MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0910 FIRE POND (PUMP HOUSE SLAB) FOOTPRINT
SURVEY UNIT 2

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A. SURVEY UNIT DESCRIPTION

FR-0910 Survey Area includes the Fire Pond footprint and the adjacent Fire Pond Pump House concrete slab, located about 700 feet northwest of the plant (Maine State Grid Coordinates 623500 N and 408250 E) as shown on map FR-0910-01 (Attachment 1). Water for firefighting was stored in a man-made water storage pond, constructed of concrete and gravel, and rubber-lined. The pond was 278 feet long, 200 feet wide and 15 feet deep, with a capacity of approximately 3.4 million gallons. Makeup water for the pond was supplied from the offsite Montsweag Reservoir, located near the junction of U.S. Route 1 and Route 144. Water was drawn from the water storage pond by two fire pumps located in the Fire Pump House. Survey Unit 2 consists of the Pump House Slab, approximately 119.3 m^2, which contained a sump and several through-slab penetrations. The concrete slab was all that remained of the Fire Pump House following its demolition. The survey unit was located outside of the plant's radiologically restricted area (RA) and industrial area.

B. SURVEY UNIT DESIGN INFORMATION

Survey Unit 2 consists of the Fire Pond Pump House slab foot print and was designated a Class 3 survey unit in accordance with the LTP (Table 5-1B; B-0400 and Table 5-1C; R0900).

The survey unit design parameters are summarized in Table 1. Given a relative shift of 3.0, it was determined that 14 direct sample points were required for the Sign Test. The direct measurement locations were randomly generated and are shown on map FR 0910-06 (Attachment 1). The direct measurements were volumetric concrete samples due to the rough condition of the slab surface. The samples were analyzed with laboratory gamma spectroscopy instrumentation.

A 1% to 10% scan coverage of the area was required.[1] The scan grids consisted of one-meter square areas in the vicinity of each of the 14 concrete samples, resulting in a scan area of 14 meters square. Scanning locations are shown on map FR0910-07 (Attachment 1). Scans were performed prior to sampling.

As an augmented survey to the 14 concrete samples and scans of the Fire Pump House slab, a survey was conducted of the accessible pipe penetrations on the slab. The location of the 12 pipe penetrations are located on map FR0910-07a in Attachment 1. Scans were conducted with a SHP 360 and accompanying smears were obtained on the accessible portion of the penetrations. The final status surveys for the piping systems will be surveyed elsewhere as required by the LTP.

The survey instruments used, their MDC values, and alarm setpoints are provided in Attachment 2.

[1] LTP Table 5-3

Background values were established, for each particular instrument probe used to scan concrete (i.e., 43-68), based on background 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	119.3 m^2	No limit for Class 3 Area
Number of Direct Measurements Required	14	Based on an adjusted LBGR of 17,049 dpm/100 cm^2, sigma[2] of 317 dpm/100 cm^2, and 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	Approximately 1 m x 1 m	Class 3 Area
Area Factor	N/A	Class 3 Area
Scan Survey Area	14 m^2	Class 3 Area: 1% - 10%
Background		
43-68 Scans (flat surfaces)	2821 dpm/100 cm^2	Ambient and Material
Scan Investigation Level	50% of DCGL See Table 2-2	LTP Revision 3
DCGL	18,000 dpm/100 cm^2	LTP Revision 3
Design $DCGL_{EMC}$	N/A	Class 3 Area

C. SURVEY RESULTS

As required, 14 concrete samples were obtained from the Fire Pump House slab. The resulting concrete volumetric sample measurement data, converted to surface activity in dpm/100 cm^2, are presented in Table 2. All direct measurements were below the DCGL.

No scan alarms occurred within this survey unit scan location. Therefore, no investigations were required.

