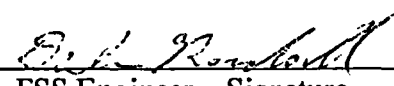
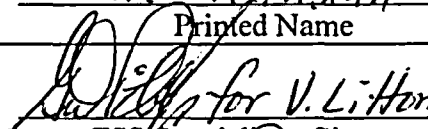
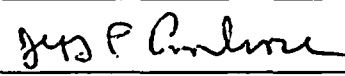
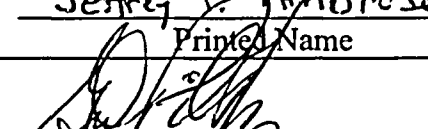



**MAINE YANKEE  
FINAL STATUS SURVEY RELEASE RECORD  
FR-0220 SPARE TRANSFORMER PAD FOOTPRINT  
SURVEY UNIT 1**

|              |   |                      |
|--------------|---|----------------------|
| Prepared By: | <div style="text-align: center;"><br/>FSS Engineer – Signature</div> <div style="text-align: center;"><u>Dale Randall</u><br/>Printed Name</div>               | Date: <u>3-22-05</u> |
| Reviewed By: | <div style="text-align: center;"><br/>FSS Specialist – Signature</div> <div style="text-align: center;"><u>George Pillsbury</u><br/>Printed Name</div>        | Date: <u>3/22/05</u> |
| Reviewed By: | <div style="text-align: center;"><br/>Independent Review – Signature</div> <div style="text-align: center;"><u>Jeffrey P. Ambrose</u><br/>Printed Name</div> | Date: <u>3-22-05</u> |
| Approved By: | <div style="text-align: center;"><br/>Superintendent, FSS – Signature</div> <div style="text-align: center;"><u>George Pillsbury</u><br/>Printed Name</div>  | Date: <u>3/28/05</u> |
| Approved By: | <div style="text-align: center;"><br/>FSS, MOP – Signature</div> <div style="text-align: center;"><u>JAMES R. FOWLER</u><br/>Printed Name</div>              | Date: <u>3/31/05</u> |

**MAINE YANKEE  
FINAL STATUS SURVEY RELEASE RECORD  
FR-0220 SPARE TRANSFORMER PAD FOOTPRINT  
SURVEY UNIT 1**

**A. SURVEY UNIT DESCRIPTION**

Survey area FR-0220 Survey Unit 1, Spare Transformer Pad Footprint, consists of the subsurface soils below the demolished spare transformer pad. The soil within this shallow excavation is a mix of native soils, gravel and ledge. The area is a near surface excavation with slight sloping that permitted accessibility. Survey Unit 1 is located around grid coordinates 407,450 N and 624,200 E using the Maine State Coordinate System (West Zone), NAD 1927.

The survey unit area is shown in relation to other major site structures in map FR0220-01. All maps referenced in this release record are provided in Attachment 1, unless otherwise noted. The survey unit total area is approximately 183 m<sup>2</sup>.

**B. SURVEY UNIT DESIGN INFORMATION**

The area was designated a Class 3 land survey unit per the LTP (Table 5-1C) for R0200 (Yard East). Since the survey unit was surrounded by FR-0200, the design sigma value for that area was applied. The survey unit design parameters are shown 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 randomly determined and are illustrated on map FR-0220-02. All direct measurements consisted of soil samples obtained at the required locations. The samples were analyzed with laboratory gamma spectroscopy.

Scan grids of 1 m by 1 m and 1m by 2m were established as indicated on survey map FR-0220-03. A 1% to 10% scan coverage of the area was required. The 16 scan grids provided a total scan area of approximately 18 m<sup>2</sup>, meeting the scan requirement. The survey instruments used, their MDCs, and alarm setpoints are provided in Attachment 2.

Background values were established for the scan measurements based on local scaler values in the survey unit. These background values were used to establish scan alarm setpoints. Due to variability in background between soil and ledge media within the survey unit, the grids were divided into two different background groups based on the predominant media at the scan grid location. Specific values are specified in Table 1.

