

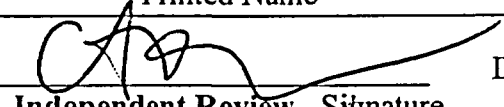
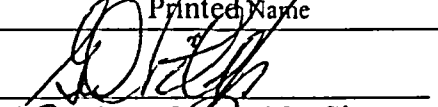



**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0800 ADMIN & PARKING AREA
SURVEY UNIT 1**

Prepared By:	<u></u> FSS Engineer - Signature <u>Jeffrey P. Ambrose</u> Printed Name	Date: <u>3-31-05</u>
Reviewed By:	<u></u> FSS Specialist - Signature <u>ROBERT TOZZIE</u> Printed Name	Date: <u>4/4/05</u>
Reviewed By:	<u></u> Independent Review - Signature <u>C.A. Olsen</u> Printed Name	Date: <u>5. apr. 05</u>
Approved By:	<u></u> Superintendent, FSS - Signature <u>George Pillsbury</u> Printed Name	Date: <u>4/7/05</u>
Approved By:	<u></u> FSS, MOP - Signature <u>JAMES R. PACKER</u> Printed Name	Date: <u>4/7/05</u>

**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0800 ADMIN & PARKING AREA
SURVEY UNIT 1**

A. SURVEY UNIT DESCRIPTION

The survey unit is equal to the survey area and is located outside and north of the site Industrial Area. The survey unit consists of the parking area and land surrounding the former Staff Building. The survey unit consists of open, graded land. Asphalt-covered parking areas and roadways formerly covered the major portion of the survey unit. A small building of metal construction on a concrete slab, called the "Annex" (Warehouse 4), formerly sat on the SW corner of the survey unit. This building was used for many purposes over the years including warehousing, office space, and training facilities. Most recently it was used as office space, craft break room, and stored the body counting facility. Other than sealed sources used for operation of the body counter, there is no history of the use or storage of radioactive materials in this building. Several office trailers and storage trailers currently occupy the North end of the survey unit. Several of the storage trailers contain FSS samples that contain, or potentially contain, radioactive materials in sealed containers. FSS also processes soil samples in the FSS Sample Prep Trailer that is currently located at the northern end of the survey unit. Open samples are routinely handled in the Sample Prep Trailer. Frequent radiological surveys of these trailers have never shown indication of loose contamination. The storage trailers and Sample Prep Trailer formerly were staged along the West side the Annex.

The entire survey unit of 9,080 m² is contained within coordinates 623825E & 624250E and 407850N & 408325N using the Maine State Coordinate System (West Zone) NAD 1927. The location of Survey Unit 1 as referenced to other site landmarks is shown on map FR 0800-1 SITE. The boundary of Survey Unit 1 is shown on map FR0800-1 REF. FR-0800 lies within the area covered by survey unit FR-0900 Survey Unit 1.

B. SURVEY UNIT DESIGN INFORMATION

The survey unit was designated a Class 3 land survey per the LTP (Table 5-1C). 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 FR0800-1a (Attachment 1). Direct measurements (soil samples) were collected from the required locations and analyzed with laboratory gamma spectroscopy instrumentation.

In accordance with the LTP Table 5-3, gamma scans were required for 1 to 10% of the survey design area. Scan grids typically measuring 2 m by 5 m (10 m²) were established in the following areas:

- Along the perimeter of the former Annex (i.e., east, north, and west)
- Along the perimeter of the former Staff Building (i.e., east, north, and west)
- Along the doors of the storage trailers (i.e., north side)
- In front of the FSS Sample Preparation Trailer doors (i.e., south side)
- Centrally located in the parking area.
- Along the west parking area access road boundaries (i.e., east and west)
- Along the east parking area access road boundaries

The specific scan grids are also depicted on map FR0800-1b.

E-600/SPA-3 instrumentation was used to perform the scan surveys. The survey instruments used are listed by model and serial number in Attachment 2 (Table 2-1). The original 91 scan grids provided a scan area of approximately 910 m², exceeding 10% of the total survey area. Configuration of the original scan grids is illustrated on FR0800-1b (Attachment 1). Background values were established based on local scaler values in the survey unit. These background values were used to determine scan alarm set points and to divide the scan grids into three different background groups. The background values were also used to confirm the scan MDCs where used were appropriate. Scan MDCs are listed in Attachment 2 (Table 2-2) and are compared to the DCGL and the investigation level.

TABLE 1
SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	9,080 m ²	No limit for Class 3, based on LTP Table 5-2
Number of Direct Measurements Required	14	Based on adjusted LBGR of 3.81 pCi/g, sigma ¹ of 0.13 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	2 m x 5 m (10 m ²)	Class 3 Area; $\leq 10 \text{ m}^2$
Area Factor	N/A	Class 3 Area
Scan Area	910 m ² , > 10%	Class 3 Area – 1% to 10% (LTP Table 5-3)
Background		
SPA-3 (Scan)	12,200 cpm	Group 1
	10,100 cpm	Group 2
	9,220 cpm	Group 3
Scan Investigation Level (E-600/SPA-3)	3 Sigma of Background plus Background	See Table 2-2, Attachment 2 (Reference 3)
DCGL	4.2 pCi/g Cs-137	LTP, Rev. 4, Section 6.7
Design DCGL _{EMC}	N/A	Class 3 Area

C. SURVEY RESULTS

As required, 14 direct soil measurements were performed in Survey Unit 1 and the results are presented in Table 2. All direct measurements were below 50% of the unitized DCGL. The HPGe sample analyses identified one sample with residual Co-60 and two samples with residual Cs-137 above the respective MDAs. Although all results were below the investigation levels specified in LTP Table 5-7, one direct measurement location was investigated as discussed in Section D.

