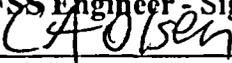
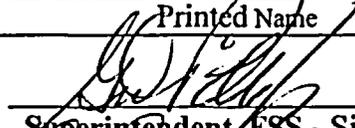
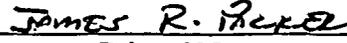


**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0100 RCA YARD WEST
SURVEY UNIT 3**

Prepared By:	 _____ FSS Engineer - Signature  _____ Printed Name	Date: <u>8 FEB 2005</u>
Reviewed By:	 _____ FSS Specialist - Signature  _____ Printed Name	Date: <u>8 Feb 2005</u>
Reviewed By:	 _____ Independent Review - Signature  _____ Printed Name	Date: <u>2/8/05</u>
Approved By:	 _____ Superintendent FSS - Signature  _____ Printed Name	Date: <u>2/10/05</u>
Approved By:	 _____ FSS, MOP - Signature  _____ Printed Name	Date: <u>2/17/05</u>

**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0100 RCA YARD WEST
SURVEY UNIT 3**

A. SURVEY UNIT DESCRIPTION

FR 0100 RCA Yard West Survey Unit 3 was located south of the former Containment Building and encompassed portions of areas that were originally surveyed under packages FR-0111-07, FR-1000-01, FR-0400-01, and FR-0400-02. Additionally, a portion of FR-0100 Survey Unit 3 was not originally included under any other survey package. The 1476 m² area is located at coordinates 407,290 N and 623,761 E using Maine State Coordinate System (West Zone) NAD 1927. The location of the survey unit in relation to the Containment Building and the surrounding site features are shown on map FR 0100-3 SITE (Attachment 1).

Survey Unit 3 is an area composed primarily of soil and backfill, and is relatively flat or gently sloping. The southern portion is a sharp sloping ravine with exposed ledge walls. Map FR0100-3 REF (Attachment 1) indicates the survey unit boundaries and gradients.

B. SURVEY UNIT DESIGN INFORMATION

Survey Unit 3 met the LTP Revision 3 definition for a Class 1 survey unit. The survey unit design parameters are shown in Table 1. Given a relative shift of 0.8, it was determined that 40 direct measurements were required for the Sign Test. Because the measurement locations were based on a systematic square grid with a random start point, the N=40 design led to a survey unit map with 43 locations which are illustrated on map FR0100-3 DP REF (Attachment 1). Direct measurements (soil samples) were collected from required locations and analyzed with laboratory gamma spectroscopy instrumentation.

In accordance with the LTP, scans covering 100% of the 1476 m² area were required for the Class 1 survey unit. This was accomplished by use of an *in situ* gamma spectroscopy detector (ISOCS) configured at a 3-meter distance from the surface to obtain overlapping 28-m² fields of view. The ISOCS detector was positioned perpendicular to the surface. Locations of the 83 survey scans are shown on map FR0100-3a (Attachment 1).

The ISOCS scans were configured to ensure 100% scan coverage of all exposed surfaces within Survey Unit 3. The survey instruments used are listed by model and serial number in Attachment 2 (Table 2-1). Scan MDCs are also listed in Attachment 2 (Table 2-2) and are compared to the DCGL, the investigation level, and the DCGL_{EMC}. The scan MDC is less than the scan investigation level, thus providing high confidence (95% or higher) that an elevated area would be detected in the scanning process. Further, since the investigation level was always less than the design DCGL_{EMC}, no EMC sample size adjustment was necessary.

