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

The survey was designed as a Class 1 area; the FSS results were consistent with that classification. The direct measurement sample standard deviation was less than the design sigma. Thus, no additional measurements were required.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 1 was designed, performed and evaluated in mid 2004. The design was performed to the criteria of the LTP, Revision 3 (Reference 3). No subsequent LTP changes with potential impact to this survey unit needed to be evaluated.

I. CONCLUSION

The FSS of this survey unit was designed based on the LTP designation as a Class 1 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.

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 one outlier.

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 FR-0500 Survey Unit 1 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

1. Maine Yankee Engineering Calculation, EC-009-01

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

3. NRC letter to Maine Yankee, dated February 28, 2003, Approval of LTP Rev. 3 and Addenda

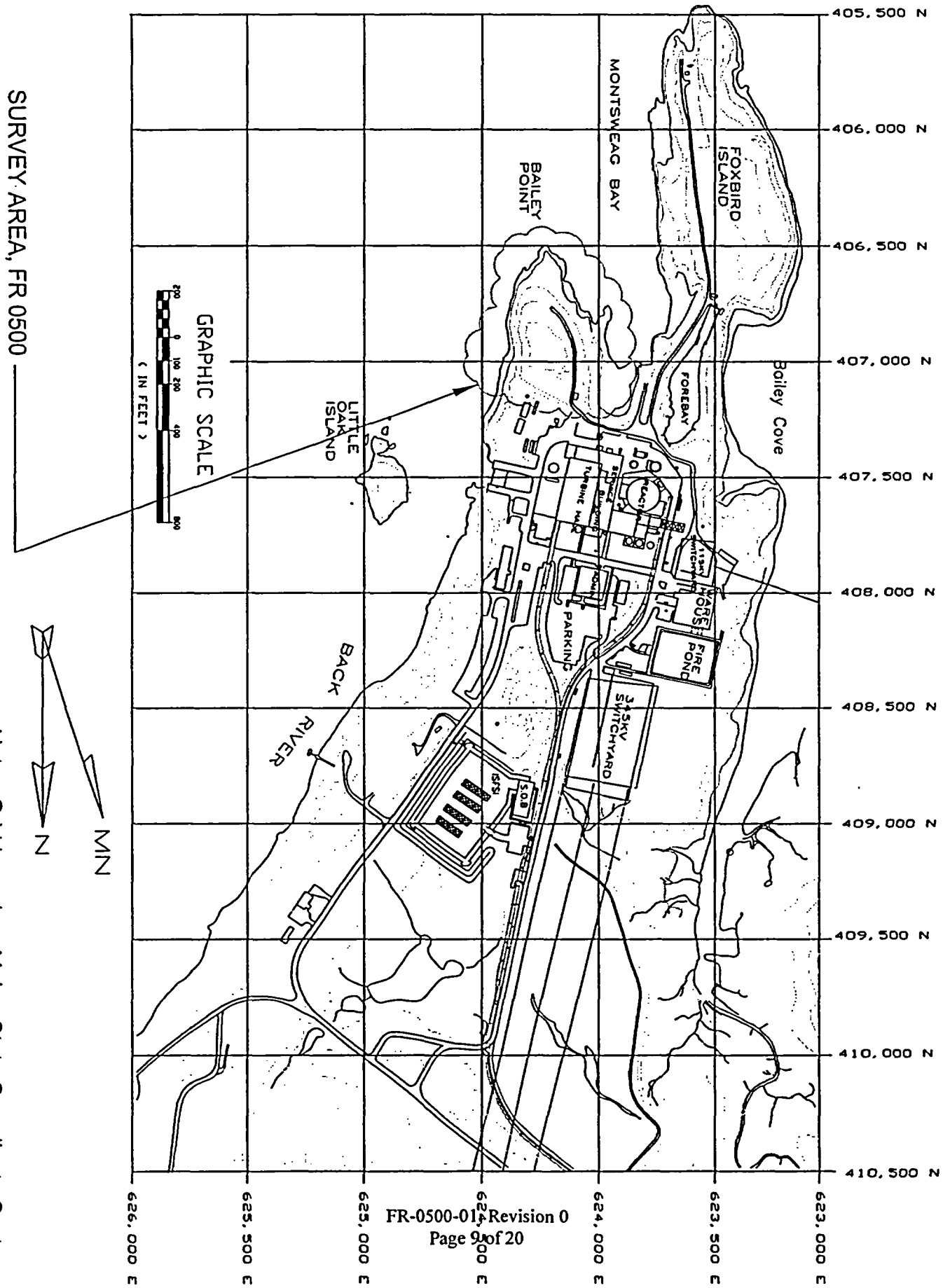
4. Maine Yankee letter to NRC, MN-03-009, February 6, 2003