A total of 91 grids were initially scanned using E-600/SPA-3 instrumentation. Twenty-four verified scan alarms were received. The investigation results are discussed in Section D.

¹ LTP Revision 4, Table 5-1C for Admin & Parking Area, R0800

TABLE 2
DIRECT MEASUREMENTS

Sample Number	Cs-137 (pCi/g)	Uncertainty	Co-60 (pCi/g)	Uncertainty	Unitized Value of Unity Rule
FR0800-01-3S001SS	< 4.72E-02		< 4.75E-02		4.29E-02
FR0800-01-3S002SS	< 4.94E-02		< 4.82E-02		4.39E-02
FR0800-01-3S003SS	< 6.44E-02		< 6.07E-02		5.58E-02
FR0800-01-3S004SS	1.92E-01	4.97E-02	3.77E-01	4.46E-02	2.97E-01
FR0800-01-3S005SS	< 5.57E-02		< 5.55E-02		5.03E-02
FR0800-01-3S006SS	< 6.67E-02		< 7.08E-02		6.31E-02
FR0800-01-3S007SS	< 5.98E-02		< 6.14E-02		5.52E-02
FR0800-01-3S008SS	6.14E-02	3.02E-02	< 5.66E-02		5.23E-02
FR0800-01-3S009SS	< 4.84E-02		< 4.76E-02		4.33E-02
FR0800-01-3S010SS	< 5.17E-02		< 5.44E-02		4.86E-02
FR0800-01-3S011SS	< 4.50E-02		< 4.66E-02		4.18E-02
FR0800-01-3S012SS	< 4.81E-02		< 5.57E-02		4.86E-02
FR0800-01-3S013SS	< 4.61E-02		< 4.89E-02		4.36E-02
FR0800-01-3S014SS	< 5.57E-02		< 5.96E-02		5.30E-02
Mean	6.37E-02		7.79E-02		6.71E-02
Median	5.37E-02		5.56E-02		4.95E-02
Standard Deviation	3.76E-02		8.64E-02		6.65E-02
Range	4.50E-02 to 1.92E-01		4.66E-02 to 3.77E-01		4.18E-02 to 2.97E-01

“<” indicates MDA value. Bold indicates positive detection value.

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

Soil scans performed with the E-600/SPA-3 during initial surveys identified twenty-four scanned grids with verified alarms. One of the twenty-four scan grids with verified alarms was located on the east parking area access road (S004). Three of the twenty-four investigated scan grids were located around the perimeter of the former Warehouse 4 (S048-50). Five of the twenty-four investigated grids were located within the parking area (S059-60, S065-66, and S073). Seven of the twenty-four investigated grids (S078, S081-82, and S085-88) were located along the west parking area access road. The other eight remaining investigated grids (S014, S015, S020, S028-31, S034) were located along the perimeter of the former Staff Building. As a result, investigation package XR0800-01 was written to perform additional scans within the twenty-four identified grids and to collect soil samples at the highest scan location within each grid. The grids requiring investigation are illustrated on XR0800-01a (Attachment 1). As a result of the investigations, a total of twenty-four soil samples were collected. The soil samples taken within each of the twenty-four grids did not identify Cs-137 or Co-60 concentrations above the MDA. The investigation results are shown in Table 3-1 (Attachment 3).

A second investigation of FR-0800-01 was performed to evaluate direct measurement (soil sample) FR0800-01-3S004SS. This direct point was located on the west side of Warehouse 4. Both Cs-137 and Co-60 activity, greater than the MDA, was identified at 0.192 and 0.377 pCi/g respectively. While neither value exceeded 50% of the DCGL, an investigation consisting of a SPA-3 gamma scan and four more soil samples was performed. Each soil sample was obtained at the corner of a 1 m by 1 m grid centered around S004. No Co-60 was identified above the MDA. Two of the four samples contained Cs-137 above the MDA, up to 0.19 pCi/g, a small fraction of the DCGL of 4.2 pCi/g. The investigation results are shown in Table 3-2 (Attachment 3).

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. Of the 14 soil samples collected, two samples identified Cs-137 activity greater than the MDA, with the highest reported value (sample S004) being less than 5% of the DCGL. In addition, this sample was the only one with Co-60 activity identified greater than the MDA, with a value of 0.38 pCi/g, which is approximately 25% of the DCGL (1.5 pCi/g Co-60). All Cs-137 and Co-60 mean and median activities were less than 50% of the DCGL.

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 (0.064 pCi/g). The net result is negative and would equate to an annual dose rate of 0.0 mrem/year. Taking into account the average residual contamination level for Co-60, the annual dose rate would equate to 0.52 mrem/y.³ 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.

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

³ This annual dose equivalent is based on an allowable soil dose of 10 mrem/y for areas outside the Restricted Area. Therefore, the annual dose rate would equate to

$$\text{Annual Dose Rate} = 10 \times \left(\frac{0.078}{1.5} \right) = 0.52 \text{ mrem / y}$$

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, key release criteria were satisfied, with one exception. An “investigate” flag was produced because the direct measurement sigma exceeded the unitized design sigma, however, sufficient power is evident, since the survey unit easily passed the Sign Test.