**TABLE 1****SURVEY UNIT DESIGN PARAMETERS**

| Survey Unit                            | Design Criteria                 | Basis  |
|--|---------------------------------|--|
| Area                                   | 183 m <sup>2</sup>              | No limit for Class 3 Area  |
| Number of Direct Measurements Required | 14                              | Based on an adjusted LBGR of 3.69 pCi/g, sigma <sup>1</sup> of 0.17 pCi/g, and a 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                         | 1m x 1m and 1m x2m              | Class 3 Area   |
| Area Factor                            | N/A                             | Class 3 Area   |
| Scan Survey Area                       | 18 m <sup>2</sup>               | Class 3 Area 1% - 10%  |
| Background                             |                                 |  |
| SPA-3 (scan)                           | 13,056 cpm                      | Soil   |
|  | 13,744 cpm                      | Ledge / Rock   |
| Scan Investigation Level               | 3 Sigma of Background plus DCGL | Directed by then current Rev of Procedure PMP 6.7.8 Rev (G) <sup>2</sup>   |
| DCGL                                   | 4.2 pCi/g                       | LTP Revision 3 (Reference 4)   |
| Design DCGL <sub>EMC</sub>             | N/A                             | Class 3 Area   |

**C. SURVEY RESULTS**

As required, 14 direct soil measurements were made and the results are presented in Table 2. All direct measurements were below the DCGL. One verified alarm was received during the scans. The investigation of the verified alarm is discussed below.

<sup>1</sup> Design sigma based on LTP Revision 2, Table 5-1C, East Yard, FR-0200.

<sup>2</sup> All changes with potential influence to the FSS results are evaluated in Section H.

**TABLE 2**  
**DIRECT MEASUREMENTS**

| Sample Number             | Cs-137 (pCi/g) <sup>3</sup> | Uncertainty |
|---------------------------|-----------------------------|-------------|
| FR-0220-1-3-S001          | < 5.43E-02                  | N/A         |
| FR-0220-1-3-S002          | < 5.87E-02                  | N/A         |
| FR-0220-1-3-S003          | < 5.62E-02                  | N/A         |
| FR-0220-1-3-S004          | < 5.70E-02                  | N/A         |
| FR-0220-1-3-S005          | < 5.40E-02                  | N/A         |
| FR-0220-1-3-S006          | < 6.12E-02                  | N/A         |
| FR-0220-1-3-S007          | < 5.06E-02                  | N/A         |
| FR-0220-1-3-S008          | < 6.14E-02                  | N/A         |
| FR-0220-1-3-S009          | < 5.28E-02                  | N/A         |
| FR-0220-1-3-S010          | < 5.50E-02                  | N/A         |
| FR-0220-1-3-S011          | < 5.33E-02                  | N/A         |
| FR-0220-1-3-S012          | < 5.76E-02                  | N/A         |
| FR-0220-1-3-S013          | < 5.80E-02                  | N/A         |
| FR-0220-1-3-S014          | < 4.27E-02                  | N/A         |
| <b>Mean</b>               | <b>5.52E-02</b>             |             |
| <b>Median</b>             | <b>5.56E-02</b>             |             |
| <b>Standard Deviation</b> | <b>4.75E-03</b>             |             |
| <b>Range</b>              | <b>4.27E-02 to 6.14E-02</b> |             |

“<” indicates values less than the MDA, MDA value is reported.

#### **D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS**

The scans identified one verified alarm location (scan grid 31) upon ledge. An investigation was conducted via survey investigation package XR0220-01. The investigation involved dividing the 1-m<sup>2</sup> grid into nine equal area sub grids as shown on map XR0220-02. A scan was performed on each of the sub-grids. This process yielded five verified alarms. Each of these localized areas was then counted using the Exploranium™ GR-130 to check the ledge for the presence of plant-derived nuclides.

All investigation results were less than MDA for Cs-137 and Co-60. The Exploranium™ GR-130 MDAs were 0.423, and 1.16 pCi/g respectively (Reference 6). Investigation results are summarized in Attachment 3 (Table 3-1).

<sup>3</sup> The samples were also analyzed for Co-60; all were less than an MDA of 0.1 pCi/g.

## **E. SURVEY UNIT DATA ASSESSMENT**

An analysis of the direct sample measurement results, including the mean, median, standard deviation, and sample result range are provided in Table 2. Both the mean and median activities were less than the DCGL for Cs-137. The maximum direct measurement result was less than 1.5% of the Cs-137 DCGL. Further, since the activity is less than the action levels in LTP Table 5-7, no additional investigations or any reclassification is required.