TABLE 1
SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	1,476 m ²	Class 1, < 2,000 m ²
Number of Direct Measurements Required	40	Based on an LBGR of 1.2 pCi/g, sigma ¹ of 1.33 pCi/g and a relative shift of 0.8. Type I = Type II = 0.05
Sample Area	37 m ²	1,476 m ² / 40 = 37 m ²
Sample Grid Spacing	6.1 m	(37) ^{1/2}
Scan Grid Area	ISOCS scan at 3 meters	See Section B
Area Factor	1.6	Class 1 Area, LTP Table 6-12
Scan Area	1,476 m ²	Class 1 Area – 100%
Scan Investigation Level	1.0 pCi/g Cs-137 0.36 pCi/g Co-60	ISOCS investigation levels with detector at 3-meter height (Reference 6)
DCGL	2.39 pCi/g Cs-137 0.86 pCi/g Co-60	References 4 and 7
Design DCGL _{EMC}	3.82 pCi/g Cs-137 1.38 pCi/g Co-60	DCGL x Area Factor for Class 1 survey unit, per LTP Section 5.6.3

C. SURVEY RESULTS

A total of 43 direct measurements were performed in Survey Unit 3. Twelve samples contained Cs-137 with levels of residual activity below the DCGL. No samples contained Co-60. All other measurements were below the MDA. The results are presented in Table 2. No investigations were necessary or performed as a result of the direct measurements.

ISOCS gamma scans were performed at 83 locations using an investigation level of 1.0 pCi/g Cs-137 and 0.36 pCi/g Co-60. The gamma scans were performed for a sufficient count time to achieve a Minimum Detectable Activity (MDA) of approximately 25% of the DCGL. All identified scan activity levels and MDAs were below the investigation levels. Co-60 was not detected above the MDA in any of the measurements. Therefore, no investigation surveys were performed as a result of the scan surveys.

¹ LTP Revision 3, Table 5-1C for RCA Yard West, R0100

**TABLE 2
DIRECT MEASUREMENTS**

Sample Number	Cs-137 (pCi/g)	Uncertainty (pCi/g)
FR01000301S001	< 5.26E-02	
FR01000301S002	< 5.39E-02	
FR01000301S003	< 5.98E-02	
FR01000301S004	9.36E-02	2.82E-02
FR01000301S005	6.50E-02	2.65E-02
FR01000301S006	1.12E-01	3.24E-02
FR01000301S007	2.18E-01	3.78E-02
FR01000301S008	1.09E-01	3.29E-02
FR01000301S009	1.27E-01	3.00E-02
FR01000301S010	< 6.38E-02	
FR01000301S011	7.61E-02	2.26E-02
FR01000301S012	< 6.14E-02	
FR01000301S013	< 6.18E-02	
FR01000301S014	< 5.04E-02	
FR01000301S015	< 5.29E-02	
FR01000301S016	< 5.22E-02	
FR01000301S017	< 5.78E-02	
FR01000301S018	1.17E+00	9.38E-02
FR01000301S019	< 6.58E-02	
FR01000301S020	< 4.94E-02	
FR01000301S021	1.22E-01	3.15E-02
FR01000301S022	< 5.79E-02	
FR01000301S023	< 5.12E-02	
FR01000301S024	7.75E-02	2.45E-02
FR01000301S025	< 4.53E-02	
FR01000301S026	< 5.22E-02	
FR01000301S027	< 5.57E-02	
FR01000301S028	< 5.15E-02	
FR01000301S029	< 4.98E-02	
FR01000301S030	< 5.92E-02	
FR01000301S031	< 5.92E-02	
FR01000301S032	< 6.03E-02	
FR01000301S033	< 5.20E-02	
FR01000301S034	< 5.53E-02	
FR01000301S035	< 4.94E-02	
FR01000301S036	< 5.17E-02	
FR01000301S037	< 5.90E-02	
FR01000301S038	< 5.95E-02	
FR01000301S039	1.63E-01	3.80E-02
FR01000301S040	< 5.42E-02	
FR01000301S041	< 5.53E-02	
FR01000301S042	< 5.46E-02	
FR01000301S043	1.25E-01	3.19E-02
Mean	9.70E-02	
Median	5.90E-02	
Standard Deviation	1.71E-01	
Range	4.53E-02 to 1.17E+00	

“<” indicates MDA value. Bold indicates positive detection value. No Co-60 detected above MDA.

