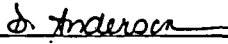

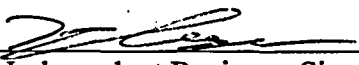
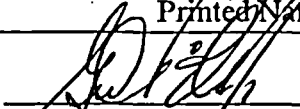



**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0100 RCA YARD WEST
SURVEY UNIT 2**

Prepared By:	<u></u> FSS Engineer – Signature <u>D. ANDERSON</u> Printed Name	Date:	<u>2/2/05</u>
Reviewed By:	<u></u> FSS Specialist – Signature <u>Larry Dockins</u> Printed Name	Date:	<u>2/2/05</u>
Reviewed By:	<u></u> Independent Review – Signature <u>W J Cooper</u> Printed Name	Date:	<u>2/4/05</u>
Approved By:	<u></u> Superintendent, FSS – Signature <u>G. Pillsbury</u> Printed Name	Date:	<u>2/7/05</u>
Approved By:	<u></u> FSS, MOP – Signature <u>JAMES R. BAKER</u> Printed Name	Date:	<u>2/17/05</u>

**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-0100 RCA YARD WEST
SURVEY UNIT 2**

A. SURVEY UNIT DESCRIPTION

FR-0100 RCA Yard West Survey Unit 2 occupied the southeast corner of the original Restricted Area "backyard." The 1,558 m² area was previously excavated to remediate the contaminated soil and the remaining terrain surveyed under final survey packages FR-0111 Survey Units 3, 4 and 7. Following final survey of the excavations, the area was backfilled to grade (approximate 20-ft. El.). The southwest portion of this survey unit slopes gently towards the old Forebay area. FR-0100 Survey Unit 2 is located at coordinates 407,400N and 623,800E, using Maine State Coordinate System (West Zone) NAD 1927. The location of the survey unit in relation to the former Containment Building and the surrounding FR-0100 survey units is shown on Map FR0100U2-SITE (Attachment 1).

B. SURVEY UNIT DESIGN INFORMATION

The survey unit was designated a Class 1 land survey per the LTP (Table 5-1C) and the survey unit design parameters are shown in Table 1. Given a relative shift of 0.8, it was determined that 40 direct measurements were required for the Sign Test. A decision to use E-600/SPA-3 instrumentation for scan surveys in Survey Unit 2 affected the number of direct measurements to be performed due to the scan MDC of the instrumentation (5.9 pCi/g Cs-137, per LTP Table 5-6). The DCGL for soils inside the Restricted Area was limited to 2.39 pCi/g Cs-137. The data quality objective for the scan MDC of open land areas is to identify areas of significant elevated activity, i.e., those exceeding the DCGL_{EMC}. To obtain a DCGL_{EMC} of 6 pCi/g Cs-137, which is greater than the E-600/SPA-3 scan MDC, an Area Factor of 2.5 (6 pCi/g ÷ 2.39 pCi/g DCGL = 2.5) is required. From LTP Table 6-12, the sample area corresponding to an area factor of 2.5 is approximately 11 m². Therefore, the total area of 1,558 m² divided by a sample area of 11 m² required a minimum of 142 samples.

Because the measurement locations were based on a systematic square grid with a random start point, the N=142 design led to a survey unit map with 154 locations. The direct point locations are illustrated on map FR0100U2-DIRT (Attachment 1). Direct measurements (soil samples) were collected from required locations and analyzed with laboratory gamma spectroscopy instrumentation.

The Class 1 survey unit required scans covering 100% of the 1,558 m² area in accordance with LTP Table 5-3. E-600/SPA-3 instrumentation was used to perform the gamma scans. Equal size grids measuring 1.71 m by 5.83 m (approximately 10 m²) were established. Configuration of the 156 survey scans are shown on map FR0100U2-SCAN (Attachment 1). Background values were established based on local scaler values in the survey unit. These background values were used to determine scan alarm setpoints and to divide the scan grids into 4 different background groups, as shown on FR0100U2-Areas. The alarm setpoints were established to confirm the scan MDCs used were appropriate.

Survey instruments used 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, the investigation level, and the DCGL_{EMC}. As discussed above, an EMC sample size adjustment was made to provide a high level of confidence that elevated areas could be detected by the scan process.

TABLE 1
SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	1,558 m ²	Class 1, < 2,000 m ²
Number of Direct Measurements Required	142	Based on investigation level of 6 pCi/g, AF of 2.5 and a sample area of 11 m ² .
Sample Area	11 m ²	1,558 m ² / 142 = 11 m ²
Sample Grid Spacing	3.3 m	(11) ^{1/2}
Scan Grid Area	10 m ²	≤ 10 m ²
Area Factor	2.5	Based on investigation level of 6 pCi/g and a DCGL of 2.39 pCi/g
Scan Area	1,558 m ²	Class 1 Area – 100%
Background		
SPA-3	9,823 cpm	Group 1
	10,762 cpm	Group 2
	12,000 cpm	Group 3
	9,357 cpm	Group 4
Scan Investigation Level	3 Sigma of Background plus Background	Reference 7 See Table 2-2, Attachment 2
DCGL	2.39 pCi/g Cs-137 0.86 pCi/g Co-60	References 4 and 8
Design DCGL _{EMC}	6.0 pCi/g Cs-137 2.15 pCi/g Co-60	DCGL x Area Factor for Class 1 survey unit, per LTP Section 5.6.3

C. SURVEY RESULTS

A total of 154 direct measurements were performed in Survey Unit 2. The results are presented in Table 2. All direct measurements were below the DCGL.

E-600/SPA-3 gamma scans were performed in 156 grids. A total of 17 verified alarms were received during the soil scans. In addition, 1 grid (S024) with a higher than expected background measurement was not scanned during the initial survey. As a result, a total of 18 grids were investigated using survey investigation package XR 0100-02. The investigation results are discussed in Section D.

