

**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FD-0600 SERVICE WATER
SURVEY UNIT 2**

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SURVEY UNIT 2**

A. SURVEY UNIT DESCRIPTION

Survey Unit 2 is the discharge portion of Survey Area FD-0600, Service Water. The Service Water System consisted of two buried inlet pipes that carried seawater through component cooling heat exchangers then discharged through a single buried pipe to the Forebay Seal Pit. The discharge side of the system received effluent discharges from the connected radiological liquid effluent pipe. The liquid effluent pipe had detectable levels of loose and fixed contamination, and was removed prior to performing the survey.

The survey area consists of one Class 3 piping survey unit¹. 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 Attachment 5A of the License Termination Plan (Reference 1).

Survey Unit 2 consists of the outlet side piping and was surveyed in two phases as the locations became accessible. Phase 1 consisted of concrete pipe while Phase 2 consisted of metal pipe. The surveyed portions are located near grid coordinates 407375N, 623700E (Phase 1) and 407625N, 624000E (Phase 2) using the Maine State Coordinate System (West Zone) NAD 1927. FD-0600 Survey Unit 2 is shown in relation to other major site structures in map FD0600-02 SITE. All maps referenced in this release record are provided in Attachment 1 unless otherwise noted. The survey unit is approximately 322 m².

B. SURVEY UNIT DESIGN INFORMATION

The area was designated a Class 3 piping survey unit per Attachment 5A of the LTP. To allow for timing of system accessibility, it was designed and performed in two phases. Phase 1 was performed on the area just upstream of the Forebay Seal Pit in August of 2004, and Phase 2 was performed just downstream of the radwaste inlet header in May of 2005.

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 (to accommodate an efficient field layout, 32 were taken).

¹ FD-0600 Unit 1 was intended to include the buried portions of the inlet pipes. The survey was not performed as this piping section was excavated and removed.

Direct measurement locations were determined by equally distributing the measurement locations along the circumference and length of the accessible areas of the piping. Locations are illustrated on the maps FD0600-02a and FD0600-02b.

The survey was also designed to include 10 scan grids for flat surfaces, each of approximately 0.73 m² area (again see maps FD0600-2a, FD0600-2b). 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 damp concrete surfaces and damp/rough metal surfaces, the 43-68 data was evaluated with damp concrete efficiencies, as appropriate. As an additional check, an ISOCS measurement was performed on the areas scanned for Phase 2 of the survey as shown on map FD0600-2c.

The 43-68 background values were established for each of the two phases of the survey based on local scaler measurements taken in the survey unit. These ambient background values, listed in Table 1, were used to establish net activity for direct measurements, scan alarm setpoints, and to confirm the scan MDCs used were appropriate.

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	322 m ²	
Number of Direct Measurements Required	30	Based on an LBGR of 4,900 dpm/100cm ² , sigma ² of 727 dpm/100 cm ² , and a relative shift of 6.7. Type I = Type II = 0.05, N = 14 (Minimum = 30 per the LTP)
Sample Area	N/A	Class 3
Sample Grid Spacing	N/A	Class 3
Scan Grid Area	0.73 m ²	12" bands of 30" ID pipe per scan grid
Area Factor	N/A	Class 3
Scan Survey Area	7.3 m ² (2.27%)	Class 3 (1- 10%) required
Background		
PHASE 1 43-68 Direct and Scan (damp concrete surfaces)	5,807 dpm/100 cm ²	Ambient (360 cpm) Efficiency = 0.0492 EC 033-01
PHASE 2 43-68 Direct and Scan (metal piping, damp concrete surface eff. was conservatively applied)	4,646 dpm/100 cm ²	Ambient (288 cpm) Efficiency = 0.0492 EC 033-01
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-two direct measurements were made in Survey Unit 2. Once corrected for ambient background (material backgrounds were not used), all direct measurements were less than 50% of the DCGL. The resulting data are presented in Table 2 below. No verified alarms were received during the surface scans with the 43-68 probe. The ISOCS measurement performed in Phase 2 was less than MDA for Cs-137 and detected 289 dpm/100 cm² for Co-60 (3% of the DCGL). Therefore, no investigations were required.

² Design sigma is based on the sigma value from the LTP for the Turbine Building (B0500).

