

**ISRA 009 – AP/STP-1E1.
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-1E1 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 ~0.041 pCi/g and ~0.046 pCi/g respectively. Minimum detectable activity for tritium averaged ~0.78 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 background in soil is conservatively assumed to be zero. Tritium data is therefore compared to the MDA of the analysis and the EPA preliminary remediation goal (PRG)⁵ for residential 10⁻⁶ risk.

Conclusions

Cesium-137 - Based on the results of the statistical analysis of Appendix 1, soil to be excavated from AP/STP-1E1 does not exceed the local background for Cs-137. The incremental dose from Cs-137 above background is therefore zero mrem/y. All Cs-137 results are non-detect. The highest Cs-137 result is 0.008 pCi/g which is less than the highest background result of 0.213

¹ Boeing, "Northern Drainage Waste Sampling for Radionuclides." Revision 9, November 5, 2007. (Attachment 3 to Northern Drainage Work Plan) and "ISRA Waste Sampling for Radionuclides", Attachment A to the ISRA Soil Management Plan.

² NUREG-1505, Nuclear Regulatory Commission, "A Non-parametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys." January 1998. http://www.philrutherford.com/Radiation_Cleanup_Standards/NUREG-1505.pdf

³ DTSC, "Selecting Inorganic Constituents as Chemicals of Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities." February 1997.

⁴ McLaren/Hart, "Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservancy." Jan 19, 1995. <http://www.etec.energy.gov/Health-and-Safety/Documents/BrandeisBardin/AddSoilandWaterSamp.pdf>

⁵ EPA preliminary remediation goals for radionuclides (Effective January 1, 2007) - <http://epa-prgs.ornl.gov/radionuclides/>.

pCi/g. The highest non-background subtracted, non-detect Cs-137 result is equivalent to an effective dose of 0.0075 mrem/y⁶.

Strontium-90 - Based on the results of the statistical analysis of Appendix 1, soil to be excavated from AP/STP-1E1 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 0.029 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 0.0017 mrem/y⁶.

Tritium - All tritium results are non-detect, the average tritium result is 0.039 pCi/g and the highest tritium result is 0.768 pCi/g. The highest non-detected, non-background subtracted tritium result is equivalent to an effective dose of 0.16 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-1E1 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.

⁹ Division 104, Part 9, Chapter 5, Article 1, Section 114715, “No person shall bury, throw away, or in any manner dispose of radioactive wastes within the state except in a manner and at locations as will result in no significant radioactive contamination of the environment.” For the purposes of this requirement, “significant” is defined in Section 114710 as amounts of radioactive materials that are likely to expose persons to ionizing radiation greater than the guide levels published by the Federal Radiation Council (FRC). The FRC no longer exists, but the applicable guide level last published by the FRC was 500 mrem per year to a member of the public. Because the regulatory dose limit to members of the public has since been lowered to 100 mrem per year, CDPH/RHB conservatively utilizes the lower dose for purposes of defining “significant” radioactive contamination in this Article of the California Health and Safety Code.

<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=114001-115000&file=114705-114780>

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 decommissioned material or to provide approval for disposal of specific decommissioned material shipped offsite (e.g., to Class I or II landfills). The California DPH has not imposed a requirement that Boeing or the Department of Energy (DOE) seek DPH verification sampling or approval of all decommissioned material destined for Class I or II landfills in compliance with the Governor's Executive Order."*

Appendix 1

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

Soil Data from ISRA 009 - AP/STP-1E1

No.	Sample ID	Stockpile ID	Sampling Date	Laboratory Batch	Cesium-137 (pCi/g)				Strontium-90 (pCi/g)				Tritium (pCi/g)			
					Activity	+/- 2σ Error	MDA	Non-detect?	Activity	+/- 2σ Error	MDA	Non-detect?	Activity	+/- 2σ Error	MDA	Non-detect?
1	APWC0401S001	N/A	7/29/2010	257560	-0.00615	0.026	0.0447	NDA	0.00544	0.0274	0.0476	NDA	0.768	0.505	0.786	NDA
2	APWC0402S001	N/A	7/29/2010	257560	-0.0117	0.0221	0.0369	NDA	0.0146	0.0267	0.0463	NDA	-0.205	0.4	0.794	NDA
3	APWC0403S001	N/A	7/29/2010	257560	-0.0122	0.0245	0.0416	NDA	0.0287	0.0282	0.0462	NDA	-0.0857	0.405	0.775	NDA
4	APWC0404S001	N/A	7/29/2010	257560	0.00834	0.0239	0.042	NDA	-0.00501	0.0215	0.0447	NDA	-0.323	0.367	0.762	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	-0.005	0.041			0.011	0.046			0.039	0.779		
Maximum	0.008	0.045			0.029	0.048			0.768	0.794		
Minimum	-0.012	0.037			-0.005	0.045			-0.323	0.762		
Count			4				4				4	
Number of Non-Detects			4				4				4	
% Non-Detects			100%				100%				100%	

