

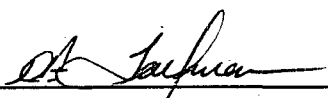
Rancho Seco


Final Status Survey Summary Report

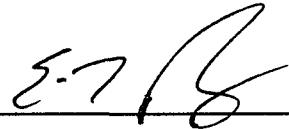
March 2, 2009

Tank Farm SW Quad, "A" Steam Sump & SF Cooler Pad Areas

Survey Unit F8100011

Prepared By: Dan A. Tallman  Date: March 2, 2009
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Reviewed By:  Date: 3/2/09
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Approved By:  Date: 3-3-09
Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8100011, Tank Farm SW Quad, "A" Steam Sump & SF Cooler Pad Areas

Survey Unit Description:

Operating History: The area surrounded the tanks used to store radioactive liquids. This area was used for the storage of radioactive material. Operating records and the HSA document several events with the potential for a release of radioactivity associated with this survey area. The HSA documented the storage of radioactive material within the area that may have had the potential to contaminate the area.

Records of soil samples taken near the BWST showed soil contamination levels as high as 230 pCi/g prior to remediation.

Site Characterization: Soil samples were collected and analyzed for the presence of plant-derived radionuclides. Cs-137 was the primary nuclide of plant origin detected with a mean activity level of 379 pCi/g and a maximum value of 1,040 pCi/g. Based on the classification procedure (DSIP-0020) and levels of Cs-137 reported, the area was determined to be a Class 1 land area.

Survey Unit Design Information:

The Survey Unit Design Parameters are presented in Table 1 below. The survey unit and measurement locations are depicted on the maps in Attachment 1. Direct measurement locations were determined using a random-start, fixed grid pattern and 672 m² were scanned for 100% coverage. Soil samples were collected at each direct measurement location and analyzed by HPGe detector while locations falling on asphalt were measured using In-Situ Gamma Spectroscopy. The instrumentation used for the survey along with the MDC values are listed in Tables 2-1 and 2-2 in Attachment 2.

Table 1. Survey Unit Design Parameters

Survey Design Parameter	Value	Comment
Survey Area:	F810	Tank Farm SW Quad, "A"
Survey Unit:	0011	Steam Sump & SF Cooler Pad Areas
Class:	1	Open Land Area
SU Area (m²):	672	LTP Table 5-4
Evaluator:	D.A.Tallman	
DCGL for Cs-137 surrogate (pCi/g):	52.6	
DCGL for Co-60 (pCi/g):	12.6	
Area Factor:	1.4	Class 1
Design DCGL_{mc} (pCi/g):	74.2	Class 1
LBGR (pCi/g):	25.6	Adjusted
Design Sigma (pCi/g):	10.7	DTBD-06-001, Table 5-4A or B
Type I Error:	0.05	
Type II Error:	0.05	
Sample Area (m²):	44.8	Class 1
Total Area Scanned (m²):	672	
Scan Coverage (%):	100%	Class 1
Z_{1-α} :	1.645	
Z_{1-β} :	1.645	
Sign P:	0.99379	
Calculated Relative Shift:	2.5	
Relative Shift Used:	2.5	Uses 3.0 if Rel Shift >3
N-Value:	12	
Design N-Value + 20%:	15	NUREG-1575 Table 5-5
Grid Spacing L:	6.7	Class 1

Survey Results:

A total of 20 direct measurements were made in F8100011. The results are shown in Table 2-1. Statistical data including the mean, median, and standard deviation are shown in Table 2-2. All of the direct measurements were less than Unity. Thirty-Six (36) of the scan measurements indicated areas of elevated activity with an observed scan range of 4990 – 242929 cpm with the 44-10 NaI detector. Measurements were counted to the MDCs shown in Table 2-1 of Attachment 2.

Table 2-1. Direct Measurement Results
(all activity values in pCi/g)

