MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0110 PAB ALLEYWAY
SURVEY UNIT 4

Prepared By:	FSS Engineer – Signature W J Cooper Printed Name	Date: 12/6/04
Reviewed By:	FSS Specialist – Signature Vicki Hilton Printed Name	Date: 12-6-04
Reviewed By:	Independent Review – Signature George P. Tsibouy Printed Name	Date: 12/7/04
Approved By:	Superintendent, FSS – Signature George P. Tsibouy Printed Name	Date: 12/7/04
Approved By:	FSS, MOP – Signature James R. Becker Printed Name	Date: 12/7/04

MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0110 PAB ALLEYWAY
SURVEY UNIT 4

A. SURVEY UNIT DESCRIPTION

Survey Unit FR-0110-04 is an excavated area that consists of soil and backfill. The excavation was made in order to remove buried pipes running between the PAB and the Containment Spray Building, located near grid coordinates 407,500 N and 623,800 E using the Maine State Coordinate System (West Zone) NAD 1927, as shown on Map FR 0110-00, Attachment 1.

The Alleyway was originally a paved area located above the pipe excavation within the Restricted Area, bordered on the west by the Personnel Hatch, Main Steam Valve House, Reactor Motor Control Center, and the Emergency Feedwater Pump Room, on the east by the Service Building, and by the PAB on the north. The survey unit is 205 m^2.

B. SURVEY UNIT DESIGN INFORMATION

The area was designated a Class 1 land survey unit per the LTP (Table 5-1C, R0100, RCA Yard West). The Alleyway excavation was begun in late 2002 and the removed soil was spread and surveyed for possible reuse. Nearly all of the removed soil was found to be acceptable for reuse. The soil survey effort was suspended when the ground froze, and upon returning to soil surveying in the spring of 2003, it was determined that radioactivity had migrated into the remaining soil from the open, abandoned pipes in the excavation. Consequently, significant soil remediation had to be performed. Since the survey unit was already Class 1, no reassessment of classification was required.

The survey unit design parameters are shown in Table 1. Given a relative shift of 1.2, it was determined that 23 direct measurements were required for the Sign Test; however, the number of samples was increased because an additional sample point fell within the area when the locations were laid out. Twenty-four direct measurements were actually performed. Measurement locations were randomly determined, using a fixed grid with a randomly determined start point, and are illustrated on the map FR 0110-SS-04 (Attachment 1). All direct measurements consisted of soil samples obtained at the required locations. The samples are analyzed with laboratory gamma spectroscopy.

Forty-seven scan grids of approximately 4.4 m^2 were established, as indicated on survey map FR 0110-04. A 100% scan coverage of the area was required. The survey instruments used, their MDCs, and alarm setpoints are provided in Attachment 2. Since the design $DCGL_{EMC}$ is greater than the investigation level, no EMC sample size adjustment is required.

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, and to confirm the scan MDCs used were appropriate.

TABLE 1

SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	205 m^2	< Class 1 limit per LTP Rev. 3
Number of Direct Measurements Required	23	Based on an LBGR of 1.6 pCi/g, sigma of 1.33 pCi/g[1] and a relative shift of 1.2 Type I = Type II = 0.05
Sample Area	8.9 m^2	205m^2 / 23
Sample Grid Spacing	2.9 m x 2.9 m	$(8.9)^{1/2}$
Scan Grid Area	~ 4.4 m^2	
Area Factor	2.3 (conservative)	LTP Rev, Table 3 6-12
Scan Survey Area	205 m^2	Class 1 Area – 100%
Background		
SSPA-3 (scan)	Average background ± 1000 cpm	DI 6-150, LTP Section 5
Scan Investigation Level	3 sigma of background plus BKG	EC-009-01, See Table 2-2 (Attachment 2)
DCGL	3.2 pCi/g[2]	LTP, Rev 3 and Addenda (Reference 3, 4, and 5)
Design $DCGL_{EMC}$	7.3	Area factor * DCGL

C. SURVEY RESULTS

As required, 24 direct soil measurements were made and the results are presented in Table 2. Two of the direct measurements (S017 and S023) were above the DCGL unity fraction. The maximum direct result was 2.28 times the DCGL unity fraction. These grids were both remediated, with subsequent resampling. The post-remediation sample results are used in Table 2. The original results are used in the Sign Test. The mean residual activity is 37% of the unity fraction.

Of the 47 grids scanned, 35 required investigation either due to a low background at the start of the scan (3), high background at the start of the scan (5), or because the scan setpoint was exceeded (27). A discussion of the investigation performed in the survey unit is contained in Section D.

It should be noted that the Co-60 DCGL is 0.86 pCi/g. This is an "adjusted DCGL" and can be derived from the unitized dose for surface soil, LTP Table 6-7 and the updated dose model in the activated concrete related license amendment (References 5 and 6). The Co-60 DCGL for surface soil is 1 pCi/g x 10/6.58 mrem/y (from LTP Table 6-7) or 1.5 pCi/g Co-60. This DCGL is further limited by the dose contribution allowed for surface soil only in the basement fill model per LTP Section 6 Attachment IX (revised LTP Table 6-11), in the activated concrete license amendment. Thus, the Co-60 adjusted DCGL is 1.5 pCi/g x 5.63/10 mrem/y or 0.86 pCi/g.