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

Based on the scan 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 result range, is provided in Table 2. Positively detected values are bolded in the table. Of the 43 soil samples collected, 12 positively identified Cs-137 activity below the DCGL value of 2.39 pCi/g and no samples identified Co-60 activity. All other values were below the MDA. Identified sample activities or Minimum Detectable Activities for Cs-137 are listed in Table 2. The mean and median activities were less than the DCGL for Cs-137. The average of the Cs-137 measurements was approximately 0.10 pCi/g, indicating that the direct measurements averaged 4.1% of the DCGL limit.

Based on the Sign Test contained in Attachment 4, it is apparent that the general residual radioactivity within the survey unit is less than the DCGL and is in compliance with the release criteria. Because the S018 direct measurement is more than three standard deviations above the mean value for the survey unit direct measurements, it appears to be an outlier of small size.

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 mean fallout Cs-137 value (0.19 pCi/g)² for disturbed soil from the survey unit sample mean activity (0.10 pCi/g). This would equate to an annual dose rate of 0.0 mrem/year. Also, for purposes of demonstrating compliance with the radiological criteria for license termination and the enhanced State of Maine criteria, background activity was not subtracted from the 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. The direct measurements clearly pass the Sign Test. As discussed in Section E, the subject release criteria have been satisfied. In addition, the sample standard deviation is smaller than the design sigma; therefore no additional samples were required.

² See Attachment E to Maine Yankee Procedure PMP 6.7.8 (Reference 5).

2. The Quantile Plot was generated from the Cs-137 activity 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 below the DCGL of 2.39 pCi/g for Cs-137 for land inside the restricted area. The one outlier is due to the identification of Cs-137 at S018 at approximately 49% of the DCGL.
3. A Histogram Plot was also developed based on the Cs-137 activity data values. This plot shows a log-normal distribution with one outlier (S018).
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.

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

The survey was designed as a Class 1 land survey 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. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 3 was designed, performed, and evaluated in the December 2004 to February 2005 time frame. The design was performed to the criteria of the LTP Revision 3 (References 2 and 4). Maine Yankee LTP Change No. 05-001 (Reference 7) modified the Table 6-11 "Contaminated Material DCGL" to reflect an increased Deep Soil DCGL of 0.86 pCi/g for Co-60. This change had no impact on Survey Unit 3 since this survey only applied to surface soil and there were no Co-60 results above MDA. No subsequent LTP changes with potential impact to this survey unit need 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 2.39 pCi/g Cs-137. There were no investigations.

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 Revision 3 Addenda (References 2 and 4) with significant aspects of the design discussed in Section B and Table 1. ISOCS scans performed at a distance of 3 meters in a systematic grid pattern throughout the survey unit did not identify activity above the scan investigation levels of 1.0 pCi/g Cs-137 and 0.36 pCi/g Co-60. Therefore, no investigations were required as a result of the scan process.

It is concluded that FR 0100 Survey Unit 3 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

1. Maine Yankee License Termination Plan, Revision 3, October 15, 2002 and Addenda provided by 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 (LTP Supplement to LTP Revision 3)
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. Maine Yankee Calculation No. EC-003-04, Use of Canberra In Situ Object Counting System (ISOCS) for FSS Surveys
7. Maine Yankee LTP Change No. 05-001, Deep Soil Co-60 DCGL