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 per Reference 5) for disturbed soil from the survey unit sample mean activity (0.055 pCi/g). The result is a negative net activity value. This would equate to an annual dose rate of 0 mrem/y. 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 3 survey unit. All of the measurements are well below the DCGL of 4.2 pCi/g.
3. A Histogram Plot was also developed based on the direct measurement values. This plot shows that the direct data were essentially a normal distribution.
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 THE 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 total standard deviation was less than the design sigma, indicating that a sufficient number of sample measurements were taken.

## **H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS**

The FSS of Survey Unit 1 was designed and performed in the summer of 2002. The design was performed to the criteria of the LTP, Revision 2 (Reference 4). The following LTP changes and procedural changes with potential impact to this survey unit were evaluated and determined not to have an impact on the FSS results for this survey unit.

1. Requirement to check background  $\pm 1,000$  cpm prior to scanning each grid (LTP Rev. 3 Addenda, 11-26-02).
2. Increased scan MDC to 5.9 pCi/g (LTP Rev. 3 Addenda, 11-26-02).
3. Change in alarm setpoint methodology during the evolution of the use of E600 (use of scaler vs. peak values to establish the investigation level and deletion of the DCGL term).
4. LTP changes in the activated concrete license amendment (proposed in MY letter to the NRC, MN-03-049, 09/11/03).
5. The procedural commitment to the state of Maine of limiting grid size to 10 m<sup>2</sup> (documented in MY letter to the NRC, MN-03-009, 2/26/03).

## **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 50% of 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 less than that used for design so no additional samples were required.

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 normal distribution, with variance consistent with expectations for a Class 3 survey unit.

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 one verified alarm for evaluation. Attachment 3 shows the areas identified by verified alarms and provides the results, all of which were less than DCGL.

It is concluded that FR-0220 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 issued October 15, 2002
3. Maine Yankee letter to the NRC, MN-02-061, dated November 26, 2002
4. Maine Yankee License Termination Plan, Revision 2, issued August 13, 2002
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
6. Maine Yankee Engineering Calculation, EC-004-04, submitted to the NRC under letter MN 05-002 in January 2005