---

1 Design sigma from the LTP Rev 3 Table 5-1C for R0100, RCA Yard West.

2 Design initially used a DCGL of 3.2 pCi/g Cs-137. The Cs-137 DCGL was reduced to 2.39 pCi/g (Reference 5).

TABLE 2

DIRECT MEASUREMENTS

Sample Number	Co-60 (pCi/g)	Uncertainty	Cs-137 (pCi/g)	Uncertainty	Unitized Value of Unity Rule
FR0110-04-S001	<4.67E-02		4.90E-02	2.00E-02	0.07
FR0110-04-S002	1.94E-01	2.51E-02	9.46E-01	7.45E-02	0.62
FR0110-04-S003	5.79E-02	1.76E-02	1.54E-01	2.68E-02	0.13
FR0110-04-S004	1.16E-01	2.59E-02	5.85E-01	6.61E-02	0.38
FR0110-04-S005	6.90E-02	1.99E-02	1.14E-01	2.65E-02	0.13
FR0110-04-S006	<4.01E-02		6.77E-02	2.43E-02	0.07
FR0110-04-S007	2.14E-01	2.49E-02	2.57E-01	3.20E-02	0.36
FR0110-04-S008	< 4.62E-02		9.49E-02	2.70E-02	0.09
FR0110-04-S009	1.40E-01	2.21E-02	9.80E-01	7.51E-02	0.57
FR0110-04-S010	5.09E-02	2.36E-02	7.57E-01	7.01E-02	0.38
FR0110-04-S011	<4.49E-02		2.94E-01	3.67E-02	0.18
FR0110-04-S012	<3.44E-02		1.01E-01	2.44E-02	0.08
FR0110-04-S013	<3.72E-02		1.52E-01	2.74E-02	0.11
FR0110-04-S014	<4.59E-02		1.37E-01	2.62E-02	0.11
FR0110-04-S015	5.22E-01	3.78E-02	7.63E-01	6.38E-02	0.93
FR0110-04-S016	1.44E-01	2.50E-02	1.75E-01	3.28E-02	0.24
*XR0110-04-S030	2.11E-01	3.11E-02	1.65E-01	3.81E-02	0.31
FR0110-04-S018	<4.30E-02		9.67E-02	2.49E-02	0.09
FR0110-04-S019	5.31E-01	4.42E-02	6.33E-01	6.33E-02	0.88
FR0110-04-S020	5.05E-01	4.20E-02	8.21E-01	7.29E-02	0.93
FR0110-04-S021	2.18E-01	3.02E-02	3.67E-01	4.72E-02	0.41
FR0110-04-S022	5.17E-01	3.70E-02	7.72E-01	6.24E-02	0.92
*XR0110-04-S028	3.42E-01	3.50E-02	4.59E-01	5.18E-02	0.59
FR0110-04-S024	1.46E-01	2.43E-02	1.37E-01	2.98E-02	0.23
Mean	1.80E-01		3.78E-01		0.37
Median	1.28E-01		2.16E-01		0.28
Standard Deviation	1.74E-01		3.15E-01		0.30
Range	0.034 to 0.53		0.049 to 0.98		0.075 to 0.93

"<" indicates values less than the minimum detectable activity (MDA)

* The sample results exceeded the unitized DCGL. The area was remediated and the post remediation sampling results are reported in the table. The Sign Test was performed using the original sample results (see Attachment 4).

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

Survey Unit 4 was partitioned into 47 grids as shown on map FR 0110-04 (Attachment 1). Of the 47 grids, 35 required investigation either due to a low background at the start of the scan, high background at the start of the scan, or because the scan setpoint was exceeded. In addition, two direct measurements exceeded the DCGL. These were subsequently investigated and remediated as noted above.

Investigation of the scan grids consisted of a 100% scan with the SSPA-3. The highest reading in the grid was flagged and a soil or rock sample was collected for laboratory gamma analysis. The results of the investigations are shown in Attachment 3. Detectable concentrations of Co-60 and/or Cs-137 were found in 24 of the investigated grids with four having sample activity exceeding the DCGL. Three of these four grids were resampled post-remediation. The post-remediation sample results are used for the Elevated Measurement Comparison test shown in Table 3-1. During bounding surveys following remediation, one additional grid (S024) was found to exceed the DCGL. These results are also included in Table 3-1. Samples from the other investigated grids did not show positive Co-60 or Cs-137, and so, for purposes of the EMC test, were assumed to be present at the observed MDA. The investigation results are summarized in Attachment 3 (Table 3-1).

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. Of the 24 soil/rock samples, none had concentrations of Co-60 and Cs-137 that exceeded unity post-remediation. The average of the DCGL unity fractions was 0.37 and the maximum unity fraction (after remediation) was 0.93 times the DCGL. The Elevated Measurement Comparison unity limit test was applied to the investigation data. The EMC test was 78% of unity, passing the EMC test. Final sigma was less than the design sigma; therefore, no additional samples were required. It should be noted that although the two direct measurements with activity above the DCGL are not included in Table 2, the original results were used in the Sign Test.

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[3] (0.19 pCi/g) for disturbed soil from the survey unit sample mean Cs-137 activity (0.378 pCi/g). The result is a net value of 0.188 pCi/g. When the survey unit mean for Co-60 (0.180 pCi/g) is included, this would equate to an annual dose rate of 1.6 mrem/y[4]. However, for the 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.

---

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

4 Based on 5.63 mrem/y at the DCGL per the LTP and Addenda (0.188/2.39 + 0.180/0.86) * 5.63.

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 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, except two samples had activity above the unitized DCGL, were satisfied for the FSS of this survey unit. The elevated measurements were appropriately evaluated and found acceptable. It should be noted that due to the change in the DCGL (2.39 pCi/g vs 3.2 pCi/g), the final Sign Test summary was evaluated with a type II error equal to 0.20.