Attachment 1
Survey Unit Maps

Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: RCA Yard West Soils



Note: Grid based on Maine State Coordinate System
(West Zone) NAD 1927

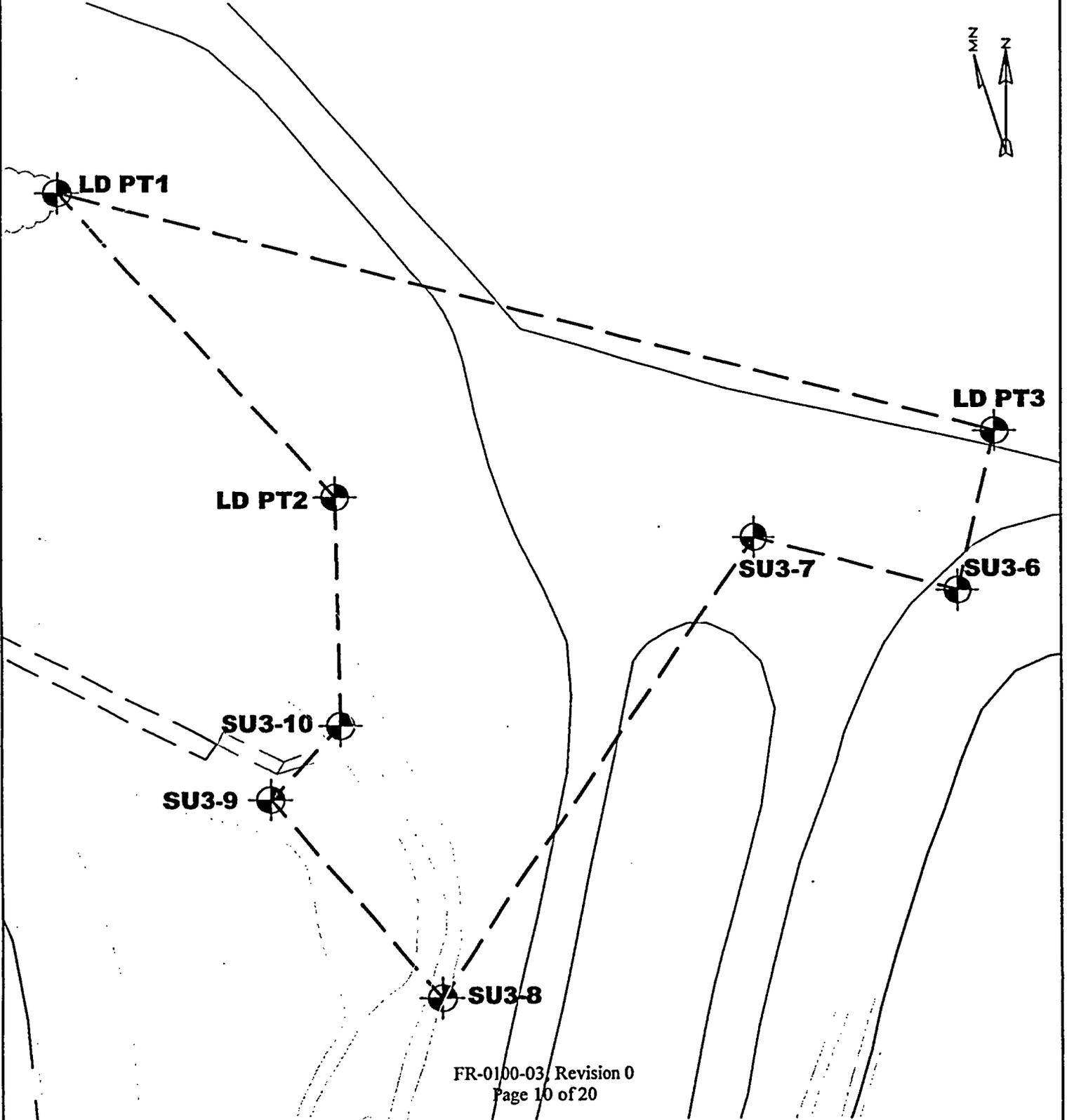
SURVEY AREA (PARTIAL), FR 0100

Revision 0

Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: RCA Yard West Soil

Final Status Survey FR0100 Survey Unit 3: RCA Yard West Soil Reference Map



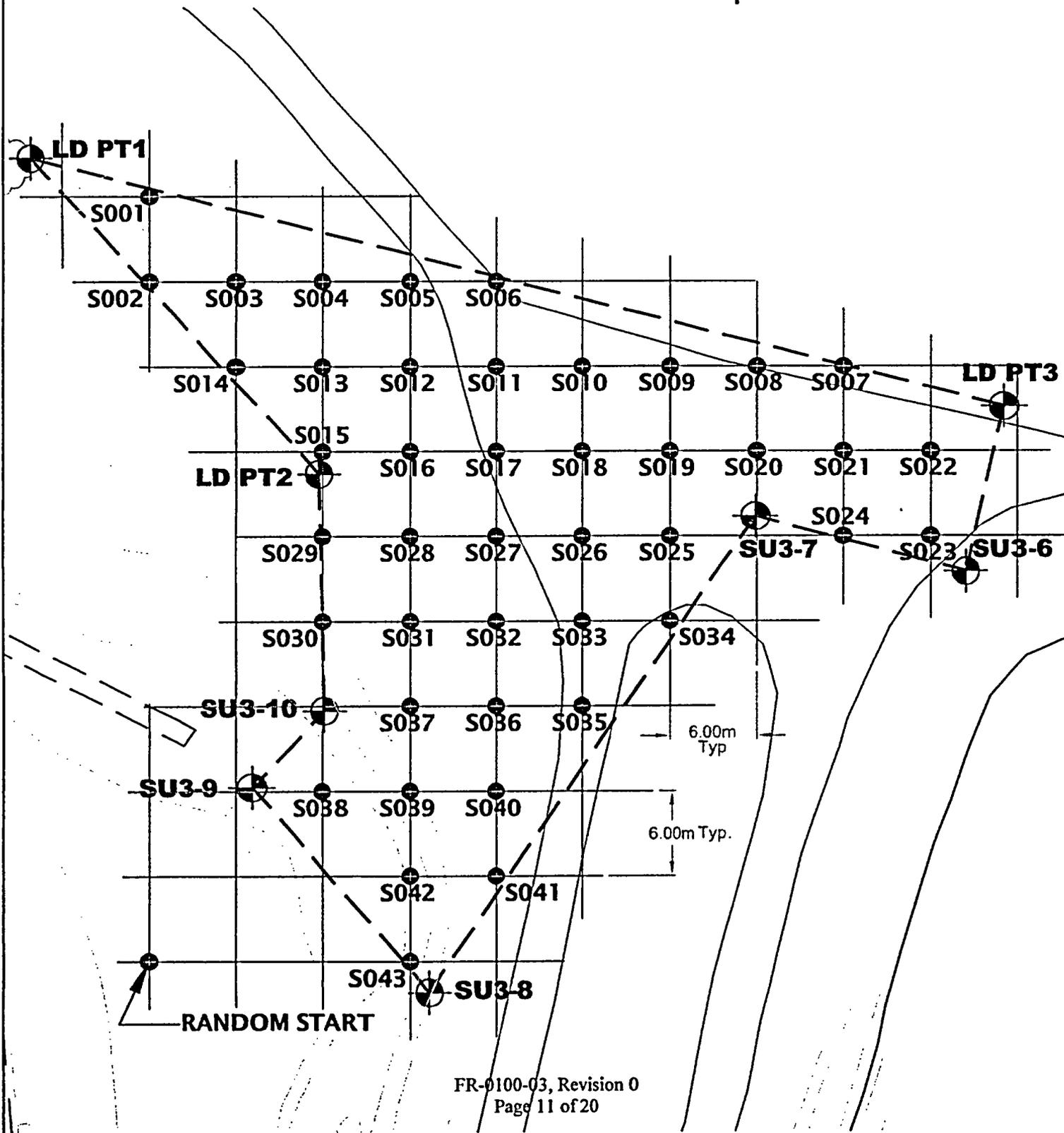
Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: RCA Yard West Soil

