



2013 – Report on Environmental Monitoring in the Environs of Palos Park and Argonne National Laboratory

April 2014

Executive Summary

In the early 1940's, Enrico Fermi and a team of scientists assembled the world's first atomic "pile" (nuclear reactor), named "CP-1" for "Chicago Pile 1" under an abandoned squash court beneath the Stagg Field football stadium at the University of Chicago, resulting in the first self-sustaining nuclear chain reaction on December 2, 1942. Recognizing the potential radiation exposure to the population of the city of Chicago, in 1943, the reactor was transferred to Red Gate Woods which is part of Palos Forest Preserve, a wooded site 20 miles southwest of downtown Chicago. There, the reactor was rebuilt, and renamed CP-2.

An additional reactor, CP-3, was also built on the site. By 1954, research programs were transferred to the current site of Argonne National Laboratory, so CP-2 and CP-3 reactors were decommissioned, surveyed, decontaminated, demolished, and components buried at "Site A" in Red Gate Woods. The US Department of Energy performed a limited remediation for Site A in 1996-1997 after high levels of radioactive material (specifically tritium) were found in surface water that drain from the site. In addition to the 19-acre Site A, radioactive material from nuclear research conducted from 1945-1949 is buried in a 150 ft x 140 ft area called "Plot M," also in Red Gate Woods. The material in Plot M is "entombed" under a 1-foot thick concrete barrier, with side walls extending down 8 feet into the ground, and covered with 2.5 feet of dirt on top.

The Illinois Emergency Management Agency (IEMA) is charged with protecting the citizens of Illinois from the potentially harmful effects of radioactive materials. To that end, the IEMA's Bureau of Radiation Safety monitors the environment in Illinois for the presence of radionuclides. One of the locations monitored by IEMA is the area in and around the Site A/Plot M Disposal Sites within and around Red Gate Woods.

In partnership with Argonne National Laboratory, Argonne staff collects samples of water, and supplies IEMA with 'splits' of samples from six locations in Red Gate Woods near Palos Park. These samples are analyzed for man-made and natural radionuclides. IEMA collects water samples from 11 additional locations that are accessible to the public and analyzes them for man-made and natural radionuclides. All samples are collected quarterly.

This report contains tables of data showing results of analysis of samples taken by both Argonne staff and IEMA staff. Analysis was performed by the IEMA Radiochemistry Laboratory in Springfield. Analyses of samples obtained for this site indicate the level of ground water contamination in publicly-accessible areas is below U.S. Environmental Protection Agency (US EPA) drinking water standards for the various radionuclides tested. The highest levels of radioactivity were found in water from boreholes around Plot M, but this water is not readily accessible to the public.

Negative numbers in the tables of this report are the values reported by the IEMA Radiochemistry Laboratory. Each batch of samples is counted with a sample "blank" to determine a "background" for each machine and each type of medium being analyzed. That 'background' reading is then subtracted from the analytical results. When the sample has very little radioactivity, subtracting the "background" values may actually result in a negative number.

Understanding a Test Result with a Confidence Interval

What does a tritium result of (519 ± 99.5) pCi/L, with 95% confidence, mean? First, the unit, pCi/L, is used to measure the amount of tritium, in picocuries (pCi), present in one liter (L) of the sample. Thus, the result tells us that the analysis found 519 picocuries of tritium per liter. However, all measurements have some uncertainty associated with them – some range of values which the analysis, if repeated, could reasonably be expected to be the result. In this case, the uncertainty is ± 99.5 pCi/L. If repeated, the analysis could reasonably be expected to return values as low as $519 - 99.5 = 419.5$ pCi/L and as high as $519 + 99.5 = 618.5$ pCi/L. The statement “with 95% confidence” tells us just how certain we can be about that range of values – in this case, we judge that there is a 95% probability that the sample contains between 419.5 and 618.5 picocuries of tritium per liter of water.