[2] LTP Table 5-1B, B0400, Fire Pump House

TABLE 2

DIRECT MEASUREMENTS

Sample Number	Cs-137 (dpm/100 cm^2)	Co-60 (dpm/100 cm^2)
FR0910-02-3-C001	< 18.4	< 21.6
FR0910-02-3-C002	< 21.9	< 24.6
FR0910-02-3-C003	< 18.8	< 22.6
FR0910-02-3-C004	< 21.8	< 25.4
FR0910-02-3-C005	< 25.4	< 26.1
FR0910-02-3-C006	< 21.9	< 26.0
FR0910-02-3-C007	< 21.1	< 25.0
FR0910-02-3-C008	< 25.6	< 23.9
FR0910-02-3-C009	< 24.3	< 28.3
FR0910-02-3-C010	< 27.6	< 34.7
FR0910-02-3-C011	< 25.0	< 25.5
FR0910-02-3-C012	< 29.8	< 34.3
FR0910-02-3-C013	< 27.3	< 29.2
FR0910-02-3-C014	< 23.8	< 29.6
Mean	**23.8**	**26.9**
Median	**24.0**	**25.7**
Standard Deviation	**3.3**	**3.9**
Range	**18.4 to 29.8**	**21.6 to 34.7**

NOTES:
1. Sample collected over an area of 6 by 9 inches or 348.4 cm^2.
2. Table 2 represents volumetric results converted to surface activity.
3. "<" indicates values at the MDA prior to conversion.

D. SURVEY UNIT INVESTIGATIONS AND RESULTS

Scanning results of the concrete slab did not produce any alarms; therefore, no investigations were conducted.

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. The concrete sampling results yielded no positive indications of plant-derived nuclides. The sample results were converted to surface activity as indicated in Table 2. The mean and median activities were a small fraction of the DCGL (18,000 dpm/100 cm^2). The maximum direct sample result for combined Cs-137 and Co-60 activity was 64.1 dpm/100 cm^2.

The combined mean residual contamination level is 50.7 dpm/100 cm^2. This is equivalent to an annual dose of 8.48E-04 mrem/y.[3]

[3] This annual dose equivalent is based on LTP Table 6-11 which shows the contaminated concrete dose contribution (for surfaces contaminated at the DCGL) to be 0.301 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, 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 18,000 dpm/100cm^2.

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 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.

As mentioned in Section B, the entrances of 12 pipe penetrations were scanned with a SHP 360 and smeared to check for loose alpha and beta activity. The maximum penetration scan value was 200 c/m which was equivalent to 8023 dpm/100 cm^2 gross activity. The net result after subtracting ambient background is 6458 dpm/100 cm^2. The smear results were less than the alpha MDA of 3.2 dpm/100 cm^2 and the beta MDA of 3.5 dpm/100 cm^2 (except two smears that were positive for beta but were below 5 dpm). These results demonstrate that the pipe penetrations do not pose a risk to the final status survey results for FR-0910 Survey Unit 2.

G. CHANGES IN INITIAL SURVEY UNIT ASSUMPTIONS ON 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 standard deviation was less than the design sigma. Thus, no additional measurements were required.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 2 was designed, performed, and evaluated in late 2002. The design was performed to the criteria of the LTP, Revision 2. The only subsequent change with the potential to impact this survey unit was the establishment of a scan MDC for gas filled detectors (Reference 2).

This LTP change was evaluated and found to have no impact on the results or conclusions of the FSS of FR-0910 Survey Unit 2.

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 the DCGL of 18,000 dpm/100 cm^2.

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 normal distribution, with one outlier.

The scan survey design for this survey unit was developed in accordance with the LTP with significant aspects of the design discussed in Section B and Table 1. Scanning resulted in no verified alarms; therefore, no investigations were required.