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. The survey unit average is well below the DCGLs of 0.86 pCi/g and 2.39 pCi/g for Co-60 and Cs-137 respectively.

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 with no 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.

G. CHANGES IN INITIAL SURVEY UNIT ASSUMPTIONS ON 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. Since the DCGLs were changed (decreased) by addendum to the LTP to account for the activated containment concrete pathway the design of the survey unit was confirmed and data reviewed against the revised DCGLs.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 4 was designed and performed per the criteria LTP Rev. 3 with Addenda (Reference 3 and 4). The subsequent LTP change with potential impact to this FSS requiring evaluations was the LTP change related to the activated concrete license amendment (Reference 5 and 6) which reduced the DCGLs for soil inside the RA.

These changes were evaluated and found to have no impact on the FSS results or conclusions for this survey unit. The revised DCGLs were used for the evaluation of the results included herein.

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, the average of the direct measurements was well below the DCGL unity.

A Sign Test Summary analysis demonstrated that the Sign Test criteria were satisfied with type II error of 0.20. 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 normal distribution with no 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. Verified alarms were investigated and the survey unit meets the Elevated Measurement Comparison unity rule per LTP methodology.

It is concluded that FR0110 Survey Unit 4 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

1. Maine Yankee Calculation EC-009-01

2. 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

3. Maine Yankee License Termination Plan, Revision 3, Maine Yankee letter to the NRC, MN-02-048, dated October 15, 2002

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

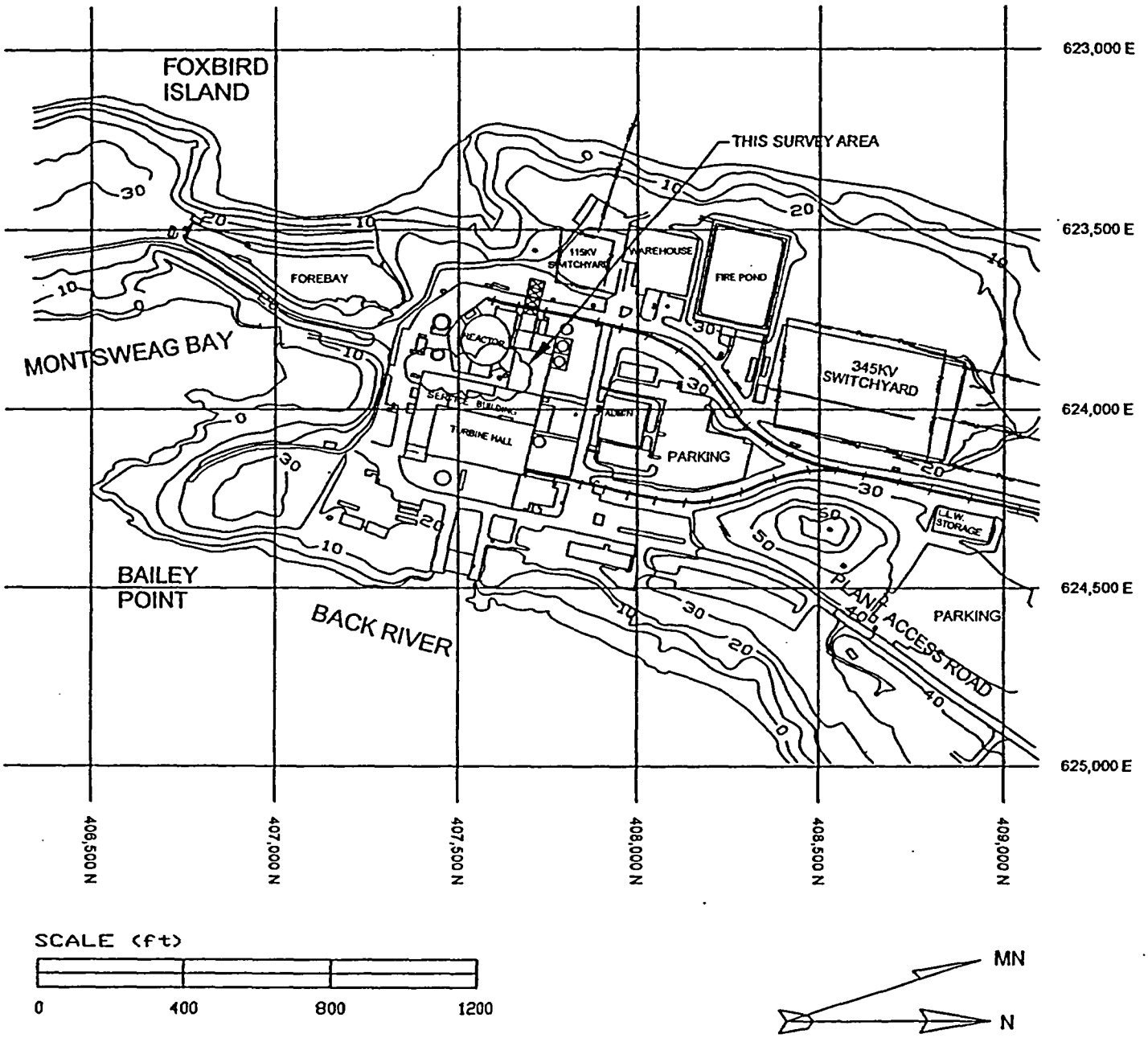
5. Proposed License Amendment Related to Changes in the Activated Concrete Remediation Plans, Maine Yankee letter to the NRC, MN-03-049, dated September 11, 2003