2. The Quantile Plot was generated from the 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 50% of the unitized DCGL for land outside the restricted area.
3. A Histogram Plot was also developed based on the direct measurement data values. This plot shows a 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 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 3 land survey area. The FSS results (all direct measurements, scan results, and investigation results) were consistent with the Class 3 land survey classification. The direct measurement sample standard deviation was greater than the design sigma. However, a sufficient number of sample measurements were taken to pass the Sign Test. Therefore, 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 the March 2005 to April 2005 time frame. The design was performed to the criteria of the LTP Revision 4 (Reference 1).

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 of the direct measurements were less than 50% of the DCGLs of 4.2 pCi/g Cs-137 and 1.5 pCi/g Co-60. One direct measurement was deemed an outlier and was investigated. The investigation results were found acceptable for a Class 3 survey unit.

A Sign Test Summary analysis demonstrated that the Sign Test criteria were satisfied. The direct measurement sigma was determined to be greater than that used for design, but a sufficient number of samples were taken to produce adequate power.

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 one outlier.

The scan survey design for this survey unit was developed in accordance with the LTP Revision 4 (Reference 1) with significant aspects of the design discussed in Section B and Table 1. Scans performed with E-600/SPA-3 instrumentation resulted in a total of twenty-four verified alarms. An investigation was conducted via package XR-0800-01. Twenty-four verified alarms were investigated for this survey package. As a result of the investigations, a total of twenty-four additional direct measurements were obtained. All twenty-four direct measurements were MDA values and were less than 50% of the DCGL of 4.2 pCi/g Cs-137. In addition, no Co-60 was detected during XR-0800-01.

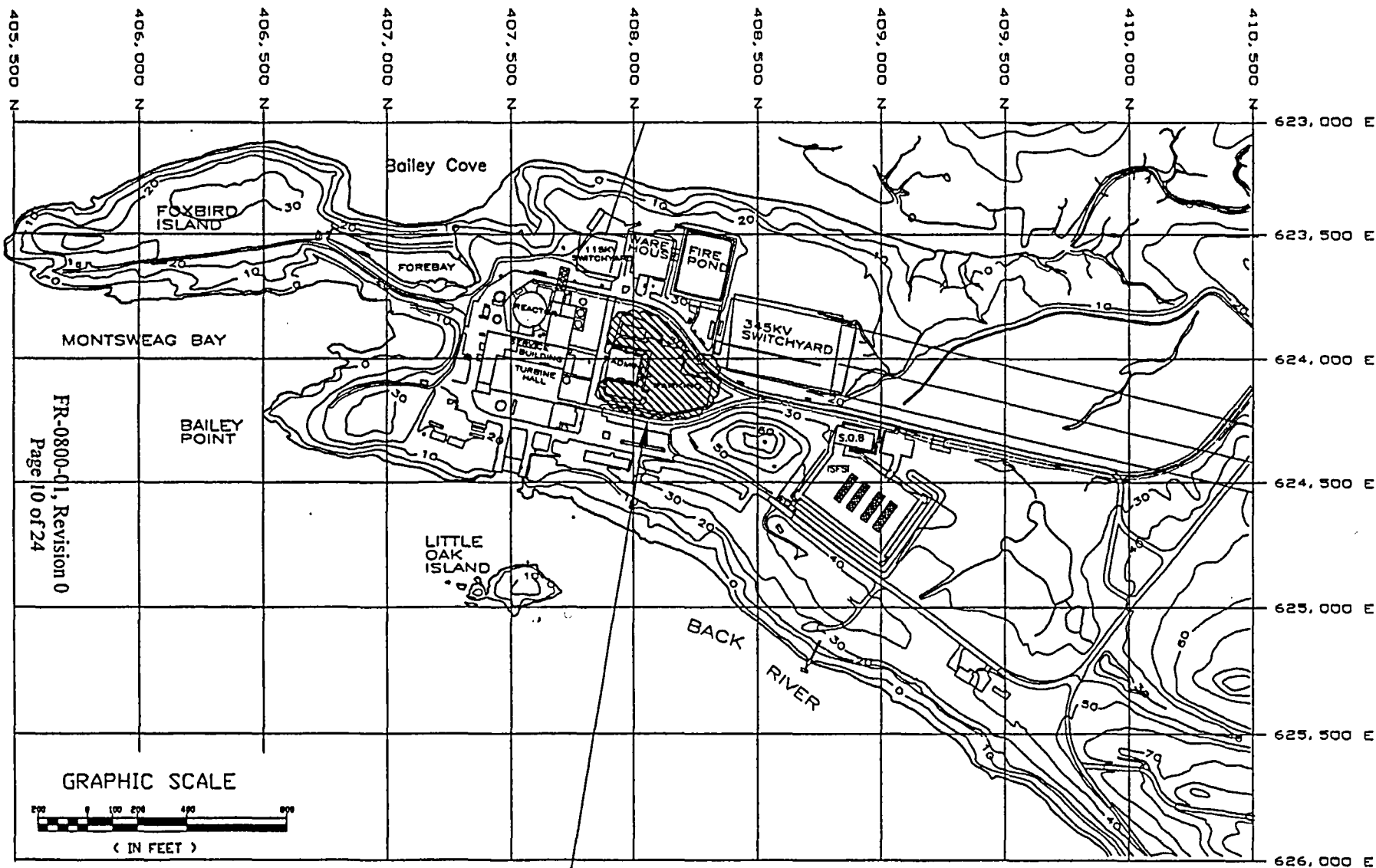
It is concluded that FR-0800 Survey Unit 1 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