It is concluded that FR-0910, Survey Unit 2, met 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, Maine Yankee letter to the NRC, MN-02-048, dated October 15, 2002

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

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

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

6. MY letter to the NRC, MN-03-049, dated September 11, 2003, "Proposed Change: Revised Activated Concrete DCGL and More Realistic Activated Concrete Dose Modeling"

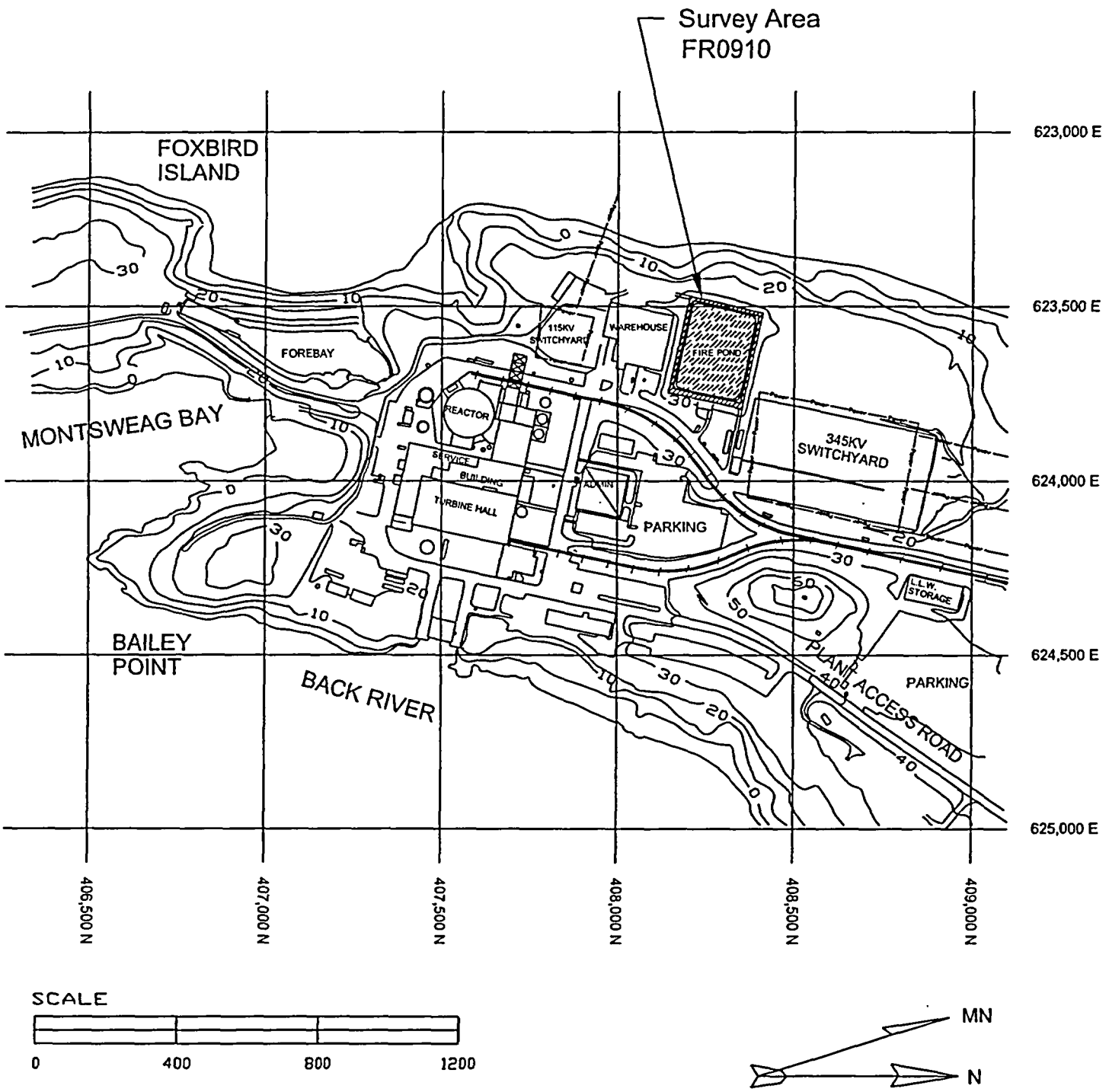
7. NRC Letter to Maine Yankee, dated February 18, 2004, Approval of Activated Concrete Amendment