TABLE 2**DIRECT MEASUREMENTS**

Sample Location	Gross Activity dpm/100 cm ²	Net Activity (Table 1 Background Subtracted) dpm/100 cm ²
FD0600-02-C001	9,227	3,420
FD0600-02-C002	8,775	2,968
FD0600-02-C003	8,808	3,000
FD0600-02-C004	8,679	2,871
FD0600-02-C005	7,114	1,307
FD0600-02-C006	6,614	807
FD0600-02-C007	7,082	1,274
FD0600-02-C008	7,678	1,871
FD0600-02-C009	7,872	2,065
FD0600-02-C010	6,630	823
FD0600-02-C011	6,888	1,081
FD0600-02-C012	6,388	581
FD0600-02-C013	7,436	1,629
FD0600-02-C014	7,291	1,484
FD0600-02-C015	7,243	1,436
FD0600-02-C016	7,662	1,855
FD0600-02-M022	5,565	919
FD0600-02-M023	5,710	1,065
FD0600-02-M024	5,565	919
FD0600-02-M025	5,662	1,016
FD0600-02-M026	5,226	581
FD0600-02-M027	5,646	1,000
FD0600-02-M028	5,856	1,210
FD0600-02-M029	5,581	936
FD0600-02-M030	7,227	2,581
FD0600-02-M031	7,275	2,629
FD0600-02-M032	7,485	2,839
FD0600-02-M033	7,598	2,952
FD0600-02-M034	5,259	613
FD0600-01-M035	5,114	468
FD0600-02-M036	4,920	274
FD0600-02-M037	4,372	-274
Mean	6,733	1,506
Median	6,985	1,242
Standard Deviation	1,257	952
Sample Range	4,372 to 9,227	-274 to 3,420

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

No investigations were required as there were no verified scan alarms.

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 below the DCGL. The maximum direct sample result with background subtracted was equivalent to 3,420 dpm/100 cm².

When adjusted for background, the mean residual contamination level is 1,506 dpm/100 cm². This is equivalent to an annual dose of 0.0004 mrem³.

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

F. ADDITIONAL DATA EVALUATION

Attachment 4 provides additional data evaluation associated with Survey Unit 2, 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).

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 design sigma, however, sufficient power is evident, particularly when one considers that 32 samples were taken for the FSS of this survey unit.

³ From Table 6-11 of the LTP, the buried piping dose is 2.52E-03 mrem/y; therefore, $(1,506/9,800) \times 2.52E-03 = 0.0004$ mrem/y.

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 survey unit. It also should be noted that the maximum net activity (3,420 dpm/100 cm² at location C001) is well below the DCGL of 9,800 dpm/100 cm².
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.

As mentioned in Section B, an ISOCS measurement was obtained at the Phase 2 location of the survey. The measurement results indicated residual Co-60 activity of 289 dpm/100 cm² which is well below the DCGL of 9,800 dpm/100 cm².

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 greater than the design sigma; however, a sufficient number of sample measurements were taken.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 2 was designed, performed, and evaluated in the August 2004 to May 2005 time frame. 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) and the issuance of Revision 4 of the LTP (Reference 5). Changes represented in these subsequent proposed license amendments have been evaluated and have no impact on the design, conduct, or assessment of the final status survey of 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 beta direct measurements were less than the DCGL of 9,800 dpm/100 cm².

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 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 (Section C). Since there were no alarms, the survey unit was determined to satisfy the elevated measurement comparison unity rule per LTP methodology.

It is concluded that FD-0600 Survey Unit 2 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

