

**ISRA 009 – AP/STP-1F.
Soil Sampling for Radionuclides.
Results and Statistical Analysis.
Waste Certification.**

This data package provides the laboratory results and statistical analysis of the 4 samples taken at the ISRA Outfall 009, AP/STP-1F area. This analysis and data interpretation complies with the procedure approved by the California Department of Public Health¹.

Samples taken for waste disposal characterization were analyzed for strontium-90, tritium and gamma emitting radionuclides by gamma spectroscopy, using an off-site laboratory. Minimum detectable activity (MDA) for cesium-137 and strontium-90 averaged ~0.043 pCi/g and ~0.046 pCi/g respectively. Minimum detectable activity for tritium averaged ~1.0 pCi/g. The gamma spectroscopy library also included the following contaminants-of-concern: Na-22, K-40, Mn-54, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Th-228, Th-232, U-235, U-238 and Am-241.

Statistical evaluation of sample analytical results to determine whether or not the sampled waste contains Cs-137 or Sr-90 activity elevated above local background was conducted using the Wilcoxon Rank Sum Test using protocols described in NUREG-1505² and DTSC guidance³ (See Appendix 1). Appendix 2 shows the complete analytical results for all radionuclides. Complete laboratory data packages are available on request.

Local background data for cesium-137 and strontium-90 was taken from Table 20 of the 1995 McLaren/Hart report⁴. Background for tritium in soil is not well established, and is not reported in the 1995 McLaren/Hart report, therefore tritium bac

0.213 pCi/g. The highest non-background subtracted Cs-137 result is equivalent to an effective dose of 0.053 mrem/y⁶.

Strontium-90 - Based on the results of the statistical analysis of Appendix 1, soil to be excavated from AP/STP-1F does not exceed the local background for Sr-90. The incremental dose from Sr-90 above background is therefore zero mrem/y. All Sr-90 results are non-detect. The highest Sr-90 result is 0.04 pCi/g which is non-detect and less than the highest background result of 0.13 pCi/g. The highest non-background subtracted, non-detect Sr-90 result is equivalent to an effective dose of 0.0024 mrem/y⁶.

Tritium - All tritium results are non-detect, the average tritium result is -0.008 pCi/g and the highest tritium result is 0.226 pCi/g. The highest non-detected, non-background subtracted tritium result is equivalent to an effective dose of 0.048 mrem/y⁶.

This waste is certified to be “radiologically” acceptable for shipment to, and disposal at, any waste disposal facility. The waste requires no further radiological controls.

This waste meets the requirements of disposal facility permits^{7,8} and complies with the California Health & Safety Code⁹.

The Governor’s Executive Order D-62-02 prohibits the “*disposal of decommissioned materials to Class III landfills or unclassified management units.*” The soil from AP/STP-1F is not decommissioned material, and does not originate from the proximity of any radiological facility. The sampling in this certification has therefore been conducted as a best management practice that complies with the requirements of D-62-02. Verification sampling and/or approval by the

⁶ EPA dose compliance considerations for radionuclides (Effective August 3, 2010) -

California Department of Public Health (CDPH) Radiologic Health Branch (RHB) are not required for the off-site disposal of decommissioned material or of the subject material¹⁰.



Phil Rutherford
Manager, Health, Safety & Radiation Services

¹⁰ The California Department of Public Health (CDPH) Radiologic Health Branch (RHB) has stated in a November 9, 2007 email to Phil Rutherford (Boeing) ... *"The Governor's Executive Order D-62-02, does not specifically require the Department of Health Services (now the Department of Public Health) to perform verification sampling of*