8. MY letter to the NRC, MN-03-009, February 26, 2003

Attachment 1

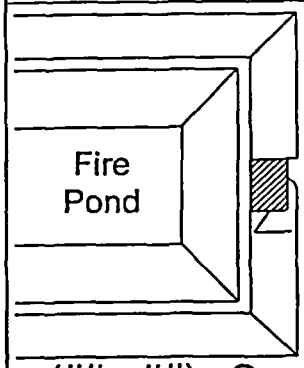
Survey Unit Maps

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR-0910-01
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Fire Pond	



Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0910-06

Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey | Survey Area Name: Fire Pump House



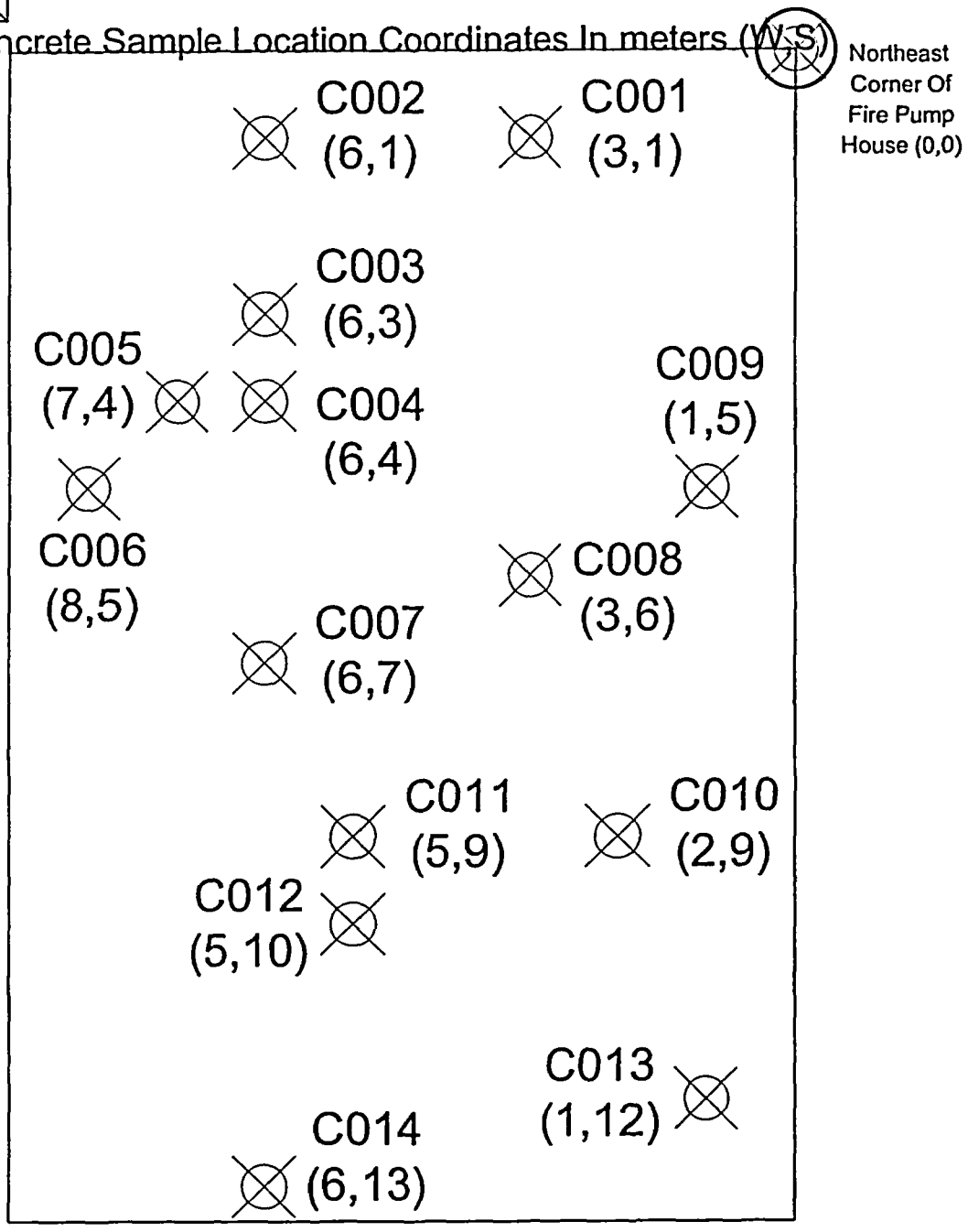
Fire Pump House Foot Print
FR 0910 Survey Unit 02
Concrete Sample Locations