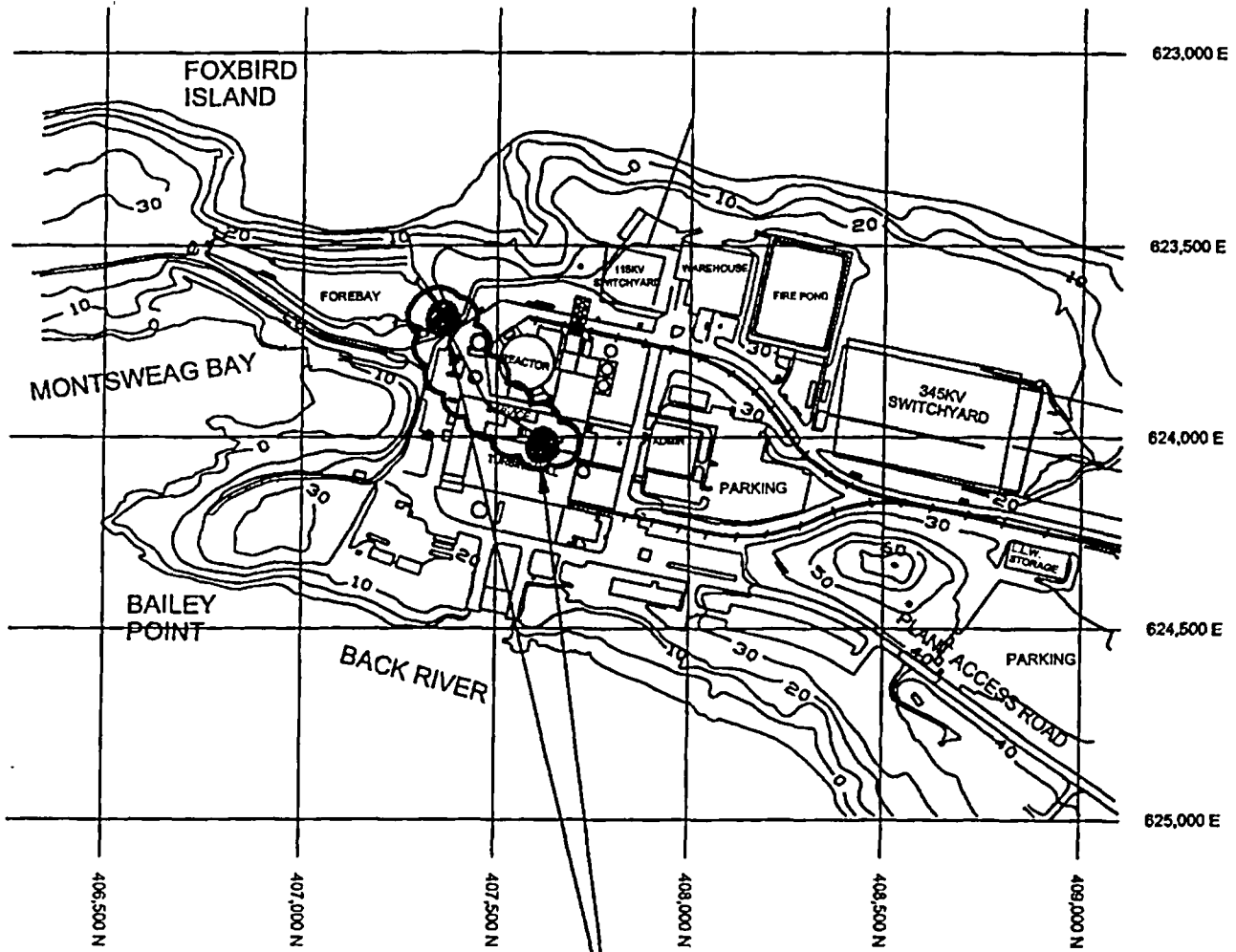
J. REFERENCES

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 License Termination Plan, Revision 4, February, 2005

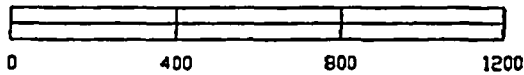
Attachment 1
Survey Unit Maps

Survey Type: Characterization Turnover Final Status Survey

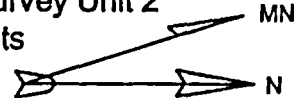
Survey Area Name: Service Water Piping System - Discharge