Final Status Survey

FR0100 Survey Unit 3: RCA Yard West Soil

Direct Points Reference Map



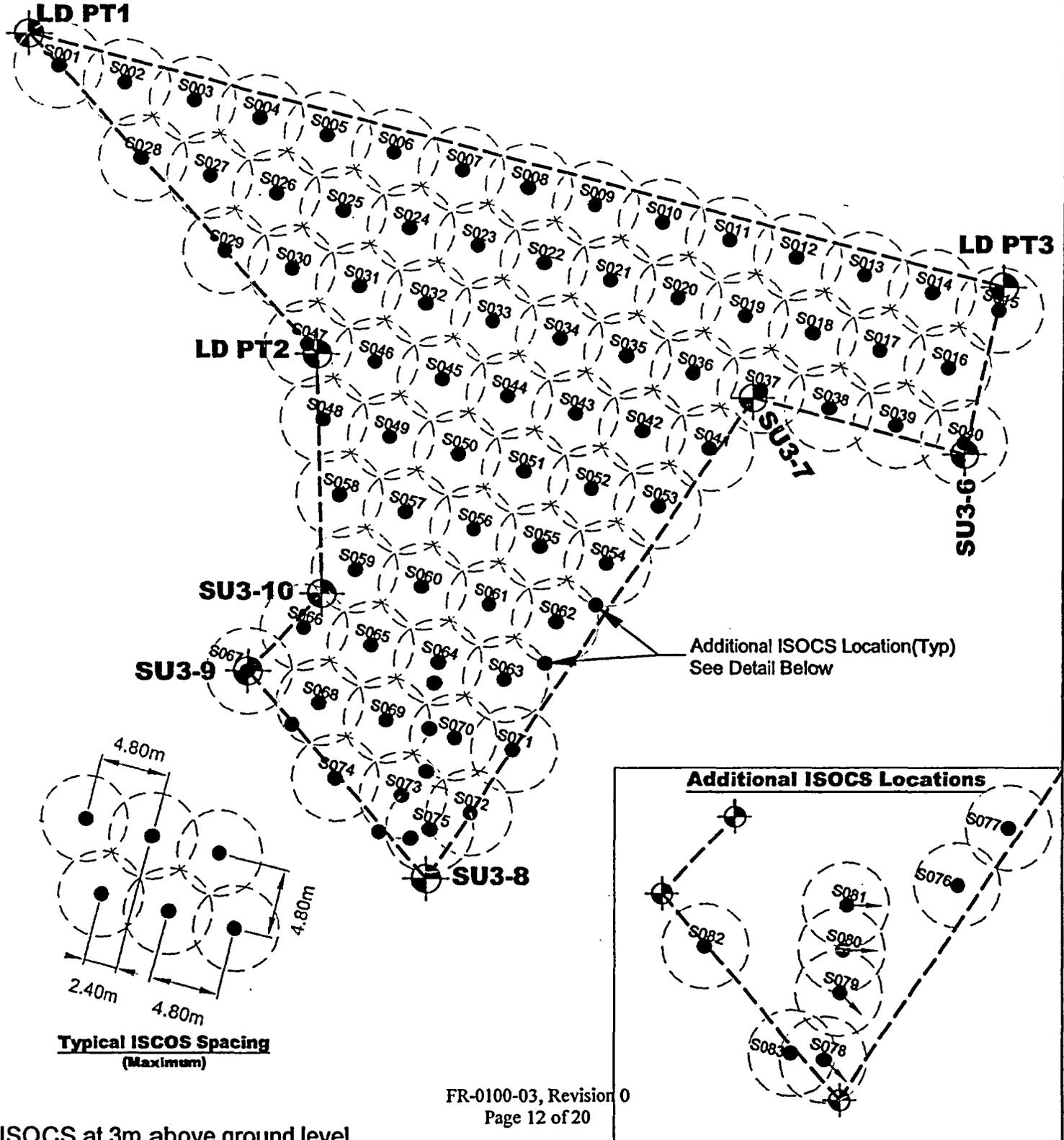
Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: RCA Yard West Soil

Final Status Survey

FR0100 Survey Unit 3: RCA Yard West Soil

ISOCS Scan Map S001 - S083



ISOCS at 3m above ground level.
Field of view is approximately $\varnothing 6.0\text{m}$.