⊗ - Concrete sample Location

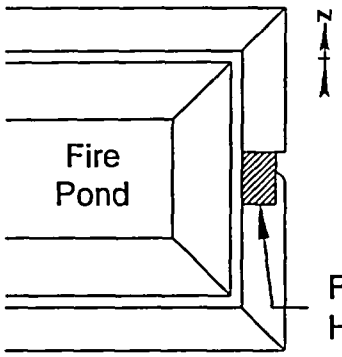
N

Starting At The Northeast Corner Of The Fire Pump House Footprint

(## - ##) - Concrete Sample Location Coordinates In meters (W,S)



Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0910-07
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Fire Pump House	



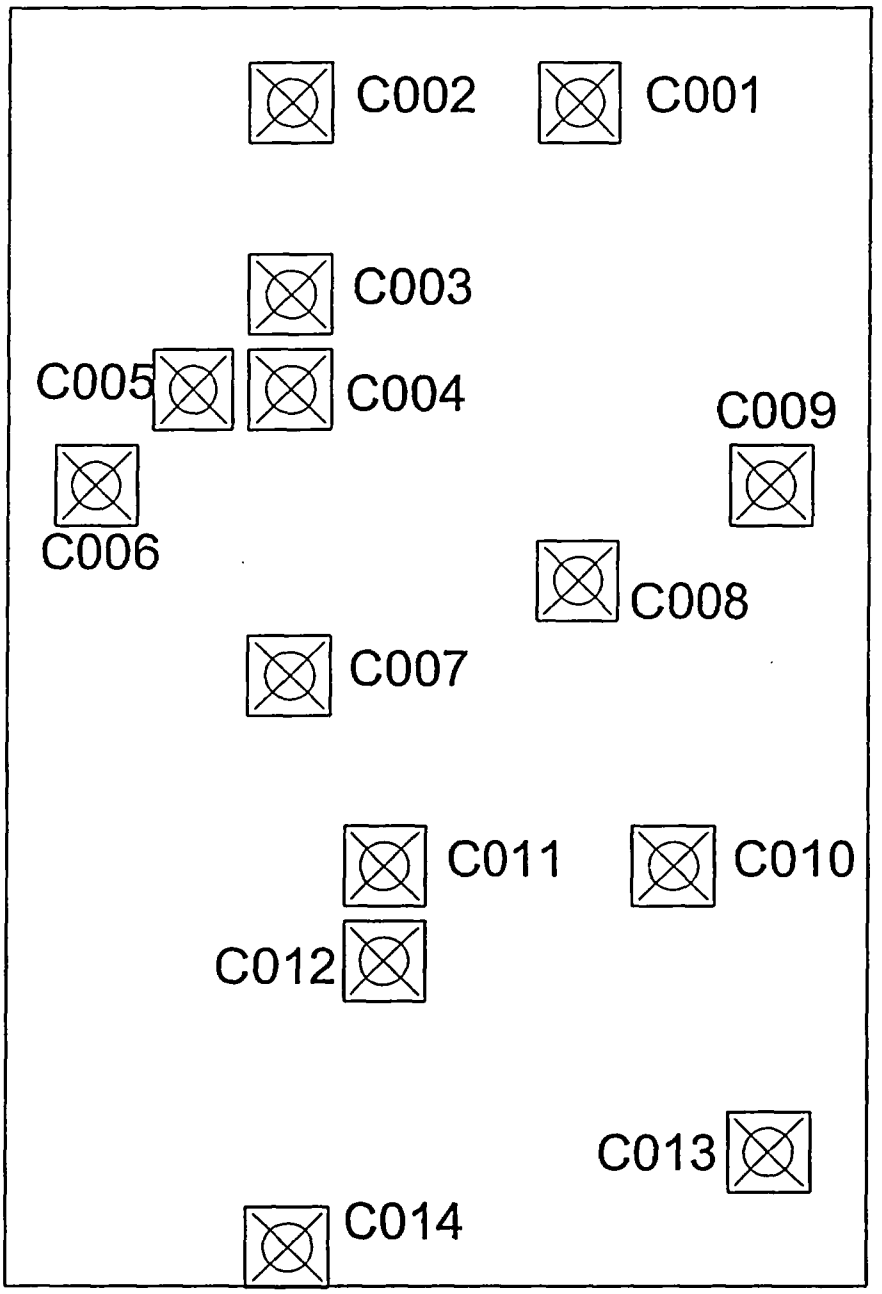
Fire Pump House Foot Print
FR 0910 Survey Unit 02
Concrete Scan Locations