SCALE



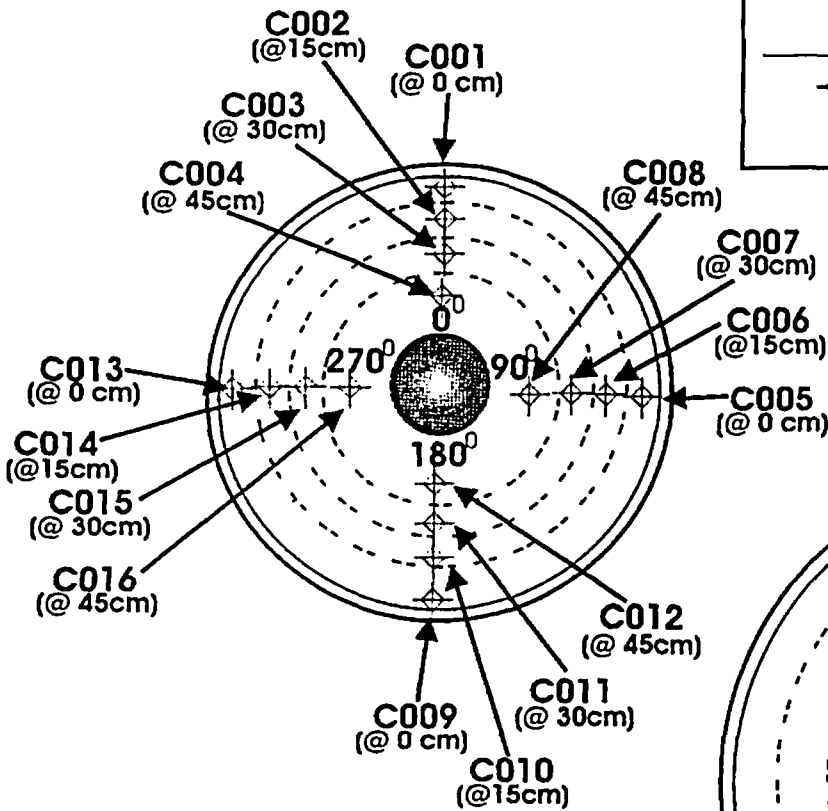
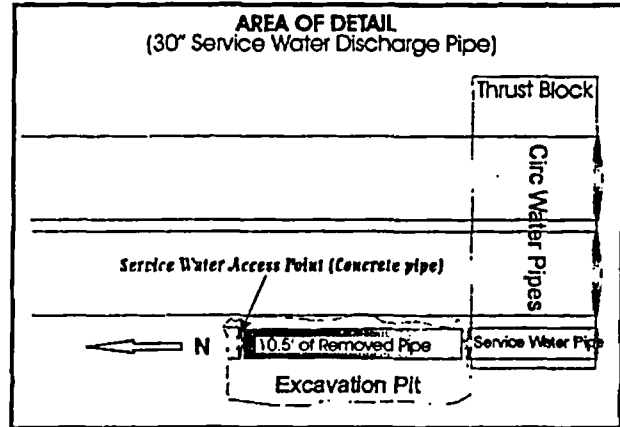
FD0600 - Survey Unit 2
Access Points



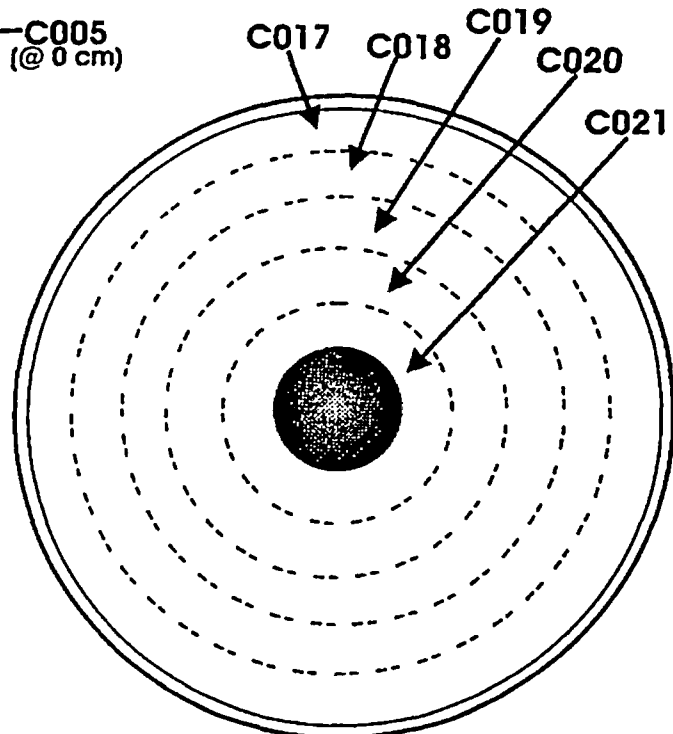
FD0600 SU2 Service Water System Piping

Direct and Scan Locations

Access Upstream of Seal Pit/Thrust Block



Service Water Discharge
DIRECT LOCATIONS
(30" Inner Diameter)