Appendix 1

Wilcoxon Rank Sum Statistical Test for Cesium-137 and Strontium-90

Soil Data from ISRA 009 - AP/STP-1F

No.	Sample ID	Stockpile ID	Sampling Date	Laboratory Batch	Cesium-137 (pCi/g)				Strontium-90 (pCi/g)				Tritium (pCi/g)			
					Activity	+/- 2 Error	MDA	Non-detect?	Activity	+/- 2 Error	MDA	Non-detect?	Activity	+/- 2 Error	MDA	Non-detect?
1	APWC0701S001	N/A	7/30/2010	257647	0.0142	0.0218	0.0389	NDA	0.04	0.0284	0.0449	NDA	-0.0896	0.585	1.01	NDA
2	APWC0702S001	N/A	7/30/2010	257647	0.00096	0.0284	0.0502	NDA	0.0384	0.0292	0.0471	NDA	-0.212	0.579	1.01	NDA
3	APWC0703S001	N/A	7/30/2010	257647	-0.0215	0.0258	0.0426	NDA	-0.0156	0.0226	0.0464	NDA	0.226	0.599	1.02	NDA
4	APWC0704S001	N/A	7/30/2010	257647	0.0574	0.0375	0.0403		0.00242	0.0252	0.0461	NDA	0.0444	0.584	1.01	NDA

	Cesium-137 (pCi/g)				Strontium-90 (pCi/g)				Tritium (pCi/g)			
	Activity	MDA	Non-detect?		Activity	MDA	Non-detect?		Activity	MDA	Non-detect?	
Average	0.013	0.043			0.016	0.046			-0.008	1.013		
Maximum	0.057	0.050			0.040	0.047			0.226	1.020		
Minimum	-0.022	0.039			-0.016	0.045			-0.212	1.010		
Count			4				4				4	
Number of Non-Detects			3				4				4	
% Non-Detects			75%				100%				100%	

Wilcoxon Rank Sum Test -- (Cesium-137)**General Information:**

The Wilcoxon Rank Sum method tests whether or not measurements of samples from a survey area (S) tend to be consistently larger than those from a background reference area (R) by more than the DCGL.

The null hypothesis, H_0 , is: Survey sample concentrations exceed those in the background by more than the DCGL.

The alternative hypothesis, H_a , is: Survey sample concentrations do not exceed those in the background by more than the DCGL.

How to use this template:

- 1) Enter analysis results in Data Tab.
- 2) The Wilcoxon Rank Sum test is prescribed in, NUREG-1505, Nuclear Regulatory Commission, "A Non-parametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys." January 1998.

Derived Concentration Guideline Level, DCGL (pCi/g)	0.00
Type I Error Rate, alpha:	0.05
Type II Error Rate, beta:	0.05
Number of Background Samples, m:	51
Number of Survey Samples, n:	4
z-value for alpha	1.645
No. of groups of tied measurements, g	10
Critical Value (excluding ties)	1478.8
Critical Value (including ties)	1478.7
Sum of Reference Ranks	1510.0
Sum of Survey Ranks	30.0
Sum of All Ranks	1540
Check Rank Sum $(n+m)*(n+m+1)/2$	1540

If the sum of the reference ranks is larger than the critical value, there is enough evidence to reject the null hypothesis and accept the

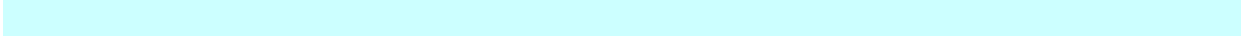
Test Result:

Survey sample concentrations do not exceed those in the background by more than the DCGL

	Bkgd Ref (R)	Survey (S)
Mean	0.087	0.013
Max	0.213	0.057
Min	0.015	-0.022
	0.062	0.033
m-1.96*	-0.035	-0.052
m+1.96*	0.210	0.078

No.	Soil ID	Cs-137	Adjusted Cs-137	Area	Ranks	Reference Ranks
1		0.092	0.092	R	32	32
2		0.020	0.020	R	10	10
3		0.020	0.020	R	10	10
4		0.100	0.100	R	36.5	36.5
5		0.020	0.020	R	10	10
6		0.158	0.158	R	47.5	47.5
7		0.175	0.175	R	49	49
8		0.209	0.209	R	54	54
9		0.180	0.180	R	50	50
10		0.030	0.030	R	18	18
11		0.213	0.213	R	55	55
12		0.025	0.025	R	15	15
13		0.020	0.020	R	10	10
14		0.020	0.020	R	10	10
15		0.074	0.074	R	28	28
16		0.147	0.147	R	43	43
17		0.100	0.100	R	36.5	36.5

