Rancho Seco

Final Status Survey Summary Report

January 6, 2009

Tank Farm N.E. Quadrant - Subsurface soil

Survey Unit F8100032

Prepared By: Dan A. Tallman _____ Date: January 6, 2009

FSS Engineer

Reviewed By: _____ Date: 1-7-09

Lead FSS Engineer

Approved By: _____ Date: 2-20-09

Dismantlement Superintendent, Radiological

Survey Unit:

F8100032, Tank Farm N.E. Quadrant - Subsurface soil

Survey Unit Description:

Operating History: This area, traditionally referred to as the Tank Farm, surrounded the tanks used to store radioactive liquids. Subsequent to plant operations, this area was used for the storage of radioactive material and equipment, include that used to perform the demolition of the reactor building concrete structures. 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.

Site Characterization: As documented in F8100031, surface 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 potential for sub-surface contamination within the unit, the decision to perform an investigation of the sub-surface soil was made. This investigation resulted in the collection of 43 soil samples, the locations of which coincided with those of the surface soil evaluation. The results of these samples and the statistical tests performed are also consistent with the evaluations performed on the surface soil component evaluated in F8100031. Based on the classification procedure (DSIP-0020) and consistent with the classification applied to the surface soil component, the area was designated 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 spatial locations were based on the surface soil locations sampled in F8100031. Sub-Surface samples were then collected at one meter intervals. Samples taken from a depth of -15 cm (depth of surface soil samples) to -115 cm are designated as minus one meter (-1m) samples while those taken from the interval -115cm to -215 cm are referred to as minus two meter (-2m) samples. Due to the existence of numerous sub-surface utility support structures (piping, cable duct-boxes, sewer lines, etc.) as well as over dimension fill and debris existing undetected below grade level, sample refusal was not an uncommon occurrence. One incident of refusal culminated in the inability to acquire a two meter sample within a one meter radius (the relocation allowance criteria) of the surface and one meter sample locations accounting for the existence of 22 minus one meter samples and 21 minus two meter samples. Each soil sample taken was analyzed by HPGe detector. 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 N.E. Quadrant - Subsurface soil
Survey Unit:	0032	Open Land Area
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	1942	
Evaluator:	D.A.Tallman	
DCGL Cs137 surrogate (pCi/g)**:**	51.2	
Area Factor:	1.2	Class 1
Design DCGLemc (pCi/g)**:**	61.5	Class 1
LBGR (pCi/g)**:**	25.6	Default = 50% DCGL
Design Sigma (pCi/g)**:**	10.7	DTBD-06-001, Table 5-4D
Type I Error:	0.05	
Type II Error:	0.05	
Nuclide:	Cs137	
Sample Area (m^2)**:**	100	Class 1
Total Area Scanned (m^2)**:**	1942	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.97725	
Calculated Relative Shift:	2.3	
Relative Shift Used:	2.3	Uses 3.0 if Rel Shift >3
N-Value:	12	
Design N-Value + 20%:	15	NUREG-1575 Table 5-5
Grid Spacing L:	10	Class 1 modified to meet minimum "N"

Survey Results:

A total of 43 direct measurements were made in F8100032. The results including mean, median, standard deviation and range are shown in Table 2. All of the direct measurements were less than the DCGL. Soil samples were counted to the MDC shown in Table 2-1 of Attachment 2.

Table 2. Direct Measurement Results

(all activity values in pCi/g)