TABLE 2
DIRECT MEASUREMENTS

Sample Number	Cs-137 (pCi/g)	Uncertainty (pCi/g)	Co-60 (pCi/g)	Uncertainty (pCi/g)	Unitized Value of Unity Rule
FR0100021S001	< 4.10E-02		< 4.76E-02		7.25E-02
FR0100021S002	< 4.76E-02		< 5.31E-02		8.17E-02
FR0100021S003	< 4.23E-02		< 4.45E-02		6.94E-02
FR0100021S004	< 3.90E-02		< 4.13E-02		6.43E-02
FR0100021S005	< 4.42E-02		< 4.67E-02		7.28E-02
FR0100021S006	< 4.53E-02		< 5.51E-02		8.30E-02
FR0100021S007	< 4.06E-02		< 4.21E-02		6.59E-02
FR0100021S008	< 3.81E-02		< 4.03E-02		6.28E-02
FR0100021S009	< 4.15E-02		< 4.87E-02		7.40E-02
FR0100021S010	< 3.79E-02		< 4.25E-02		6.53E-02
FR0100021S011	< 4.81E-02		< 4.41E-02		7.14E-02
FR0100021S012	< 3.80E-02		< 4.15E-02		6.42E-02
FR0100021S013	< 3.75E-02		< 4.26E-02		6.52E-02
FR0100021S014	< 3.51E-02		< 3.78E-02		5.86E-02
FR0100021S015	< 3.98E-02		< 3.85E-02		6.14E-02
FR0100021S016	< 3.57E-02		< 4.50E-02		6.73E-02
FR0100021S017	< 4.34E-02		< 5.23E-02		7.90E-02
FR0100021S018	< 4.70E-02		< 5.03E-02		7.82E-02
FR0100021S019	< 4.76E-02		< 5.25E-02		8.10E-02
FR0100021S020	< 4.42E-02		< 4.17E-02		6.70E-02
FR0100021S021	< 4.04E-02		< 4.50E-02		6.92E-02
FR0100021S022	< 5.68E-02		< 6.71E-02		1.02E-01
FR0100021S023	< 3.77E-02		< 4.05E-02		6.29E-02
FR0100021S024	< 4.38E-02		< 4.27E-02		6.80E-02
FR0100021S025	< 3.66E-02		< 4.70E-02		7.00E-02
FR0100021S026	< 3.72E-02		< 4.87E-02		7.22E-02
FR0100021S027	< 3.64E-02		< 4.30E-02		6.52E-02
FR0100021S028	< 4.17E-02		< 4.32E-02		6.77E-02
FR0100021S029	< 4.96E-02		< 5.22E-02		8.15E-02
FR0100021S030	< 3.99E-02		< 4.80E-02		7.25E-02
FR0100021S031	< 4.34E-02		< 5.11E-02		7.76E-02
FR0100021S032	< 4.78E-02		< 4.72E-02		7.49E-02
FR0100021S033	< 4.10E-02		< 4.74E-02		7.23E-02
FR0100021S034	< 3.94E-02		< 4.09E-02		6.40E-02
FR0100021S035	< 4.12E-02		< 4.39E-02		6.83E-02
FR0100021S036	< 3.68E-02		< 3.44E-02		5.54E-02
FR0100021S037	< 4.37E-02		< 4.70E-02		7.29E-02
FR0100021S038	< 3.92E-02		< 4.32E-02		6.66E-02
FR0100021S039	< 3.96E-02		< 4.69E-02		7.11E-02
FR0100021S040	< 3.68E-02		< 4.25E-02		6.48E-02
FR0100021S041	< 5.22E-02		< 5.36E-02		8.42E-02

Sample Number	Cs-137 (pCi/g)	Uncertainty (pCi/g)	Co-60 (pCi/g)	Uncertainty (pCi/g)	Unitized Value of Unity Rule
FR0100021S042	< 4.07E-02		< 4.54E-02		6.98E-02
FR0100021S043	< 4.19E-02		< 4.90E-02		7.45E-02
FR0100021S044	< 4.46E-02		< 5.02E-02		7.70E-02
FR0100021S045	< 4.28E-02		< 4.41E-02		6.92E-02
FR0100021S046	< 4.14E-02		< 4.72E-02		7.22E-02
FR0100021S047	< 4.37E-02		< 5.06E-02		7.71E-02
FR0100021S048	< 4.41E-02		< 4.91E-02		7.55E-02
FR0100021S049	< 5.35E-02		< 5.31E-02		8.41E-02
FR0100021S050	1.24E-01	3.42E-02	< 5.77E-02		1.19E-01
FR0100021S051	< 5.28E-02		< 5.51E-02		8.62E-02
FR0100021S052	< 4.24E-02		< 4.83E-02		7.39E-02
FR0100021S053	< 4.94E-02		< 4.49E-02		7.29E-02
FR0100021S054	< 4.02E-02		< 4.10E-02		6.45E-02
FR0100021S055	1.41E-01	3.61E-02	< 5.10E-02		1.18E-01
FR0100021S056	1.22E-01	3.41E-02	< 4.96E-02		1.09E-01
FR0100021S057	< 4.39E-02		< 4.84E-02		7.46E-02
FR0100021S058	< 3.97E-02		< 4.78E-02		7.22E-02
FR0100021S059	< 4.31E-02		< 5.20E-02		7.85E-02
FR0100021S060	< 4.75E-02		< 4.87E-02		7.65E-02
FR0100021S061	< 4.40E-02		< 4.80E-02		7.42E-02
FR0100021S062	< 4.86E-02		< 4.28E-02		7.01E-02
FR0100021S063	< 5.48E-02		< 5.22E-02		8.36E-02
FR0100021S064	6.83E-02	2.80E-02	< 5.46E-02		9.21E-02
FR0100021S065	1.21E-01	3.44E-02	< 5.76E-02		1.17E-01
FR0100021S066	< 4.50E-02		< 4.55E-02		7.17E-02
FR0100021S067	< 4.15E-02		< 4.66E-02		7.16E-02
FR0100021S068	9.24E-02	3.35E-02	< 5.56E-02		1.03E-01
FR0100021S069	1.23E-01	3.48E-02	< 5.10E-02		1.11E-01
FR0100021S070	7.58E-02	2.58E-02	< 4.99E-02		8.98E-02
FR0100021S071	< 4.53E-02		< 4.49E-02		7.12E-02
FR0100021S072	< 4.73E-02		< 6.23E-02		9.22E-02
FR0100021S073	< 4.58E-02		< 4.56E-02		7.22E-02
FR0100021S074	< 4.23E-02		< 4.45E-02		6.94E-02
FR0100021S075	< 4.93E-02		< 5.22E-02		8.13E-02
FR0100021S076	< 5.28E-02		< 5.99E-02		9.17E-02
FR0100021S077	6.86E-02	3.43E-02	< 4.91E-02		8.58E-02
FR0100021S078	1.11E-01	2.56E-02	< 4.77E-02		1.02E-01
FR0100021S079	8.98E-02	2.85E-02	< 4.84E-02		9.39E-02
FR0100021S080	1.51E-01	3.19E-02	< 4.80E-02		1.19E-01
FR0100021S081	< 4.20E-02		< 4.36E-02		6.83E-02
FR0100021S082	< 4.51E-02		< 6.08E-02		8.96E-02
FR0100021S083	8.44E-02	2.81E-02	< 4.64E-02		8.93E-02
FR0100021S084	< 5.61E-02		< 4.75E-02		7.87E-02
FR0100021S085	< 3.85E-02		< 4.41E-02		6.74E-02
FR0100021S086	< 4.17E-02		< 4.57E-02		7.06E-02
FR0100021S087	< 4.17E-02		< 4.43E-02		6.90E-02