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

Attachment 1

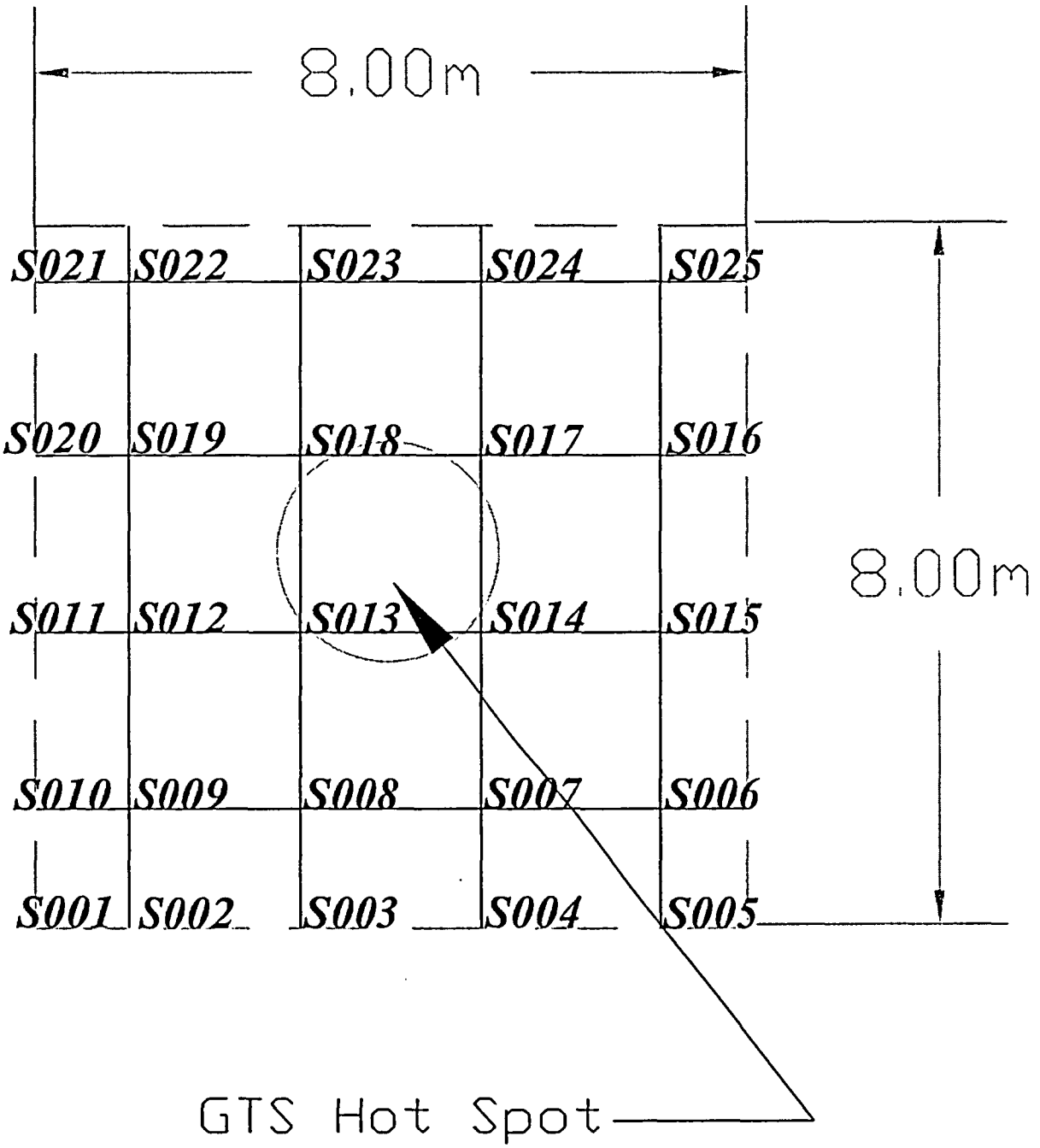
Survey Unit Maps

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0500 SITE Revised: 