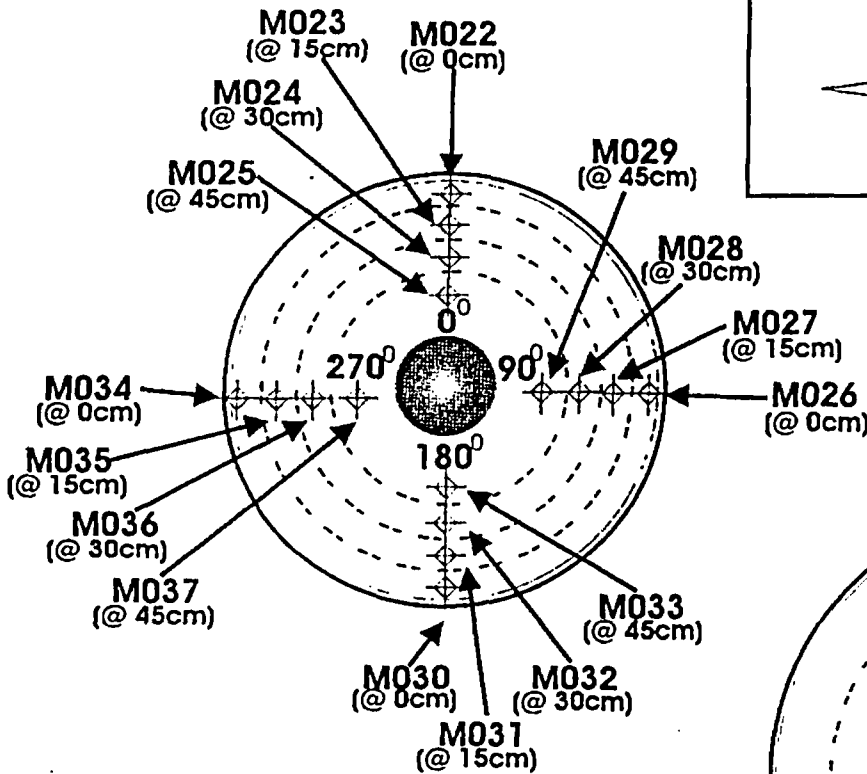
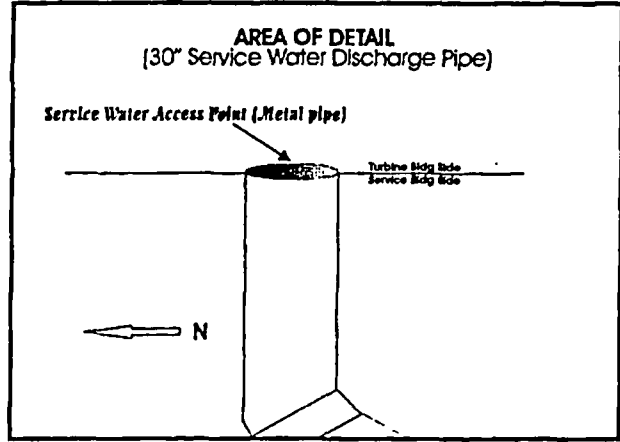
Service Water Discharge
SCAN LOCATIONS
(30" Inner Diameter)

NOTE: DASHED LINES REPRESENT 2 PROBE LENGTHS (appx. 30cm).
DIRECTS TAKEN EVERY 15cm.
(Drawing Not to Scale)

