MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FD-3500 STORM DRAINS
SURVEY UNIT 4

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FD-3500 STORM DRAINS
SURVEY UNIT 4

A. SURVEY UNIT DESCRIPTION

Survey Unit 4 is a portion of Survey Area FD-3500, the Storm Drains survey area. The Storm Drains accommodated the overboard discharge of surface water through buried piping of varying diameters and material types across the developed portion of the site. The survey area consists of Class 1 and Class 3 piping sections. The classification of individual piping sections was based on their potential for contamination, this determination was based primarily on location. The survey classes for particular sections are specified in section 5A of the License Termination Plan (LTP, Reference 1).

Survey Unit 4 consists of storm drain piping in the vicinity of the Warehouse and Fire Pond areas. This included concrete piping upstream of manhole 27 (the SU's system low point) and is designated as Section 7 in the LTP. The survey unit also includes an unconnected section of 8" PVC storm drain line that ran under Warehouse 2/3. This portion of the system is located near grid coordinate 408,000 N and 623,750 E using the Maine State Coordinate System (West Zone) NAD 1927. The associated piping is shown in relation to other major site structures in map FD 3500-4 SITE. All maps referenced in this release record are provided in Attachment 1 unless otherwise noted. The survey unit is approximately 162.6 m^2.

B. SURVEY UNIT DESIGN INFORMATION

The area was incorrectly designated a Class 1 piping survey unit per the LTP (Attachment 5A). Due to its location and low potential for containing residual contamination, this section of pipe was reclassified to Class 3 in accordance with the LTP and site procedures.

The survey unit design parameters are shown in Table 1. Given an adjusted relative shift of 3.0, it was determined that 14 direct measurements were required for the Sign Test; however, the number of samples was increased because the LTP also requires a minimum of 30 direct samples points. Therefore, 30 measurements were taken.

A representative portion of the system piping, obtained from the system low point, was excavated and placed in secure storage to accommodate surveys due to accessibility and safety concerns. The lowest elevation of the survey unit is considered to be an appropriate location for sampling, as is suggested by the LTP as a key element of the survey design for Class 3 piping. Measurement locations were randomly distributed over the interior circumference and length of this pipe. The location from which the pipe section was removed is shown on map FD3500-4 REF. The direct measurement locations are illustrated on map FD3500-4b.

The survey was also designed to include 16 scan grids for flat surfaces, each of 0.18 m^2 area (see map FD 3500-4a) for a total area of 2.9 m^2. This meets the 1% to 10% scan requirement for a Class 3 area. Instrument scan setpoints were approximately set at the DCGL plus background, as shown in Table 2-2 (Attachment 2).

To accommodate measurement geometry requirements for surfaces of differing curvatures, the 43-68 data was evaluated with a reduced surface efficiency of 10.4%, which is appropriate for concrete pipe with an ID of 15" (Reference 5).

Ambient background was established for the 43-68 instrument probe based on local scaler measurements in the survey unit. The average scaler value for background, listed in Table 1, was used to establish net activity for direct measurements. Material backgrounds were not used.

Since scan measurements are performed in peak hold mode, it is appropriate to apply a peak hold background for calculating scan setpoints. The background applied was the peak hold average ambient value used in determining the material background for concrete (622 cpm) Reference 6.

The instruments used in this survey are listed by model and serial number in Attachment 2 (Table 2-1). Scan MDCs are also listed in Attachment 2 (Table 2-2) and are compared to the DCGL and the investigation level. As shown in this table, the scan MDC is less than the scan investigation level in all cases, thus providing high confidence (95% or higher) that an elevated area would be detected in the scanning process.

TABLE 1

SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	162.6 m^2	
Number of Direct Measurements Required	30	Based on an adjusted LBGR of 8,576 dpm/100cm^2, sigma[1] of 408 dpm/100 cm^2, and a relative shift of 3.0. N=14 for Type I = Type II = 0.05 Minimum = 30 per the LTP Attachment 5A
Sample Area	N/A	Class 3
Sample Grid Spacing	N/A	Class 3
Scan Grid Area	0.18 m^2	6" bands for 15" diameter piping
Area Factor	N/A	Class 3
Scan Survey Area	2.9 m^2 (1.8%)	Class 3 (1– 10%) required
Background		
43-68 Direct (dry concrete surfaces)	2,289 dpm/100 cm^2	Ambient Scaler Value
43-68 Scan (dry concrete surfaces)	4,747 dpm/100 cm^2	Peak hold ambient value (Reference 6)
Scan Investigation Level	DCGL plus background	See Table 2-2 (Attachment 2)
DCGL	9,800 dpm/100 cm^2	LTP, Rev. 3
Design $DCGL_{EMC}$	N/A	Class 3

C. SURVEY RESULTS

Thirty direct measurements were made in Survey Unit 4. The direct measurements were less than 50% of the DCGL. The resulting data are presented in Table 2. No verified alarms were received during the surface scans. Therefore, no investigations were required.