4-08-04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Point	



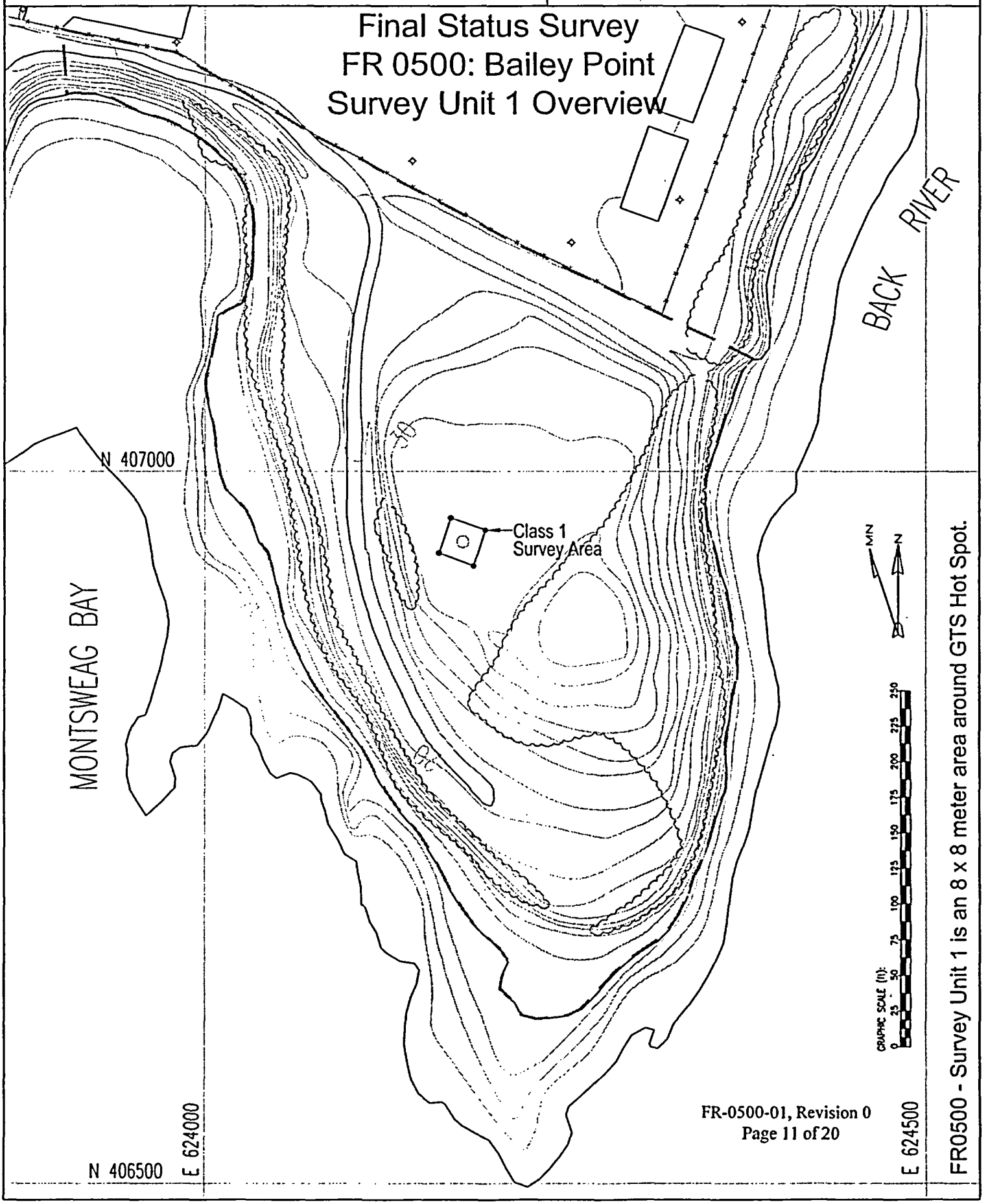
Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0500-01a Revised : 4/15/04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Point - Survey Unit 1	

