

**ISRA 009 – AP/STP-1A.
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-1A 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 ~0.044 pCi/g and ~0.043 pCi/g respectively. Minimum detectable activity for tritium averaged ~0.51 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

background result of 0.213 +/- 0.04 pCi/g. The highest non-background subtracted Cs-137 result is equivalent to an effective dose of 0.19 mrem/y⁶.

Strontium-90 - Based on the results of the statistical analysis of Appendix 1, soil to be excavated from AP/STP-1A 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 0.062 pCi/g and the highest tritium result is 0.186 pCi/g. The highest non-detected, non-background subtracted tritium result is equivalent to an effective dose of 0.040 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-1A 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) - <http://epa-dccs.ornl.gov/>. Soil concentrations that meet the 10⁻⁶ residential risk PRG are < 0.5 mrem/y. The Cs-137 residential PRG of 0.0597 pCi/g is equivalent to 0.056 mrem/y. The Sr-90 residential PRG of 0.231 pCi/g is equivalent to 0.014 mrem/y. The tritium residential PRG of 2.28 pCi/g is equivalent to 0.486 mrem/y.

⁷ This waste is exempt from regulation and licensing or is expressly authorized for disposal under the Radiation Control Law (Division 104, Part 9, Chapter 8 of the California Health & Safety Code).

⁸ This waste is not prohibited from disposal by any government agency with jurisdictional authority over this waste.

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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.



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Appendix 1

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

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

Sample ID	Stockpile ID	Sampling Date	Cesium-137 (pCi/g)				Strontium-90 (pCi/g)				Tritium (pCi/g)				
			Activity	MDA	Non-detect?	Activity	+/- 2 Error	MDA	Non-detect?	Activity	+/- 2 Error	MDA	Non-detect?		
1	APWC0801S001	7/28/2010	257424	-0.0262	0.0301	0.0475	NDA	0.0325	0.0295	0.048	NDA	0.097	0.282	0.499	NDA
2	APWC0802S001	7/28/2010	257424	0.208	0.0452	0.0385		0.0399	0.0303	0.0487	NDA	0.186	0.301	0.518	NDA
3	APWC0803S001	7/28/2010	257424	3.81E-05	0.026	0.0455	NDA	0.0141	0.0173	0.0294	NDA	-0.0686	0.272	0.51	NDA
4	APWC0804S001	7/28/2010	257424	-0.000851	0.0262	0.0457	NDA	-0.00424	0.0233	0.0472	NDA	0.0317	0.293	0.53	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	0.045	0.044		0.021	0.043		0.062	0.514	
Maximum	0.208	0.048		0.040	0.049		0.186	0.530	
Minimum	-0.026	0.039		-0.004	0.029		-0.069	0.499	
Count			4			4			4
Number of Non-Detects			3			4			4
% Non-Detects			75%			100%			100%

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

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	1481.0
Sum of Survey Ranks	59.0
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 alternative hypothesis. Otherwise the null hypothesis is accepted.

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	0.045
Max	0.213	0.208
Min	0.015	-0.026
	0.062	0.109
m-1.96*	-0.035	-0.169
m+1.96*	0.210	0.259

No.	Soil ID	Cs-137	Adjusted Cs-137	Area	Ranks	Reference Ranks
1		0.092	0.092	R	31	31
2		0.020	0.020	R	10	10
3		0.020	0.020	R	10	10
4		0.100	0.100	R	35.5	35.5
5		0.020	0.020	R	10	10
6		0.158	0.158	R	46.5	46.5
7		0.175	0.175	R	48	48
8		0.209	0.209	R	54	54
9		0.180	0.180	R	49	49
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	27	27
16		0.147	0.147	R	42	42
17		0.100	0.100	R	35.5	35.5

No.	Soil ID	Cs-137	Adjusted Cs-137	Area	Ranks	Reference Ranks
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Wilcoxon Rank Sum Test -- (Strontium-90)**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

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	22	22
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	22	22
40		0.035	0.035	R	17.5	17.5
41		0.025	0.025	R	11.5	11.5
42		0.005	0.005	R	2	2
43		0.020	0.020	R	8	8
44		0.010	0.010	R	3.5	3.5
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	22	22
52	APWC0801S001	0.033	0.033	S	16	0
53	APWC0802S001	0.040	0.040	S	19	0
54	APWC0803S001	0.014	0.014	S	5	0
55	APWC0804S001	-0.004	-0.004	S	1	0
Sum					1540.0	1499.0

Appendix 2
Radionuclide Results

ISRA Outfall 009 - AP/STP 1A

Project Name	Sampling Organization	Sampling Date	Sampling Location (General)	Sampling Location (Specific)	Sample Serial Number	Media Type	Isotope	Value	Error (+/-)	MDA	Non-Detect?	Units	Error Type	Analysis Protocol	Analysis Organization	Document	Status
2010 ISRA Waste Characterization	MWH	7/28/2010	AP/STP 1A	APWC0801	APWC0801S001	Soil	Americium-241	-0.00799	0.0333	0.0535	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257424	Waste
2010 ISRA Waste Characterization	MWH	7/28/2010	AP/STP 1A	APWC0802	APWC0802S001	Soil	Americium-241	-0.068	0.0837	0.157	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257424	Waste
2010 ISRA Waste Characterization	MWH	7/28/2010	AP/STP 1A	APWC0803	APWC0803S001	Soil	Americium-241	0.0961	0.123	0.222	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257424	Waste
2010 ISRA Waste Characterization	MWH	7/28/2010	AP/STP 1A	APWC0804	APWC0804S001	Soil	Americium-241	0.0808	0.115	0.22	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257424	Waste
2010 ISRA Waste Characterization	MWH	7/28/2010	AP/STP 1A	APWC0801	APWC0801S001	Soil	Cesium-134	0	0.0587	0.0677	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257424	Waste