Tritium Results

Tritium was measured in water samples using EPA Method 906.0. Reported uncertainties are counting uncertainties only, and are at the 95% confidence level, 1.96 sigma. The *a priori* method detection limit of approximately 170 pCi/L is based on typical instrument background, counting time, and instrument efficiency and may vary slightly between instruments. Liquid scintillation counting was performed on a liquid scintillation analyzer, calibrated for tritium analysis.

Summary of Tritium Results of Split Samples from Argonne

General Description	IEMA Sample ID	Sample Date	Tritium Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
Red Gate Well 5160	120229	3/20/2013	1940	113	114
Red Gate Well 5160	120229	6/4/2013	2050	114	113
Red Gate Well 5160	120229	9/4/2013	2230	149	186
Red Gate Well 5160	120229	10/22/2013	2130	123	131
Dolomite Well D10	120266	3/20/2013	677	86.3	114
Dolomite Well D10	120266	6/4/2013	638	84.9	113
Dolomite Well D10	120266	9/4/2013	460	119	186
Dolomite Well D10	120266	11/1/2013	523	91.1	131
Dolomite Well D13	120269	3/20/2013	916	91.9	114
Dolomite Well D13	120269	6/4/2013	875	90.5	113
Dolomite Well D13	120269	9/4/2013	950	128	186
Dolomite Well D13	120269	11/1/2013	184	82.9	131
Borehole 4	120275	3/20/2013	355000	1220	114
Borehole 4	120275	6/4/2013	374000	1250	113
Borehole 4	120275	9/4/2013	370000	3630	525
Borehole 4	120275	10/22/2013	364000	1240	131
Borehole 10	120278	3/20/2013	209000	938	114
Borehole 10	120278	6/4/2013	37100	400	113
Borehole 10	120278	9/4/2013	208000	2060	395
Borehole 6 *	120276	10/22/2013	634000	1630	131
Borehole 54	120285	3/28/2013	41.3	69.1	114
Borehole 54	120285	6/4/2013	124	71.1	113
Borehole 54	120285	9/4/2013	18.5	111	186
Borehole 54	120285	10/22/2013	87.6	80.5	131

*Note: Borehole 6 was used in October because Borehole 10 was dry.

Summary of Tritium Results of IEMA Samples

General Description	IEMA Sample ID	Sample Date	Tritium Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
St. James Church Well	120227	3/19/2013	-19.8	99.5	168
St. James Church Well	120227	6/27/2013	21.7	67.9	113
St. James Church Well	120227	9/18/2013	85	111	185
St. James Church Well	120227	12/11/2013	150	113	185
Sag Slough East Well #5021	120209	3/19/2013	10.8	68	114
Sag Slough East Well #5021	120209	6/27/2013	30.4	68.1	113
Sag Slough East Well #5021	120209	9/18/2013	39.1	111	185
Sag Slough East Well #5021	120209	12/11/2013	82.8	112	185
Red Gate Woods Well #5160	120229	3/19/2013	1860	134	168
Red Gate Woods Well #5160	120229	6/27/2013	2150	116	113
Red Gate Woods Well #5160	120229	9/18/2013	2160	123	131
Red Gate Woods Well #5160	120229	12/11/2013	2200	148	185
Henry de Tonte Woods Well #5159	120205	3/19/2013	191	73.3	114
Henry de Tonte Woods Well #5159	120205	6/27/2013	853	89.8	113
Henry de Tonte Woods Well #5159	120205	9/18/2013	116	81.2	131
Maple Lake East Well #5153	120238	6/27/2013	43.5	68.6	113
Maple Lake East Well #5153	120238	9/18/2013	-59.8	109	185
Maple Lake East Well #5153	120238	12/11/2013	39.1	111	185
Bullfrog Lake Well #5031	120210	3/19/2013	-23.8	67	114
Bullfrog Lake Well #5031	120210	6/27/2013	0	67.2	113
Bullfrog Lake Well #5031	120210	9/18/2013	-70	76.3	131
Bullfrog Lake Well #5031	120210	12/11/2013	-78.2	108	185
Rain Barrel Slough Well #5162	120213	3/19/2013	-50.6	98.8	168
Rain Barrel Slough Well #5162	120213	6/27/2013	17.4	67.8	113
Rain Barrel Slough Well #5162	120213	9/18/2013	-10.9	77.9	131
Rain Barrel Slough Well #5162	120213	12/11/2013	-18.4	110	185
S&S Canal Downstream	120224	3/19/2013	13	68.1	114
S&S Canal Downstream	120224	9/18/2013	-122	107	185
S&S Canal Downstream	120224	12/11/2013	39.5	79.4	132
S&S Canal Upstream	120221	3/19/2013	-74.8	98.3	168
S&S Canal Upstream	120221	6/27/2013	34.8	68.3	113
S&S Canal Upstream	120221	9/18/2013	-11.5	110	185
S&S Canal Upstream	120221	12/11/2013	11.5	110	185
I&M Canal Downstream	120223	3/19/2013	497	110	168
I&M Canal Downstream	120223	6/27/2013	43.5	68.6	113
I&M Canal Downstream	120223	9/18/2013	-50.6	109	185
I&M Canal Upstream	120220	3/19/2013	-24.2	99.4	168
I&M Canal Upstream	120220	6/27/2013	50	68.8	113
I&M Canal Upstream	120220	9/18/2013	2.3	110	185