Soil Data from ISRA 009 - AP/STP-1E1

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	1530.0
Sum of Survey Ranks	10.0
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	-0.005
Max	0.213	0.008
Min	0.015	-0.012
σ	0.062	0.010
$m-1.96\sigma$	-0.035	-0.024
$m+1.96\sigma$	0.210	0.013

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	11	11
3		0.020	0.020	R	11	11
4		0.100	0.100	R	36.5	36.5
5		0.020	0.020	R	11	11
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	19	19
11		0.213	0.213	R	55	55
12		0.025	0.025	R	16	16
13		0.020	0.020	R	11	11
14		0.020	0.020	R	11	11
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	16	16
24		0.188	0.188	R	51	51
25		0.198	0.198	R	53	53
26		0.030	0.030	R	19	19
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	6	6
34		0.031	0.031	R	21	21
35		0.042	0.042	R	24	24
36		0.097	0.097	R	33.5	33.5
37		0.015	0.015	R	6	6
38		0.020	0.020	R	11	11
39		0.085	0.085	R	31	31
40		0.080	0.080	R	30	30
41		0.015	0.015	R	6	6
42		0.020	0.020	R	11	11
43		0.035	0.035	R	22.5	22.5
44		0.035	0.035	R	22.5	22.5
45		0.025	0.025	R	16	16
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	19	19
51		0.140	0.140	R	41.5	41.5
52	APWC0401S001	-0.006	-0.006	S	3	0
53	APWC0402S001	-0.012	-0.012	S	2	0
54	APWC0403S001	-0.012	-0.012	S	1	0
55	APWC0404S001	0.008	0.008	S	4	0
Sum					1540.0	1530.0

Soil Data from ISRA 009 - AP/STP-1E1

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)	0.0001
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	9
Critical Value (excluding ties)	1478.8
Critical Value (including ties)	1478.4
Sum of Reference Ranks	1516.0
Sum of Survey Ranks	24.0
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	0.051	0.011
Max	0.130	0.029
Min	0.005	-0.005
σ	0.030	0.014
$m-1.96*\sigma$	-0.008	-0.017
$m+1.96*\sigma$	0.109	0.039

No.	Soil ID	Sr-90	Adjusted Sr-90	Area	Ranks	Reference Ranks
1		0.030	0.030	R	16	16
2		0.010	0.010	R	4.5	4.5
3		0.045	0.045	R	30.5	30.5
4		0.045	0.045	R	30.5	30.5
5		0.050	0.050	R	40	40
6		0.040	0.040	R	22	22
7		0.035	0.035	R	18.5	18.5
8		0.050	0.050	R	40	40
9		0.050	0.050	R	40	40
10		0.130	0.130	R	54.5	54.5
11		0.120	0.120	R	53	53
12		0.040	0.040	R	22	22
13		0.045	0.045	R	30.5	30.5
14		0.130	0.130	R	54.5	54.5
15		0.050	0.050	R	40	40
16		0.088	0.088	R	48	48
17		0.080	0.080	R	45	45

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	9	9
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	12.5	12.5
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	18.5	18.5
41		0.025	0.025	R	12.5	12.5
42		0.005	0.005	R	2	2
43		0.020	0.020	R	9	9
44		0.010	0.010	R	4.5	4.5
45		0.020	0.020	R	9	9
46		0.020	0.020	R	9	9
47		0.050	0.050	R	40	40
48		0.030	0.030	R	16	16
49		0.030	0.030	R	16	16
50		0.020	0.020	R	9	9
51		0.040	0.040	R	22	22
52	APWC0401S001	0.005	0.005	S	3	0
53	APWC0402S001	0.015	0.015	S	6	0
54	APWC0403S001	0.029	0.029	S	14	0
55	APWC0404S001	-0.005	-0.005	S	1	0
Sum					1540.0	1516.0