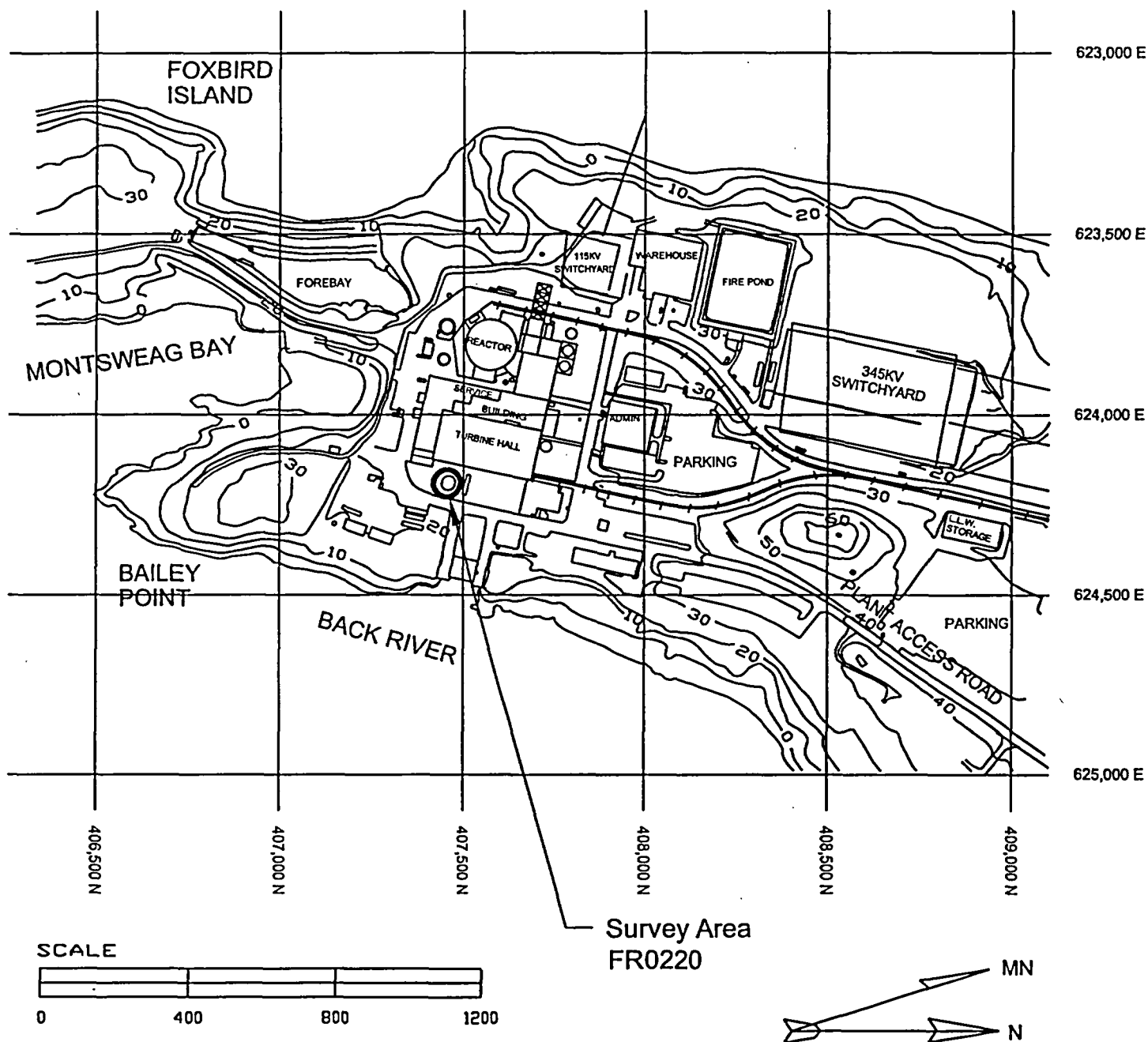
# **Attachment 1**

## **Survey Unit Maps**



Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

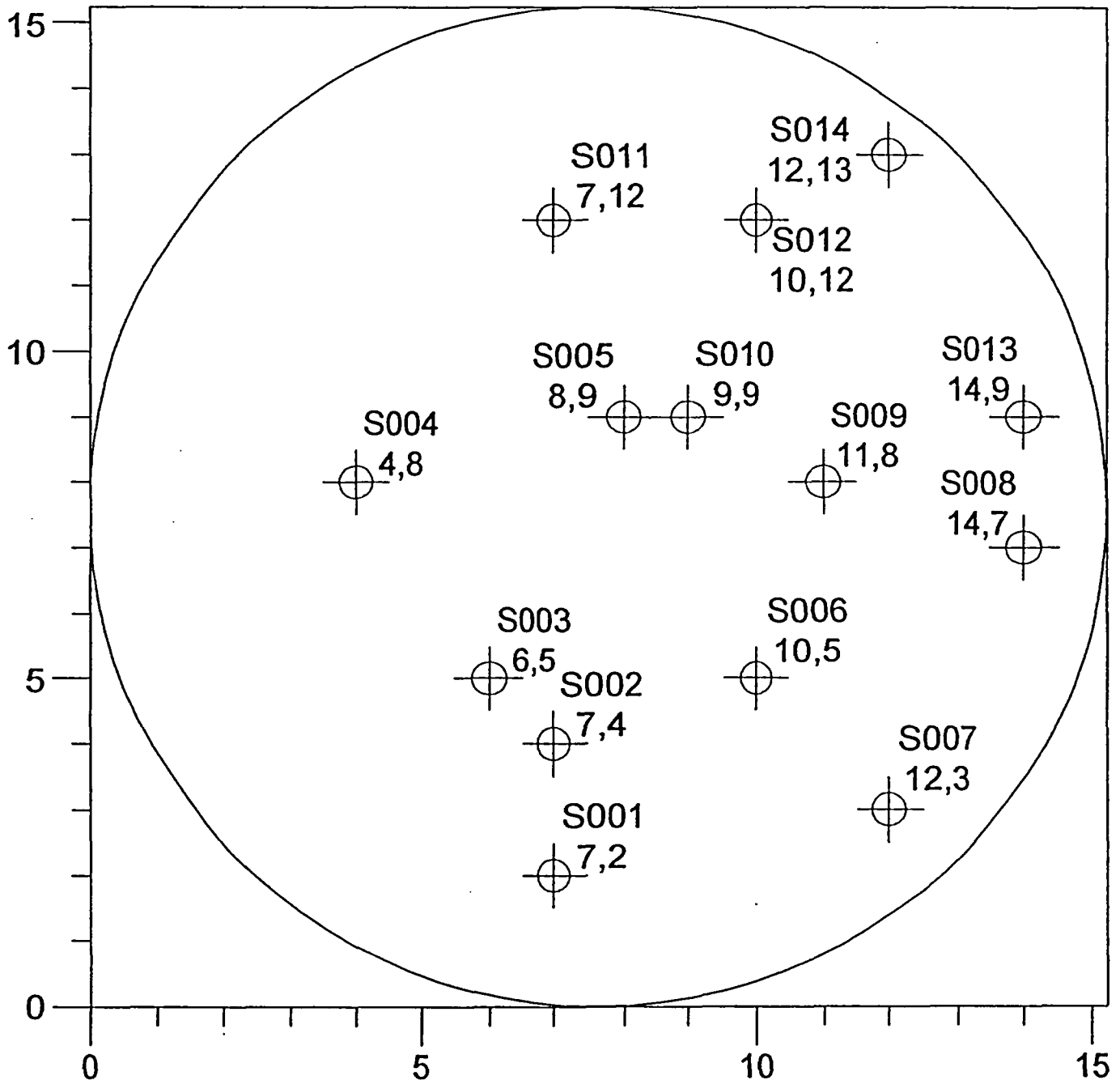
Survey Area Name: Spare Transformer Excavation Pit



Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

Survey Area Name: Spare Transformer Excavation Pit

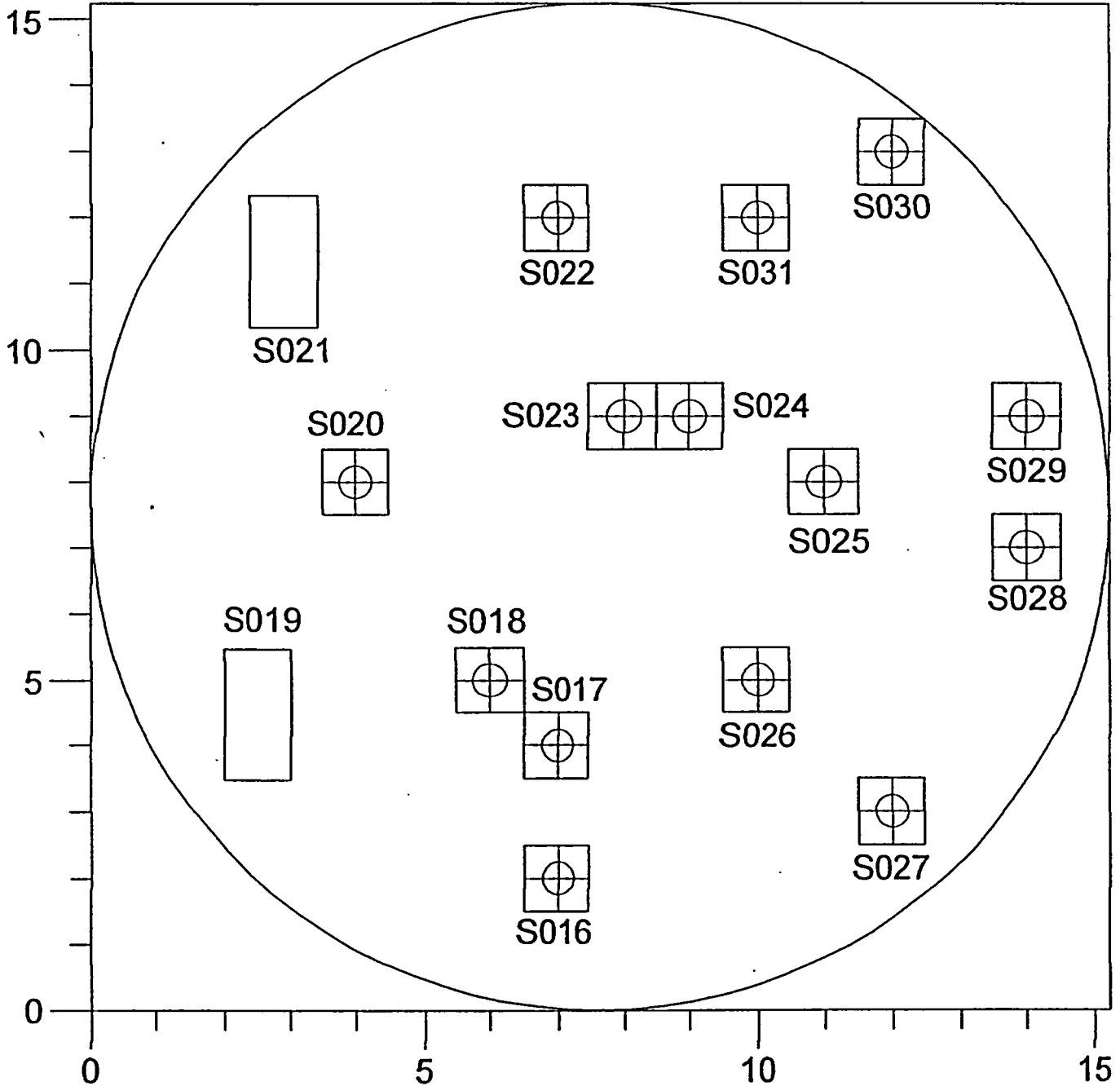
Spare Transformer  
Excavation Pit  
Soil Sample Locations