[1] Design sigma is based an averaging of sigma values from selected areas drained in FD 3500.

TABLE 2

DIRECT MEASUREMENTS

Sample Location	Gross Activity dpm/100 cm^2	Net Activity (Table 1 Background Subtracted) dpm/100 cm^2
FD3500043C001BD4368	3,396	1,107
FD3500043C002BD4368	4,594	2,305
FD3500043C003BD4368	3,671	1,381
FD3500043C004BD4368	3,800	1,511
FD3500043C005BD4368	3,823	1,534
FD3500043C006BD4368	3,915	1,625
FD3500043C007BD4368	3,442	1,152
FD3500043C008BD4368	3,770	1,480
FD3500043C009BD4368	3,518	1,229
FD3500043C010BD4368	3,114	824
FD3500043C011BD4368	4,060	1,770
FD3500043C012BD4368	3,312	1,023
FD3500043C013BD4368	3,365	1,076
FD3500043C014BD4368	3,419	1,129
FD3500043C015BD4368	3,602	1,313
FD3500043C016BD4368	3,770	1,480
FD3500043C017BD4368	3,465	1,175
FD3500043C018BD4368	4,228	1,938
FD3500043C019BD4368	3,900	1,610
FD3500043C020BD4368	3,549	1,259
FD3500043C021BD4368	3,251	962
FD3500043C022BD4368	3,426	1,137
FD3500043C023BD4368	2,991	702
FD3500043C024BD4368	3,938	1,648
FD3500043C025BD4368	3,785	1,496
FD3500043C026BD4368	3,472	1,183
FD3500043C027BD4368	3,365	1,076
FD3500043C028BD4368	3,442	1,152
FD3500043C029BD4368	3,770	1,480
FD3500043C030BD4368	3,724	1,435
Mean	**3,629**	**1,340**
Median	**3,575**	**1,286**
Standard Deviation	**333**	**333**
Sample Range	**2,991 to 4,594**	**702 to 2,305**

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

No investigations were required as there were no verified scan alarms and all direct measurements were below 50% of the DCGL.

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. Without subtracting background, all direct measurement results were less than 50% of the DCGL. The maximum direct sample result with background subtracted was equivalent to 2,305 dpm/100 cm^2.

When adjusted for background, the mean of the direct measurements is 1,340 dpm/100 cm^2. This is equivalent to an annual dose of 0.0004 $mrem^2$.

There were no verified alarms, and therefore there were no investigations.

F. ADDITIONAL DATA EVALUATION

Attachment 4 provides additional data evaluation associated with Survey Unit 4, 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 Sign Test Summary table calculated the total standard deviation by propagating the individual standard deviation values used in the subtracted background survey design (using the square root of the sum of the squares method). Therefore, median, mean, and standard deviation values listed in the Sign Test Summary table are slightly different from those listed in Table 2. These differences, however, are minor and have no impact on the statistical analysis or conclusions.

   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, except for the final sigma exceeding the design sigma, all of the key release criteria were clearly satisfied for the FSS of this survey unit. The difference in sigma values is discussed further in Section G.

2. The Quantile Plot was generated from direct measurement data listed in Table 2 and indicates general symmetry about the median. The data set and plot are consistent with expectations for a Class 3 survey unit. There is no reason to conclude that the data set represents other than random variations in a Class 3 concrete surface survey unit. It also should be noted that the maximum net activity (2,305 dpm/100 cm^2 at location C002) is well below 50% of the DCGL of 9,800 dpm/100 cm^2.

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[2] From table 6-11 of the LTP, the buried piping dose is 2.52E-03 mrem/y, therefore, (1,340/9,800) x 2.52E-03 = 0.0004 mrem/y.

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 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. The total standard deviation was essentially equal to the design sigma (408 dpm/100 cm^2 vs 409 dpm/100 cm^2). Thus, a sufficient number of sample measurements were taken.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 4 was designed and performed using the criteria of the approved LTP (Revision 3 Addenda). The only subsequent LTP changes (with potential impact to this FSS) were provided in the proposed license amendment related to modifications of the activated concrete remediation plan submitted September 11, 2003 (Reference 4). Changes represented in this later proposed license amendment have been evaluated and have no impact on the design, conduct, or assessment of the final status survey of Survey Unit 4.