Appendix 2
Radionuclide Results

ISRA Outfall 009 - AP/STP-1E1

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	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Americium-241	-0.0641	0.129	0.235	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Americium-241	-0.032	0.0618	0.111	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Americium-241	0.0317	0.1	0.172	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Americium-241	0.0626	0.0824	0.138	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Cesium-134	0	0.0318	0.061	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Cesium-134	0	0.0424	0.0547	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Cesium-134	0	0.0534	0.0662	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Cesium-134	0	0.0448	0.0632	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Cesium-137	-0.00615	0.026	0.0447	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Cesium-137	-0.0117	0.0221	0.0369	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Cesium-137	-0.0122	0.0245	0.0416	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Cesium-137	0.00834	0.0239	0.042	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Cobalt-60	0.0194	0.0273	0.0492	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Cobalt-60	-0.00365	0.0233	0.0387	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Cobalt-60	-0.0197	0.0268	0.0423	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Cobalt-60	0.0176	0.0251	0.0454	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Europium-152	0.0459	0.0761	0.121	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Europium-152	-0.0455	0.0531	0.0868	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Europium-152	0.0133	0.0708	0.111	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Europium-152	0.049	0.0983	0.109	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Europium-154	0.0146	0.0934	0.161	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Europium-154	-0.0353	0.0675	0.109	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Europium-154	0.022	0.0845	0.147	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Europium-154	0.0166	0.0769	0.134	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Manganese-54	0.00415	0.0241	0.0415	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Manganese-54	0	0.0232	0.0333	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Manganese-54	0.0106	0.0268	0.0471	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Manganese-54	0.00272	0.0232	0.0394	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Potassium-40	22.8	0.36	0.401	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Potassium-40	24.1	2.3	0.245	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Potassium-40	24	2.41	0.29	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Potassium-40	24	2.37	0.368	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Sodium-22	0.00513	0.0329	0.0567	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Sodium-22	-0.0137	0.0236	0.0378	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Sodium-22	0.00775	0.0297	0.0519	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Sodium-22	0.00584	0.0271	0.0471	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Strontium-90	0.00544	0.0274	0.0476	NDA	pCi/g	2 sigma	EPA 905.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Strontium-90	0.0146	0.0267	0.0463	NDA	pCi/g	2 sigma	EPA 905.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Strontium-90	0.0287	0.0282	0.0462	NDA	pCi/g	2 sigma	EPA 905.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Strontium-90	-0.00501	0.0215	0.0447	NDA	pCi/g	2 sigma	EPA 905.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Thorium-228	1.17	0.144	0.0685	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Thorium-228	1.21	0.178	0.0527	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Thorium-228	1.28	0.142	0.0624	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Thorium-228	1.13	0.127	0.063	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Thorium-232	1.28	0.258	0.158	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Thorium-232	1.28	0.242	0.12	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Thorium-232	1.27	0.277	0.171	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Thorium-232	1.34	0.291	0.161	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Tritium	0.768	0.505	0.786	NDA	pCi/g	2 sigma	EPA 906.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Tritium	-0.205	0.4	0.794	NDA	pCi/g	2 sigma	EPA 906.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Tritium	-0.0857	0.405	0.775	NDA	pCi/g	2 sigma	EPA 906.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Tritium	-0.323	0.367	0.762	NDA	pCi/g	2 sigma	EPA 906.0 Modified	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Uranium-235	-0.00353	0.15	0.265	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Uranium-235	0.0532	0.108	0.2	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Uranium-235	0.0156	0.141	0.244	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Uranium-235	0.0413	0.13	0.227	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0401	APWC0401S001	Soil	Uranium-238	0.976	1.15	2.1	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0402	APWC0402S001	Soil	Uranium-238	0.386	0.61	1.15	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0403	APWC0403S001	Soil	Uranium-238	1.41	1.06	1.47	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste
2010 ISRA Waste Characterization	MWH	7/29/2010	AP/STP-1E1	APWC0404	APWC0404S001	Soil	Uranium-238	1.24	0.948	1.21	NDA	pCi/g	2 sigma	DOE HASL 300, 4.5.2.3/Ga-01-R	GEL	257560	Waste