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

Attachment 1

Survey Unit Maps

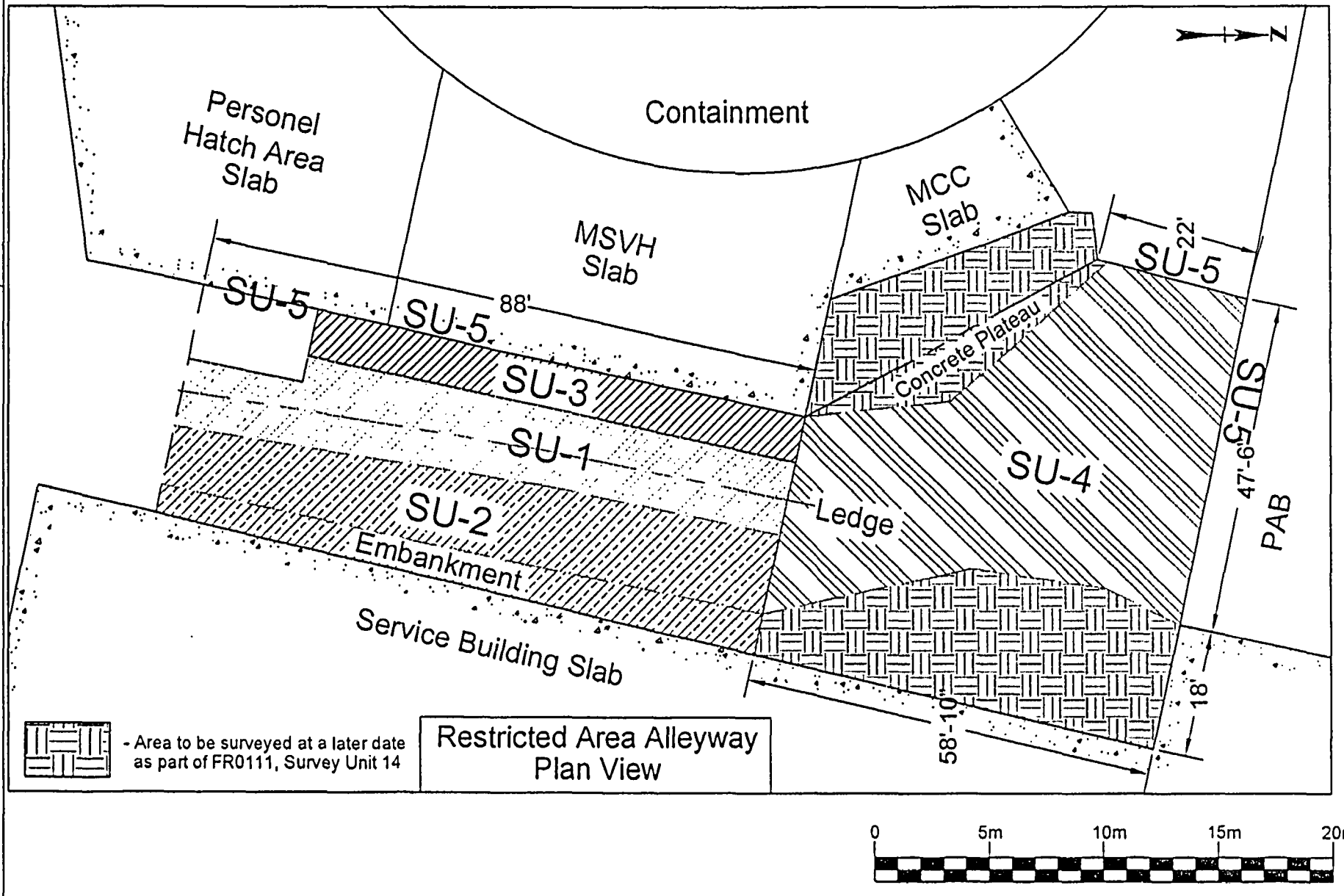
Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0110-00
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Alleyway Excavation	Date: 6-25-03