I. CONCLUSION

The FSS of this survey unit was designed based on the reclassified 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 beta direct measurements were less than the DCGL of 9,800 dpm/100 cm^2.

A Sign Test Summary analysis demonstrated that the Sign Test criteria were satisfied. The direct measurement total sigma was determined to be essentially equal to 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 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 a no verified alarms. Since there were no alarms, no investigations were required.

It is concluded that FD-3500 Survey Unit 4 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

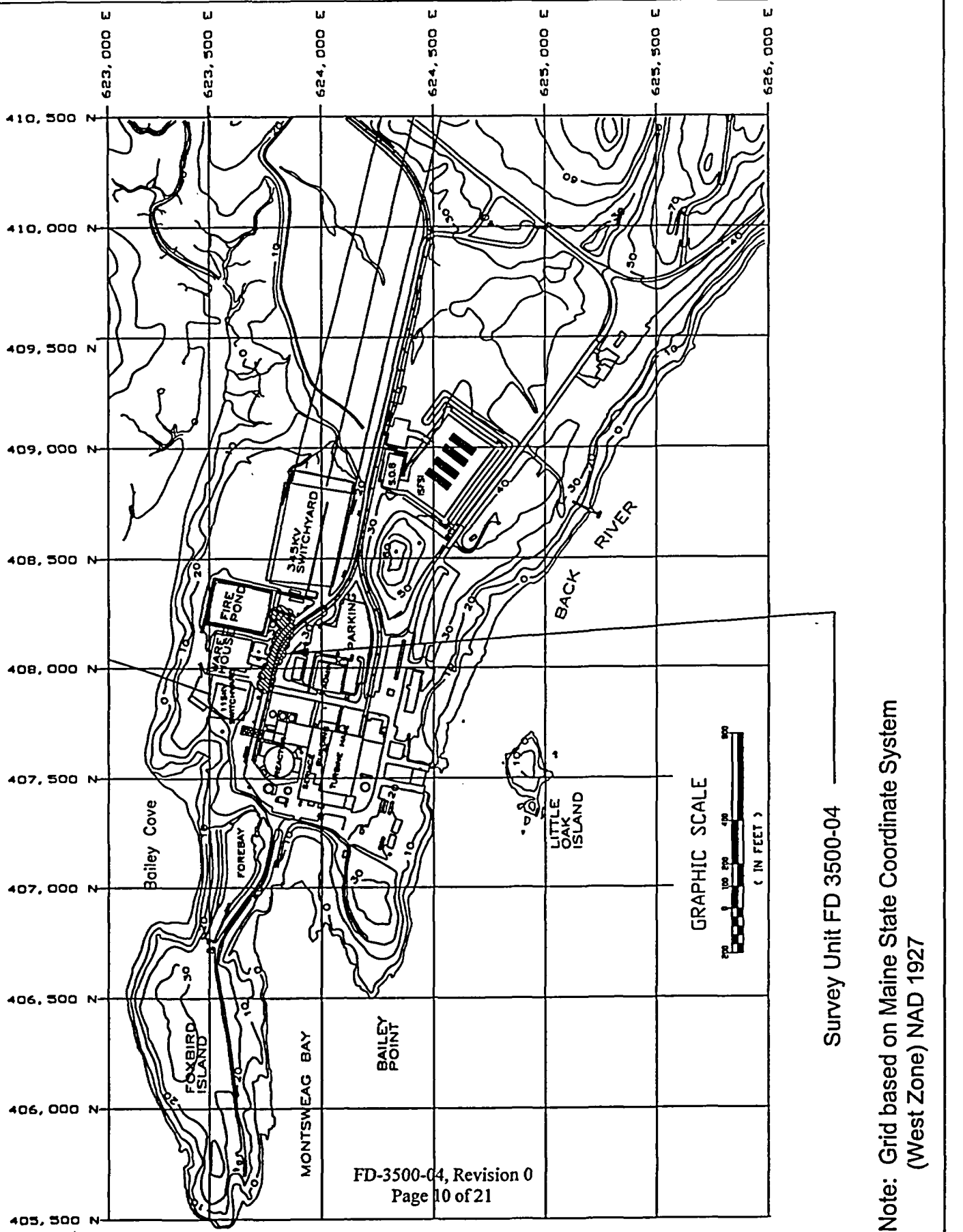
J. REFERENCES

1. Maine Yankee License Termination Plan, Revision 3, October 15, 2002
2. Maine Yankee letter to the NRC, MN-02-061, dated November 26, 2002
3. NRC letter to Maine Yankee, dated February 28, 2003
4. Maine Yankee letter to the NRC, MN-03-049, dated September 11, 2003
5. Maine Yankee Calculation EC-010-01
6. Maine Yankee Calculation EC-039-01