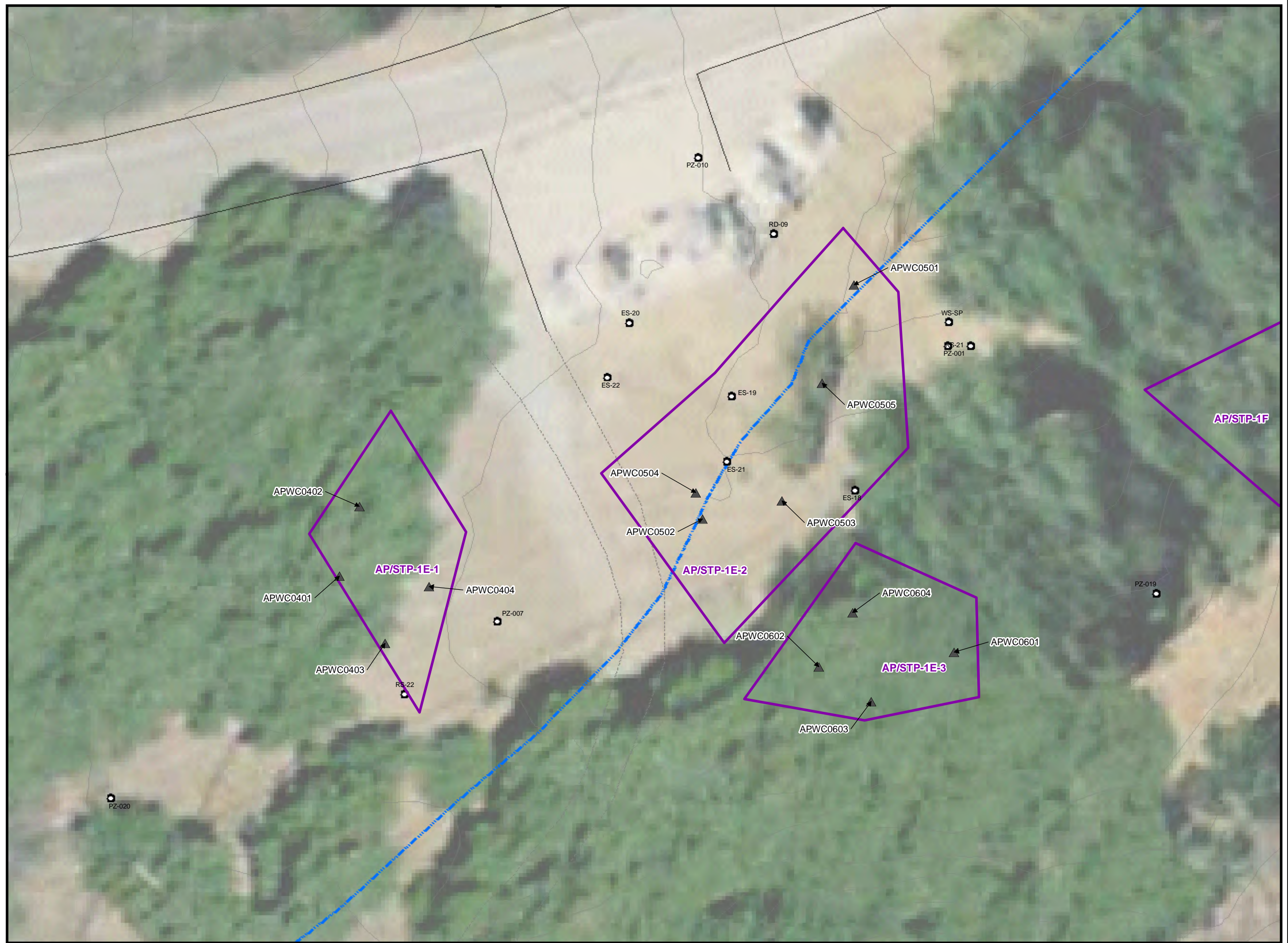
Outfall 009
Sample Locations for AP/STP - 1E-1,
AP/STP - 1E-2, AP/STP - 1E-3

Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- Report Group Boundary
- NPDES Outfall
- Dirt Road
- A/C Paving
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide
- Elevation Contour

Figure Legend

- Waste Characterization Sample



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