Final Status Survey Unit Reference Map
Alleyway Piping Excavation Pit

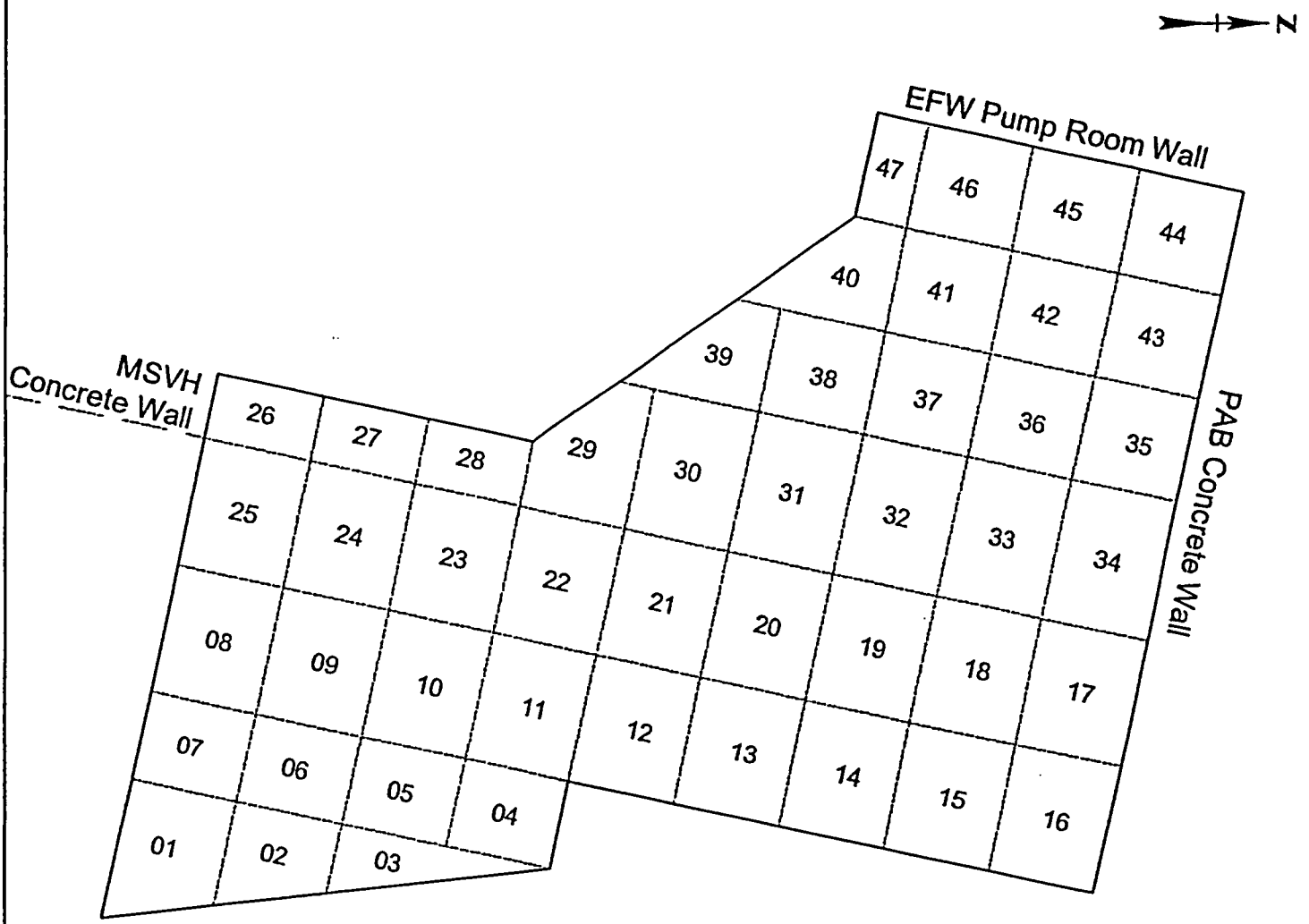
Maine Yankee Decommissioning Team | *Maine Yankee Decommissioning Project Survey Form* | Map ID #: FR 0110-REF

Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey | Survey Area Name: Alleyway Excavation | Date: 6-25-03



Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0110-04
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Alleyway Excavation	Date: 6-25-03

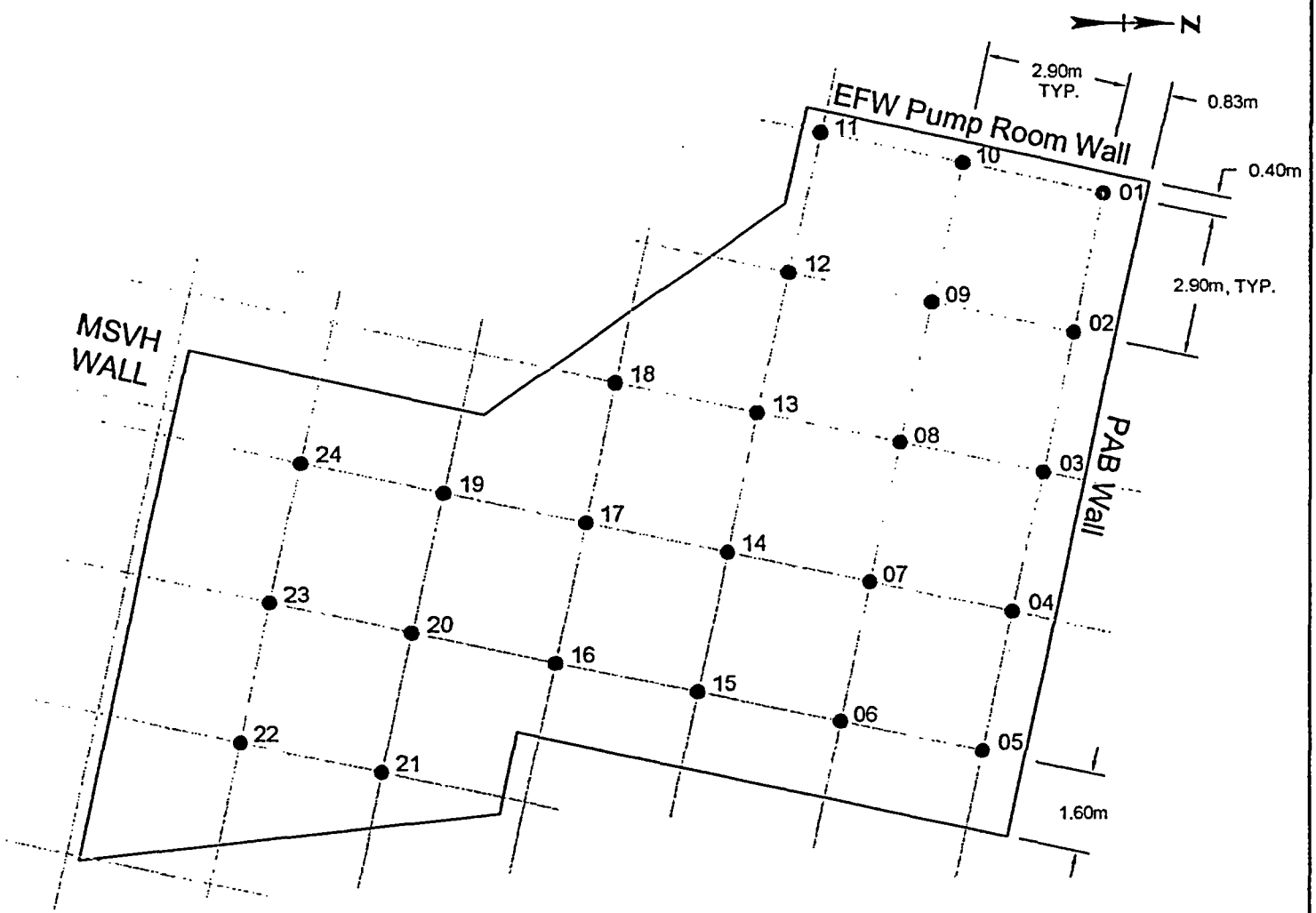
FR 0110-04: Alleyway Piping Excavation Pit
Soil Area South of PAB Wall Survey Scan 01-47