Sample ID	Cs137				Co60				Unity Total
	MDA	Activity	Uncertainty	Unity Value	MDA	Activity	Uncertainty	Unity Value	
F8100011S0001SS	6.23E-02	1.67E00	1.21E-01	0.0318	6.85E-02	<6.85E-02		0.0054	0.0372
F8100011S0002SS	7.82E-02	4.34E-01	7.52E-02	0.0083	5.45E-02	<5.45E-02		0.0043	0.0126
F8100011S0003SS	5.22E-02	2.04E-01	4.95E-02	0.0039	5.76E-02	<5.76E-02		0.0046	0.0084
F8100011S0004SS	5.32E-02	1.10E-01	4.19E-02	0.0021	6.42E-02	<6.42E-02		0.0051	0.0072
F8100011S0005SS	7.99E-02	1.52E00	1.24E-01	0.0289	5.56E-02	1.51E-01	4.12E-02	0.012	0.0408
F8100011S0006SS	5.30E-02	4.88E-01	6.66E-02	0.0093	7.12E-02	<7.12E-02		0.0057	0.0149
F8100011S0007SS	4.67E-02	1.09E-01	3.83E-02	0.0021	4.37E-02	<4.37E-02		0.0035	0.0055
F8100011S0008SS	5.22E-02	7.92E-01	8.01E-02	0.0151	6.45E-02	<6.45E-02		0.0051	0.0202
F8100011S0009SS	5.95E-02	2.45E-01	5.44E-02	0.0047	5.29E-02	<5.29E-02		0.0042	0.0089
F8100011S0010SS	5.75E-02	1.40E-01	4.61E-02	0.0027	5.75E-02	<5.75E-02		0.0046	0.0072
F8100011 A0011GD	9.62E-01	<9.62E-01		0.0183	9.08E-01	<9.08E-01		0.0721	0.0904
F8100011S0012SS	5.20E-02	2.43E-01	5.02E-02	0.0046	4.22E-02	<4.22E-02		0.0033	0.008
F8100011S0013SS	4.88E-02	6.50E-01	7.64E-02	0.0124	6.07E-02	<6.07E-02		0.0048	0.0172
F8100011S0014SS	6.00E-02	3.75E-01	6.57E-02	0.0071	7.37E-02	<7.37E-02		0.0058	0.013
F8100011 A0015GD	1.00E00	<1.00E00		0.019	9.55E-01	<9.55E-01		0.0758	0.0948
F8100011S0016SS	5.03E-02	1.76E-01	4.58E-02	0.0033	4.85E-02	<4.85E-02		0.0038	0.0072
F8100011S0017SS	6.35E-02	4.76E-01	6.87E-02	0.0091	6.64E-02	<6.64E-02		0.0053	0.0143
F8100011S0018SS	5.61E-02	2.68E-01	5.62E-02	0.0051	6.91E-02	<6.91E-02		0.0055	0.0106
F8100011S0019SS	6.04E-02	1.55E-01	4.92E-02	0.0029	7.29E-02	<7.29E-02		0.0058	0.0087
F8100011S0020SS	6.26E-02	6.88E-01	8.28E-02	0.0131	9.34E-02	<9.34E-02		0.0074	0.0205

Table 2-2. Direct Measurements Results Summary

	Cs137 Activity (pCi/g)	Co60 Activity (pCi/g)	Cs137 Unity	Co60 Unity	Unity Total
DCGLw	52.6	12.6			
Mean	5.35E-01	1.54E-01	0.0102	0.0122	0.0224
Median	4.05E-01	6.55E-02	0.0077	0.0052	0.0128
Standard Deviation	4.55E-01	2.67E-01	0.0087	0.0212	0.0258
Cs137 Activity Range (pCi/g)	1.09E-01 to 1.67E00				
Co60 Activity Range (pCi/g)	4.22E-02 to 9.55E-01				
Cs137 Unity Range	0.0021 to 0.0318				
Co60 Unity Range	0.0033 to 0.0758				
Total Unity Range	0.0055 to 0.0948				
Sample Count	20				

Survey Unit Data Assessment:

The survey design required 20 direct measurements for the Sign Test. The critical value and the results of the Sign Test are presented in Table 3. The sample mean and median values were less than the DCGL. The sample standard deviation was less than the design standard deviation so no additional samples were required.

Table 3. Data Assessment Results

Survey Results Parameter	Value	Comment
Actual Direct Measurements (N):	20	Class 1
Median (Unity):	0.013	
Mean (Unity):	0.022	
Direct Measurement Std Deviation (Unity):	0.026	
Maximum (Unity):	0.095	
Sign Test Final N Value:	20	
S+ Value:	20	
Critical Value:	14	
Sufficient Samples Collected:	Yes	
Maximum Value < Unitized DCGL:	Yes	
Median Value < Unitized DCGL:	Yes	
Mean Value < Unitized DCGL:	Yes	
Maximum Value < DCGL_{mc} (Unity):	Yes	
Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
Does the Survey Unit Pass All Criteria?	Yes	

Survey Unit Investigations and Results:

Thirty-Six (36) investigations (scan grids 01-07, 15, 16, 30, 34-45, 47, 48, 50, 51, 53-56, 58-60, 65, 66, & 77) were required for the scan measurements and the results are reported in Attachment 3. The EMC unity rule was not exceeded as shown in Table 3-1.