N

Fire Pump House

⊗ - Concrete sample Location

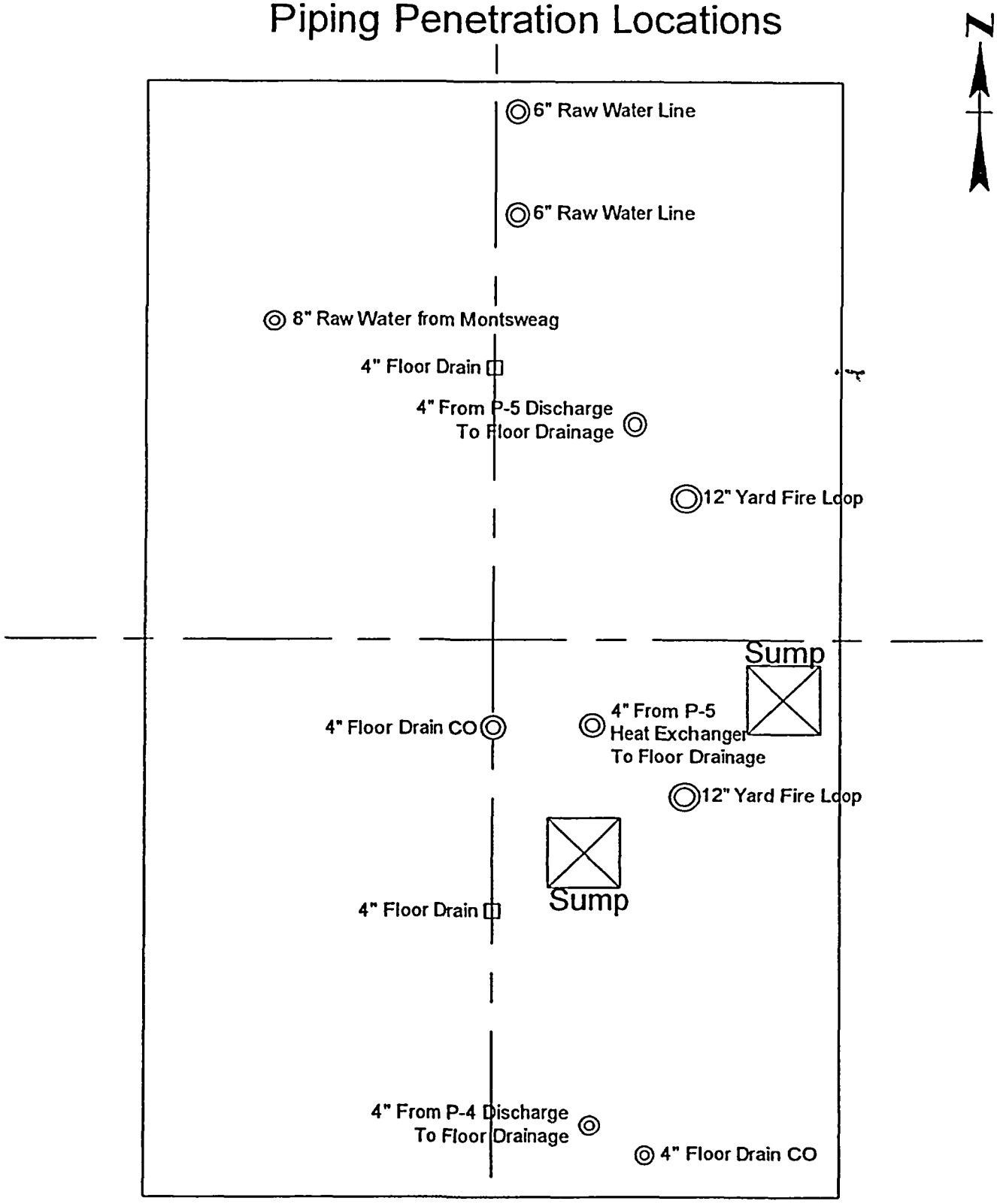
☐ - Concrete Scan Location (.85 square meter)