Attachment 1

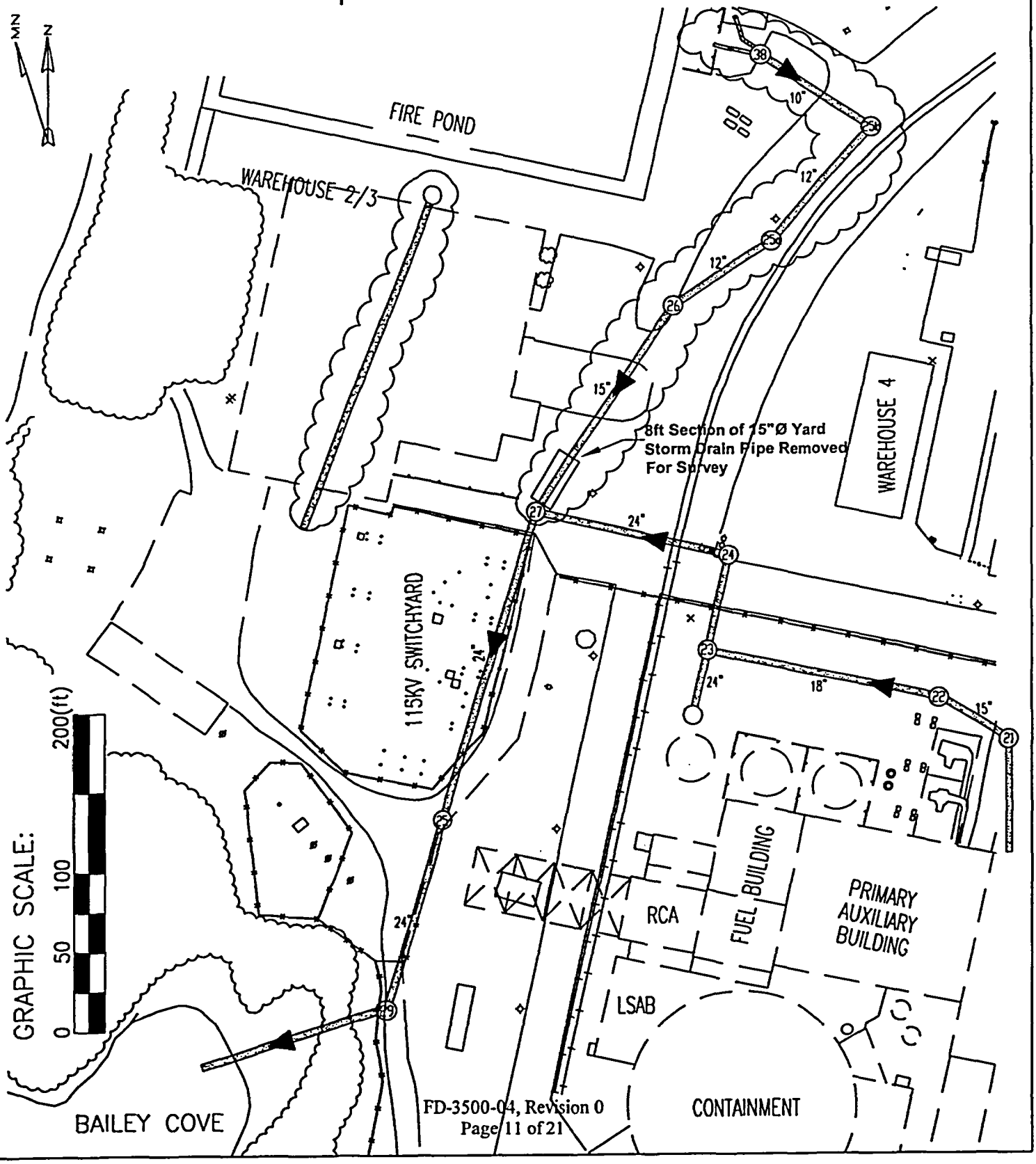
Survey Unit Maps

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FD 3500-4 SITE Revised: 3-7-05
Survey Type: ☐ Characterization ☐ Turnover ■ Final Status Survey	Survey Area Name: Yard Storm Drains and Outfalls	