Measurement ID	Cs137 MDA	Cs137 Activity	Uncertainty
Mean:		4.85E-02	
Median:		4.78E-02	
Standard Deviation:		8.61E-03	
Range:	3.29E-02 to 6.98E-02		
F8100032S0011SS	6.98E-02	< 6.98E-02	
F8100032S0021SS	4.43E-02	< 4.43E-02	
F8100032S0031SS	5.95E-02	< 5.95E-02	
F8100032S0041SS	5.04E-02	< 5.04E-02	
F8100032S0051SS	5.60E-02	< 5.60E-02	
F8100032S0061SS	6.36E-02	< 6.36E-02	
F8100032S0071SS	4.01E-02	6.26E-02	3.16E-02
F8100032S0081SS	4.71E-02	< 4.71E-02	
F8100032S0091SS	5.66E-02	< 5.66E-02	
F8100032S0101SS	5.93E-02	< 5.93E-02	
F8100032S0111SS	4.60E-02	< 4.60E-02	
F8100032S0121SS	3.40E-02	< 3.40E-02	
F8100032S0131SS	5.62E-02	< 5.62E-02	
F8100032S0141SS	5.49E-02	< 5.49E-02	
F8100032S0151SS	5.18E-02	< 5.18E-02	
F8100032S0161SS	4.37E-02	< 4.37E-02	
F8100032S0171SS	5.62E-02	< 5.62E-02	
F8100032S0181SS	5.44E-02	< 5.44E-02	
F8100032S0191SS	4.83E-02	< 4.83E-02	
F8100032S0201SS	5.57E-02	< 5.57E-02	
F8100032S0211SS	5.52E-02	< 5.52E-02	
F8100032S0221SS	3.74E-02	< 3.74E-02	
F8100032S0012SS	4.52E-02	< 4.52E-02	
F8100032S0022SS	3.94E-02	< 3.94E-02	
F8100032S0042SS	4.12E-02	< 4.12E-02	
F8100032S0052SS	4.14E-02	< 4.14E-02	
F8100032S0062SS	5.00E-02	< 5.00E-02	
F8100032S0072SS	4.32E-02	< 4.32E-02	
F8100032S0082SS	3.87E-02	< 3.87E-02	
F8100032S0092SS	4.08E-02	< 4.08E-02	
F8100032S0102SS	4.34E-02	< 4.34E-02	
F8100032S0112SS	3.44E-02	< 3.44E-02	
F8100032S0122SS	4.15E-02	< 4.15E-02	
F8100032S0132SS	5.53E-02	< 5.53E-02	
F8100032S0142SS	4.70E-02	< 4.70E-02	
F8100032S0152SS	4.31E-02	< 4.31E-02	
F8100032S0162SS	3.66E-02	< 3.66E-02	
F8100032S0172SS	4.90E-02	< 4.90E-02	
F8100032S0182SS	4.46E-02	< 4.46E-02	
F8100032S0192SS	5.43E-02	< 5.43E-02	
F8100032S0202SS	5.28E-02	< 5.28E-02	
F8100032S0212SS	4.78E-02	< 4.78E-02	
F8100032S0222SS	3.29E-02	< 3.29E-02	

Survey Unit Data Assessment:

The survey design required 43 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):	43	
Median (pCi/g)**:**	4.78E-02	
Mean (pCi/g)**:**	4.85E-02	
Standard Deviation (pCi/g)**:**	8.61E-03	
Maximum (pCi/g)**:**	6.98E-02	
Sign Test Final N Value:	43	
S+ Value:	43	
Critical Value:	27	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGLemc:	Yes	Class 1
Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
The survey unit passes all conditions?	Yes	

Survey Unit Investigations and Results:

No investigations were required, therefore, no investigation results are reported.

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. No potential areas of elevated activity were detected.

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 as a subsurface survey, the scan coverage requirement is not applicable. All of the direct measurements were less than the DCGL. No 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.