ALARA Statement:

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL (i.e. the survey unit average activity is less than the DCGL and the EMC criterion has been met), the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 1 land survey and the sample results are consistent with that classification. The variability of the survey results was less than the characterization data used for survey design. Potential areas of elevated activity were detected and evaluated as shown in Attachment 3. Therefore the EMC criterion was met.

Conclusion:

The FSS of this survey unit was properly designed as a Class 1 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. All of the direct measurements were less than Unity. Thirty-six (36) investigations were required.

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.

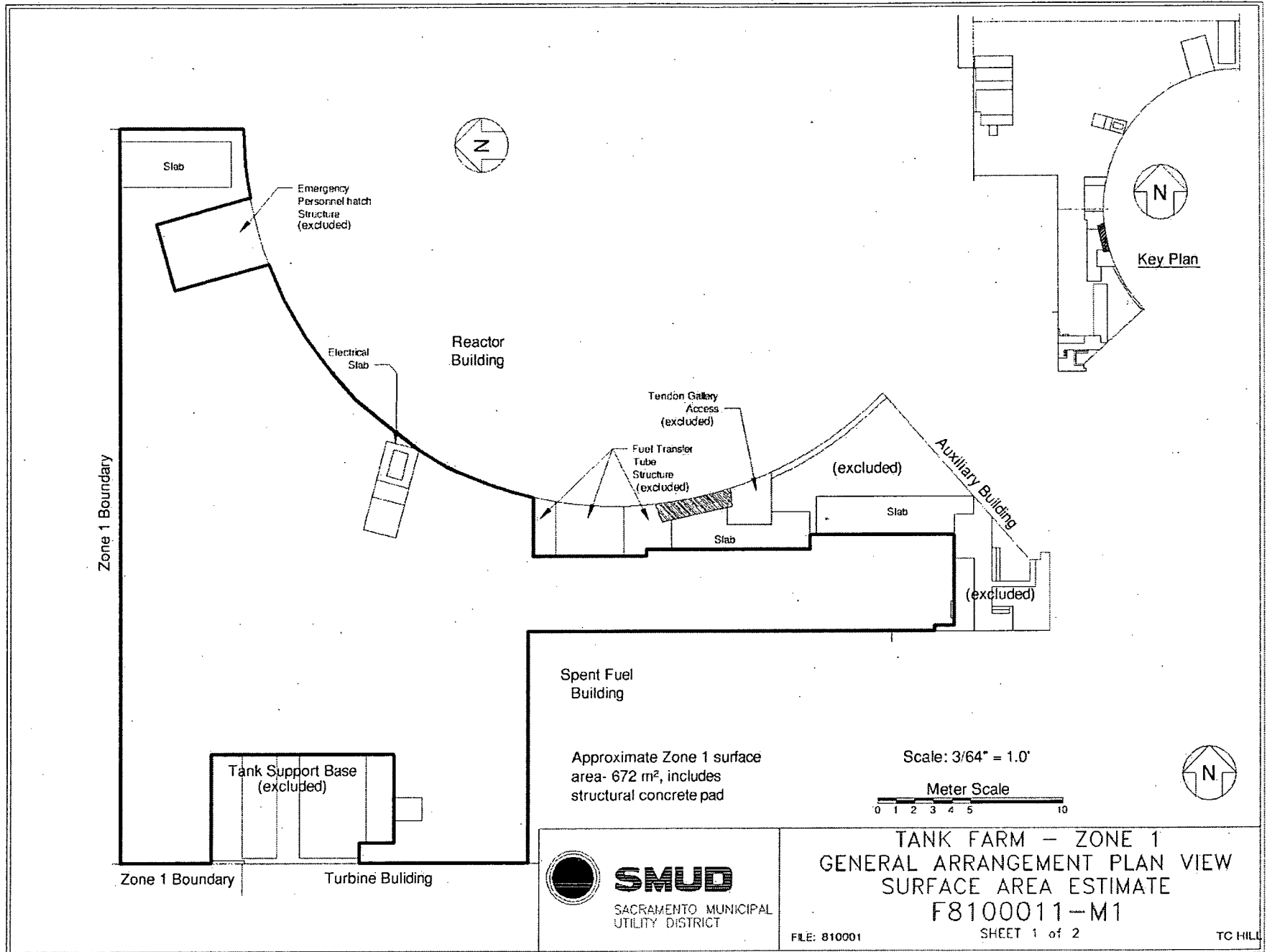
It is concluded that survey unit F8100011 meets the release criteria of 10CFR20.1402.