Total Area: 119.3 Sq Meters
14 Scan Areas - .84 SQ meters
for a total of 11.9 SQ meters
scanned in this area.

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FR 0910-07a
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Fire Pump House	

Fire Pump House Foot Print
FR 0910 Survey Unit 02
Piping Penetration Locations



Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
1619	148117 (43-68)
1647	467 (SHP360)

HPGe Detectors for Lab Analysis of Volumetric Samples

Detector Number	MDC (pCi/g)
DET 2	0.05 – 0.13
DET 3	0.05 – 0.13

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Detector	43-68 (Flat)	Comments
Scan MDC (dpm/100 cm^2)	1,832	LTP Table 5-6
DCGL (dpm/100 cm^2)	18,000	LTP Revision 3
Investigation Level (Alarm Setpoint) (dpm/100 cm^2)	9,000	~ 50% DCGL

Attachment 3

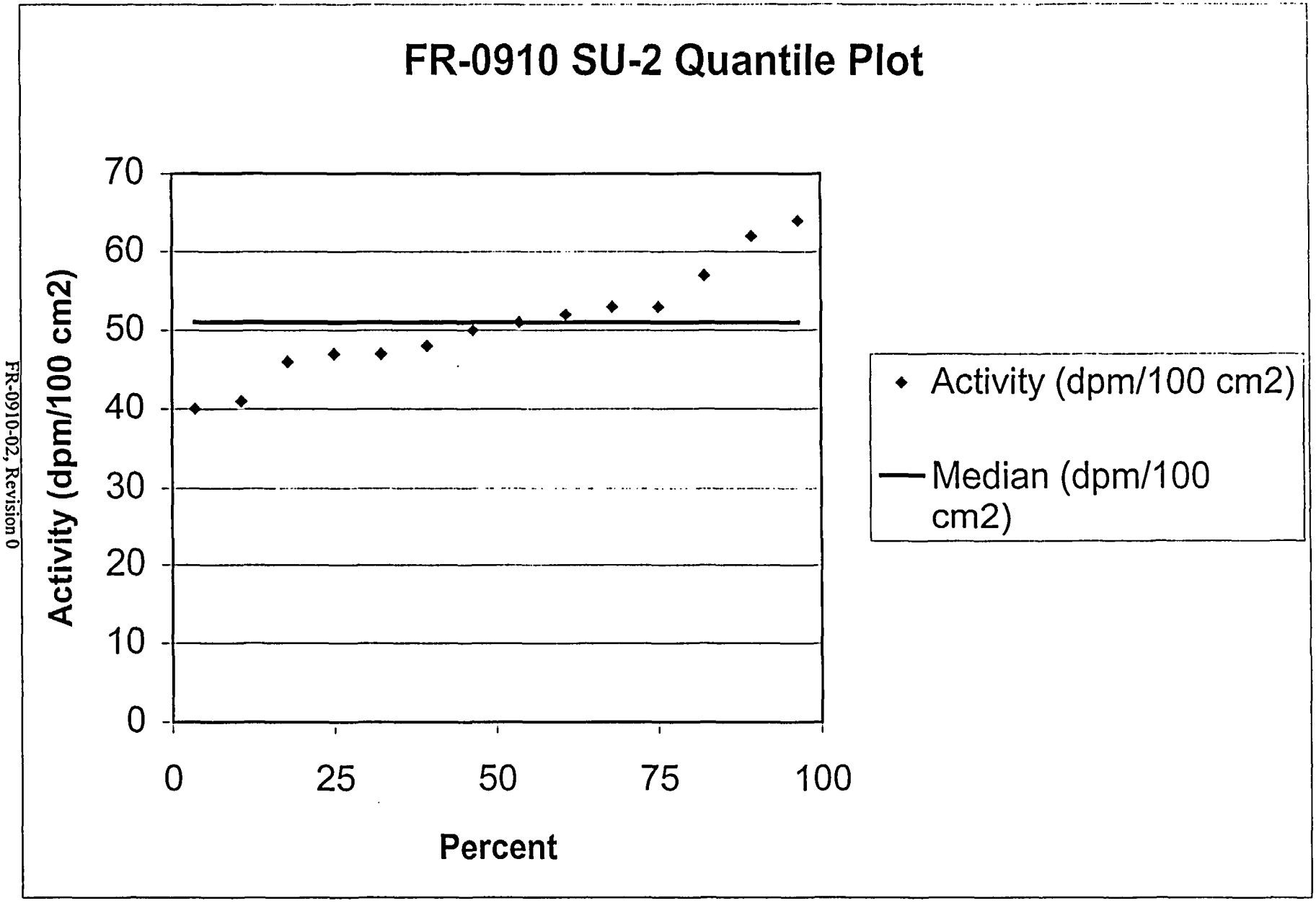
Investigation Table
(None Required)