Strontium Results

For the first half of the year, Radiostrontium was measured in water samples using EPA Method 905.0. The reported uncertainties are at the 95% confidence level, 1.96 sigma.

For samples taken after July 2013, Radiostrontium was measured in water using EPA 402-R-10-001d, “Rapid Radiochemical Method for Total Radiostrontium (Sr-90) in Water for Environmental Restoration Following Homeland Security Events.”

For all samples, Gas proportional counting was performed on a low-background gas proportional counter.

Summary of Strontium Results of Split Samples from Argonne

General Description	IEMA Sample ID	Sample Date	Strontium Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
Red Gate Well 5160	120229	3/28/2013	-0.306	0.879	1.511
Red Gate Well 5160	120229	6/4/2013	-0.271	0.658	1.169
Red Gate Well 5160	120229	9/4/2013	-0.7	1.8	1.0
Red Gate Well 5160	120229	10/22/2013	-0.4	1.8	1.0
Dolomite Well D10	120266	3/27/2013	-0.167	0.897	1.527
Dolomite Well D10	120266	6/4/2013	-0.459	0.814	1.466
Dolomite Well D10	120266	9/4/2013	0.6	1.8	0.9
Dolomite Well D10	120266	11/1/2013	-0.2	1.7	0.9
Dolomite Well D13	120269	3/27/2013	-0.610	0.872	1.535
Dolomite Well D13	120269	6/4/2013	-0.123	0.748	1.284
Dolomite Well D13	120269	9/4/2013	-0.1	1.7	0.9
Dolomite Well D13	120269	11/1/2013	-0.3	1.6	0.9
Borehole 4	120275	3/27/2013	0.025	0.917	1.539
Borehole 4	120275	6/4/2013	0.909	0.788	1.142
Borehole 4	120275	9/4/2013	-0.4	1.6	0.9
Borehole 4	120275	10/22/2013	-0.7	1.7	0.9
Borehole 10	120278	3/27/2013	0.537	0.930	1.503
Borehole 10	120278	6/4/2013	0.404	0.878	1.389
Borehole 10	120278	9/4/2013	-0.4	1.6	0.9
Borehole 6 *	120276	10/22/2013	0.4	1.8	1.0
Borehole 54	120285	3/23/2013	-0.213	0.900	1.539
Borehole 54	120285	6/4/2013	-0.365	0.629	1.138
Borehole 54	120285	9/4/2013	0.2	1.9	1.0
Borehole 54	120285	10/22/2013	0.7	1.6	0.9

*Note: Borehole 6 was used in October because Borehole 10 was dry.

