Rancho Seco

Final Status Survey Summary Report

January 8, 2009

## Tank Farm - N.W. Quadrant Subsurface Soil

## Survey Unit F8100022

Prepared By: Dan A. Tallman\_ \_ Date: January 8, 2009 hver FSS Engineer 09 **Reviewed By** Date: Lead FSS Engineer 2-20-0 Approved By: Date: **Dismantlement Superintendent, Radiological** 

### FINAL STATUS SURVEY SUMMARY REPORT

#### Survey Unit:

F8100022, Tank Farm - N.W. 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 F8100021, 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 34 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 F8100021. 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 F8100021. 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. No 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. 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.

Survey Design Parameter	Value	Comment
Survey Area:	F810	Tank Farm - N.W. Quadrant
		Subsurface Soil
Survey Unit:	. 0022	Open Land Area
Class:	. 1	LTP Table 5-4
<b>SU Area</b> (m <sup>2</sup> ):	1618	IAW F8100021
Evaluator:	D.A.Tallman	
DCGL for Cs-137 surrogate (pCi/g):	52.6	
DCGL for Co-60 (pCi/g):	12.6	
Area Factor:	· · · · · · · · · · · · · · · · · · ·	Class 1 - IAW F8100021
<b>Design DCGLemc</b> (pCi/g):	62.97	Class 1 - IAW F8100021
LBGR (pCi/g):	26.3	50% DCGL for Cs-137
	·	surrogate (pCi/g):
<b>Design Sigma</b> (pCi/g):	10.7	DTBD-06-001, Table 5-4B
		IAW F8100021
Type I Error:	0.05	
Type II Error:	0.05	
Sample Area (m <sup>2</sup> ):	107.9	Class 1
<b>Total Area Scanned</b> (m <sup>2</sup> ):	0	SubSurface Soil
Scan Coverage (%):	0%	SubSurface Soil - NA
$Z_{1-\alpha}$ :	1.645	
Z <sub>1-β</sub> :	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:	10	Reduced to 10 meters to
		meet minimum "N"
		IAW F8100021

# Table 1. Survey Unit Design Parameters

# **Survey Results:**

A total of 34 direct measurements were made in F8100022. 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. Soil samples 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)

	Cs137		Co60						
Sample ID	MDA	Activity	Uncertainty	Unity Value	MDA	Activity	Uncertainty	Unity Value	Unity Total
F8100022S0011SS	4.38E-02	<4.38E-02		0.0008	4.37E-02	<4.37E-02		0.0035	0.0043
F8100022S0021SS	6.08E-02	1.09E-01	4.55E-02	0.0021	6.36E-02	<6.36E-02		0.005	0.0071
F8100022S0031SS	6.22E-02	<6.22E-02	4.27E-02	0.0012	7.76E-02	<7.76E-02		0.0062	0.0073
F8100022S0041SS	4.87E-02	<4.87E-02		0.0009	2.07E-02	<2.07E-02		0.0016	0.0026
F8100022S0051SS	4.87E-02	<4.87E-02		0.0009	5.50E-02	<5.50E-02		0.0044	0.0053
F8100022S0061SS	5.80E-02	<5.80E-02		0.0011	5.41E-02	<5.41E-02		0.0043	0.0054
F8100022S0071SS	6.13E-02	1.92E-01	5.46E-02	0:0036	4.89E-02	<4.89E-02		0.0039	0.0075
F8100022S0081SS	5.81E-02	<5.81E-02		0.0011	5.43E-02	<5.43E-02		0.0043	0.0054
F8100022S0091SS	8.28E-02	7.10E-01	9.78E-02	0.0135	7.25E-02	<7.25E-02		0.0058	0.0193
F8100022S0101SS	5.64E-02	<5.64E-02		0.0011	4.60E-02	<4.60E-02		0.0037	0.0047
F8100022S0111SS	3.88E-02	<3.88E-02		0.0007	1.68E-02	<1.68E-02		0.0013	0.0021
F8100022S0121SS	4.74E-02	<4.74E-02		0.0009	3.80E-02	<3.80E-02		0.003	0.0039
F8100022S0131SS	5.60E-02	1.01E-01	4.46E-02	0.0019	7.94E-02	<7.94E-02		0.0063	0.0082
F8100022S0141SS	1.28E-01	3.62E01	5.53E-01	0.6879	4.34E-02	3.65E-01	4.98E-02	0.029	0.7169
F8100022S0151SS	4.25E-02	<4.25E-02		0.0008	4.33E-02	<4.33E-02		0.0034	0.0042
F8100022S0161SS	9.04E-02	<9.04E-02		0.0017	6.19E-02	<6.19E-02		0.0049	0.0066
F8100022S0171SS	5.51E-02	<5.51E-02		0.001	4.36E-02	<4.36E-02		0.0035	0.0045
F8100022S0012SS	4.05E-02	<4.05E-02		0.0008	4.78E-02	<4.78E-02		0.0038	0.0046
F8100022S0022SS	3.96E-02	<3.96E-02		0.0008	3.45E-02	<3.45E-02		0.0027	0.0035
F8100022S0032SS	7.50E-02	<7.50E-02	· ·	0.0014	6.72E-02	<6.72E-02		0.0053	0.0068
F8100022S0042SS	4.11E-02	<4.11E-02		0.0008	4.11E-02	<4.11E-02		0.0033	0.004
F8100022S0052SS	4.22E-02	<4.22E-02		0.0008	5.51E-02	<5.51E-02		0.0044	0.0052
F8100022S0062SS	5.29E-02	<5.29E-02		0.001	5.86E-02	<5.86E-02		0.0047	0.0057
F8100022S0072SS	4.88E-02	<4.88E-02		0.0009	3.97E-02	<3.97E-02		0.0032	0.0041
F8100022S0082SS	5.75E-02	<5.75E-02		0.0011	4.21E-02	<4.21E-02		0.0033	0.0044
F8100022S0092SS	4.11E-02	<4.11E-02		0.0008	4.43E-02	<4.43E-02		0.0035	0.0043
F8100022S0102SS	4.77E-02	<4.77E-02		0.0009	4.87E-02	<4.87E-02		0.0039	0.0048
F8100022S0112SS	4.39E-02	<4.39E-02		0.0008	5.81E-02	<5.81E-02		0.0046	0.0054
F8100022S0122SS	4.32E-02	<4.32E-02		0.0008	5.37E-02	<5.37E-02		0.0043	0.0051
F8100022S0132SS	4.96E-02	<4.96E-02		0.0009	4.47E-02	<4.47E-02		0.0035	0.0045
F8100022S0142SS	5.85E-02	9.93E-01	9.09E-02	0.0189	4.84E-02	<4.84E-02		0.0038	0.0227
F8100022S0152SS	2.59E-02	<2.59E-02		0.0005	2.07E-02	<2.07E-02		0.0016	0.0021
F8100022S0162SS	3.95E-02	<3.95E-02		0.0008	3.23E-02	<3.23E-02		0.0026	0.0033
F8100022S0172SS	4.30E-02	<4.30E-02		0.0008	4.39E-02	<4.39E-02		0.0035	0.0043