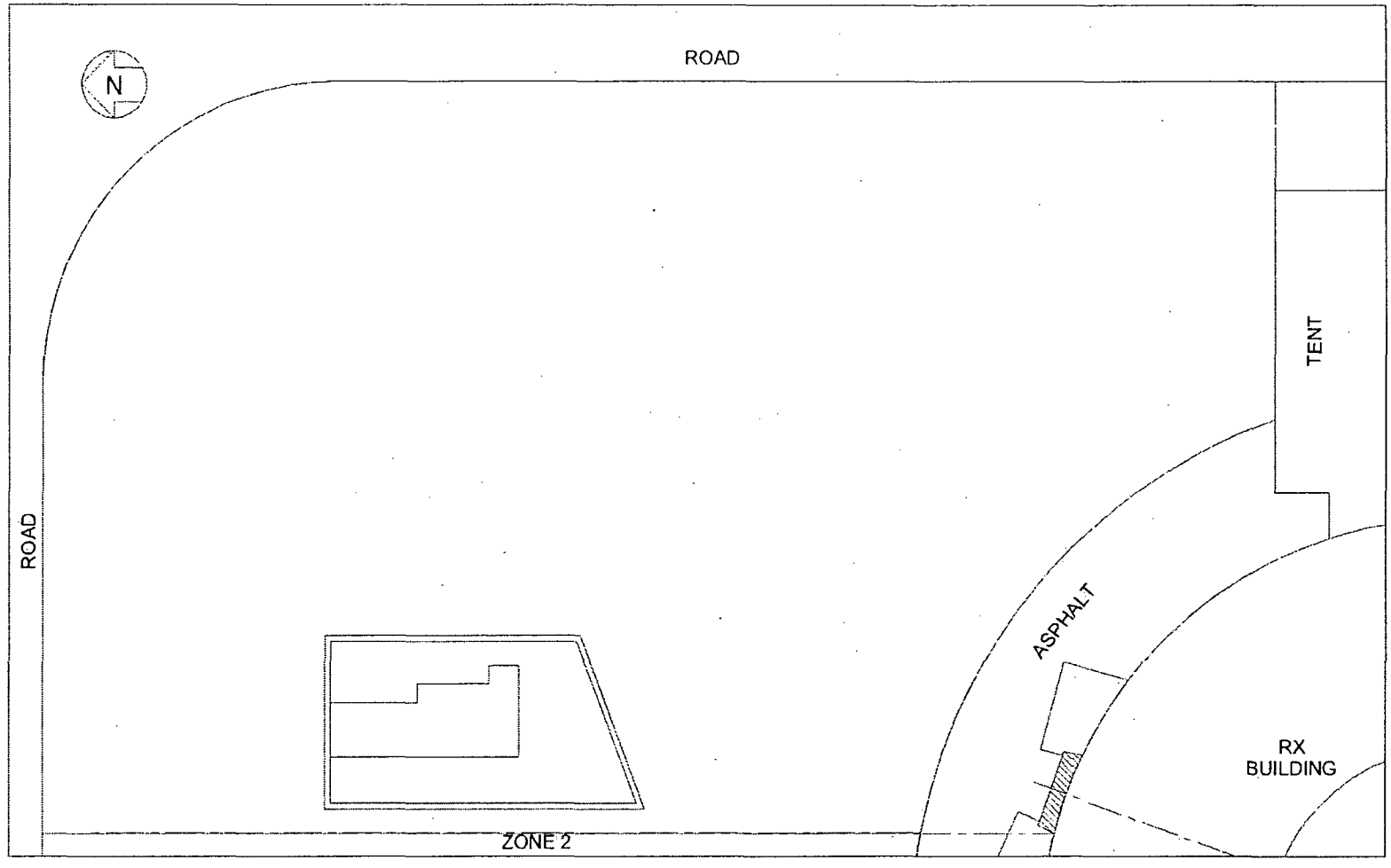
It is concluded that survey unit F8100032 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