Summary of Strontium Results of IEMA Samples

General Description	IEMA Sample ID	Sample Date	Strontium Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
St. James Church Well	120227	3/19/2013	-0.092	0.856	1.450
St. James Church Well	120227	6/27/2013	0.318	0.647	1.035
St. James Church Well	120227	9/18/2013	-0.4	2.3	1.3
St. James Church Well	120227	12/11/2013	-0.1	1.7	0.9
Sag Slough East Well #5021	120209	3/19/2013	0.234	0.926	1.532
Sag Slough East Well #5021	120209	9/18/2013	-0.8	2.4	1.3
Sag Slough East Well #5021	120209	12/11/2013	-0.4	1.7	0.9
Red Gate Woods Well #5160	120229	3/19/2013	0.000	0.933	1.569
Red Gate Woods Well #5160	120229	6/27/2013	0.024	0.563	0.942
Red Gate Woods Well #5160	120229	9/18/2013	0.1	2.4	1.3
Red Gate Woods Well #5160	120229	12/11/2013	-0.8	1.8	1.0
Henry de Tonte Woods Well #5159	120205	3/19/2013	0.169	0.633	1.035
Henry de Tonte Woods Well #5159	120205	9/18/2013	-1.2	2.9	1.6
Maple Lake East Well #5153	120238	6/27/2013	0.953	0.654	0.942
Maple Lake East Well #5153	120238	9/18/2013	-0.9	2.1	1.2
Maple Lake East Well #5153	120238	12/11/2013	-0.8	1.6	0.9
Bullfrog Lake Well #5031	120210	3/19/2013	-0.095	0.586	1.002
Bullfrog Lake Well #5031	120210	9/18/2013	0.2	2	1.1
Bullfrog Lake Well #5031	120210	12/11/2013	-0.1	1.4	0.8
Rain Barrel Slough Well #5162	120213	3/19/2013	-0.028	1.000	1.685
Rain Barrel Slough Well #5162	120213	9/18/2013	-0.7	2.3	1.2
Rain Barrel Slough Well #5162	120213	12/11/2013	-0.5	1.5	0.8
S&S Canal Downstream	120224	3/19/2013	1.015	0.624	0.892
S&S Canal Downstream	120224	9/18/2013	0.1	1.8	1.0
S&S Canal Downstream	120224	12/11/2013	-0.7	1.6	0.9
S&S Canal Upstream	120221	3/19/2013	-0.404	0.848	1.470
S&S Canal Upstream	120221	9/18/2013	-0.9	2.1	1.2
S&S Canal Upstream	120221	12/11/2013	0.1	1.5	0.8
I&M Canal Downstream	120223	3/19/2013	-0.097	0.921	1.560
I&M Canal Downstream	120223	6/27/2013	-0.233	0.567	0.994
I&M Canal Downstream	120223	9/18/2013	-0.4	1.7	0.9
I&M Canal Upstream	120220	3/19/2013	0.404	0.856	1.395
I&M Canal Upstream	120220	9/18/2013	-0.2	1.8	1.0

Gamma Spec. Results (K-40, Co-60 and Cs-137)

The gamma spectroscopy analyses in water samples were processed using the Illinois Emergency Management Method BES-SRC-PLS-115; Gamma Spectroscopy of Samples. One liter aliquots of unfiltered waters were transferred to 1-L Marinelli beakers and counted for 15 hours. The data was collected with high purity germanium detectors and analyzed with Canberra APEX Lab Productivity Suite/ Genie 2000 software. The reported uncertainties are at the 95% confidence level, 1.96 sigma. The uncertainties are propagated by the Canberra Software and include counting, nuclide half-life, nuclide abundance, and emission rate uncertainties. Uncertainties in the sample volume and reproducibility of the counting geometry relative to the efficiency calibration geometry are not included. The reported Minimum Detectable Concentrations are the results of the Canberra Currie MDA calculation.