Survey Type: ☐ Characterization ☐ Turnover ☐ Final Status Survey

Survey Area Name: Spare Transformer Excavation Pit

# Spare Transformer Excavation Pit Scan Locations



Denotes Soil Sample Locations



Denotes 1 Meter Square Scan Areas  
Except S019 and S021 Which Are 2 Meter Square Scan Areas

Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

Survey Area Name: Spare Transformer Pit

Spare Transformer Pit  
Unit 1 Soil Scan  
Grid 31



|   |   |   |
|---|---|---|
| 9 | 8 | 7 |
| 4 | 5 | 6 |
| 3 | 2 | 1 |

## **Attachment 2**

### **Survey Unit Instrumentation**

**TABLE 2-1****FIELD INSTRUMENT INFORMATION**

| <b>E-600 S/N</b> | <b>Probe S/N (type)</b> |
|------------------|-------------------------|
| 1927             | 726560 (SPA-3)          |
| 1625             | 725328 (SPA-3)          |
| 1641             | 726560 (SPA-3)          |
| 1648             | 726554 (SPA-3)          |

| <b>GR-130 S/N</b> | <b>MDC (pCi/g)</b>         |
|-------------------|----------------------------|
| 1177              | Cs-137 0.423<br>Co-60 1.16 |

**HPGe Detectors for Lab Analysis of Volumetric Samples**

| <b>Detector Number</b> | <b>MDC (pCi/g)</b> |
|------------------------|--------------------|
| FSS-1                  | 0.04 – 0.10        |
| FSS-2                  | 0.04 – 0.10        |

**TABLE 2-2****INSTRUMENT SCAN MDC, DCGL,  
AND INVESTIGATION LEVEL**

| <b>Detector</b>   | <b>SPA-3</b> | <b>Comments</b>   |
|---|--------------|---|
| <b>Scan MDC</b><br>(pCi/g)                              | 5.9          | Design Scan MDC,<br>LTP Table 5-6 (Reference 3)   |
| <b>DCGL</b><br>(pCi/g)                                  | 4.2          | Approved DCGL for land areas<br>outside the Restricted Area,<br>LTP Section 6.7 (Reference 2) |
| <b>Investigation Level</b><br>(Alarm Setpoint)<br>(cpm) | 15,800       | Soil  |
|   | 16,600       | Ledge / Rock  |