January 6, 2009

Survey Unit F8100032



Surface Area Estimates

Soil	1963.5 m²
Total	1963.5 m²

SCALE METERS

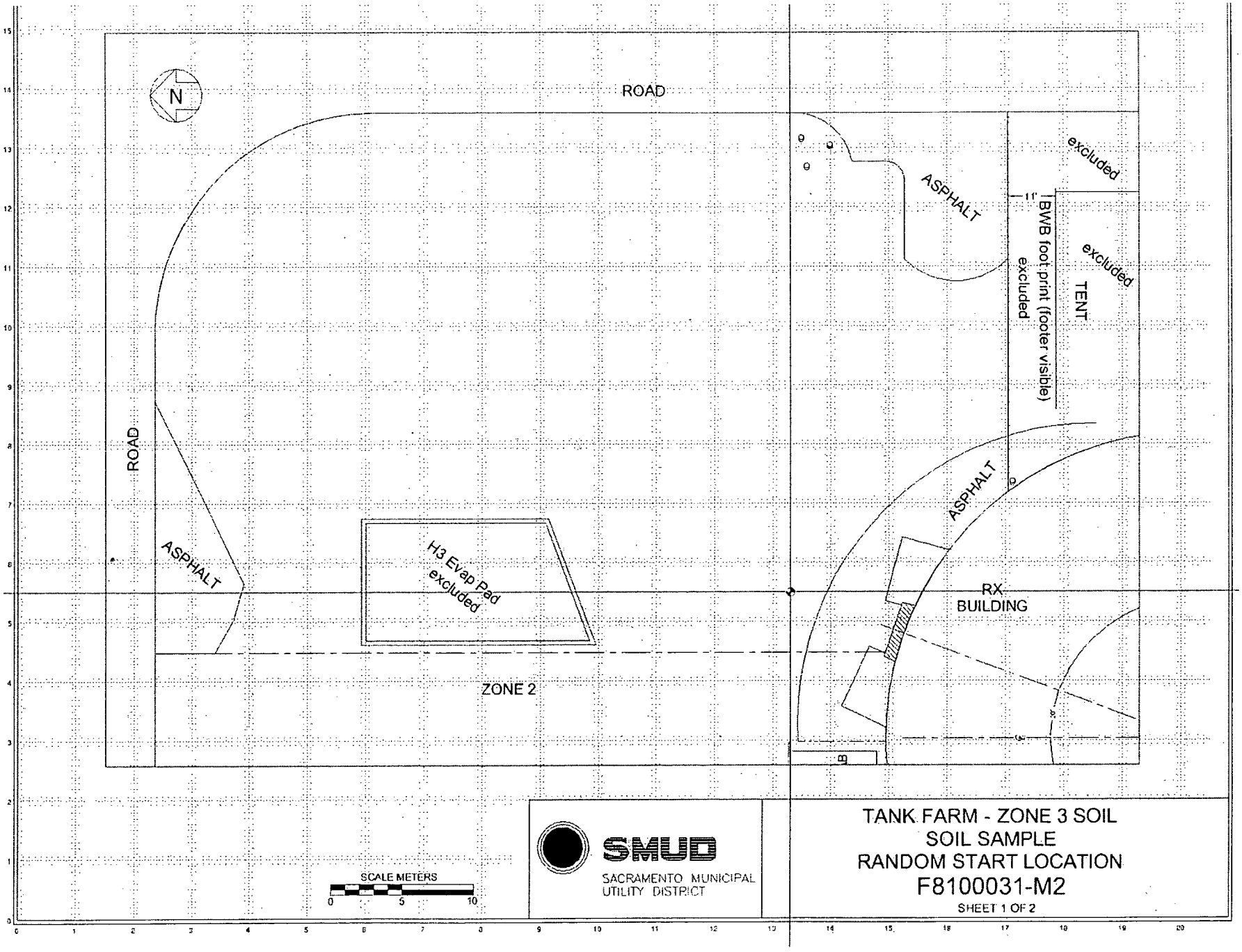
0 5 10

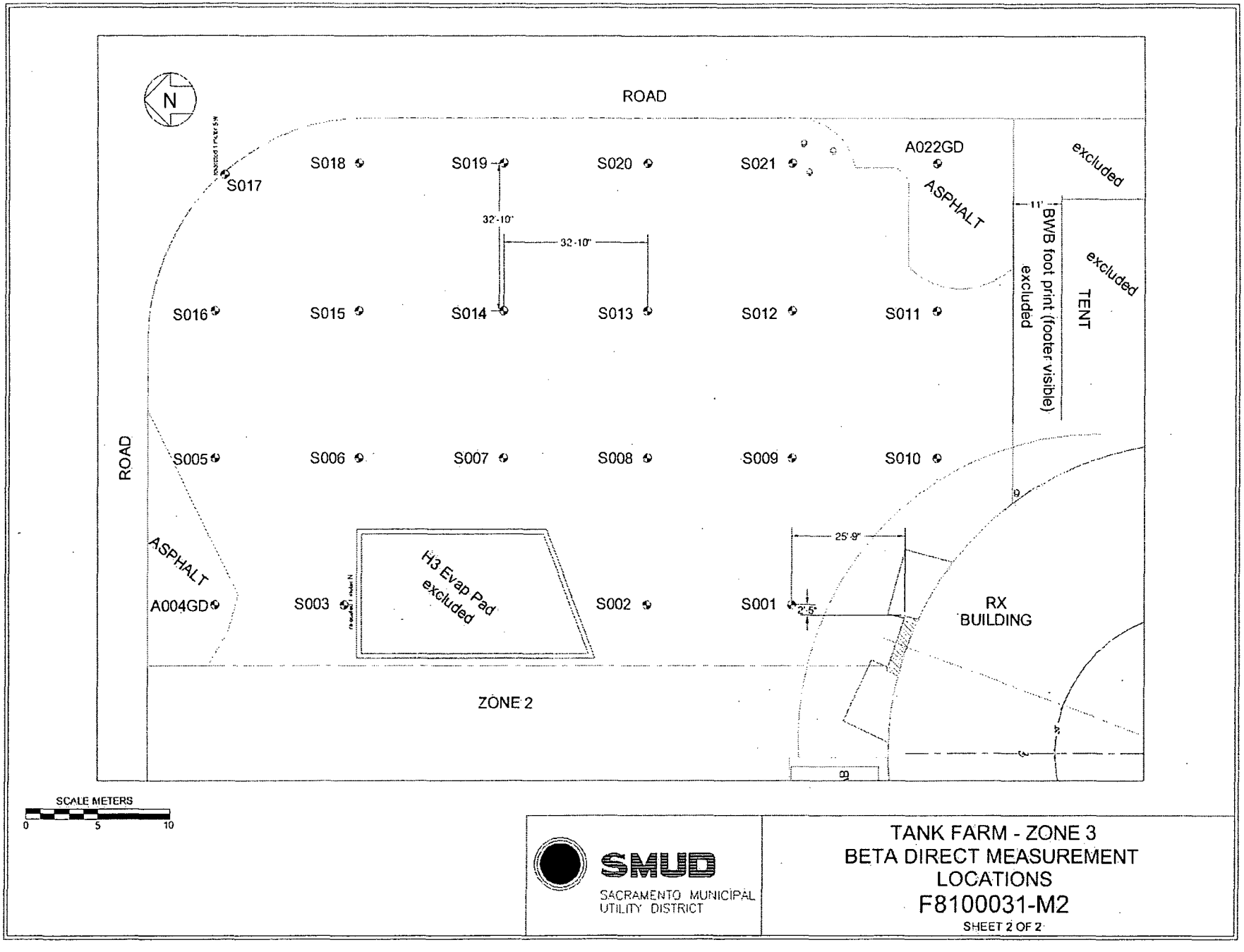
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

TANK FARM - ZONE 3 SOIL
GENERAL ARRANGEMENT PLAN VIEW
SURFACE AREA ESTIMATE
F8100031-M1

SHEET 1 OF 1


N
ROAD
ROAD
ASPHALT
ASPHALT
ASPHALT
excluded
excluded
excluded
11'
BWB foot print (footer visible)
TENT
H3 Evap Pad
excluded
RX
BUILDING
ZONE 2
SCALE METERS
0 5 10
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
TANK FARM - ZONE 3 SOIL
SOIL SAMPLE
RANDOM START LOCATION
F8100031-M2
SHEET 1 OF 2


N
ROAD
S017
S018
S019
S020
S021
A022GD
ASPHALT
excluded
11'
BWB foot print (footer visible)
excluded
TENT
excluded
32'-10"
32'-10"
S016
S015
S014
S013
S012
S011
ROAD
S005
S006
S007
S008
S009
S010
25'-9"
ASPHALT
A004GD
S003
H3 Evap Pad
excluded
S002
S001
2'-5"
RX
BUILDING
ZONE 2
SCALE METERS
0
5
10
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
TANK FARM - ZONE 3
BETA DIRECT MEASUREMENT
LOCATIONS
F8100031-M2
SHEET 2 OF 2

Attachment 2

Instrumentation

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Survey Unit F8100032

Table 2-1. Survey Unit Instrumentation

Instrument	Detector Model No.	Detector Serial No.	MDC
HPGe	N/A	05069128	Soil – 0.0698 pCi/g Cs-137 Soil – 0.0680 pCi/g Co-60

Table 2-2. Investigation Criteria and DCGL

Instrument	Parameter	Value
HPGe	Investigation Criteria	61.5 pCi/g Cs137 surr.
All	$DCGL_W$	51.2 pCi/g Cs-137 12.6 pCi/g Co-60
All	$DCGL_{EMC}$	61.5 pCi/g Cs137 surr.