Summary of Potassium (K-40) Results of Split Samples from Argonne

General Description	IEMA Sample ID	Sample Date	K-40 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
Red Gate Well 5160	120229	3/28/2013	8.883	16.611	56.037
Red Gate Well 5160	120229	6/4/2013	-11.304	15.301	53.566
Red Gate Well 5160	120229	9/4/2013	28.700	12.900	42.700
Red Gate Well 5160	120229	10/22/2013	29.000	14.400	45.500
Dolomite Well D10	120266	3/27/2013	23.372	11.661	36.687
Dolomite Well D10	120266	6/4/2013	2.949	15.829	54.059
Dolomite Well D10	120266	9/4/2013	57.400	15.100	51.600
Dolomite Well D10	120266	11/1/2013	12.600	17.300	58.100
Dolomite Well D13	120269	3/27/2013	6.655	16.512	47.146
Dolomite Well D13	120269	6/4/2013	-19.585	17.076	60.718
Dolomite Well D13	120269	9/4/2013	21.400	16.200	53.600
Dolomite Well D13	120269	11/1/2013	55.900	14.500	50.400
Borehole 4	120275	3/27/2013	-24.514	15.008	54.129
Borehole 4	120275	6/4/2013	23.936	14.970	46.026
Borehole 4	120275	9/4/2013	-0.764	17.500	60.300
Borehole 4	120275	10/22/2013	29.800	18.400	60.500
Borehole 10	120278	3/27/2013	12.107	24.493	41.853
Borehole 10	120278	6/4/2013	-20.041	17.472	61.561
Borehole 10	120278	9/4/2013	23.100	11.600	34.900
Borehole 6 *	120276	10/22/2013	36.900	15.400	47.700
Borehole 54	120285	3/23/2013	-12.286	16.769	58.387
Borehole 54	120285	6/4/2013	-6.602	17.224	59.654
Borehole 54	120285	9/4/2013	18.600	16.500	55.100
Borehole 54	120285	10/22/2013	-26.000	24.600	45.400

*Note: Borehole 6 was used in October because Borehole 10 was dry.