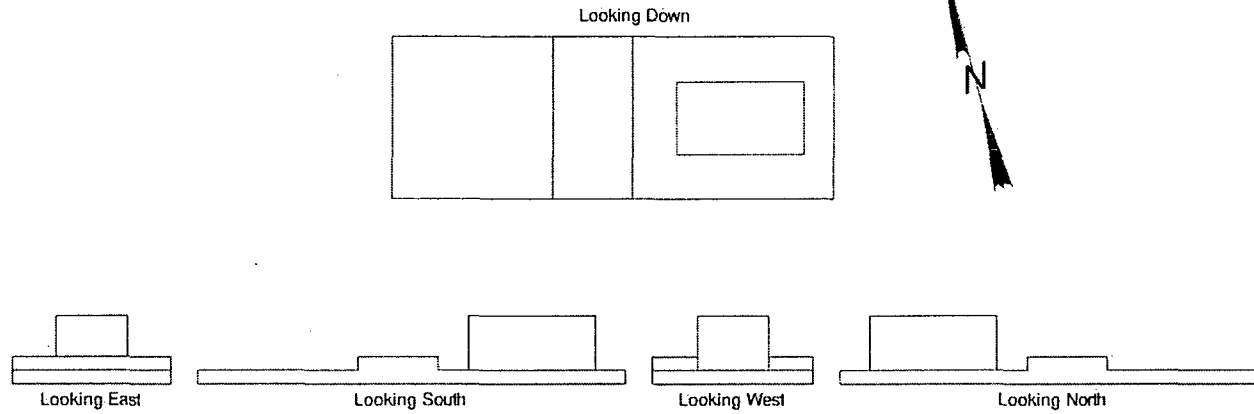
Attachment 1

Maps

March 2, 2009

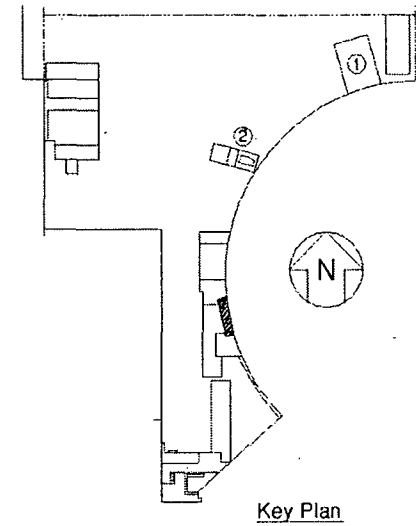
Survey Unit F8100011





Electrical Slab

Detail 2



SMUD

SACRAMENTO MUNICIPAL
UTILITY DISTRICT

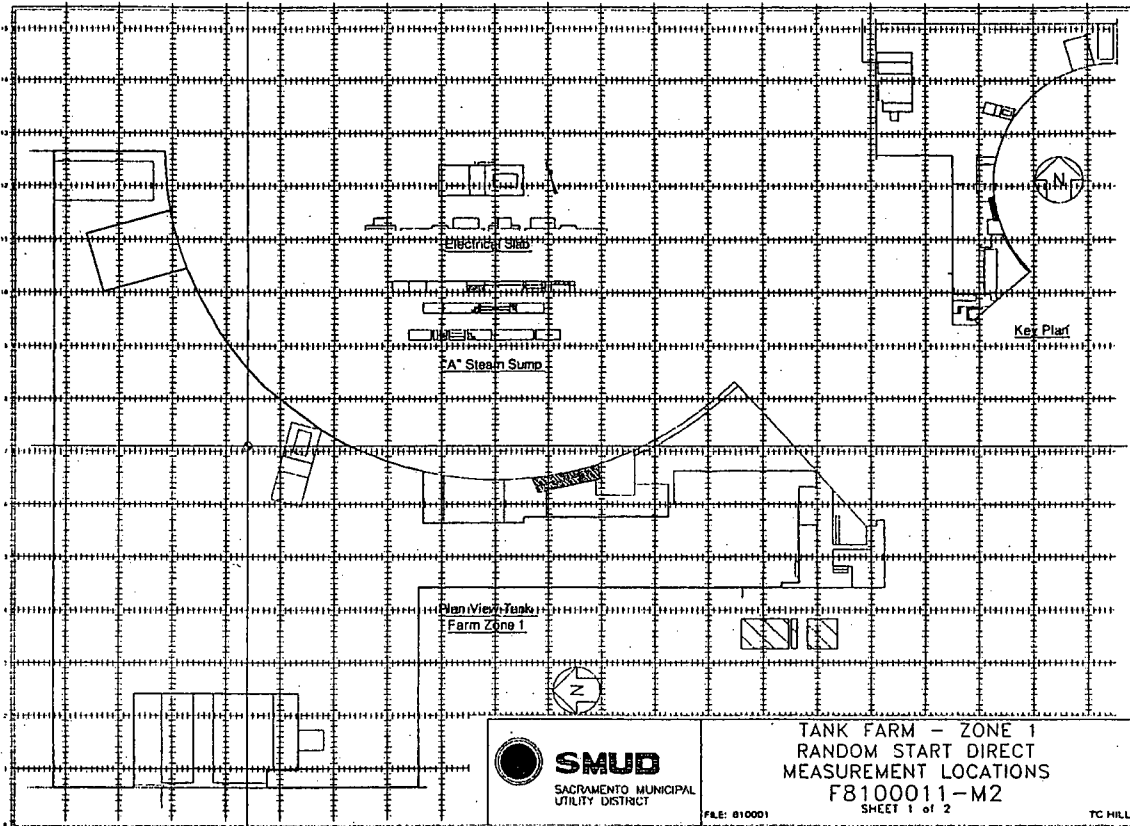
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STRUCTURE ELEVATION VIEW
SURFACE AREA ESTIMATE