No.	Soil ID	Cs-137	Adjusted Cs-137	Area	Ranks	Reference Ranks
18		0.067	0.067	R	26.5	26.5
19		0.099	0.099	R	35	35
20		0.101	0.101	R	38	38
21		0.148	0.148	R	44	44
22		0.153	0.153	R	46	46
23		0.025	0.025	R	15	15
24		0.188	0.188	R	51	51
25		0.198	0.198	R	53	53
26		0.030	0.030	R	18	18
27		0.079	0.079	R	29	29
28		0.158	0.158	R	47.5	47.5
29		0.109	0.109	R	39	39
30		0.059	0.059	R	25	25
31		0.067	0.067	R	26.5	26.5
32		0.113	0.113	R	40	40
33		0.015	0.015	R	5	5
34		0.031	0.031	R	20	20
35		0.042	0.042	R	23	23
36		0.097	0.097	R	33.5	33.5
37		0.015	0.015	R	5	5
38		0.020	0.020	R	10	10
39		0.085	0.085	R	31	31
40		0.080	0.080	R	30	30
41		0.015	0.015	R	5	5
42		0.020	0.020	R	10	10
43		0.035	0.035	R	21.5	21.5
44		0.035	0.035	R	21.5	21.5
45		0.025	0.025	R	15	15
46		0.150	0.150	R	45	45
47		0.140	0.140	R	41.5	41.5
48		0.190	0.190	R	52	52
49		0.097	0.097	R	33.5	33.5
50		0.030	0.030	R	18	18
51		0.140	0.140	R	41.5	41.5
52	APWC0701S001	0.014	0.014	S	3	0
53	APWC0702S001	0.001	0.001	S	2	0
54	APWC0703S001	-0.022	-0.022	S	1	0
55	APWC0704S001	0.057	0.057	S	24	0
Sum					1540.0	1510.0



No.	Soil ID	Sr-90	Adjusted Sr-90	Area	Ranks	Reference Ranks
18		0.100	0.100	R	52	52
19		0.069	0.069	R	44	44
20		0.097	0.097	R	50	50
21		0.084	0.084	R	47	47
22		0.098	0.098	R	51	51
23		0.045	0.045	R	30.5	30.5
24		0.045	0.045	R	30.5	30.5
25		0.020	0.020	R	8	8
26		0.045	0.045	R	30.5	30.5
27		0.089	0.089	R	49	49
28		0.050	0.050	R	40	40
29		0.045	0.045	R	30.5	30.5
30		0.050	0.050	R	40	40
31		0.045	0.045	R	30.5	30.5
32		0.040	0.040	R	21.5	21.5
33		0.045	0.045	R	30.5	30.5
34		0.045	0.045	R	30.5	30.5
35		0.045	0.045	R	30.5	30.5
36		0.025	0.025	R	11.5	11.5
37		0.082	0.082	R	46	46
38		0.045	0.045	R	30.5	30.5
39		0.040	0.040	R	21.5	21.5
40		0.035	0.035	R	16.5	16.5
41		0.025	0.025	R	11.5	11.5
42		0.005	0.005	R	3	3
43		0.020	0.020	R	8	8
44		0.010	0.010	R	4.5	4.5
45		0.020	0.020	R	8	8
46		0.020	0.020	R	8	8
47		0.050	0.050	R	40	40
48		0.030	0.030	R	14	14
49		0.030	0.030	R	14	14
50		0.020	0.020	R	8	8
51		0.040	0.040	R	21.5	21.5
52	APWC0701S001	0.040	0.040	S	21.5	0
53	APWC0702S001	0.038	0.038	S	18	0
54	APWC0703S001	-0.016	-0.016	S	1	0
55	APWC0704S001	0.002	0.002	S	2	0
Sum					1540.0	1497.5

Appendix 2
Radionuclide Results

ISRA Outfall 009 - AP/STP-1F

Project Name	Sampling Organization	Sampling Date	Sampling Location (General)	Sampling Location	2010 ISRA Waste Characterization	MWH	7/30/2010	AP/STP-1F	APWC0708	APWC0708S001	Soil	ED0714-002	0.0000	0.0000	0.0000	NDA	pCi/g	2 sigma	DOE HAS
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