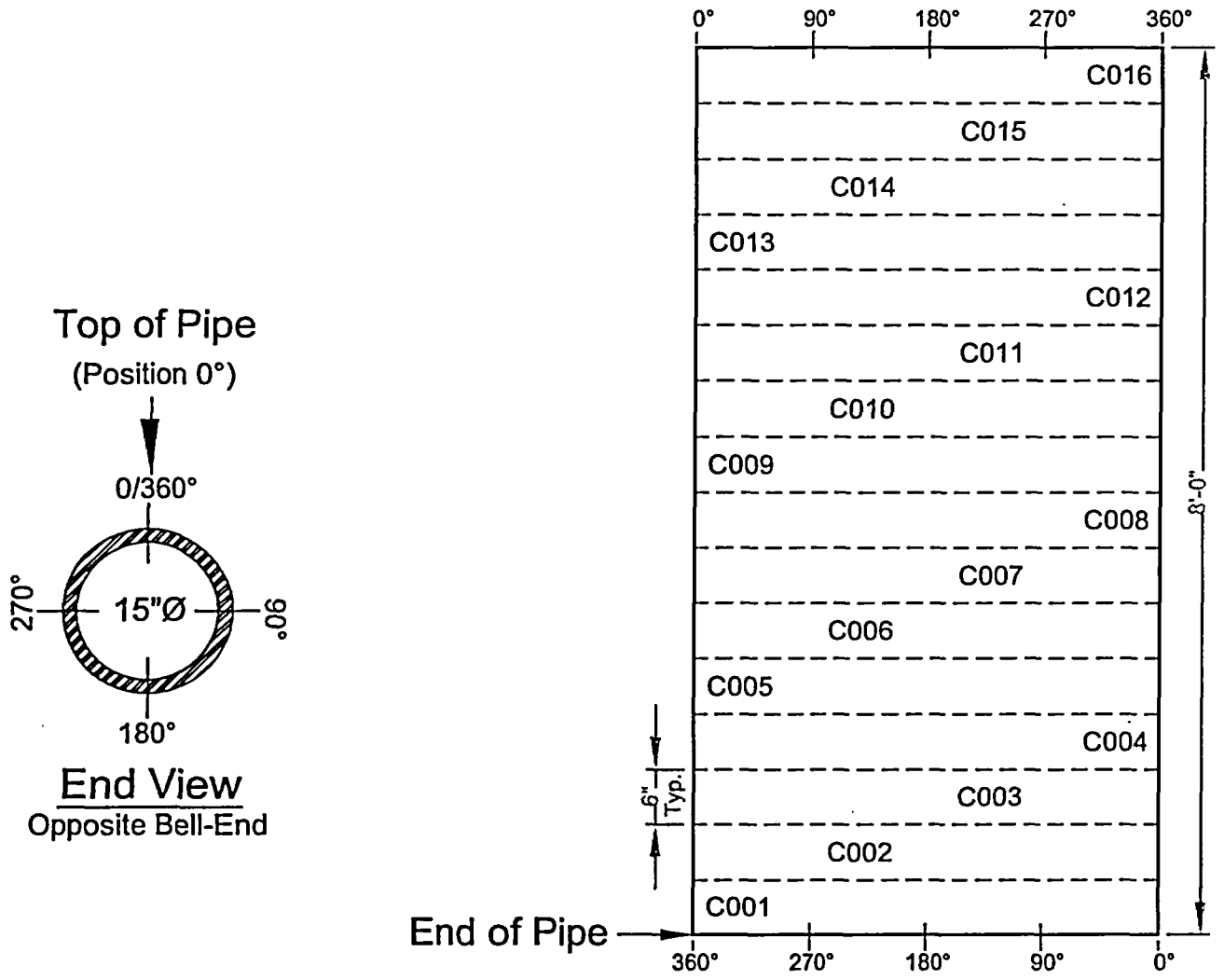
Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FD3500-4 REF Date: 3/7/05
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Yard Storm Drains and Outfalls	

Final Status Survey
FD3500 SU4: Yard Storm Drains and Outfalls
Pipe Location Reference