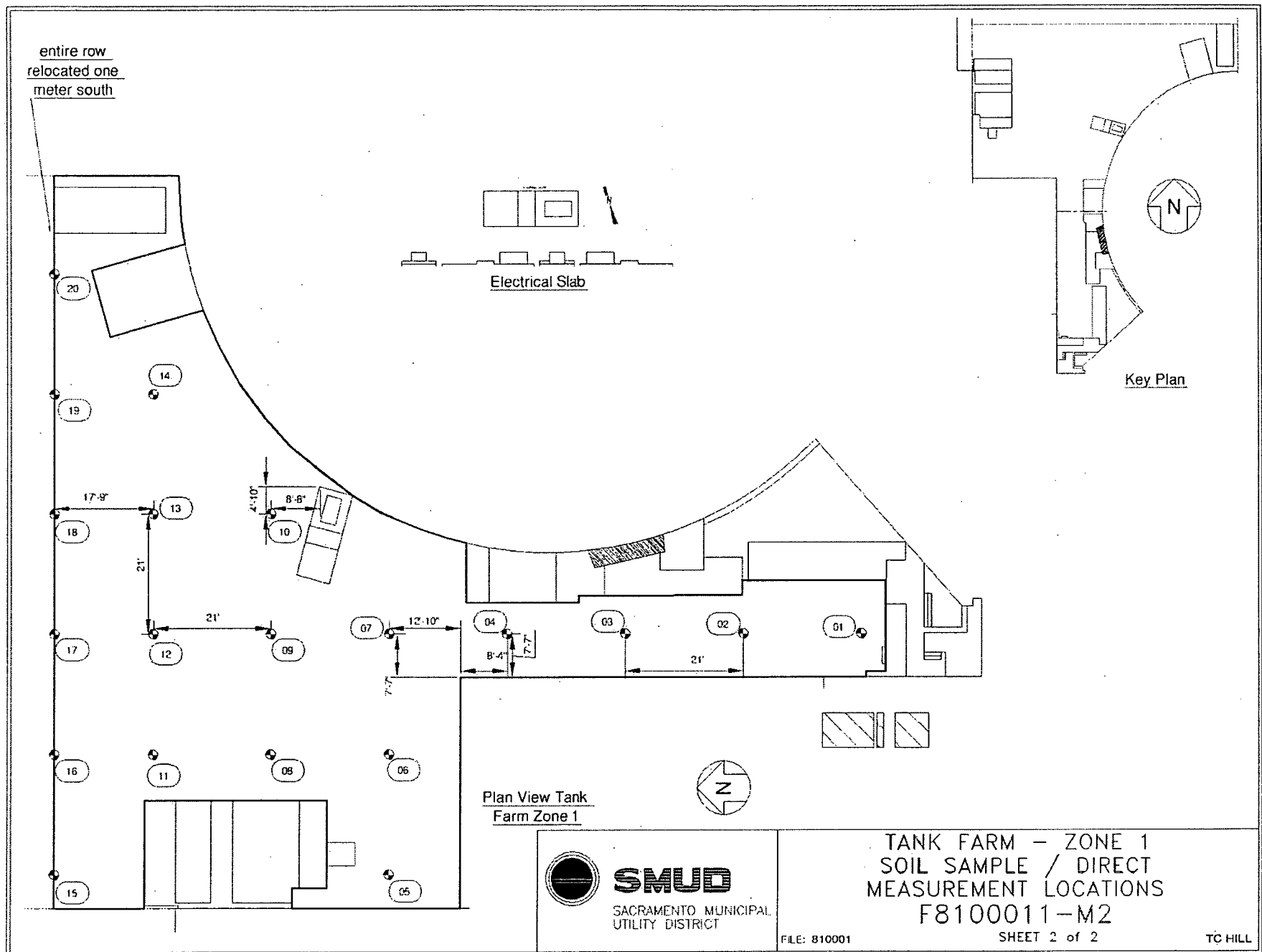
F8100011-M1

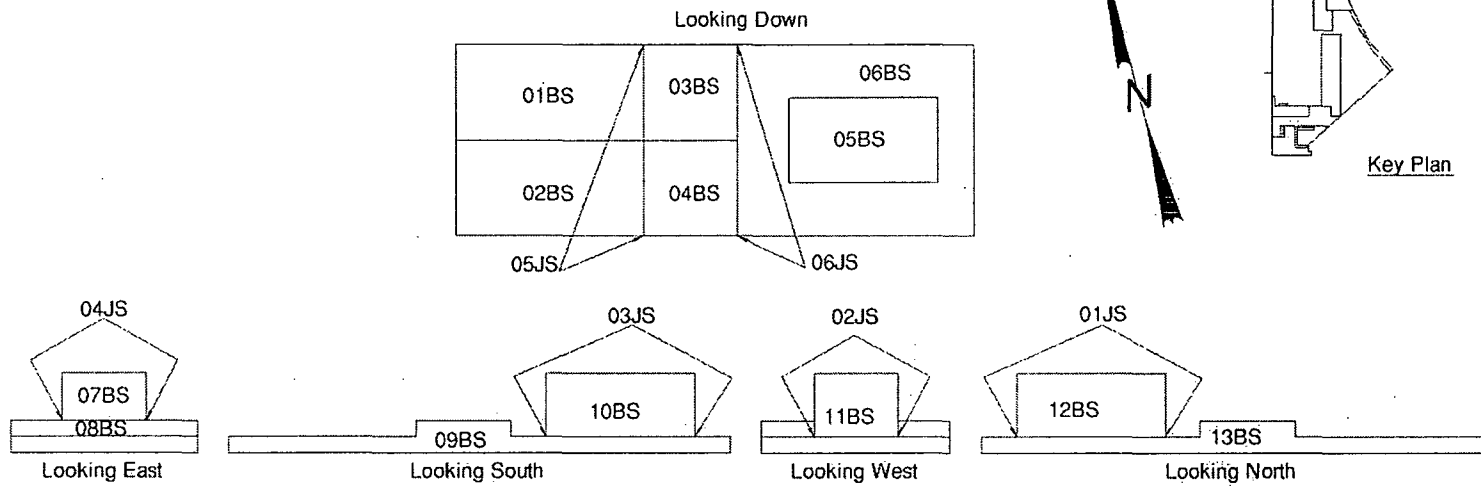
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SHEET 2 of 2