This survey area unit is approximately 205 square meters

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0110-SS-04 Survey Unit 04
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Alleyway Excavation	Date: 7-7-03

FR 0110-SS-04, Direct Point Survey, Soil
Survey Unit 04
Alleyway Piping Excavation Pit
Soil Area South of PAB Wall



L=2.9, N=23

This survey area unit is approximately 205 square meters

Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
1929	725890 (SSPA-3)
1625	725890 (SSPA-3)
1929	725328 (SSPA-3)
2489	725890 (SSPA-3)
2489	726560 (SSPA-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
DET2	0.10 (nominal)
DET3	0.10 (nominal)

TABLE 2-2

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

Detector	SSPA-3	Comments
Scan MDC (pCi/g)	5.9	Design Scan MDC, LTP Table 5-6 (Reference 4)
DCGL (pCi/g)	2.39 Cs-137 0.86 Co-60	Reference 5
Investigation Level (Alarm Setpoint) cpm	17,050 to 18,890	3 sigma of Background plus Background
$DCGL_{EMC}$ (pCi/g)	9.3 Cs-137 3.3 Co-60	DCGL * AF (3.9 as performed)

Attachment 3

Investigation Table

TABLE 3-1

INVESTIGATION TABLE

INITIAL SURVEY			INVESTIGATION RESULTS									
Grid	Alarm Setpoint cpm	Alarm Value cpm	Max. Scan Value cpm	Scan Area m^2	Area Factor	$DCGL_{EMC}$ Unity * AF	Sample Number	Co-60 (pCi/g)	+/-	Cs-137 (pCi/g)	+/-	$DCGL_{EMC}$ Unity
S001	17050	19000	17580	4.4	3.9	3.9	XR0110041S001SS	**2.66E-01**	**3.24E-02**	**2.97E-01**	**4.45E-02**	<DCGL
S003	17050	17200	19450	4.4	3.9	3.9	XR0110041S002SS	**9.97E-02**	**2.05E-02**	**1.60E-01**	**2.85E-02**	<DCGL
S004	17050	17270	16390	4.4	3.9	3.9	XR0110041S003SS	**5.97E-01**	**5.01E-02**	**8.68E-01**	**8.33E-02**	0.18
S005	17050	17430	15300	4.4	3.9	3.9	XR0110041S004SS	**4.08E-01**	**3.44E-02**	**5.45E-01**	**5.27E-02**	<DCGL
S006	17050	17810	18460	4.4	3.9	3.9	XR0110041S005SS	**4.00E-01**	**3.45E-02**	**6.51E-01**	**6.24E-02**	<DCGL
S007	17050	17650	17150	4.4	3.9	3.9	XR0110041S006SS	**5.69E-02**	**2.41E-02**	**5.50E-02**	**2.17E-02**	<DCGL
S008	18890	19450	20100	4.4	3.9	3.9	XR0110041S001RS	< 1.27E-01		< 1.04E-01		<DCGL
S009	18890	19760	19660	4.4	3.9	3.9	XR0110041S007SS	**4.76E-01**	**3.75E-02**	**6.53E-01**	**5.88E-02**	<DCGL
S010	17050	17890	18740	4.4	3.9	3.9	XR0110041S029SS	**8.81E-02**	**2.13E-02**	**1.63E-01**	**2.96E-02**	<DCGL
S013	17050	17690	19080	4.4	3.9	3.9	XR0110041S009SS	**6.04E-02**	**1.78E-02**	**6.49E-02**	**2.33E-02**	<DCGL
S014	18890	hb	22100	4.4	3.9	3.9	XR0110041S002RS	< 1.24E-01		< 1.22E-01		<DCGL
S015	18890	20400	19820	4.4	3.9	3.9	XR0110041S010SS	**1.03E-01**	**2.16E-02**	**1.17E-01**	**2.69E-02**	<DCGL
S016	18890	hb	20300	4.4	3.9	3.9	XR0110041S003RS	< 1.05E-01		< 9.45E-02		<DCGL
S017	18890	hb	22300	4.4	3.9	3.9	XR0110041S004RS	< 1.23E-01		< 9.96E-02		<DCGL
S018	18890	21100	21400	4.4	3.9	3.9	XR0110041S005RS	< 1.13E-01		< 9.59E-02		<DCGL
S019	18890	21000	19750	4.4	3.9	3.9	XR0110041S011SS	**2.06E-01**	**2.69E-02**	**3.15E-01**	**3.86E-02**	<DCGL
S022	18890	20000	19580	4.4	3.9	3.9	XR0110041S006RS	< 7.72E-02		< 7.07E-02		<DCGL
S023	18890	19070	19270	4.4	3.9	3.9	XR0110041S031SS	**3.74E-01**	**3.38E-02**	**6.53E-01**	**6.10E-02**	<DCGL
S024	18890	20000	19770	4.4	3.9	3.9	XR0110041S032SS	**7.70E-01**	**5.69E-02**	**9.77E-01**	**8.96E-02**	0.24
S025	18890	hb	20700	4.4	3.9	3.9	XR0110041S033SS	**2.68E-01**	**3.06E-02**	**3.79E-01**	**4.32E-02**	<DCGL
S026	18890	23000	20700	4.4	3.9	3.9	XR0110041S007RS	< 1.00E-01		< 8.56E-02		<DCGL