1. Maine Yankee License Termination Plan, Revision 4, October 15, 2002, provided by Maine Yankee letter to the NRC, MN-02-061, dated November 26, 2002
2. Maine Yankee Procedure PMP 6.7.8, FSS Data Processing and Reporting, Attachment E, Approach for Dealing With Background Radioactivity for Maine Yankee Final Status Surveys
3. Maine Yankee Calculation No. EC 009-01 (MY), Instrumentation Selection and MDC Calculation

Attachment 1

Survey Unit Maps



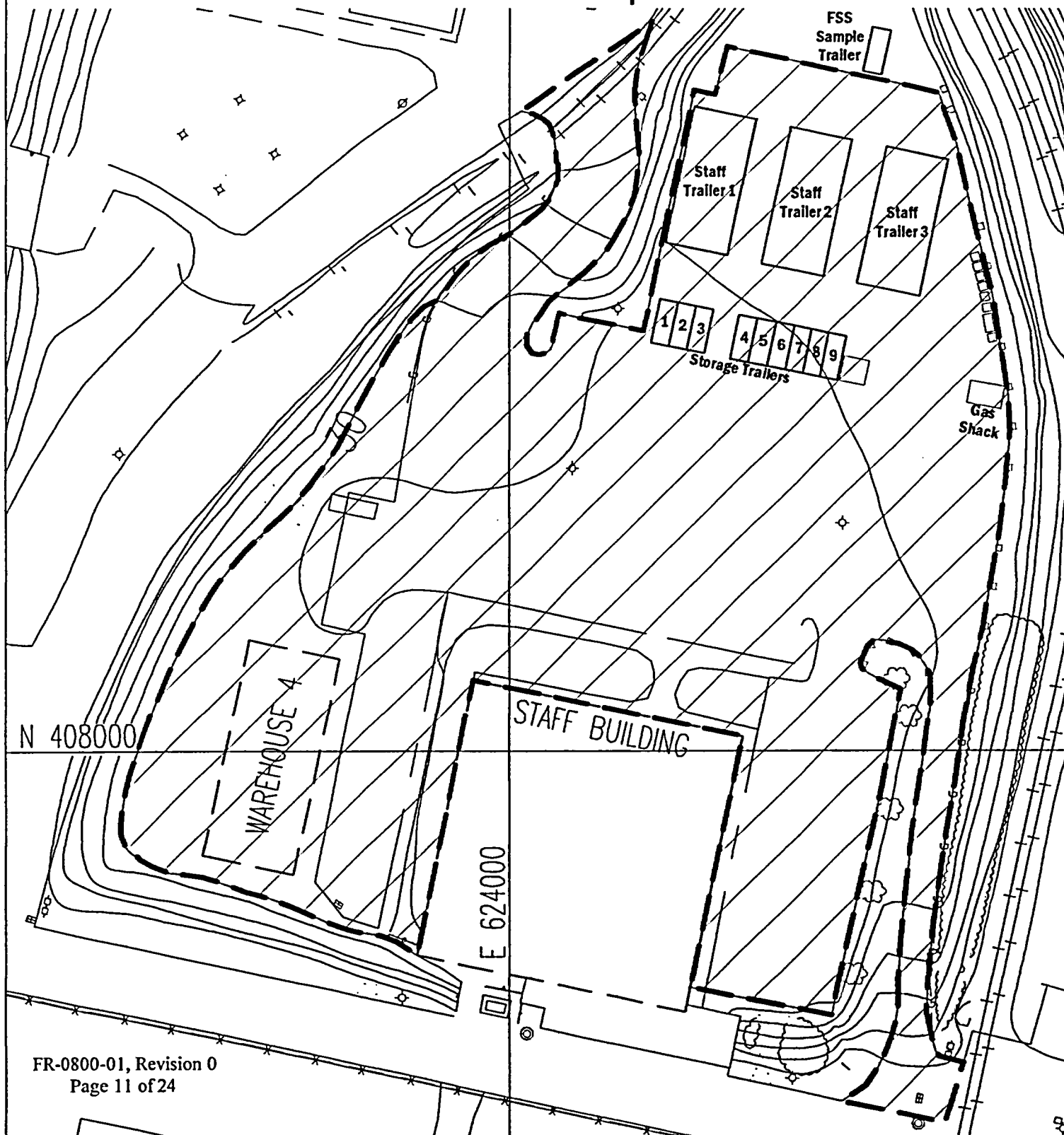
SURVEY AREA, FR0800 SU1
Admin and Parking Area