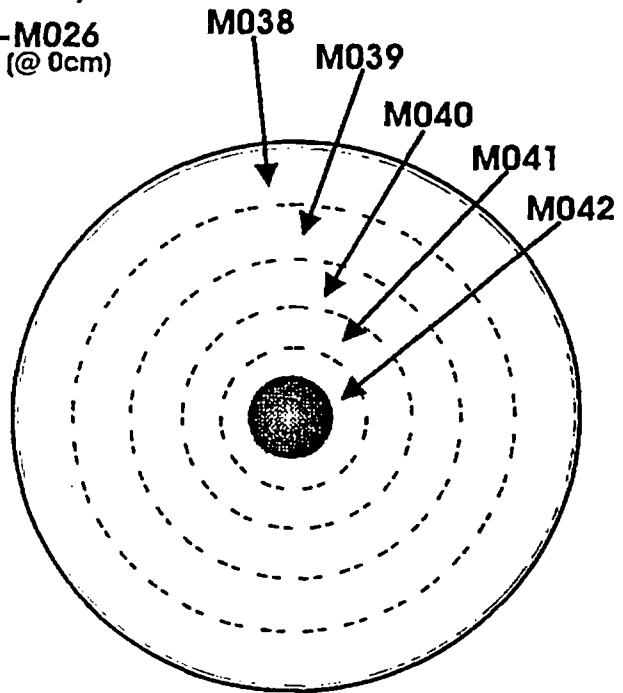
FD0600 SU2 Service Water System Piping

Direct and Scan Locations

Access at Service Bldg/Turbine Bldg Interface



Service Water Discharge
DIRECT LOCATIONS
(30" Inner Diameter)

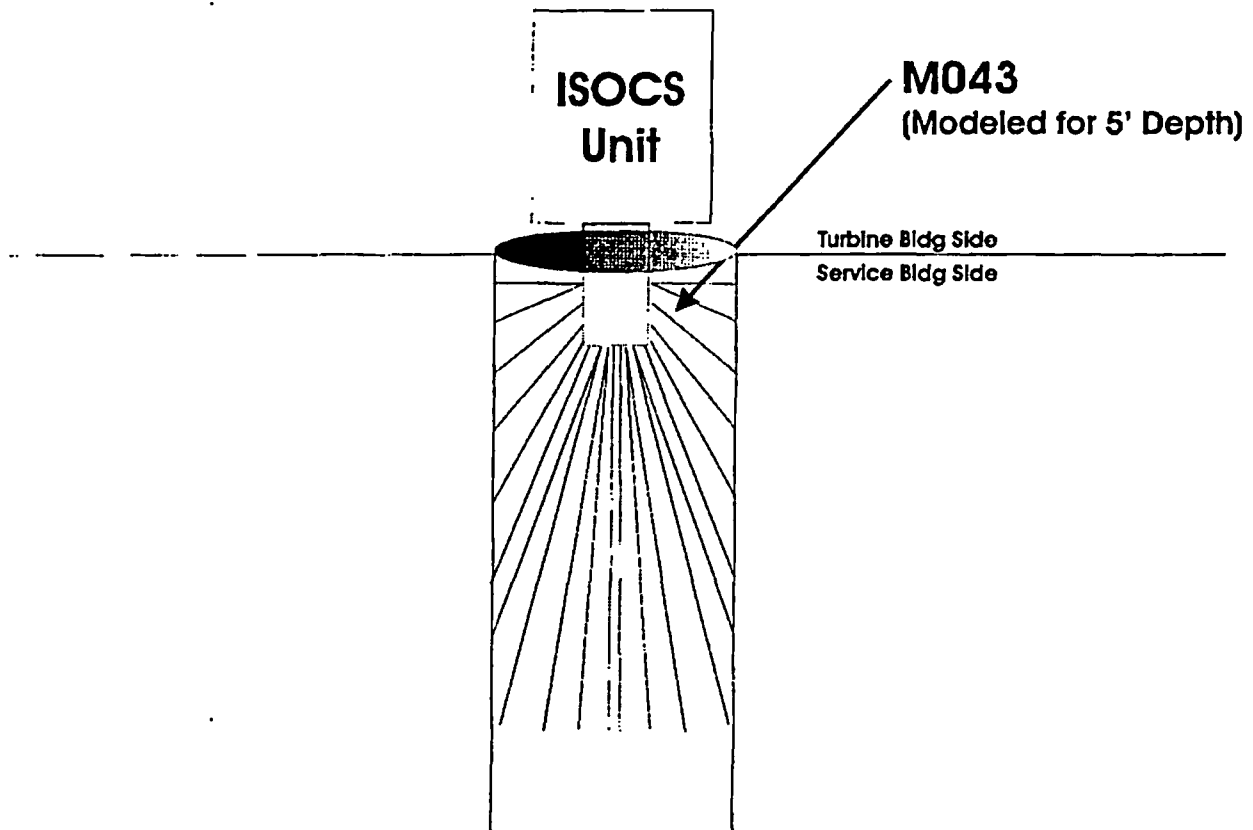
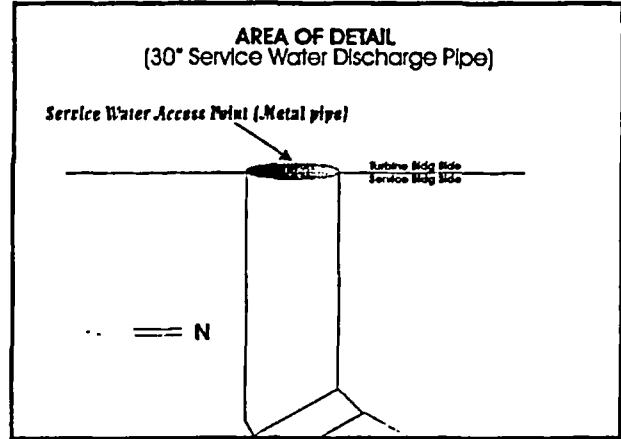