Final Status Survey
FR 0500: Bailey Point (Survey Unit 1)
Survey Scan Grids: # S001 - S025



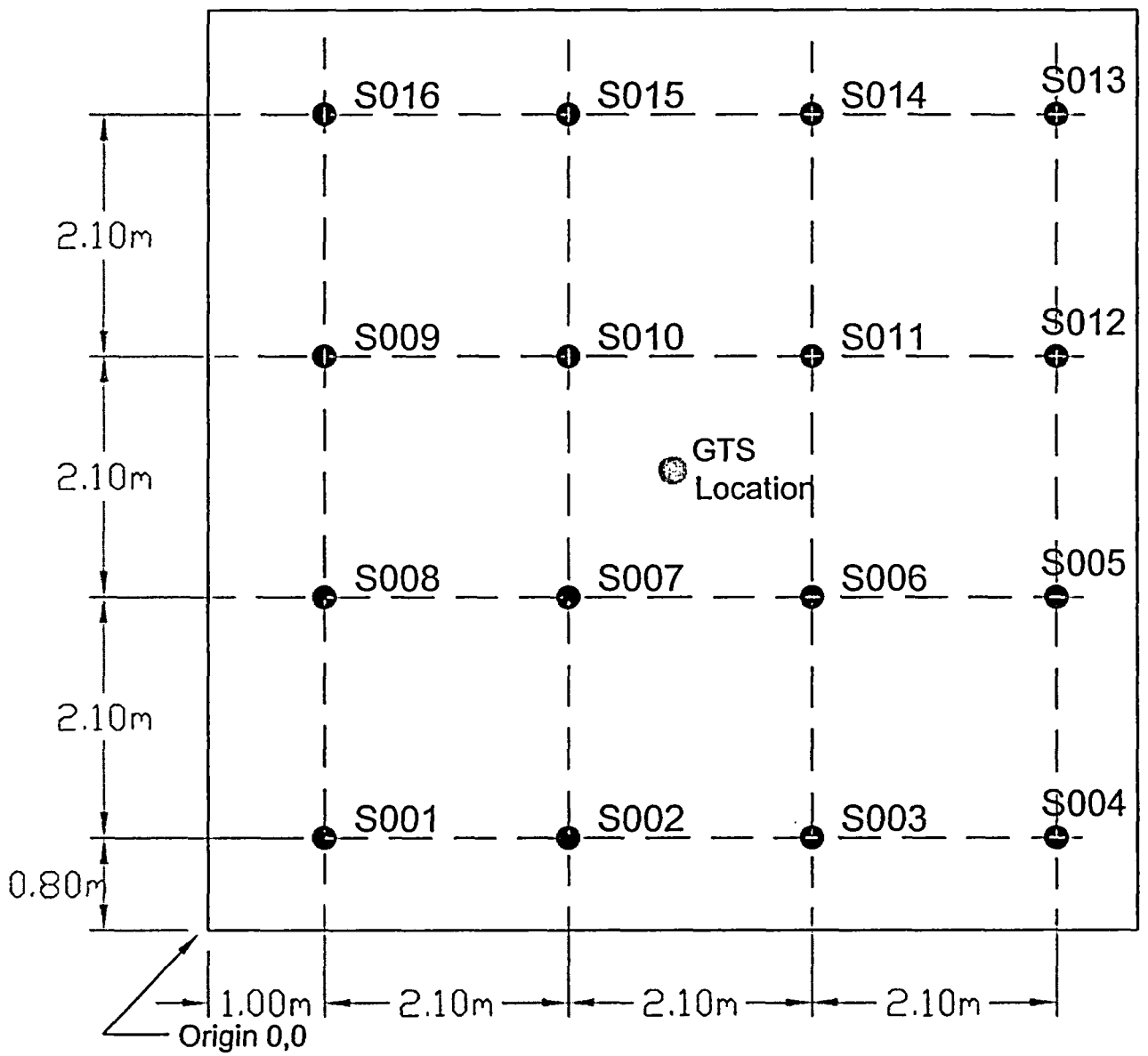
Scan Grids approximately 2 m x 2m (starting @ center GTS Hot Spot).