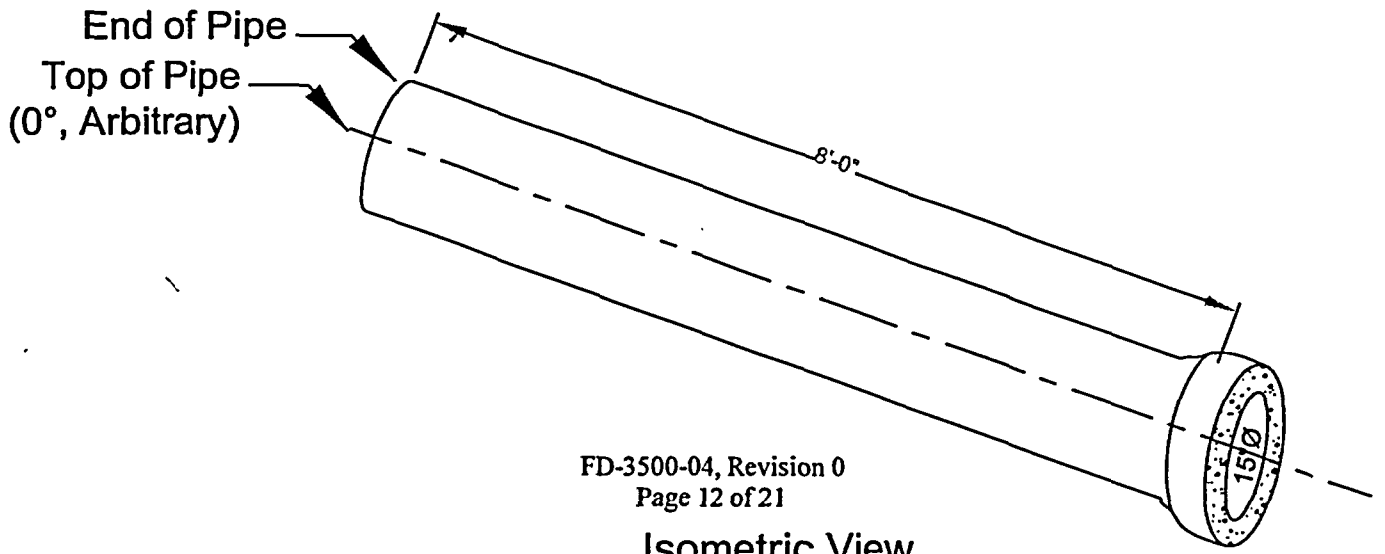


Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FD3500-4a Date: 1/25/05
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Yard Storm Drains and Outfalls	

Final Status Survey
FD3500: Yard Storm Drains and Outfalls
Survey Scans C001 - C016