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

Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

Survey Area Name: Admin and Parking Area

Final Status Survey FR0800 SU1: Admin and Parking Area Reference Map



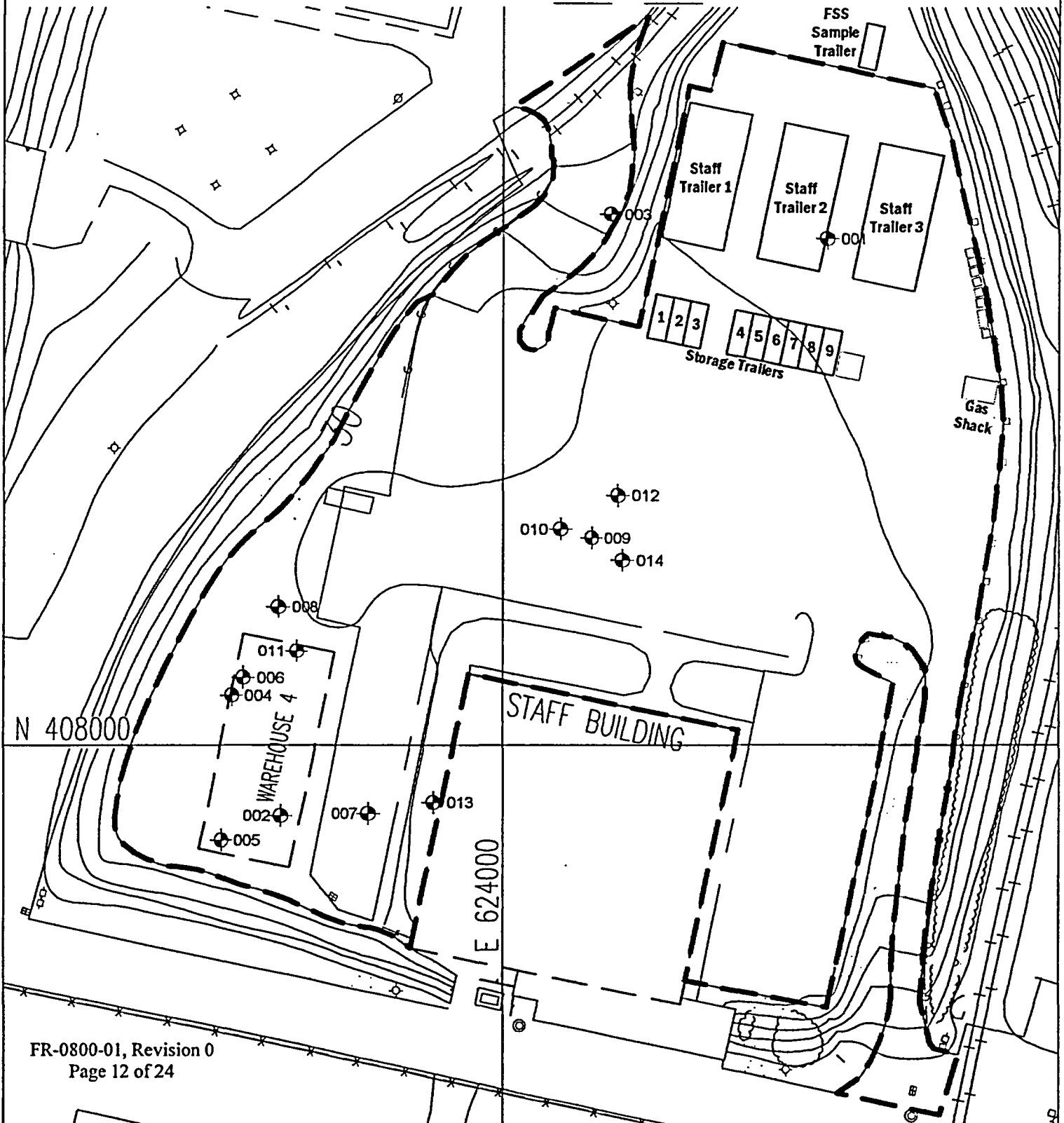
FR-0800-01, Revision 0
Page 11 of 24

FR0800 SU1 Total Surface Area = 9080 m²

Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

Survey Area Name: Admin and Parking Area

Final Status Survey
FR0800 SU1: Admin and Parking Area
Direct Points 001 - 014



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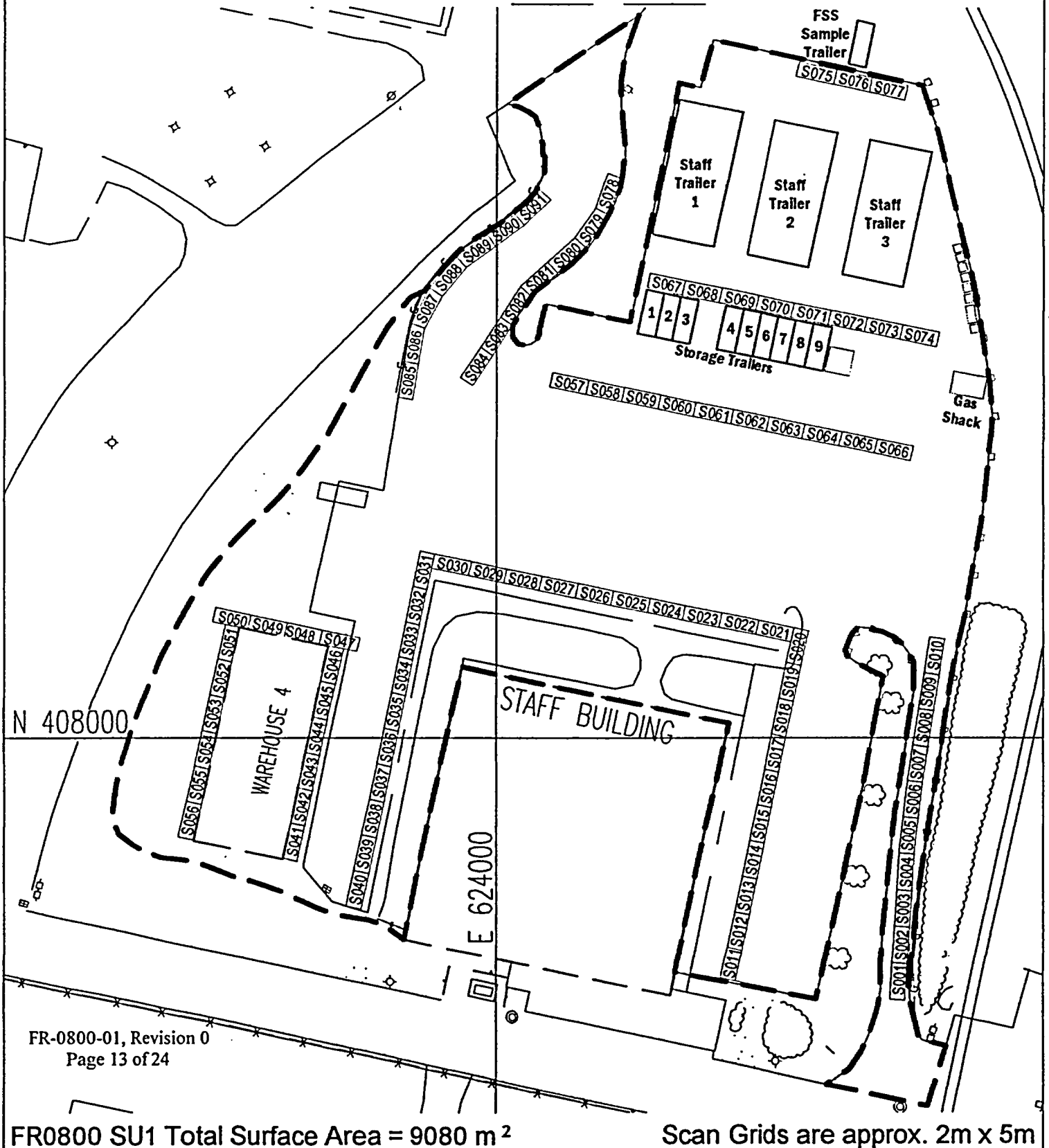
FR0800 SU1 Total Surface Area = 9080 m².