Attachment 3

Investigation

January 6, 2009

Survey Unit F8100032

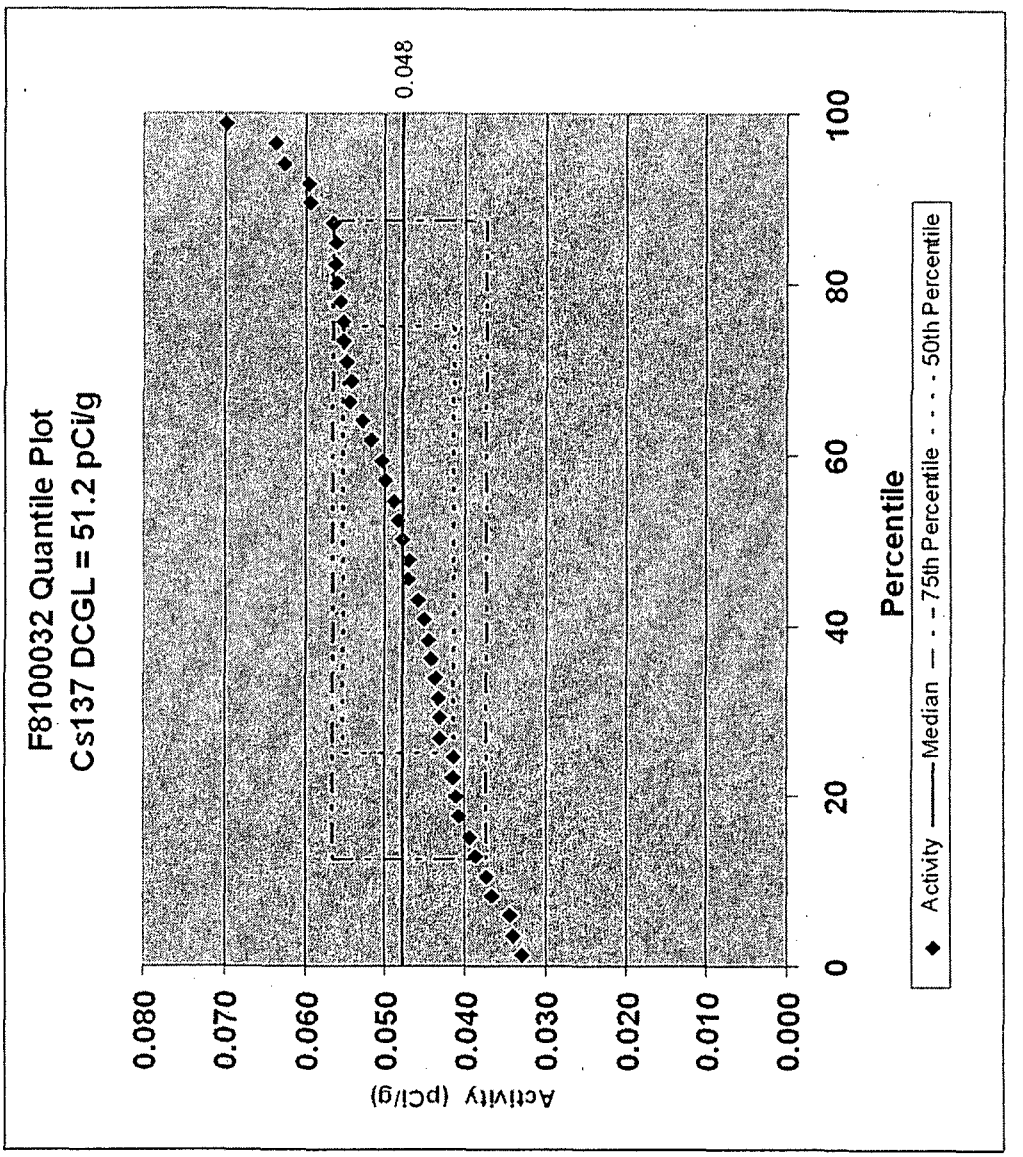
(none required)