Sample Number	Cs-137 (pCi/g)	Uncertainty (pCi/g)	Co-60 (pCi/g)	Uncertainty (pCi/g)	Unitized Value of Unity Rule
FR0100021S088	< 4.41E-02		< 4.21E-02		6.74E-02
FR0100021S089	< 4.72E-02		< 4.67E-02		7.41E-02
FR0100021S090	1.07E-01	3.33E-02	< 4.56E-02		9.79E-02
FR0100021S091	< 4.47E-02		< 4.66E-02		7.29E-02
FR0100021S092	1.48E-01	2.99E-02	< 4.98E-02		1.20E-01
FR0100021S093	1.03E-01	3.07E-02	< 5.04E-02		1.02E-01
FR0100021S094	1.12E-01	3.08E-02	< 5.82E-02		1.15E-01
FR0100021S095	1.41E-01	3.07E-02	< 4.65E-02		1.13E-01
FR0100021S096	1.86E-01	3.70E-02	< 5.92E-02		1.47E-01
FR0100021S097	1.49E-01	3.51E-02	< 5.06E-02		1.21E-01
FR0100021S098	< 5.26E-02		< 4.78E-02		7.76E-02
FR0100021S099	< 3.90E-02		< 4.66E-02		7.05E-02
FR0100021S100	< 4.43E-02		< 4.72E-02		7.34E-02
FR0100021S101	< 3.77E-02		< 4.06E-02		6.30E-02
FR0100021S102	< 4.26E-02		< 4.19E-02		6.65E-02
FR0100021S103	< 4.52E-02		< 4.37E-02		6.97E-02
FR0100021S104	< 4.57E-02		< 4.22E-02		6.82E-02
FR0100021S105	< 6.11E-02		< 5.12E-02		8.51E-02
FR0100021S106	8.09E-02	3.11E-02	< 5.44E-02		9.71E-02
FR0100021S107	1.01E-01	2.86E-02	< 4.39E-02		9.32E-02
FR0100021S108	1.51E-01	3.80E-02	< 6.03E-02		1.33E-01
FR0100021S109	1.20E-01	2.60E-02	< 4.72E-02		1.05E-01
FR0100021S110	1.92E-01	3.66E-02	< 5.66E-02		1.46E-01
FR0100021S111	1.94E-01	3.47E-02	< 5.52E-02		1.45E-01
FR0100021S112	< 4.60E-02		< 5.26E-02		8.04E-02
FR0100021S113	1.66E-01	4.40E-02	1.57E-01	3.26E-02	2.52E-01
FR0100021S114	2.51E-01	3.83E-02	1.85E-01	2.70E-02	3.20E-01
FR0100021S115	8.94E-02	3.57E-02	< 6.71E-02		1.15E-01
FR0100021S116	< 4.69E-02		< 4.42E-02		7.10E-02
FR0100021S117	< 5.56E-02		< 5.18E-02		8.35E-02
FR0100021S118	8.52E-02	2.59E-02	< 5.08E-02		9.47E-02
FR0100021S119	< 5.02E-02		< 4.66E-02		7.52E-02
FR0100021S120	1.04E-01	3.27E-02	< 5.82E-02		1.11E-01
FR0100021S121	1.63E-01	3.29E-02	< 5.21E-02		1.29E-01
FR0100021S122	1.16E-01	3.28E-02	< 5.48E-02		1.12E-01
FR0100021S123	1.22E-01	3.65E-02	< 4.75E-02		1.06E-01
FR0100021S124	3.72E-01	4.83E-02	< 5.16E-02		2.16E-01
FR0100021S125	2.14E-01	3.64E-02	< 4.67E-02		1.44E-01
FR0100021S126	1.25E-01	2.98E-02	< 5.05E-02		1.11E-01
FR0100021S127	1.34E-01	3.27E-01	< 6.33E-02		1.30E-01
FR0100021S128	1.48E-01	3.48E-02	< 5.99E-02		1.32E-01
FR0100021S129	1.51E-01	3.29E-02	< 5.07E-02		1.22E-01
FR0100021S130	< 5.99E-02		< 4.72E-02		7.99E-02
FR0100021S131	6.84E-02	2.39E-02	< 4.50E-02		8.10E-02
FR0100021S132	< 5.98E-02		< 5.23E-02		8.58E-02
FR0100021S133	1.15E-01	3.33E-02	< 5.86E-02		1.16E-01

Sample Number	Cs-137 (pCi/g)	Uncertainty (pCi/g)	Co-60 (pCi/g)	Uncertainty (pCi/g)	Unitized Value of Unity Rule
FR0100021S134	9.08E-02	2.56E-02	< 4.69E-02		9.25E-02
FR0100021S135	1.61E-01	3.12E-02	< 4.86E-02		1.24E-01
FR0100021S136	1.74E-01	3.75E-02	< 5.18E-02		1.33E-01
FR0100021S137	1.57E-01	3.73E-02	< 5.05E-02		1.24E-01
FR0100021S138	1.15E-01	2.98E-02	< 5.36E-02		1.11E-01
FR0100021S139	1.32E-01	3.36E-02	< 6.99E-02		1.36E-01
FR0100021S140	8.82E-02	3.10E-02	< 5.53E-02		1.01E-01
FR0100021S141	< 6.05E-02		< 6.34E-02		9.90E-02
FR0100021S142	1.18E-01	3.43E-02	< 5.28E-02		1.11E-01
FR0100021S143	1.59E-01	3.30E-02	< 5.77E-02		1.34E-01
FR0100021S144	3.00E-01	4.28E-02	< 5.76E-02		1.93E-01
FR0100021S145	1.23E-01	3.12E-02	< 5.13E-02		1.11E-01
FR0100021S146	1.13E-01	2.85E-02	< 4.34E-02		9.79E-02
FR0100021S147	9.76E-02	3.36E-02	< 5.28E-02		1.03E-01
FR0100021S148	1.10E-01	2.72E-02	< 4.93E-02		1.03E-01
FR0100021S149	1.28E-01	3.26E-02	< 5.20E-02		1.14E-01
FR0100021S150	1.58E-01	3.23E-02	< 4.86E-02		1.23E-01
FR0100021S151	1.24E-01	3.05E-02	< 4.53E-02		1.04E-01
FR0100021S152	9.36E-02	3.37E-02	< 4.97E-02		9.69E-02
FR0100021S153	7.42E-02	2.93E-02	< 4.68E-02		8.54E-02
FR0100021S154	6.75E-02	2.89E-02	< 5.28E-02		8.96E-02
Mean	7.96E-02		5.08E-02		9.24E-02
Median	4.95E-02		4.84E-02		8.11E-02
Standard Deviation	5.48E-02		1.52E-02		3.42E-02
Range	3.51E-02 to 3.72E-01		3.44E-02 to 1.85E-01		5.54E-02 to 3.20E-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 final surveys identified 17 scanned grids with verified alarms. In addition, one grid (S024) with a higher than expected background was not scanned during the initial final survey effort. An investigation package was written to perform additional scans within the identified grids with verified alarms, mark and log each verified alarm and collect a soil sample at the highest verified alarm location. Locations of grids that required investigations are provided on XR0100U2-SCAN (Attachment 1).

During the investigation effort, 8 of the investigated grids received excessive E-600/SPA-3 alarms. A second investigation package was written to perform the gamma scans using an *in situ* gamma spectroscopy detector (ISOCS). Two ISOCS scans were performed within each scan grid that had received excessive alarms as well as grid S024, which was not previously scanned. The ISOCS detector was positioned perpendicular to the surface at a 2-meter distance, using a 90-degree collimator, to provide a 12 m² field of view. Configuration of the ISOCS scans are provided on XR0100U2-SCAN2. ISOCS gamma scans were performed at 18 locations using an investigation level of 2.2 pCi/g Cs-137 and 0.80 pCi/g Co-60. The gamma scans were performed for a sufficient count time to achieve a Minimum Detectable Activity (MDA) of less than 25% of the DCGL. All scan activity levels were below the MDAs which were below the prescribed investigation levels. In addition to the ISOCS gamma scans, E-600/SPA3 scans were performed within each grid to identify the location of highest activity and a soil sample collected from that location.