N = 14, Random Direct Points (Class 3)

Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey

Survey Area Name: Admin and Parking Area

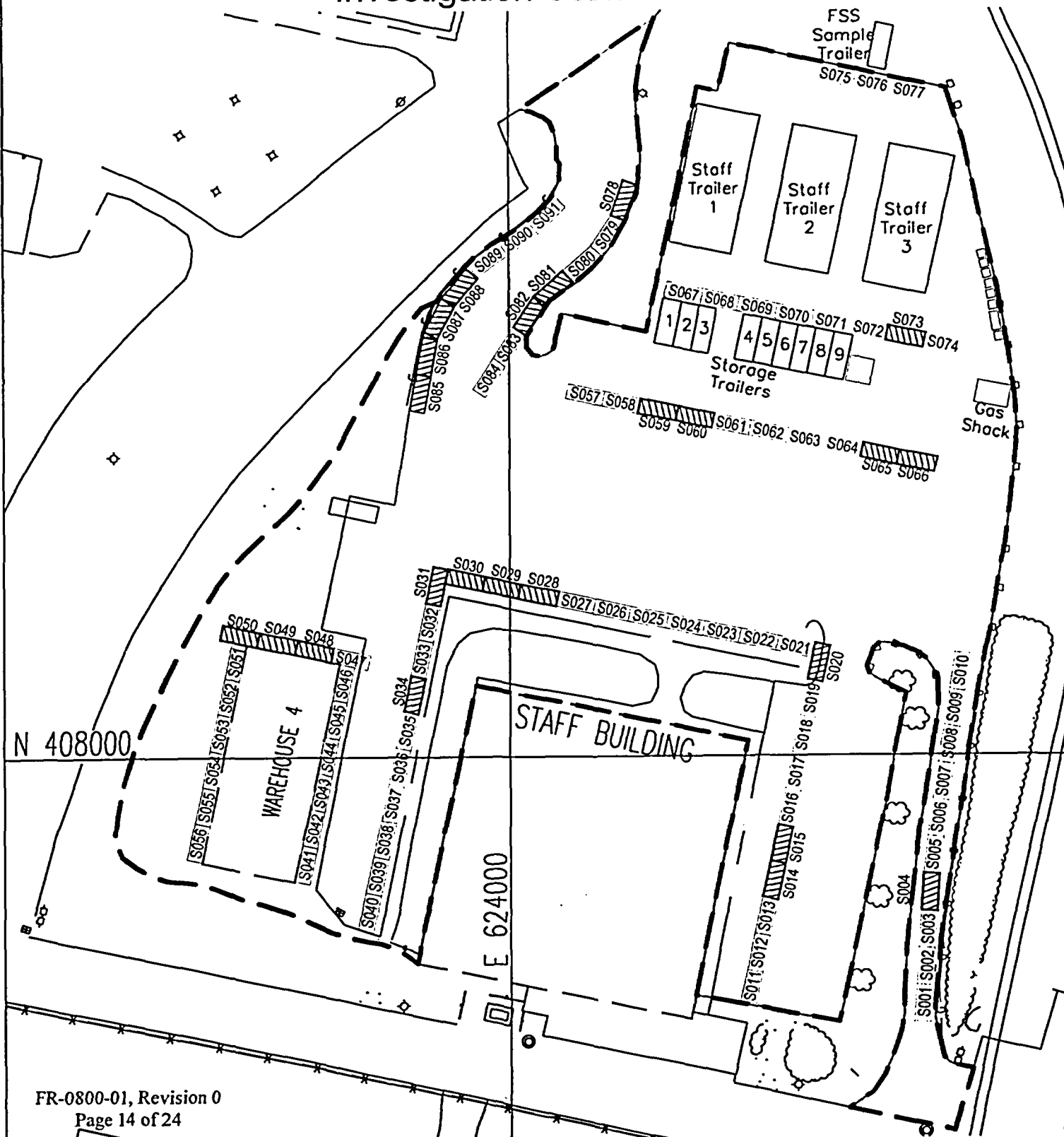
Final Status Survey FR0800 SU1: Admin and Parking Area Scan Grids S001 - S091