Attachment 4

Statistical Data

Survey Package FR-0910 Unit 2 Surface Sign Test Summary

Evaluation Input Values:		Comments
Survey Package:	FR-0910	Fire Pond Pump House
Survey Unit:	02	
Evaluator:	GP	
$DCGL_w$:	18,000	
$DCGL_{emc}$:	18,000	
LBGR:	9,000	
Sigma:	317	
Type I error:	0.05	
Type II error:	0.05	
Total Instrument Efficiency:	13.0%	
Detector Area (cm^2):	126	
Material Type:	N/A	Choosing 'N/A' sets material background to "0"
Calculated Values		**Comments**
$Z_{1-\alpha}$:	1.645	
$Z_{1-\beta}$:	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	28.3	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	
Static Data Values		**Comments**
Number of Samples:	14	
Median:	51	
Mean:	51	
Net Static Data Standard Deviation:	7	
Total Standard Deviation:	7	SRSS
Maximum:	64	
Sign Test Results		**Comments**
Adjusted N Value:	14	
S+ Value:	14	
Critical Value:	10	
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	
Sign test results:	Pass	
Final Status		**Comments**
The survey unit passes all conditions:	Pass	


FR-0910 SU-2 Quantile Plot
Activity (dpm/100 cm2)
70
60
50
40
30
20
10
0
0
25
50
75
100
Percent
Activity (dpm/100 cm2)
Median (dpm/100 cm2)

One-Sample T-Test Report

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Database	C:\Program Files\NCSS97\Fr0910C.S0
Variable	C2

Plots Section

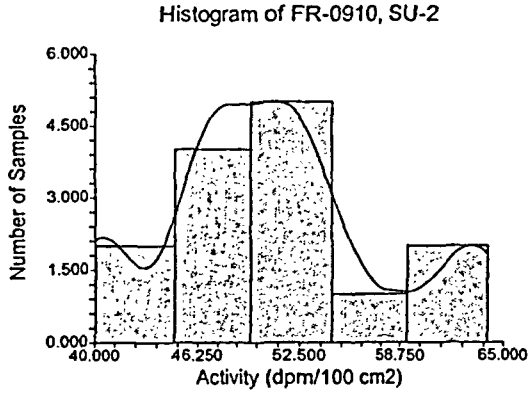

Chart Section