As a result of the investigations, a total of 18 soil samples were collected. Results of the soil samples are presented in Table 3-1 (Attachment 3). Two samples identified Co-60 below the DCGL while 9 samples identified Cs-137 below the DCGL. All other sample activities were below the MDA. In addition, the maximum reported unity value was less than 35% of the unitized DCGL.

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 154 soil samples collected, 62 identified Cs-137 activity below the DCGL value of 2.39 pCi/g while only 2 samples identified Co-60 activity below the DCGL value of 0.86 pCi/g. All other values were below the MDA. Identified sample activities or Minimum Detectable Activities are listed in Table 2. The mean and median activities were less than the DCGL for both Co-60 and Cs-137. The average of the DCGL unity fractions was 0.0924 and the maximum reported unity value was less than 35% of the unitized DCGL.

Of the 18 investigation soil samples collected, 2 identified Co-60 below the DCGL while 9 identified Cs-137 activity below the DCGL. The average of the DCGL unity fractions was 0.119 and the maximum reported unity value was 34.8% of the unitized 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)¹ for disturbed soil from the survey unit sample mean activity (0.0796 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 0.33 mrem/year². 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 sample analysis activity values.

¹ See Attachment E to Maine Yankee Procedure PMP 6.7.8 (Reference 5).

² This annual dose equivalent is based on LTP Table 6-11 which shows the RA contaminated soil contribution (for surface soils contaminated at the DCGL) to be 5.63 mrem/y. Therefore, the annual dose rate would equate

$$\text{to } Annual \text{ Dose Rate} = 5.63 \times \left(\frac{0.0508}{0.86} \right) = 0.33 \text{ mrem / y}$$

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, all of the key release criteria were clearly satisfied for the FSS of this survey unit. The sample standard deviation is smaller than the design sigma; therefore no additional samples were required.

2. The Quantile Plot was generated from the unity value data listed in Table 2. The data set and plot are consistent with expectations for a Class 1 survey unit. All of the measurements are well below the DCGLs of 2.39 pCi/g for Cs-137 and 0.86 pCi/g for Co-60 for land inside the restricted area.
3. A Histogram Plot was also developed based on the unity values. This plot shows a log-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 1 land survey area; the FSS results were consistent with that classification. The direct measurement sample standard deviation was less than the design sigma. Thus, a sufficient number of sample measurements were taken and 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 the December 2004 and January 2005 time frame. The design was performed to the criteria of the LTP Revision 3 (References 2 and 4). LTP Change No. 05-001 (Reference 8) modified the Table 6-11 "Contaminated Material DCGL" to reflect an increased Deep Soil DCGL of 0.86 pCi/g for Co-60. This change resulted in an increased dose rate of 2.04 mrem/y from RA contaminated soils at depths greater than 15 cm. The LTP change directly impacted the retrospective dose calculation portion of release records dealing with Restricted Area excavations that were necessitated by radiological remediation.

FR-0100-02 consists of surface soils that cover the excavations previously surveyed under FR-0111 Survey Units 3, 4, and 7. The Deep Soil dose for underlying soils was accounted for in the release records of the FR-0111 packages. As a result, the retrospective dose determination for FR-0100 Survey Unit 2 was based only on the contribution from surface soils within the top 15 cm. No subsequent LTP changes with potential impact to this survey unit need to be evaluated.

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, all direct measurements were less than the DCGLs of 2.39 pCi/g Cs-137 and 0.86 pCi/g Co-60.

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 log-normal distribution.

The scan survey design for this survey unit was developed in accordance with the LTP Revision 3 Addenda (References 2 and 4) with significant aspects of the design discussed in Section B and Table 1. An EMC sample size adjustment was made to provide a high level of confidence that elevated areas could be detected by the scan process. Scans performed with E-600/SPA-3 instrumentation resulted in 17 verified alarms. An investigation was conducted via package XR 0100-02 and 18 additional direct measurements were obtained. All direct measurements were less than the DCGLs of 2.39 pCi/g Cs-137 and 0.86 pCi/g Co-60.

It is concluded that FR 0100 Survey Unit 2 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

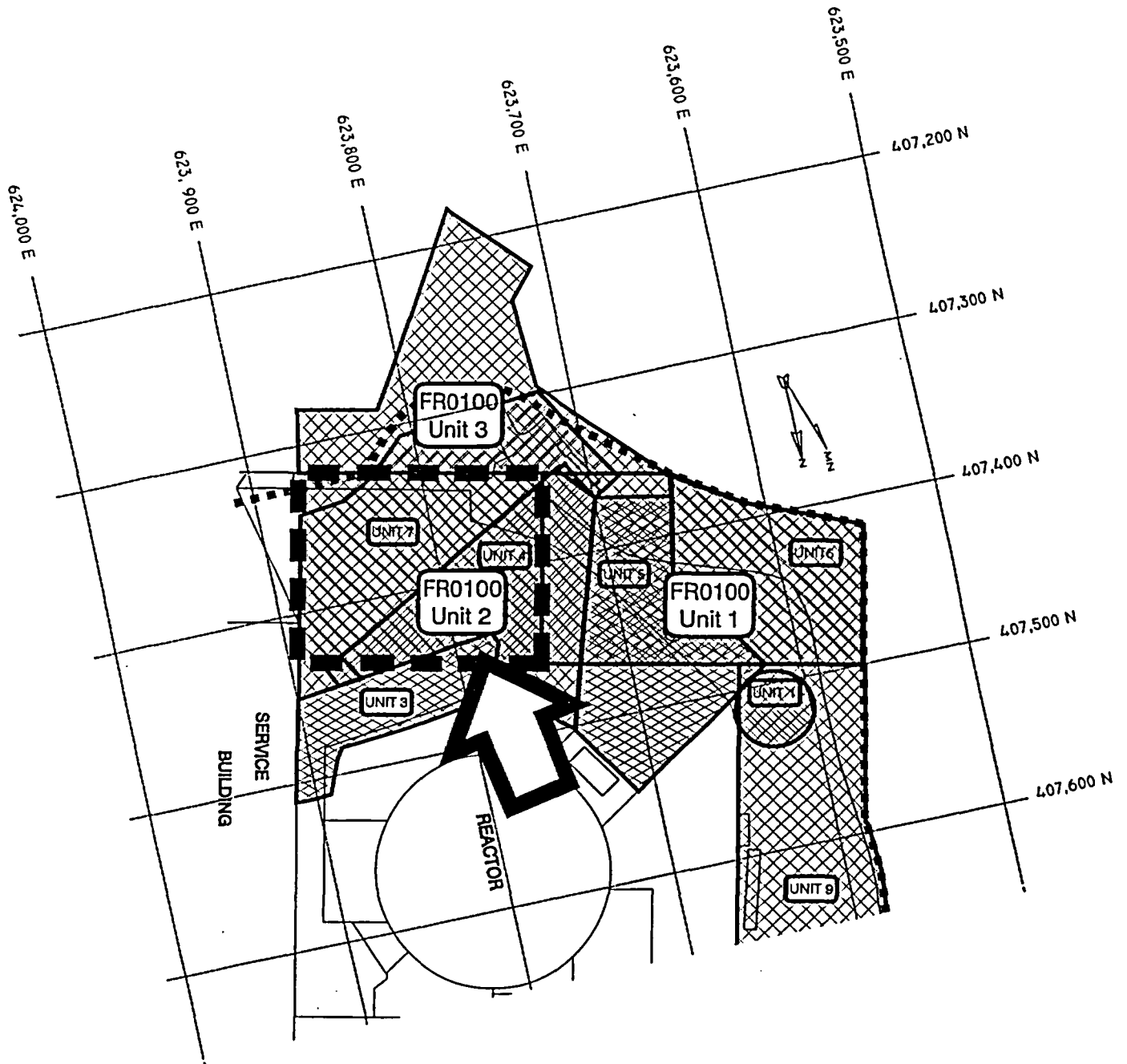
1. Maine Yankee License Termination Plan, Revision 3, October 15, 2002 and Addenda provided by Maine Yankee letter to the NRC, MN-02-061, dated November 26, 2002
2. NRC letter to Maine Yankee, dated February 28, 2003
3. Maine Yankee letter to the NRC, MN-03-049, dated September 11, 2003 (LTP Supplement to LTP Revision 3)
4. Issuance of License Amendment No. 170, NRC letter to Maine Yankee, dated February 18, 2004
5. 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
6. Maine Yankee Calculation No. EC-003-04 (MY), Use of In Situ Object Counting System (ISOCS) for FSS Surveys
7. Maine Yankee Calculation No. EC 009-01 (MY), Instrumentation Selection and MDC Calculation
8. Maine Yankee LTP Change No. 05-001, Deep Soil Co-60 DCGL