Survey Type: ☐ Turnover ☐ Final Status Survey ☒ Investigation

Survey Area Name: Admin and Parking Area

Final Status Survey XR0800 SU1: Admin and Parking Area Investigation Scan Grids



Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	SPA-3 Probe S/N
1933	2056
2618	2056
2618	2366
1933	726557
1648	725890
1928	2055

HPGe Detectors (Laboratory Analysis)

Detector No.	MDC (pCi/g)
FSS1	0.046 to 0.071
FSS2	0.045 to 0.069

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Parameter	Instrument: SPA-3	Comments
Scan MDC	5.9 pCi/g Cs-137	LTP Rev 4 Table 5-6 (Reference 2)
DCGL	4.2 pCi/g Cs-137 1.5 pCi/g Co-60	Approved DCGL for land areas outside the Restricted Area, LTP Section 6.7 (Reference 1)
Investigation Level (Alarm Setpoint)	14,800 cpm	Group 1: Grids S079, S080, S089- S091
	12,400 cpm	Group 2: S001-S010, S016, S017, S020-S023, S032, S033, S036-S039, S041-S047, S054-S066, S068-S078, S081-S088
	11,500 cpm	Group 3: S011-S015, S018, S019, S024-S031, S034, S035, S040, S048-S053, S067

Attachment 3

Investigation Table

TABLE 3-1**XR0800-01 INVESTIGATION
SOIL SAMPLING RESULTS**

Elevated Grid Sample Location	Initial Scan Value (cpm)	Alarm Setpoint (cpm)	Invest. Scaler Value (cpm)	Investigation Sample Activity (pCi/g Cs-137)	Uncertainty (pCi/g Cs-137)	DCGL Comparison
XR080013S004	12,400	12,400	11,310	< 6.17E-02	N/A	< DCGL
XR080013S014	12,070	11,500	9,710	< 5.21E-02	N/A	< DCGL
XR080013S015	12,130	11,500	9,660	< 4.03E-02	N/A	< DCGL
XR080013S020	13,940	12,400	13,330	< 4.85E-02	N/A	< DCGL
XR080013S028	11,540	11,500	10,110	< 5.56E-02	N/A	< DCGL
XR080013S029	11,810	11,500	10,310	< 4.24E-02	N/A	< DCGL
XR080013S030	11,900	11,500	10,250	< 4.30E-02	N/A	< DCGL
XR080013S031	11,630	11,500	10,090	< 5.61E-02	N/A	< DCGL
XR080013S034	12,310	11,500	10,350	< 5.96E-02	N/A	< DCGL
XR080013S048	12,680	11,500	10,680	< 6.95E-02	N/A	< DCGL
XR080013S049	11,580	11,500	10,930	< 7.48E-02	N/A	< DCGL
XR080013S050	11,970	11,500	10,860	< 5.26E-02	N/A	< DCGL
XR080013S059	15,550	12,400	12,440	< 4.20E-02	N/A	< DCGL
XR080013S060	12,360	12,400	10,650	< 4.72E-02	N/A	< DCGL
XR080013S065	12,670	12,400	10,800	< 4.48E-02	N/A	< DCGL
XR080013S066	12,730	12,400	11,180	< 5.43E-02	N/A	< DCGL
XR080013S073	13,040	12,400	11,900	< 4.56E-02	N/A	< DCGL
XR080013S078	14,180	12,400	11,950	< 5.71E-02	N/A	< DCGL
XR080013S081	13,500	12,400	12,250	< 6.07E-02	N/A	< DCGL
XR080013S082	12,620	12,400	11,750	< 4.40E-02	N/A	< DCGL
XR080013S085	12,800	12,400	11,760	< 6.67E-02	N/A	< DCGL
XR080013S086	13,560	12,400	12,960	< 6.81E-02	N/A	< DCGL
XR080013S087	13,620	12,400	12,410	< 4.82E-02	N/A	< DCGL
XR080013S088	13,050	12,400	11,660	< 4.97E-02	N/A	< DCGL
Survey Unit Mean / DCGL						0.016
Total						0.016

- NOTES:**
1. "<" indicates value less than MDA, MDA value is reported.
 2. The samples were also analyzed for Co-60; all were less than an MDA of 0.07 pCi/g.

TABLE 3-2

**XR0800-01 INVESTIGATION OF S004
SOIL SAMPLING RESULTS**

Elevated Grid Sample Location	Initial Activity (pCi/g Cs-137)	Initial Activity (pCi/g Co-60)	Investigation Activity (pCi/g Cs-137)	Investigation Activity (pCi/g Co-60)	DCGL Comparison
FR0800-01-3S004SS	1.92E-01	3.77E-01	N/A	N/A	N/A
XR0800-01-3S001SS-SE	N/A	N/A	< 7.51E-02	< 7.10E-02	< DCGL
XR0800-01-3S001SS-SW	N/A	N/A	1.90E-01	< 6.33E-02	< DCGL
XR0800-01-3S001SS-NE	N/A	N/A	< 6.71E-02	< 5.59E-02	< DCGL
XR0800-01-3S001SS-NW	N/A	N/A	1.50E-01	< 6.72E-02	< DCGL