Service Water Discharge
SCAN LOCATIONS
(30" Inner Diameter)

NOTE: DASHED LINES REPRESENT 2 PROBE LENGTHS (appx. 30cm).
DIRECTS TAKEN EVERY 15cm.
(Drawing Not to Scale)

FD0600 SU2 Service Water System Piping ISOCS Scan Location

Service Bldg/Turbine Bldg Interface Access



Service Water Discharge ISOCS SCAN LOCATION

NOTE: ISOCS Detector to be Positioned Just Inside
Plane of Pipe Opening.
(Drawing Not to Scale)

Attachment 2
Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	Probe S/N (type)
1929	148932 (43-68)
2490	177992 (43-68-5)
1929	177991 (43-68-5)

ISOCS	MDC
7605	46 dpm/100cm ² Co-60
	113 dpm/100cm ² Cs-137

TABLE 2-2

INSTRUMENT SCAN MDC, DCGL, AND INVESTIGATION LEVEL

Parameter	43-68 Phase 1 - 30"dia. damp concrete surfaces	43-68 Phase 2 - 30"dia. damp metal surfaces
Scan MDC (dpm/100 cm ²)	4,841 Note 1	4,841 Note 1
DCGL (dpm/100 cm ²)	9,800	9,800
Investigation Level (Alarm setpoint) (dpm/100 cm ²)	15,566 (~ DCGL plus background)	14,437 (~ DCGL plus background)

NOTE: 1. The scan MDC developed for the 43-68 was determined by adjusting the LTP Table 5-6 value for the change in efficiency.