Attachment 1
Survey Unit Maps

Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: Site Locator

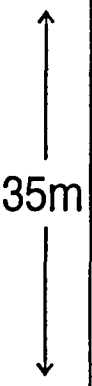
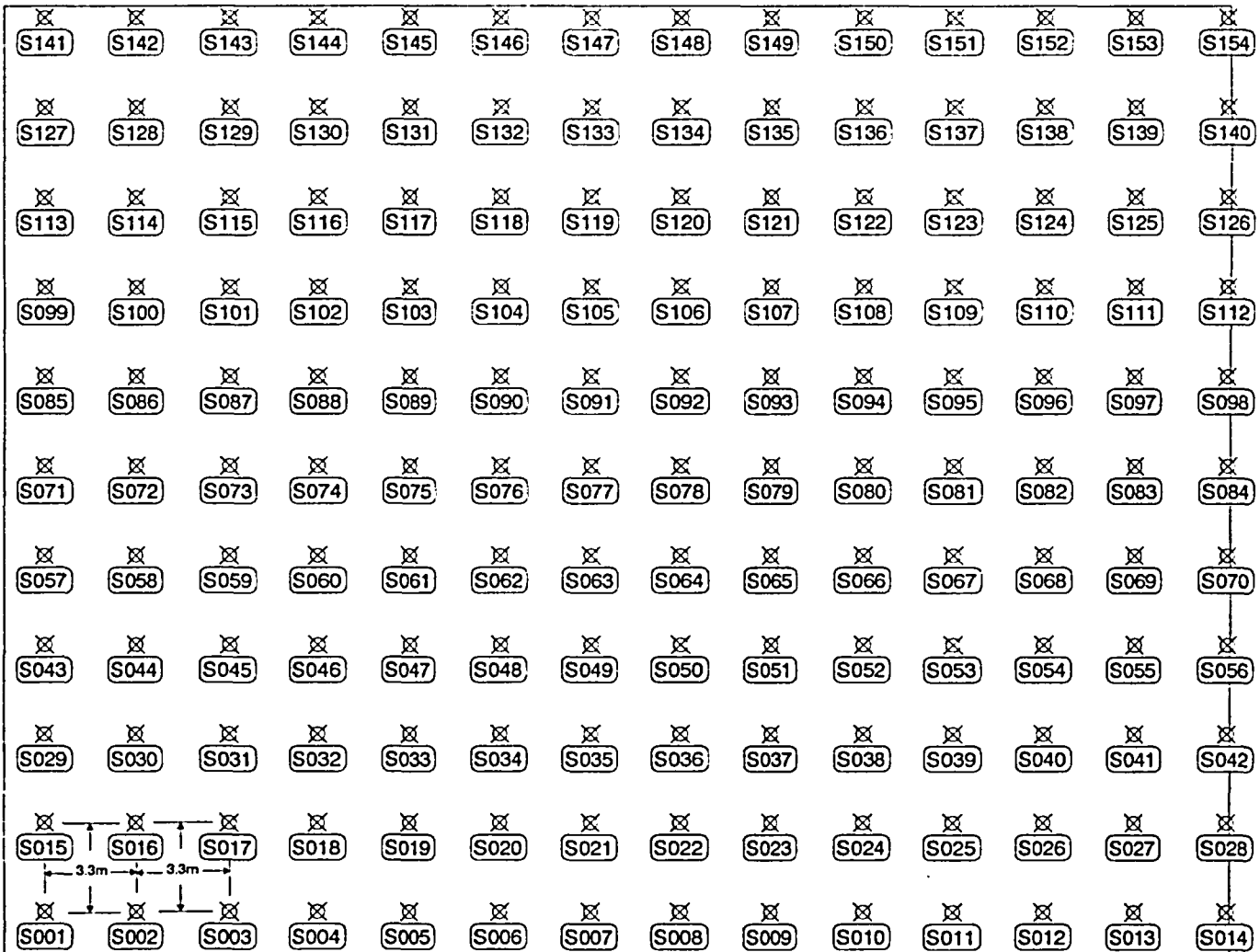
Prepared By: Larry N. Dockins Date: 12/19/04



Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: Direct Locations

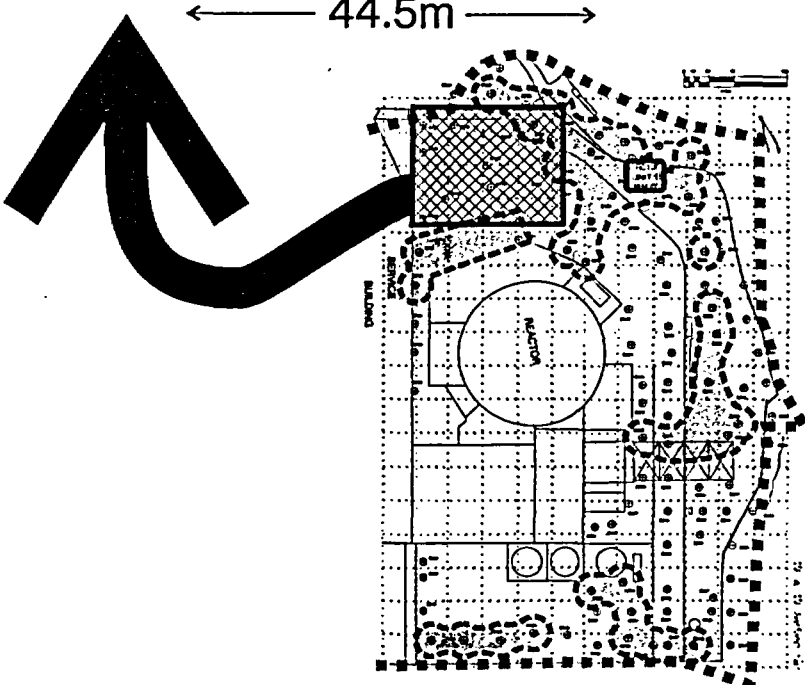
Larry N. Dockins 12/13/04



1.57m

1.5m

44.5m



Survey Type: Characterization

Turnover

Final Status Survey

Survey Area Name: Scan Locations

Prepared By: Larry N. Dockins Date: 12/13/04

S131	S105	S079	S053	S027	S001
S132	S106	S080	S054	S028	S002
S133	S107	S081	S055	S029	S003
S134	S108	S082	S056	S030	S004
S135	S109	S083	S057	S031	S005
S136	S110	S084	S058	S032	S006
S137	S111	S085	S059	S033	S007
S138	S112	S086	S060	S034	S008
S139	S113	S087	S061	S035	S009
S140	S114	S088	S062	S036	S010
S141	S115	S089	S063	S037	S011
S142	S116	S090	S064	S038	S012
S143	S117	S091	S065	S039	S013
S144	S118	S092	S066	S040	S014
S145	S119	S093	S067	S041	S015
S146	S120	S094	S068	S042	S016
S147	S121	S095	S069	S043	S017
S148	S122	S096	S070	S044	S018
S149	S123	S097	S071	S045	S019
S150	S124	S098	S072	S046	S020
S151	S125	S099	S073	S047	S021
S152	S126	S100	S074	S048	S022
S153	S127	S101	S075	S049	S023
S154	S128	S102	S076	S050	S024
S155	S0129	S103	S077	S051	S025
S156	S130	S104	S078	S052	S026