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	Cs137 Activity (pCi/g)	Co60 Activity (pCi/g)	Cs137 Unity	Co60 Unity	Unity Total	
DCGLw	52.6	12.6				
Mean	1.17E00	5.78E-02	0.0222	0.0046	0.0268	
Median	4.88E-02	4.81E-02	0.0009	0.0038	0.0047	
Standard Deviation	6.19E00	5.63E-02	0.1177	0.0045	0.122	
Cs137 Activity	Range (pCi/g)	2.59E-02 to 3.62E01				
Co60 Activity	Range (pCi/g)	1.68E-02 to 3.65E-01				
Cs137 Unit	ty Range	0.0005 to 0.6879				
Co60 Unit	y Range		0.0013 to 0.029			
Total Unit	y Range		0.0021 to 0.7169			
Sample	Count	34				

 Table 2-2. Direct Measurements Results Summary

## Survey Unit Data Assessment:

The survey design required 34 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.

Survey Results Parameter	Value	Comment
Actual Direct Measurements (N):	34	17 at one meter, 17 at two
		meters
Median (Unity):	0.005	
Mean (Unity):	0.027	
Direct Measurement Std Deviation (Unity):	0.122	
Maximum (Unity):	0.717	
Sign Test Final N Value:	34	
S+ Value:	34	
Critical Value:	22	
Sufficient Samples Collected:	Yes	
Maximum Value < Unitized DCGL:	Yes	
Median Value < Unitized DCGL:	Yes	
Mean Value < Unitized DCGL:	Yes	
Maximum Value < DCGLemc (Unity):	Yes	Class 1
Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
<b>Reject the Null Hypothesis?</b>	Yes	
Does the Survey Unit Pass All Criteria?	Yes	

 Table 3. Data Assessment Results

## Survey Unit Investigations and Results:

No investigations were required for direct measurements 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 soil survey, scan coverage is not applicable. All of the direct measurements were less than Unity. 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 F8100022 meets the release criteria of 10CFR20.1402.

FSS Summary Report

Attachment 1

Maps

<sup>-</sup> January 8, 2009

Survey Unit F8100022







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Att. 1 Maps

Attachment 2 Instrumentation January 8, 2009 Survey Unit F8100022

Instrument	Detector Model No.	Detector Serial No.	MDC
HPGe	N/A	05069128	Soil – 0.1280 pCi/g Cs-137 Soil – 0.0794 pCi/g Co-60

# Table 2-1. Survey Unit Instrumentation

# Table 2-2. Investigation Criteria and DCGL

Instrument	Parameter	Value
HPGe	Investigation Criteria	63.0 pCi/g Cs137 surr.
All	DCGLw	52.6 Cs-137 12.6 Co-60
All	DCGL <sub>EMC</sub>	63.0 pCi/g Cs137 surr.

Attachment 3 Investigation January 8, 2009

# Survey Unit F8100022

# (none required)

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Att. 4 Data Assessment





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