Attachment 3

**Investigation Table
(No Investigations Required)**

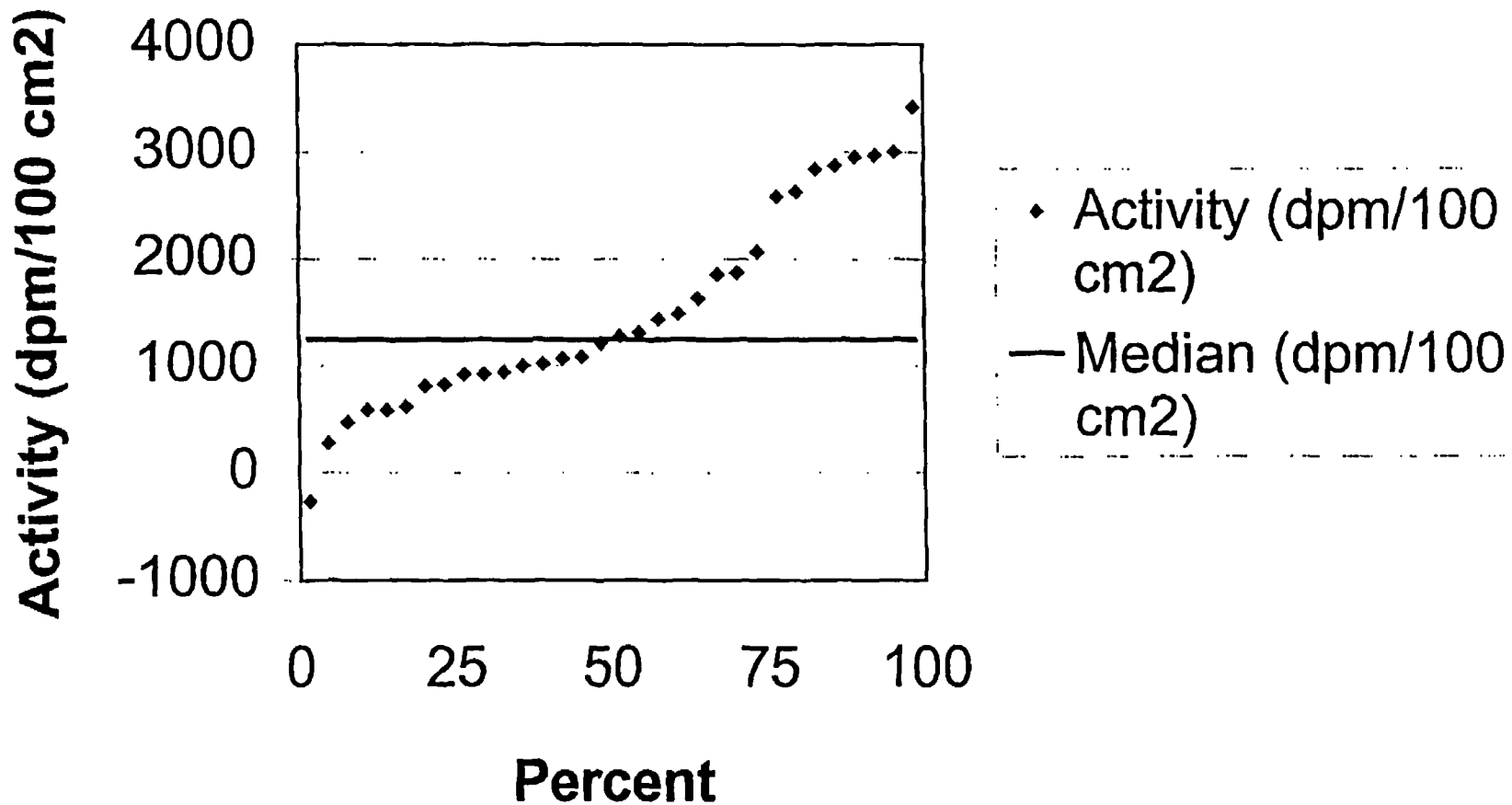
Attachment 4

Statistical Data

Survey Package FD0600 Unit 2 Surface Sign Test Summary

Survey Package: FD0600 Service Water Piping		
Survey Unit:	02	
Evaluator:	DR	
DCGL _w :	9,800	
DCGL _{enc} :	9,800	N/A Class 3 SU
LBGR:	4,900	
Sigma:	727	
Type I error:	0.05	
Type II error:	0.05	
Total Instrument Efficiency:	4.9%	data adjusted for various effs.
Detector Area (cm ²):	126	
Material Type:	N/A	Choosing 'N/A' sets material background to "0"
Z _{1-α} :	1.645	
Z _{1-β} :	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	6.7	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	
Net Static Data Statistics		
Number of Samples:	32	
Median:	1,242	
Mean:	1,506	
Net Static Data Standard Deviation:	952	
Total Standard Deviation:	952	SRSS
Maximum:	3,420	
Sign Test Statistics		
Adjusted N Value:	32	
S+ Value:	32	
Critical Value:	21	
Sign Test Results		
Sufficient samples collected:	Pass	
Maximum value < DCGL _w :	Pass	
Median value < DCGL _w :	Pass	
Mean value < DCGL _w :	Pass	
Maximum value < DCGL _{enc} :	Pass	N/A Class 3 SU
Total Standard Deviation <= Sigma:	Investigate	SU passes, See Section F
Sign test results:	Pass	
The survey unit passes all conditions:	Investigate	SU passes

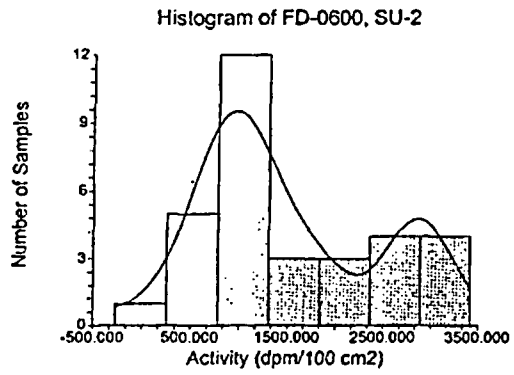
FD0600 SU-2 Quantile Plot



One-Sample T-Test Report

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Database C:\Program Files\NCSS97\FD0600 SU-2.S0
Variable C2

Plots Section



One-Sample T-Test Power Analysis

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Chart Section