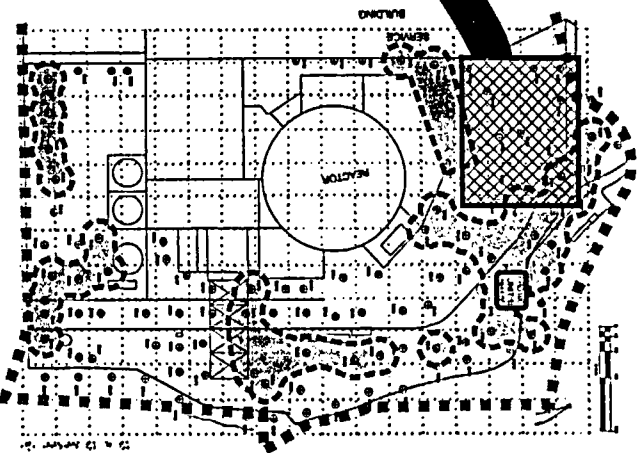
≈ 10m² per grid

44.5m

35m

5.83m

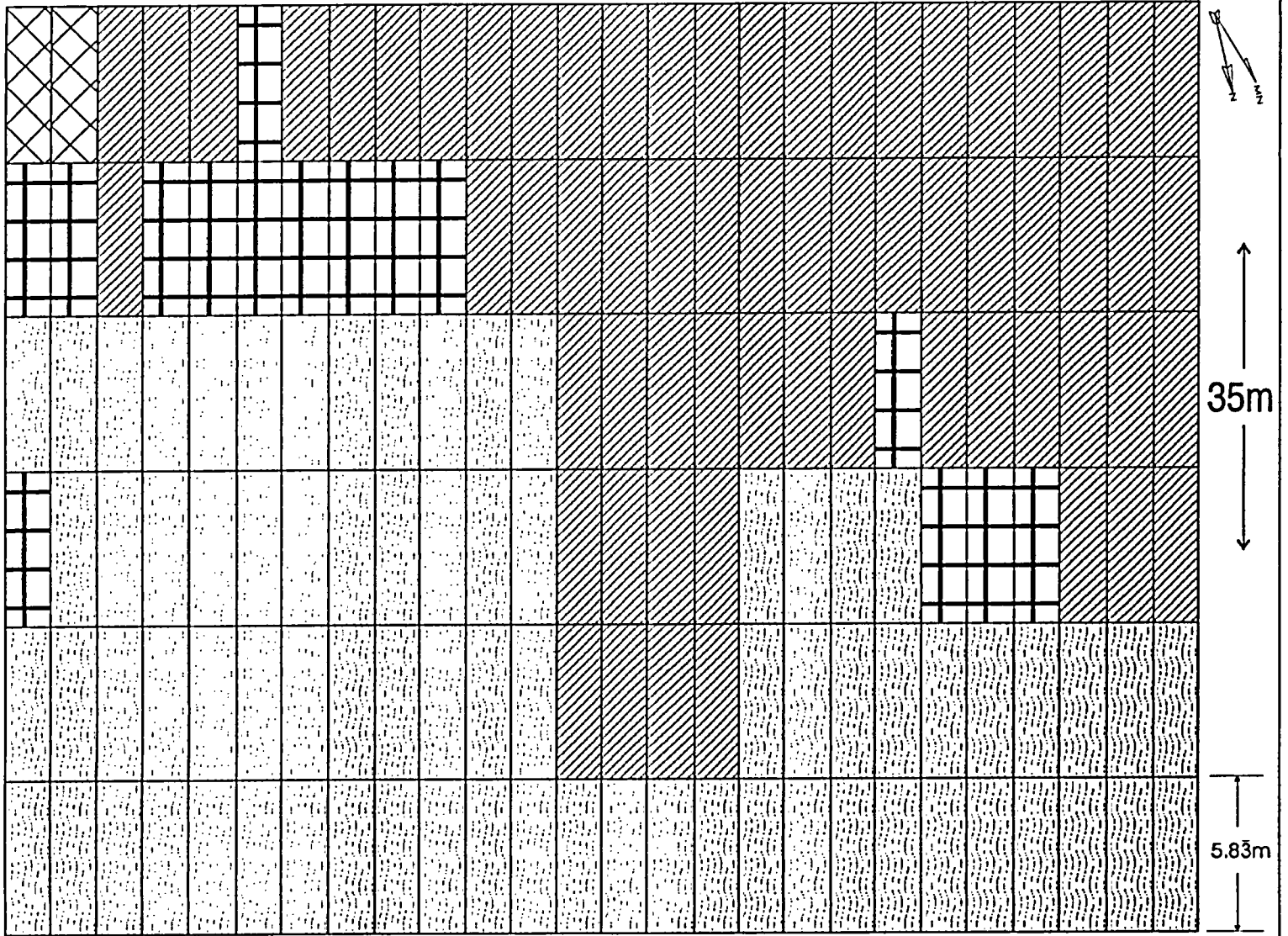
1.712m



Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: Background Areas

Prepared By: Larry N. Dockins Date: 12/29/04



≈ 10m² per grid

Backgrounds



Group 1: 8,823 to 10,823 cpm



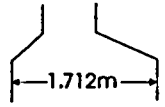
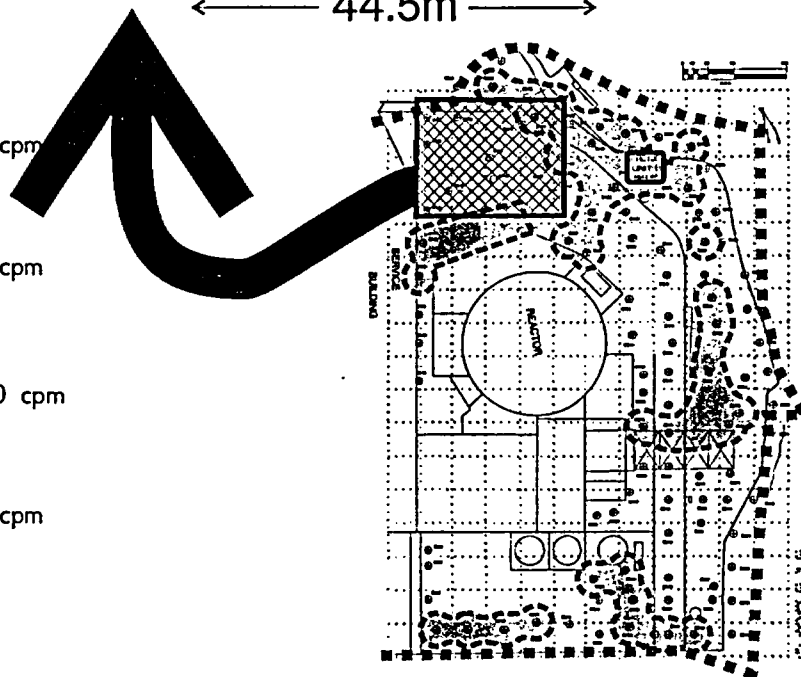
Group 2: 9,762 to 11,762 cpm



Group 3: 11,000 to 13,000 cpm



Group 4: 8,357 to 10,357 cpm



Survey Type: Characterization Turnover Final Status Survey

Survey Area Name: Investigation Locations
Prepared By: Andy Olsen Date: 1/03/05

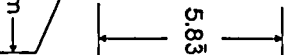
			S053	S027	
			S054	S028	
				S030	
					S005
					S007
				S035	
		S116			
S143					
S145					
			S095		
				S072	
			S099		
			S100		
			S101		
					S024
		S129			



35m

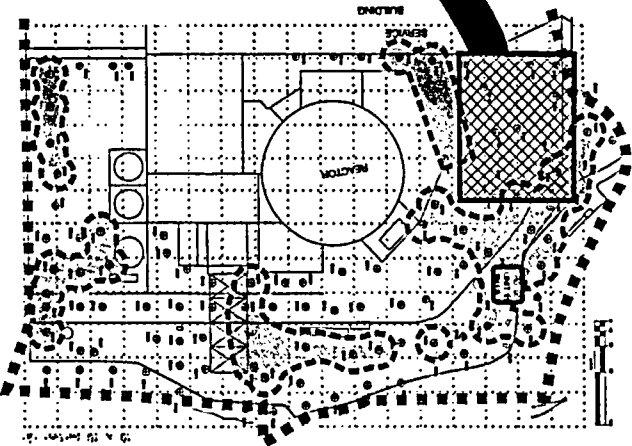


5.83m



≈ 10m² per grid

44.5m



Attachment 2
Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

E-600 S/N	SPA-3 Probe S/N
2488	725890
2490	726554
1645	2253
2619	2254
2489	726554
2491	2254

ISOCS Detectors (Field Measurements)

Detector No.	MDC (pCi/g)
7780	0.14 to 0.3

HPGe Detectors (Laboratory Analysis)

Detector No.	MDC (pCi/g)
FSS1	0.03 to 0.07
FSS2	0.03 to 0.07

TABLE 2-2

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

Parameter		Comments
Scan MDC (E-600/SPA-3)	5.9 pCi/g	Design Scan MDC, LTP Table 5-6 (Reference 1)
Scan MDC (ISOCS)	0.14 to 0.30 pCi/g	< 25% DCGL
DCGL	2.39 pCi/g Cs-137 0.86 pCi/g Co-60	Approved DCGL for land areas inside the Restricted Area, (References 4 and 8)
E-600/SPA-3 Investigation Level (Alarm Setpoint) (cpm)	12,126	(Group 1)
	13,173	(Group 2)
	14,546	(Group 3)
	11,604	(Group 4)
Investigation Level (ISOCS @ 2 m)	2.2 pCi/g Cs-137 0.8 pCi/g Co-60	Reference 6
Design DCGL _{EMC}	6.0 pCi/g Cs-137 2.15 pCi/g Co-60	DCGL x Area Factor for Class 1 survey unit, per LTP Section 5.6.3

NOTE: ISOCS scan MDCs were adjusted based on a thin layer of snow within the survey unit. As a conservative measure, a snow layer equivalent to 2 inches of water was added to the ISOCS configuration to determine the resulting instrument MDCs. The ISOCS MDCs in Tables 2-1 and 2-2 reflect the conservative adjustment.

Attachment 3
Investigation Table

TABLE 3-1

INVESTIGATION TABLE

XR0100-02 INVESTIGATION SOIL SAMPLING RESULTS

Elevated Grid Sample Location	Initial Scan Value (cpm)	Alarm Setpoint (cpm)	Invest. Scan Value (cpm)	Invest. Scaler Value (cpm)	Cs-137 (pCi/g)	Uncertainty (pCi/g)	Co-60 (pCi/g)	Uncertainty (pCi/g)	Unitized Value of Unity Rule	DCGL Comparison
XR0100021S005	13,400	13,173	< 13,173	10,810	1.16E-01	2.92E-02	< 4.96E-02		1.06E-01	< DCGL
XR0100021S007	12,080	11,604	(ISOCS)	N/A	3.77E-01	4.88E-02	< 5.19E-02		2.18E-01	< DCGL
XR0100021S024	HB	13,173	(ISOCS)	N/A	1.28E-01	2.95E-02	< 4.25E-02		1.03E-01	< DCGL
XR0100021S027	13,250	11,604	(ISOCS)	N/A	3.73E-01	4.97E-02	1.65E-01	2.72E-02	3.48E-01	< DCGL
XR0100021S028	12,500	11,604	(ISOCS)	N/A	1.71E-01	3.78E-02	1.71E-01	4.31E-02	2.71E-01	< DCGL
XR0100021S030	12,010	11,604	(ISOCS)	N/A	1.28E-01	3.05E-02	< 5.84E-02		1.22E-01	< DCGL
XR0100021S035	11,610	11,604	11,920	10,640	8.12E-02	2.51E-02	< 4.72E-02		8.89E-02	< DCGL
XR0100021S053	18,600	12,126	13,080	11,210	< 4.52E-02		< 4.71E-02		7.37E-02	< DCGL
XR0100021S054	13,990	12,126	11,220	10,820	< 3.97E-02		< 4.21E-02		6.56E-02	< DCGL
XR0100021S072	12,090	11,604	(ISOCS)	N/A	1.56E-01	3.09E-02	< 5.06E-02		1.24E-01	< DCGL
XR0100021S095	12,440	12,126	12,280	10,490	1.19E-01	3.21E-02	< 5.51E-02		1.14E-01	< DCGL
XR0100021S099	12,470	11,604	(ISOCS)	N/A	< 5.13E-02		< 5.45E-02		8.48E-02	< DCGL
XR0100021S100	12,120	11,604	(ISOCS)	N/A	< 4.56E-02		< 5.27E-02		8.04E-02	< DCGL
XR0100021S101	12,180	11,604	(ISOCS)	N/A	< 4.68E-02		< 4.83E-02		7.57E-02	< DCGL
XR0100021S116	12,970	12,126	11,850	11,400	< 3.99E-02		< 4.18E-02		6.53E-02	< DCGL
XR0100021S129	12,600	12,126	13,360	13,310	< 4.32E-02		< 4.39E-02		6.91E-02	< DCGL
XR0100021S143	13,510	12,126	11,990	10,170	< 3.74E-02		< 4.30E-02		6.56E-02	< DCGL
XR0100021S145	13,100	12,126	11,650	10,260	< 3.78E-02		< 4.38E-02		6.67E-02	< DCGL
							Survey Unit Mean / DCGL			0.0924
							Total			0.0924