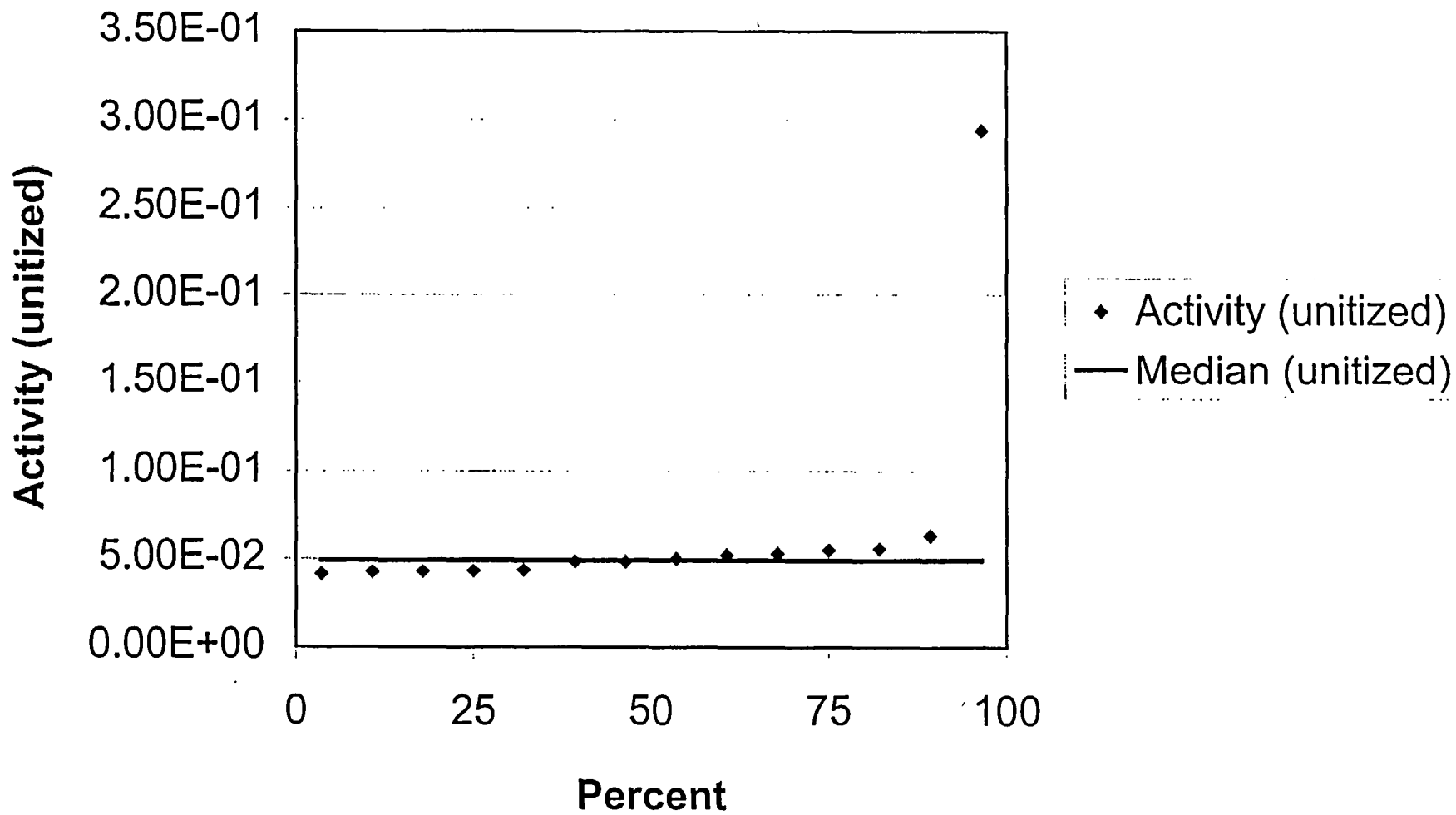
Attachment 4

Statistical Data

Survey Package FR0800 Unit 1 UNITY Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FR0800	
Survey Unit:	01	
Evaluator:	Jeff Ambrose	
DCGL _w :	1.00E+00	Cs-137 (unity)
DCGL _{emc} :	n/a	Class 3
LBGR:	5.00E-01	50% of DCGL
Sigma:	3.09E-02	LTP Rev 4, Table 5-1C (0.13/4.2) unitized
Type I error:	0.05	
Type II error:	0.05	
Nuclide:	UNITY	
Soil Type:	N/A	No material background is applied.
Calculated Values		Comments
Z _{1-α} :	1.645	
Z _{1-β} :	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	16.1	
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:	4.95E-02	
Mean:	6.71E-02	
Net Sample Standard Deviation:	6.65E-02	
Total Standard Deviation:	6.65E-02	Sum of samples and reference
Maximum:	2.97E-01	
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	(N/A Class 3)
Total Standard Deviation <=Sigma:	Investigate	Refer to Section F
Criteria comparison results:	Investigate	
Final Status		Comments
The survey unit passes all conditions:	Investigate	Survey Unit Passes

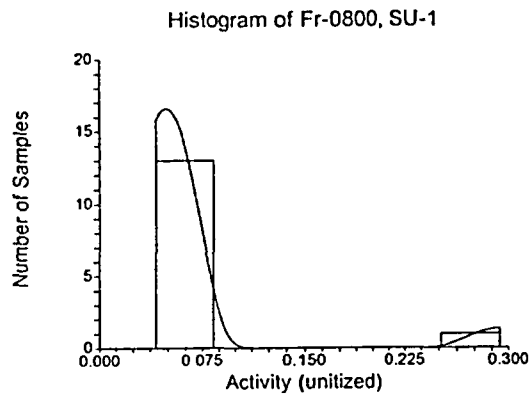
FR0800 SU-1 Quantile Plot



One-Sample T-Test Report

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Variable C2

Plots Section



One-Sample T-Test Power Analysis

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Chart Section