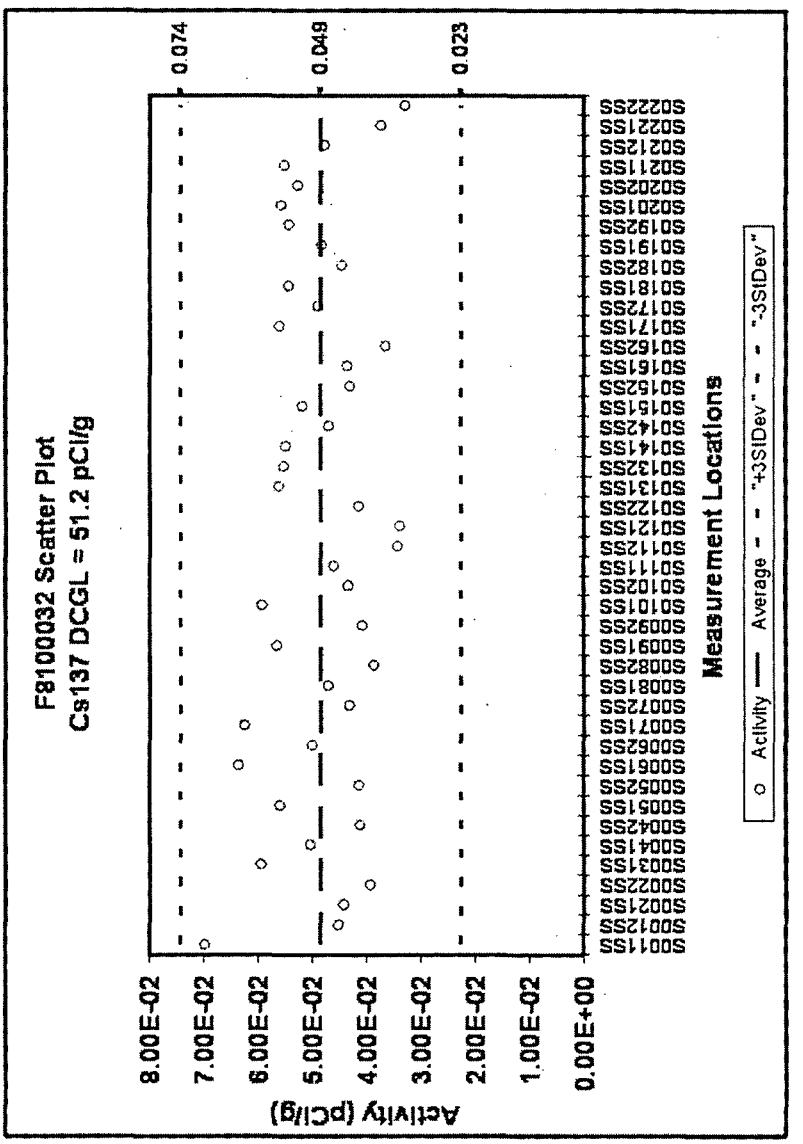
Attachment 4

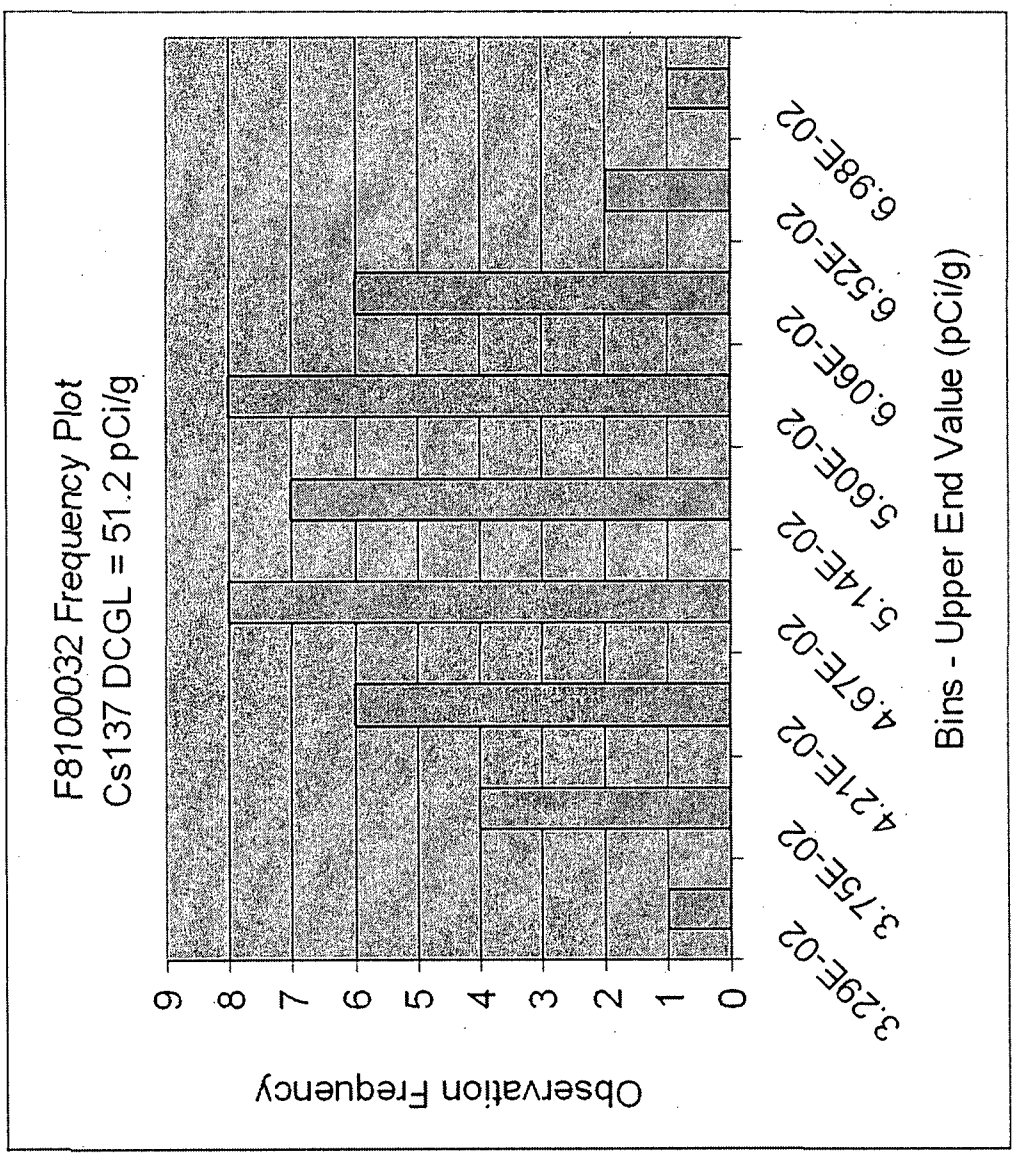
Data Assessment

January 6, 2009

Survey Unit F8100032


F8100032 Quantile Plot
Cs137 DCGL = 51.2 pCi/g
0.048
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Activity (pCi/g)
0
20
40
60
80
100
Percentile
Activity
Median
75th Percentile
50th Percentile


F8100032 Scatter Plot
Cs137 DCGL = 51.2 pCi/g
0.074
0.049
0.023
8.00E-02
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Activity (pCi/g)
Measurement Locations
Activity
Average
"+3SIDev"
"-3SIDev"


F8100032 Frequency Plot
Cs137 DCGL = 51.2 pCi/g
Observation Frequency
0
1
2
3
4
5
6
7
8
9
3.29E-02
3.75E-02
4.21E-02
4.67E-02
5.14E-02
5.60E-02
6.06E-02
6.52E-02
6.98E-02
Bins - Upper End Value (pCi/g)