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0500-01b Revised : 5/12/04
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Bailey Point	



Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0500-01c Revised : 5/11/04
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Bailey Point - Survey Unit 1	

Final Status Survey
FR 0500: Bailey Point, SU1
Direct Point Locations S001 - S016



GTS Location at ME State Coordinate 406950.4305N, 624178.6831E (West Zone)

Bailey Point totals approximately 14,400 sq-m (3.5 ac) N = 14, L = 2.1

Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
2489	725890 (SPA-3)
2490	726560 (SPA-3)
2620	726560 (SPA-3)

HPGe Detectors for Lab Analysis of Volumetric Samples

Detector Number	MDC (pCi/g)
FSS-1	0.04 – 0.10
FSS-2	0.04 – 0.10

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Detector	SPA-3	Comments
Scan MDC (pCi/g)	5.9	Design Scan MDC, LTP Table 5-6 (Reference 2)
DCGL (pCi/g)	4.2	Approved DCGL for land areas outside the Restricted Area, LTP Section 6.7 (Reference 2)
Investigation Level (Alarm Setpoint) cpm	12,700	3 sigma of Background plus Background

Attachment 3

Investigation Table

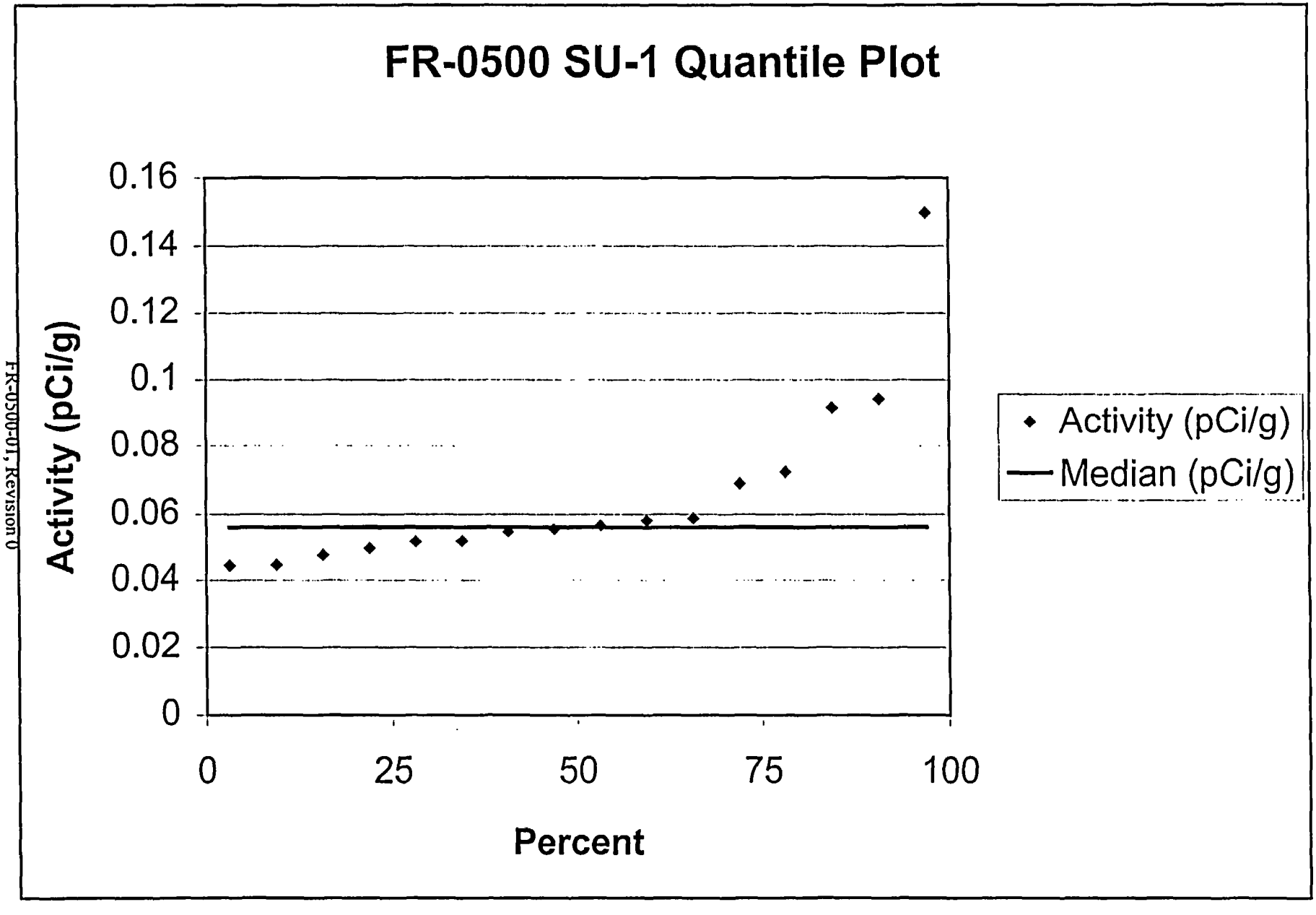
(None Required)

Attachment 4

Statistical Data

Survey Package FR0500 Unit 1 Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FR0500	Bailey Point Class 1 Area
Survey Unit:	01	
Evaluator:	DR	
$DCGL_w$:	4.20E+00	
$DCGL_{emc}$:	1.60E+01	
LBGR:	3.36E+00	
Sigma:	2.80E-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:	16	
Median:	5.60E-02	
Mean:	6.56E-02	
Net Sample Standard Deviation:	2.71E-02	
Total Standard Deviation:	2.71E-02	SRSS
Maximum:	1.50E-01	
Sign Test Results		**Comments**
Adjusted N Value:	16	
S+ Value:	16	
Critical Value:	11	
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	


FR-0500 SU-1 Quantile Plot
Activity (pCi/g)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
25
50
75
100
Percent
Activity (pCi/g)
Median (pCi/g)

One-Sample T-Test Report

Page/Date/Time 2 11/22/04 10:51:25 AM
Database
Variable C2

Plots Section

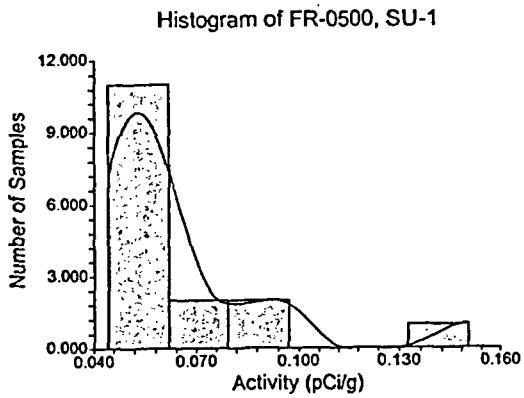


Chart Section