**Attachment 3**

**Investigation Table**

**TABLE 3-1****INVESTIGATION TABLE**

| <b>FSS SURVEY RESULTS</b> |               |                             |                               | <b>INVESTIGATION RESULTS</b>           |                           |                       |                        |
|---------------------------|---------------|-----------------------------|-------------------------------|--|---------------------------|-----------------------|------------------------|
| <b>Grid</b>               | <b>Reason</b> | <b>Alarm Setpoint (cpm)</b> | <b>Scan Measurement (cpm)</b> | <b>Sub-Grid Scan Measurement (cpm)</b> | <b>Sample ID (GR-130)</b> | <b>CS-137 (pCi/g)</b> | <b>DCGL Comparison</b> |
| S031                      | ALARM         | 16,600                      | 17,050                        | 17,060                                 | S031/2                    | <0.423                | <DCGL                  |
|                           |               |                             |                               | 16,850                                 | S031/3                    | <0.423                | <DCGL                  |
|                           |               |                             |                               | 17,340                                 | S031/5                    | <0.423                | <DCGL                  |
|                           |               |                             |                               | 16,830                                 | S031/7                    | <0.423                | <DCGL                  |
|                           |               |                             |                               | 17,370                                 | S031/9                    | <0.423                | <DCGL                  |
|                           |               |                             |                               |  | <b>SU Mean / DCGL</b>     |                       | <b>0.013</b>           |
|                           |               |                             |                               |  | <b>Total</b>              |                       | <b>0.013</b>           |

- NOTES:**
1. "<" indicates value less than MDA. MDA value is shown.
  2. The samples were also analyzed for Co-60; all were less than an MDA of 1.16 pCi/g.