INITIAL SURVEY			INVESTIGATION RESULTS									
Grid	Alarm Setpoint cpm	Alarm Value cpm	Max. Scan Value cpm	Scan Area m^2	Area Factor	$DCGL_{EMC}$ Unity * AF	Sample Number	Co-60 (pCi/g)	+/-	Cs-137 (pCi/g)	+/-	$DCGL_{EMC}$ Unity
S027	18890	21600	19660	4.4	3.9	3.9	XR0110041S008RS	< 1.07E-01		< 9.62E-02		<DCGL
S028	18890	19940	19060	4.4	3.9	3.9	XR0110041S015SS	**3.24E-01**	**3.16E-02**	**4.07E-01**	**4.40E-01**	<DCGL
S029	18890	19290	19250	4.4	3.9	3.9	XR0110041S014SS	**4.42E-02**	**2.39E-02**	**1.36E-01**	**2.66E-02**	<DCGL
S031	18890	lb	15400	4.4	3.9	3.9	XR0110041S017SS	< 4.79E-02		**6.08E-02**	**2.39E-02**	<DCGL
S032	18890	21000	19420	4.4	3.9	3.9	XR0110041S009RS	< 8.90E-02		< 8.23E-02		<DCGL
S033	18890	19420	20100	4.4	3.9	3.9	XR0110041S018SS	**2.73E-01**	**3.01E-02**	**3.41E-01**	**4.32E-02**	<DCGL
S035	18890	23400	21700	4.4	3.9	3.9	XR0110041S019SS	**1.55E-01**	**2.53E-02**	**5.42E-01**	**5.71E-02**	<DCGL
S036	18890	19170	19090	4.4	3.9	3.9	XR0110041S020SS	**5.90E-02**	**1.90E-02**	**1.68E-01**	**3.35E-02**	<DCGL
S037	18890	lb	17350	4.4	3.9	3.9	XR0110041S021SS	**6.78E-02**	**2.89E-02**	**4.18E-01**	**5.28E-02**	<DCGL
S039	18890	lb	15370	4.4	3.9	3.9	XR0110041S022SS	< 4.71E-02		**1.05E-01**	**2.48E-02**	<DCGL
S040	18890	19220	19670	4.4	3.9	3.9	XR0110041S010RS	< 1.16E-01		< 1.05E-01		<DCGL
S041	18890	19080	18800	4.4	3.9	3.9	XR0110041S011RS	< 9.91E-02		< 8.96E-02		<DCGL
S042	18890	19120	19540	4.4	3.9	3.9	XR0110041S023SS	< 5.31E-02		**3.20E-01**	**4.28E-02**	<DCGL
S043	18890	hb	20200	4.4	3.9	3.9	XR0110041S024SS	**1.09E-01**	**2.12E-02**	**5.00E-01**	**4.93E-02**	<DCGL
							Unit mean	**1.80E-01**		**3.78E-01**		0.37
										EMC Unity Sum		0.78