Total Surface Area for SU3 is approx 1476 sq-m.

Attachment 2
Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

ISOCS Detectors (Field Measurements)

Detector No.	MDC (pCi/g)
7607	0.18 to 0.32
7722	0.15 to 0.33
7780	0.14 to 0.31

HPGe Detectors (Laboratory Analysis)

Detector No.	MDC (pCi/g)
FSS1	0.04 to 0.07
FSS2	0.03 to 0.06

TABLE 2-2

**INSTRUMENT SCAN MDC, DCGL,
INVESTIGATION LEVEL AND DCGL_{EMC}**

Detector	Instrument: ISOCS	Comments
Scan MDC	0.14 to 0.33 pCi/g	~ 25% DCGL
DCGL	2.39 pCi/g Cs-137 0.86 pCi/g Co-60	Approved DCGL for land areas inside the Restricted Area, (References 4 and 7)
Investigation Level (ISOCS @ 3 m)	1.0 pCi/g Cs-137 0.36 pCi/g Co-60	(Reference 6)
Design DCGL _{EMC}	3.82 pCi/g Cs-137 1.38 pCi/g Co-60	DCGL x Area Factor for Class 1 survey unit, per LTP Section 5.6.3

Attachment 3

Investigation Table

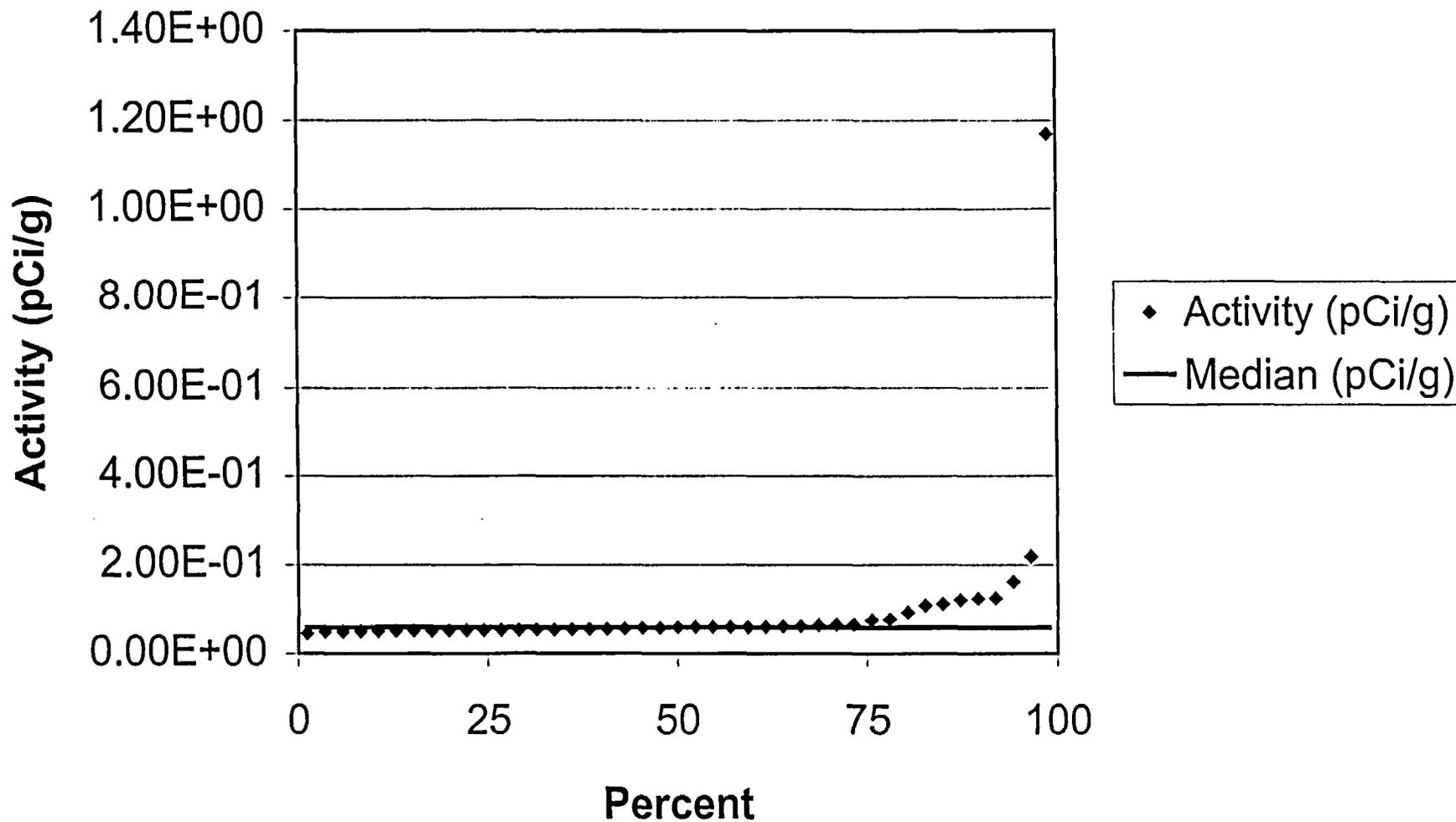
(No Investigations Required)