End View
Opposite Bell-End

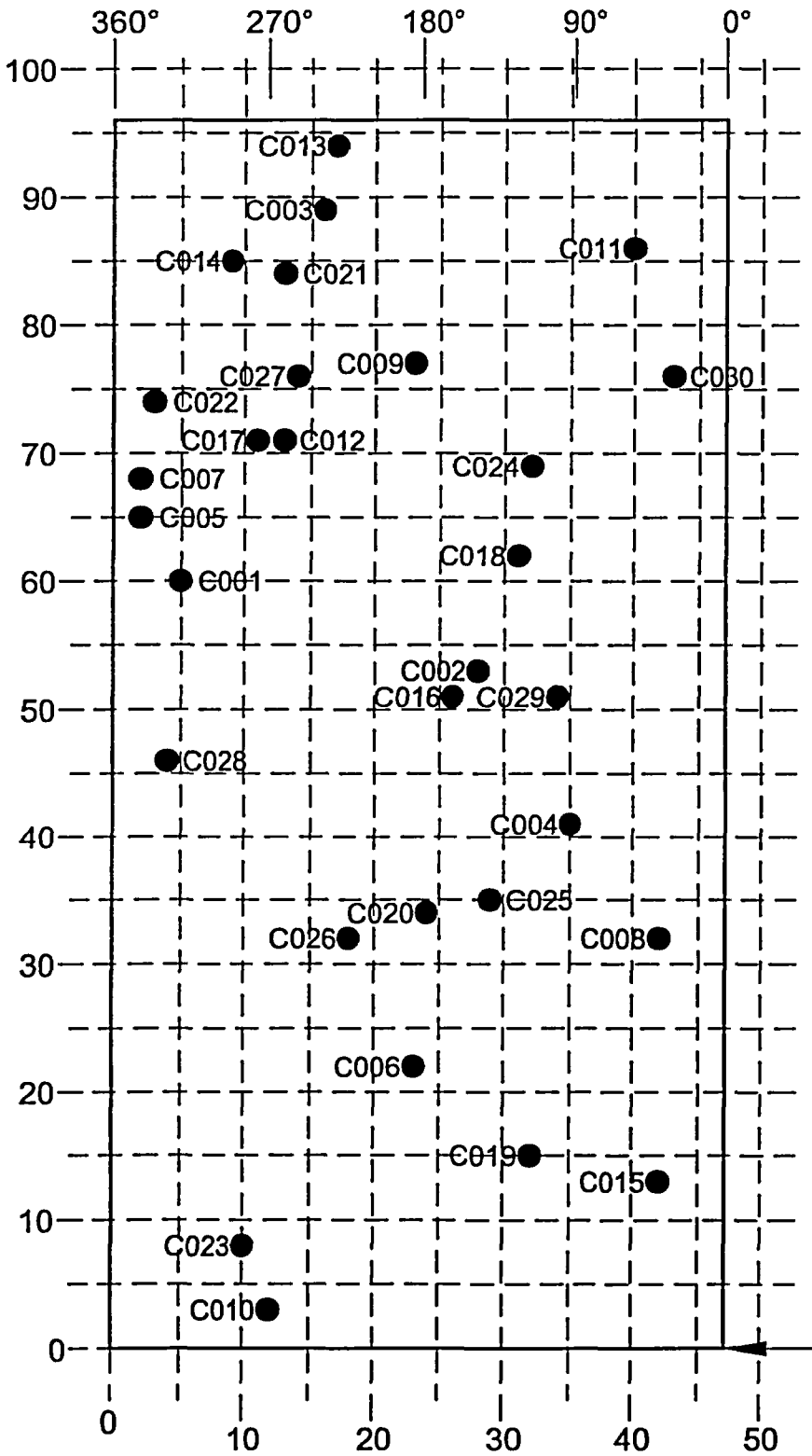


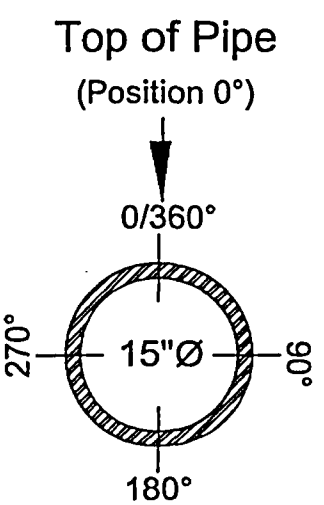
Isometric View

Total Scanned Area = 2.92 sq-m

Maine Yankee Decommissioning Team	*Maine Yankee Decommissioning Project Survey Form*	Map ID #: FD3500-4b Revised : 1/25/05
Survey Type: ☐ Characterization ☐ Turnover ☒ Final Status Survey	Survey Area Name: Yard Storm Drains and Outfalls	

Final Status Survey
FD3500: Yard Storm Drains and Outfalls
Direct Points C001 - C030





End View
Opposite Bell-End

Attachment 2

Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
2489	177991 (43-68-5)

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Detector	43-68 15"dia. dry surfaces
Scan MDC (dpm/100 cm^2)	2,290 (Note 1)
DCGL (dpm/100 cm^2)	9,800
Investigation Level (Alarm setpoint) (dpm/100 cm^2)	14,545 (≈ DCGL plus background) (Note 2)

NOTES:

1. Separate scan MDC developed for the 43-68 when applied to the pipe geometry by adjusting the LTP Table 5-6 value for the change in efficiency.

2. The survey was initially designed and implemented using an efficiency for flat concrete (0.13) which resulted in an investigation level of 1,900 cpm. This instrument setpoint corresponded to a level which would have exceeded the DCGL + background when the curved concrete efficency was applied (0.104). However, when the setpoints were re-evaluated, it was found that by using a peak hold ambient background (622 cpm) and a curved efficiency (0.104) the setpoint stands at approximately 1,900 cpm. All measurements were less than the investigation level shown in Table 2-2.