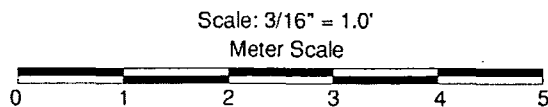
TC HILL







Electrical Slab



SMUD

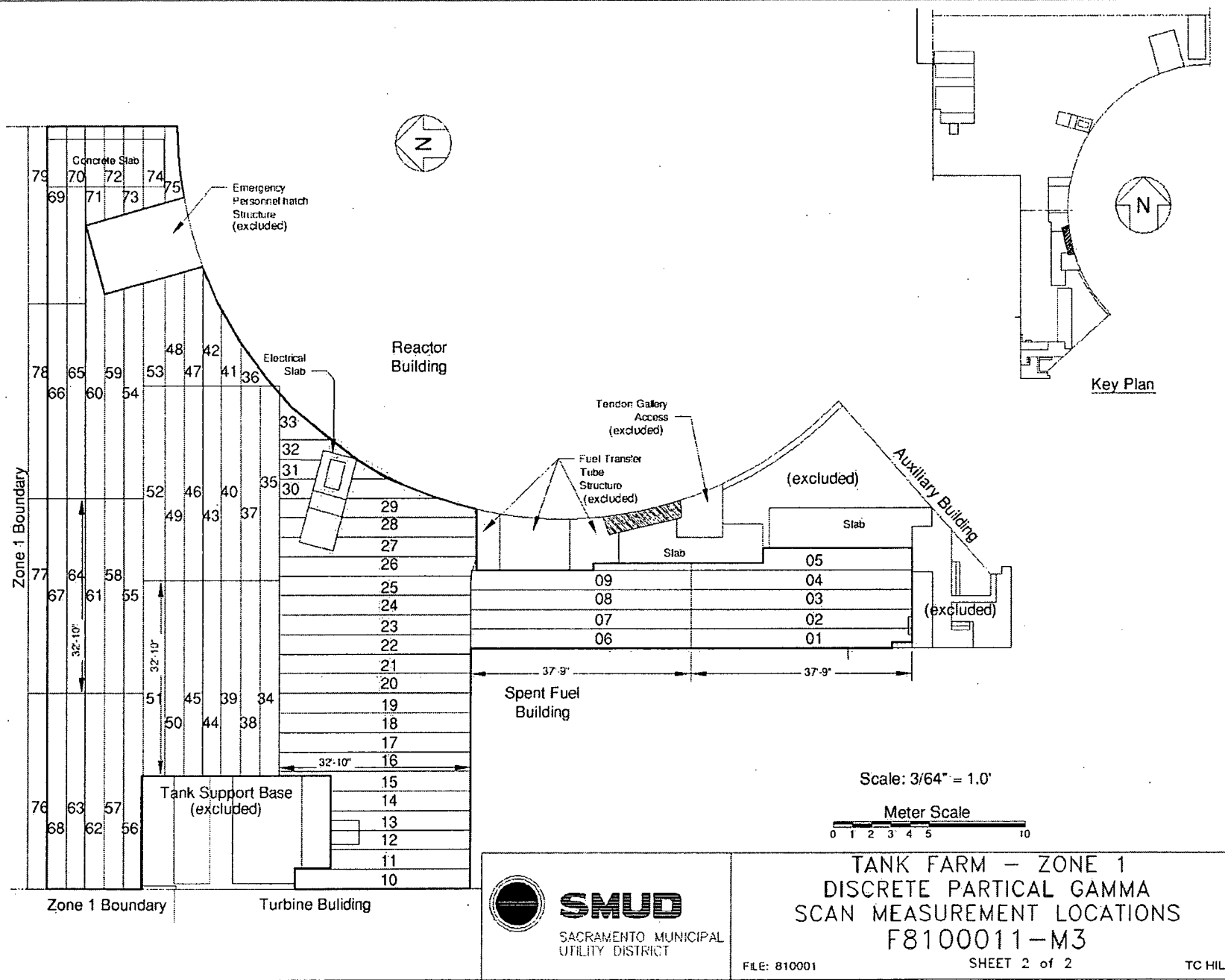
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

TANK FARM - ZONE 1
BETA SCAN
MEASUREMENT LOCATIONS
F8100011-M3

FILE: 810001

SHEET 1 of 2

TC HILL



Attachment 2

Instrumentation

March 2, 2009

Survey Unit F8100011

Table 2-1. Survey Unit Instrumentation

Instrument	Detector Model No.	Detector Serial No.	MDC
2350-1 #175834	43-68B	190482	1033
2350-1 #175834	43-116	190642	793
2350-1 #193700 #193715 #208481	44-10	256101 171374 171992	5-6 pCi/g ^{1,2}
HPGe	N/A	05069128	Soil – 0.08 pCi/g Cs-137
Inspector	N/A	08051294	Asphalt – 0.96 pCi/g Cs-137

¹ Ludlum 2350-1 with NaI Detector MDA /investigation level sufficient to detect a 1 uCi discrete Co60 particle as detailed in “Discrete Particle Detection Using the Ludlum 2350-1m and 5.08 by 5.08 NaI detectors” RFD 3/27/07.

² Ludlum 2350-1 w/ NaI detector (44-10/SPA-3) MDA for distributed soil activity ~ 5-6 pCi/g.