Attachment 4
Statistical Data

Survey Package FR0100 Unit 3 CS-137 Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FR0100	
Survey Unit:	03	
Evaluator:	Andy Olsen	
DCGL _w :	2.39E+00	Cs-137
DCGL _{emc} :	3.82E+00	AF = 1.6
LBGR:	1.20E+00	50% of DCGL
Sigma:	1.33E+00	LTP Rev 3, Table 5-1C
Type I error:	0.05	
Type II error:	0.05	
Nuclide:	CS-137	
Soil Type:	N/A	No material background is applied.
Calculated Values		Comments
Z _{1-α} :	1.645	
Z _{1-β} :	1.645	
Sign p:	0.788145	
Calculated Relative Shift:	0.8	
Relative Shift Used:	0.8	Uses 3.0 if Relative Shift is >3
N-Value:	33	
N-Value+20%:	40	
Sample Data Values		Comments
Number of Samples:	43	
Median:	5.90E-02	
Mean:	9.70E-02	
Net Sample Standard Deviation:	1.71E-01	
Total Standard Deviation:	1.71E-01	Sum of samples and reference
Maximum:	1.17E+00	
Sign Test Results		Comments
Adjusted N Value:	43	
S+ Value:	43	
Critical Value:	27	
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-0100 SU-3 Quantile Plot



One-Sample T-Test Report

Page/Date/Time 2 2/17/05 9:11:09 AM
Database C:\Program Files\NCSS97\FR0100SU-3.S0
Variable C2

Plots Section

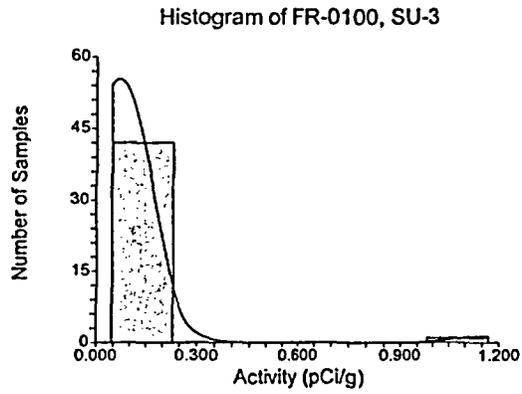


Chart Section