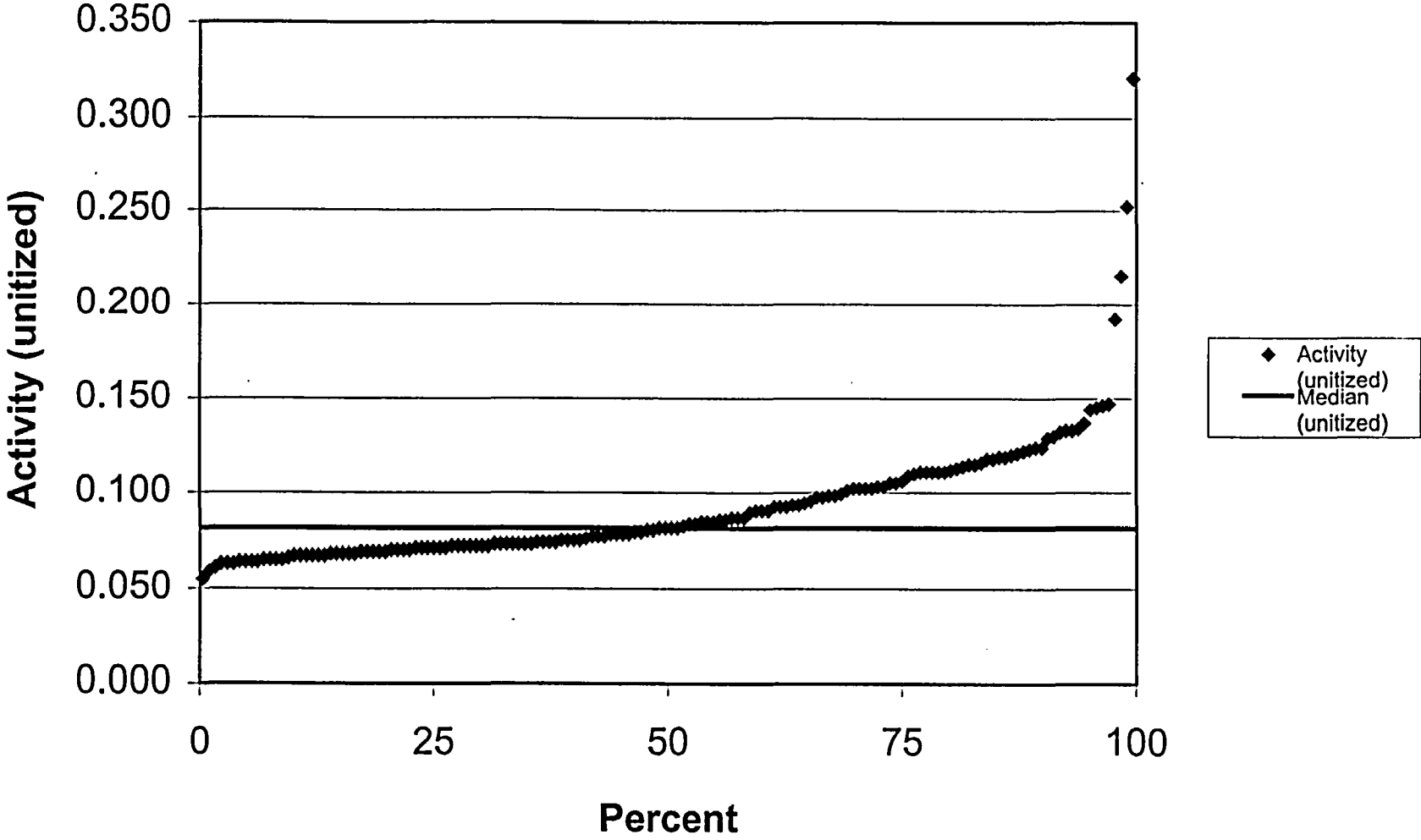
NOTE: 1. "<" indicates value less than MDA, MDA value is reported.
 2. HB indicates high background.

Attachment 4
Statistical Data

Survey Package FR0100 Unit 2 UNITY Soil Sign Test Summary

Evaluation Input Values		Comments
Survey Package:	FR0100	RCA Yard West
Survey Unit:	02	
Evaluator:	DA	
DCGL _w :	1.00E+00	Unity
DCGL _{emc} :	2.50E+00	AF x Unity
LBGR:	5.00E-01	50% of DCGL
Sigma:	5.56E-01	Unitized (1.33 pCi/g / 2.39 pCi/g)
Type I error:	0.05	
Type II error:	0.05	
Nuclide:	UNITY	
Soil Type:	N/A	
Calculated Values		Comments
Z _{1-α} :	1.645	
Z _{1-β} :	1.645	
Sign p:	0.788145	
Calculated Relative Shift:	0.8	
Relative Shift Used:	0.8	Uses 3.0 if Relative Shift is >3
N-Value:	33	
N-Value+20%:	40	
Sample Data Values		Comments
Number of Samples:	154	
Median:	8.11E-02	
Mean:	9.24E-02	
Net Sample Standard Deviation:	3.42E-02	
Total Standard Deviation:	3.42E-02	
Maximum:	3.20E-01	
Sign Test Results		Comments
Adjusted N Value:	154	
S+ Value:	154	
Critical Value:	87	
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	
Total Standard Deviation <=Sigma:	Pass	
Criteria comparison results:	Pass	
Final Status		Comments
The survey unit passes all conditions:	Pass	Survey Unit Passes

FR-0100 SU-2 Quantile Plot



One-Sample T-Test Report

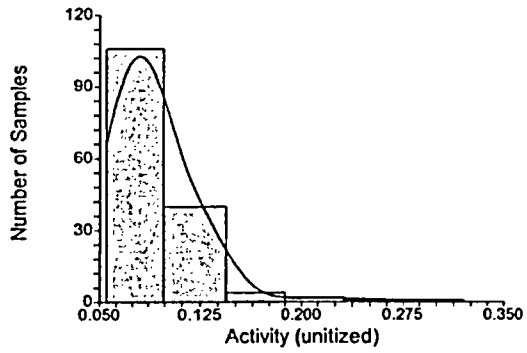
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Database

Variable C2

Plots Section

Histogram of FR-0100, SU-2



One-Sample T-Test Power Analysis

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Chart Section