Table 2-2. Investigation Criteria and DCGL

Instrument	Parameter	Value
2350/43-68B	Investigation Criteria - scan	5,840 cpm
2350/43-116	Investigation Criteria - scan	4,260 cpm
2350/44-10	Investigation Criteria - scan	9000-10119 ¹
HPGe Inspector	Investigation Criteria - direct	Soil – 74.2 pCi/g Cs-137 Asphalt – 74.2 pCi/g Cs-137
All	DCGL _w	52.6 Cs-137 12.6 Co-60
All	DCGL _{EMC}	74.2 (Cs137 _{surr.})

¹ Depending on instrument-detector and survey media combination, 2350-1/44-10 Investigation Level calculated IAW DSIP-0510 (encl. 8.6)

Attachment 3

Investigation

March 2, 2009

Survey Unit F8100011

Table 3-1 Survey Unit Investigation

<i>Grid</i>	<i>Investigation Level (cpm)</i>	<i>Initial Value (cpm)</i>	<i>Investigation Result note1</i>	<i>Elevated Area (m²)</i>	<i>Area Factor</i>	<i>DCGL_{emc}</i>	<i>Investigation Result (pCi/g)</i>	<i>DCGL_{emc} Unity Fraction</i>
01	9000	13101	3577 (a)	N/A	N/A	N/A	< DCGLw	N/A
02	9000	11399	4326 (a)	N/A	N/A	N/A	< DCGLw	N/A
03	9000	11719	4618 (a)	N/A	N/A	N/A	< DCGLw	N/A
04	9000	9972	3144 (a)	N/A	N/A	N/A	< DCGLw	N/A
05	9000	18656	2626 (a) ²	N/A	N/A	N/A	< DCGLw	N/A
06	9000	31680	9634 ⁵	N/A	N/A	N/A	< DCGLw	N/A
07	9000	242929	3009 (a) ³	N/A	N/A	N/A	< DCGLw	N/A
15	9000	12417	4.2 pCi/g (d)	N/A	N/A	N/A	< DCGLw	N/A
16	9000	9599	4729 (a)	N/A	N/A	N/A	< DCGLw	N/A
30	9000	5947	MDA ⁴	N/A	N/A	N/A	< DCGLw	N/A
34	9000	10675	3203 (a)	N/A	N/A	N/A	< DCGLw	N/A
35	9000	16346	0.107 (d) ⁶	N/A	N/A	N/A	< DCGLw	N/A
36	9000	10282	3512 (a)	N/A	N/A	N/A	< DCGLw	N/A
37	9000	9651	2729 (a)	N/A	N/A	N/A	< DCGLw	N/A
38	9000	9941	0.98 pCi/g (d)	N/A	N/A	N/A	< DCGLw	N/A
39	9000	20766	3.81 pCi/g (d) ⁷	N/A	N/A	N/A	< DCGLw	N/A
40	9000	10031	3948 (a)	N/A	N/A	N/A	< DCGLw	N/A
41	9000	9800	3526 (a)	N/A	N/A	N/A	< DCGLw	N/A
42	9000	10204	3713 (a)	N/A	N/A	N/A	< DCGLw	N/A
43	9000	9480	8936 (b)	N/A	N/A	N/A	< DCGLw	N/A
44	9000	10994	3946 (a)	N/A	N/A	N/A	< DCGLw	N/A
45	9000	14590	37.7 pCi/g (d)	N/A	N/A	N/A	< DCGLw	N/A
47	9000	9957	3793 (a)	N/A	N/A	N/A	< DCGLw	N/A
48	9000	9654	3835 (a)	N/A	N/A	N/A	< DCGLw	N/A
50	9000	9980	3990 (a)	N/A	N/A	N/A	< DCGLw	N/A
51	9000	10171	3936 (a)	N/A	N/A	N/A	< DCGLw	N/A
53	9000	10041	3645 (a)	N/A	N/A	N/A	< DCGLw	N/A
54	9000	10195	3915 (a)	N/A	N/A	N/A	< DCGLw	N/A
55	9000	9805	3763 (a)	N/A	N/A	N/A	< DCGLw	N/A
56	9000	9618	3195 (a)	N/A	N/A	N/A	< DCGLw	N/A
58	9000	9200	3555 (a)	N/A	N/A	N/A	< DCGLw	N/A

(Continued)

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Attachment 4

Data Assessment

March 2, 2009

Survey Unit F8100011