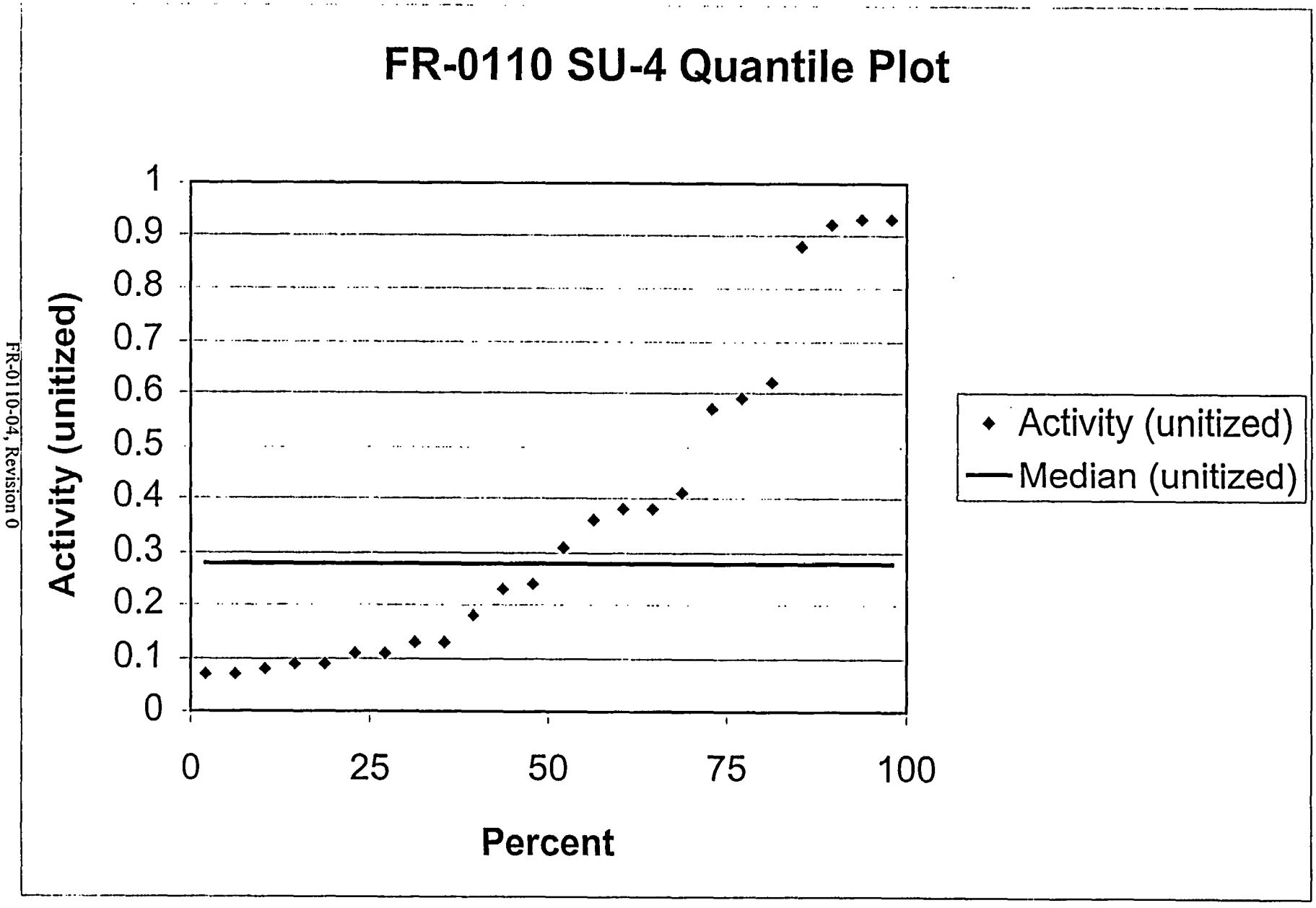
lb – investigated due to low background in the grid
hb – investigated due to high background in the grid
"<" indicates values less than the minimum detectable activity (MDA)

Attachment 4

Statistical Data

Survey Package FR0110 Unit 4 UNITY Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FR0110	Alleyway Excavation
Survey Unit:	04	
Evaluator:	WJC	
$DCGL_w$:	1.00E+00	Based on 2.39 pCi/g DCGL
$DCGL_{emc}$:	3.90E+00	
LBGR:	5.00E-01	
Sigma:	5.66E-01	
Type I error:	0.05	
Type II error:	0.2	increased Type II error to 20%
Nuclide:	UNITY	
Soil Type:	N/A	
Calculated Values		**Comments**
$Z_{1-\alpha}$:	1.645	
$Z_{1-\beta}$:	0.842	
Sign p:	0.788145	
Calculated Relative Shift:	0.8	
Relative Shift Used:	0.8	Uses 3.0 if Relative Shift is >3
N-Value:	19	
N-Value+20%:	23	
Sample Data Values		**Comments**
Number of Samples:	24	
Median:	2.99E-01	Uses pre-remediation data
Mean:	4.76E-01	Uses pre-remediation data
Net Sample Standard Deviation:	5.17E-01	Uses pre-remediation data
Total Standard Deviation:	5.17E-01	Sum of samples and reference
Maximum:	2.28E+00	
Sign Test Results		**Comments**
Adjusted N Value:	24	
S+ Value:	22	Uses pre-remediation data
Critical Value:	16	
Sign test results:	Pass	
Criteria Satisfaction		**Comments**
Sufficient samples collected:	Pass	
Maximum value <$DCGL_w$:	Investigate	Mean<1.0, sign test passes
Median value <$DCGL_w$:	Pass	
Mean value <$DCGL_w$:	Pass	
Maximum value <$DCGL_{emc}$:	Pass	
Total Standard Deviation <=Sigma:	Pass	
Criteria comparison results:	Investigate	Mean<1, sign test passes
Final Status		**Comments**
The survey unit passes all conditions:	Investigate	mean<1, sign passes, SU passes


FR-0110 SU-4 Quantile Plot
Activity (unitized)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
25
50
75
100
Percent
Activity (unitized)
Median (unitized)

One-Sample T-Test Report

Page/Date/Time	2 12/7/04 3:17:03 PM
Database	C:\Program Files\NCSS97\FR0110SU4.S0
Variable	C2

Plots Section

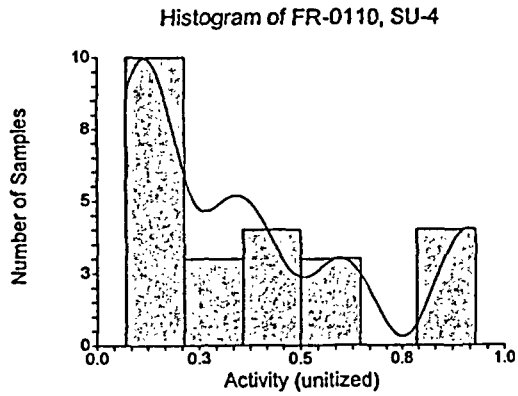


Chart Section