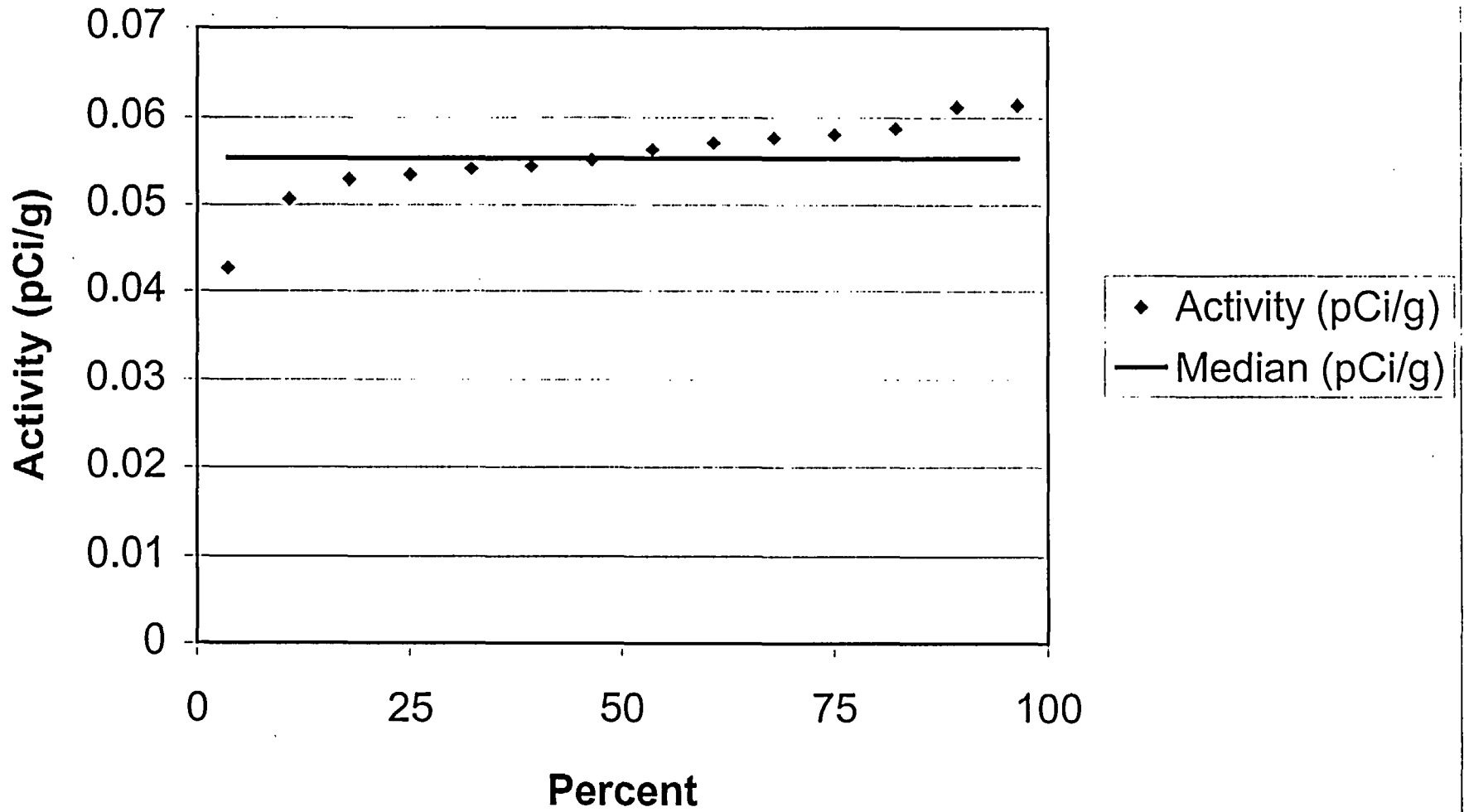


**Attachment 4**  
**Statistical Data**

## Survey Package FR0220 Unit 1 Soil Sign Test Summary

| Evaluation Input Values                |          | Comments                         |
|--|----------|----------------------------------|
| Survey Package:                        | FR0220   |                                  |
| Survey Unit:                           | 01       |                                  |
| Evaluator:                             | DR       |                                  |
| DCGL <sub>w</sub> :                    | 4.20E+00 |                                  |
| DCGL <sub>emc</sub> :                  | N/A      |                                  |
| LBGR:                                  | 3.69E+00 |                                  |
| Sigma:                                 | 1.70E-01 |                                  |
| Type I error:                          | 0.05     |                                  |
| Type II error:                         | 0.05     |                                  |
| Nuclide:                               | CS-137   |                                  |
| Soil Type:                             | N/A      |                                  |
| Calculated Values                      |          | Comments                         |
| Z <sub>1-<math>\alpha</math></sub> :   | 1.645    |                                  |
| Z <sub>1-<math>\beta</math></sub> :    | 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:                                | 5.56E-02 |                                  |
| Mean:                                  | 5.52E-02 |                                  |
| Net Sample Standard Deviation:         | 4.75E-03 |                                  |
| Total Standard Deviation:              | 4.75E-03 | Sum of samples and reference     |
| Maximum:                               | 6.14E-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 <sub>w</sub> :     | Pass     |                                  |
| Median value <DCGL <sub>w</sub> :      | Pass     |                                  |
| Mean value <DCGL <sub>w</sub> :        | Pass     |                                  |
| Maximum value <DCGL <sub>emc</sub> :   | Pass     |                                  |
| Total Standard Deviation <=Sigma:      | Pass     |                                  |
| Criteria comparison results:           | Pass     |                                  |
| Final Status                           |          | Comments                         |
| The survey unit passes all conditions: | Pass     |                                  |

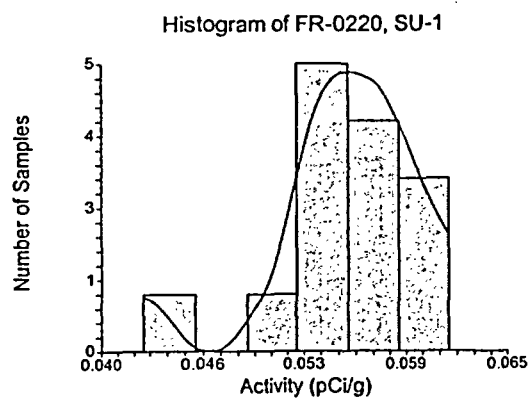
## FR-0220 SU-1 Quantile Plot



## One-Sample T-Test Report

Page/Date/Time 2 3/2/05 11:52:54 AM  
Database C:\Program Files\NCSS97\FR0220SU1.S0  
Variable C2

### Plots Section



# One-Sample T-Test Power Analysis

Page/Date/Time 2 3/2/05 11:55:24 AM

## Chart Section