Attachment 3

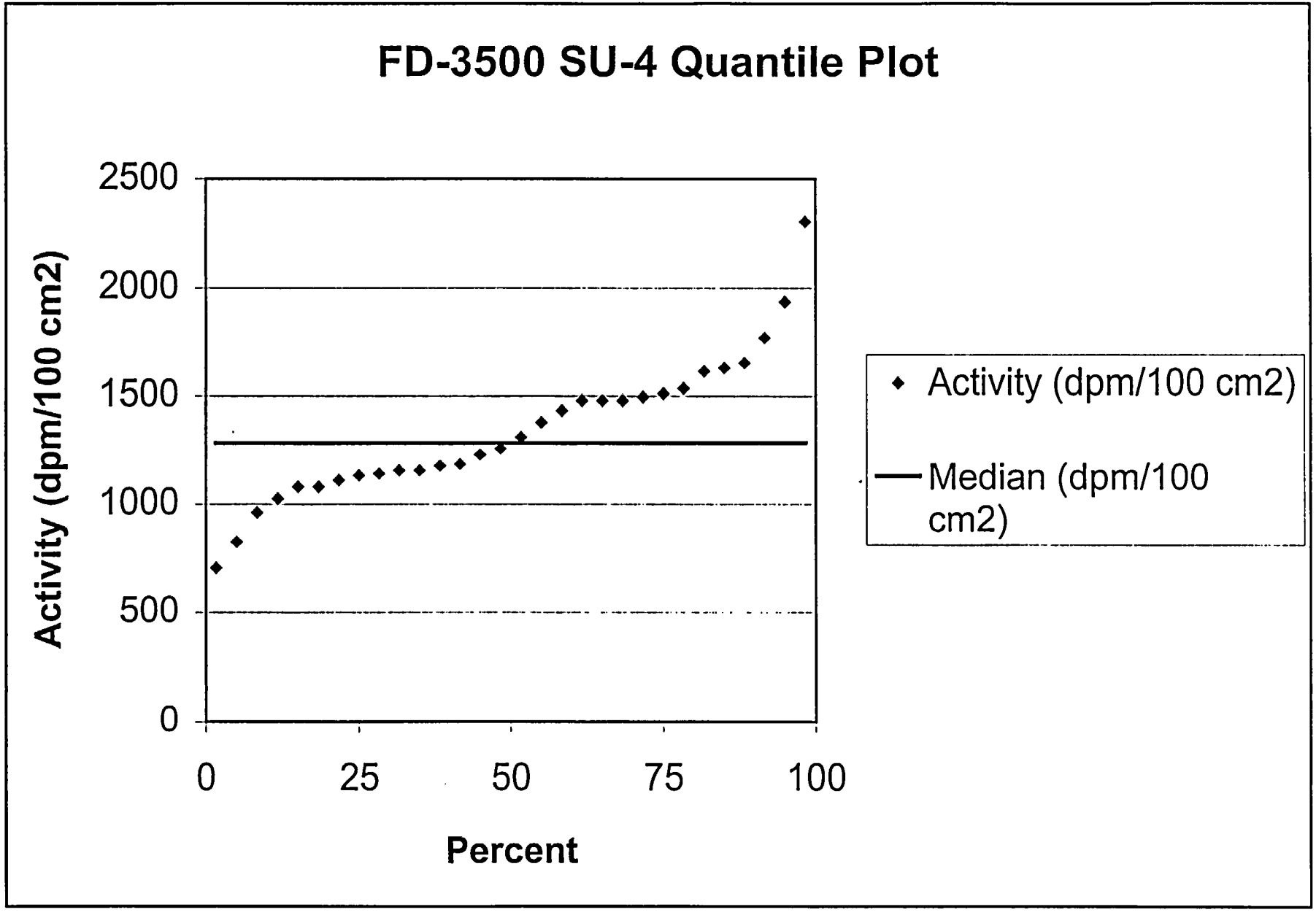
Investigation Table
(No Investigations Required)

Attachment 4

Statistical Data

Survey Package FD3500 Unit 4 Surface Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FD3500	Class 3 piping
Survey Unit:	04	Storm Drain piping
Evaluator:	DR	
$DCGL_w$:	9,800	
$DCGL_{emc}$:	9,800	N/A Class 3
LBGR:	8,576	
Sigma:	408	
Type I error:	0.05	
Type II error:	0.05	
Total Instrument Efficiency:	10.4%	
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:	3.0	
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:	30	
Median:	1,281	
Mean:	1,335	
Net Static Data Standard Deviation:	333	
Total Standard Deviation:	409	SRSS
Maximum:	2,300	
Sign Test Results		**Comments**
Adjusted N Value:	30	
S+ Value:	30	
Critical Value:	20	
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	Satisfactory see section F
Sign test results:	Pass	
Final Status		**Comments**
The survey unit passes all conditions:	Investigate	SU passes


FD-3500 SU-4 Quantile Plot
Activity (dpm/100 cm2)
2500
2000
1500
1000
500
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
Variable C2

Plots Section

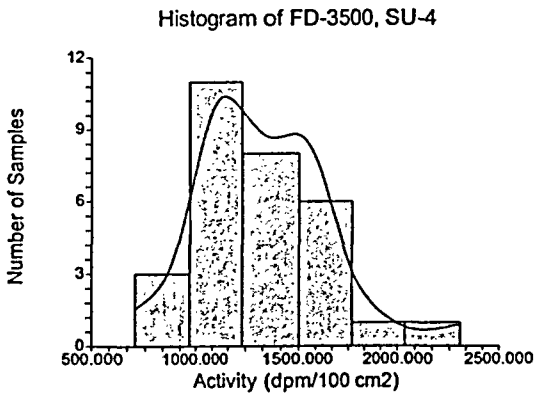

Chart Section