Summary of Potassium (K-40) Results of IEMA Samples

General Description	IEMA Sample ID	Sample Date	K-40 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
St. James Church Well	120227	3/19/2013	-14.754	16.782	58.364
St. James Church Well	120227	6/27/2013	-43.406	15.856	58.401
St. James Church Well	120227	9/18/2013	-24.000	15.600	56.400
St. James Church Well	120227	12/11/2013	-27.000	25.200	46.500
Sag Slough East Well #5021	120209	3/19/2013	-4.247	16.066	55.992
Sag Slough East Well #5021	120209	6/27/2013	-7.815	16.910	58.273
Sag Slough East Well #5021	120209	9/18/2013	16.100	16.400	54.900
Sag Slough East Well #5021	120209	12/11/2013	20.300	15.400	51.200
Red Gate Woods Well #5160	120229	3/19/2013	44.084	13.959	47.146
Red Gate Woods Well #5160	120229	6/27/2013	26.500	17.400	57.400
Red Gate Woods Well #5160	120229	9/18/2013	-2.660	17.800	60.800
Red Gate Woods Well #5160	120229	12/11/2013	26.300	20.500	34.800
Henry de Tonte Woods Well #5159	120205	3/19/2013	17.680	11.933	36.301
Henry de Tonte Woods Well #5159	120205	6/27/2013	-21.940	17.959	62.648
Henry de Tonte Woods Well #5159	120205	9/18/2013	5.240	11.800	40.000
Maple Lake East Well #5153	120238	6/27/2013	11.700	19.200	64.800
Maple Lake East Well #5153	120238	9/18/2013	-4.850	17.200	59.100
Maple Lake East Well #5153	120238	12/11/2013	22.700	10.800	33.100
Bullfrog Lake Well #5031	120210	3/19/2013	-12.192	17.786	61.429
Bullfrog Lake Well #5031	120210	6/27/2013	11.846	16.250	54.599
Bullfrog Lake Well #5031	120210	9/18/2013	42.800	10.300	34.900
Bullfrog Lake Well #5031	120210	12/11/2013	68.600	14.000	48.700
Rain Barrel Slough Well #5162	120213	3/19/2013	13.921	17.564	59.023
Rain Barrel Slough Well #5162	120213	6/27/2013	19.300	17.600	58.600
Rain Barrel Slough Well #5162	120213	9/18/2013	65.900	13.200	48.300
Rain Barrel Slough Well #5162	120213	12/11/2013	48.900	14.000	48.500
S&S Canal Downstream	120224	3/19/2013	31.575	17.108	55.870
S&S Canal Downstream	120224	9/18/2013	35.600	10.200	33.800
S&S Canal Downstream	120224	12/11/2013	-5.420	11.900	41.200
S&S Canal Upstream	120221	3/19/2013	35.034	16.536	51.417
S&S Canal Upstream	120221	6/27/2013	2.057	16.321	56.191
S&S Canal Upstream	120221	9/18/2013	-0.909	16.000	55.100
S&S Canal Upstream	120221	12/11/2013	-8.790	17.900	61.900
I&M Canal Downstream	120223	3/19/2013	-38.934	17.247	61.904
I&M Canal Downstream	120223	6/27/2013	-19.878	17.322	61.067
I&M Canal Downstream	120223	9/18/2013	4.380	16.300	55.500
I&M Canal Upstream	120220	3/19/2013	19.659	12.774	38.739
I&M Canal Upstream	120220	6/27/2013	16.800	17.900	59.800
I&M Canal Upstream	120220	9/18/2013	-19.300	16.700	58.400

Summary of Cobalt (Co-60) Results of Split Samples from Argonne

General Description	IEMA Sample ID	Sample Date	Co-60 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
Red Gate Well 5160	120229	3/28/2013	-0.999	1.164	3.110
Red Gate Well 5160	120229	6/4/2013	-0.329	1.041	3.005
Red Gate Well 5160	120229	9/4/2013	-1.110	1.290	3.570
Red Gate Well 5160	120229	10/22/2013	-1.880	1.400	3.530
Dolomite Well D10	120266	3/27/2013	0.311	1.159	3.291
Dolomite Well D10	120266	6/4/2013	2.446	1.010	3.480
Dolomite Well D10	120266	9/4/2013	0.249	1.330	3.770
Dolomite Well D10	120266	11/1/2013	-0.191	1.120	3.140
Dolomite Well D13	120269	3/27/2013	0.502	1.370	3.961
Dolomite Well D13	120269	6/4/2013	-1.610	1.456	3.724
Dolomite Well D13	120269	9/4/2013	-0.092	1.060	3.090
Dolomite Well D13	120269	11/1/2013	-0.896	1.140	3.190
Borehole 4	120275	3/27/2013	1.160	1.165	3.680
Borehole 4	120275	6/4/2013	-0.349	1.380	3.788
Borehole 4	120275	9/4/2013	-0.538	1.410	3.800
Borehole 4	120275	10/22/2013	-0.315	1.020	2.940
Borehole 10	120278	3/27/2013	-0.186	1.736	2.581
Borehole 10	120278	6/4/2013	-2.057	1.312	3.455
Borehole 10	120278	9/4/2013	1.040	0.843	2.680
Borehole 6 *	120276	10/22/2013	-0.295	1.150	3.310
Borehole 54	120285	3/23/2013	-0.558	1.059	3.024
Borehole 54	120285	6/4/2013	-1.796	1.324	3.481
Borehole 54	120285	9/4/2013	-1.640	1.180	3.110
Borehole 54	120285	10/22/2013	0.521	1.760	2.760

*Note: Borehole 6 was used in October because Borehole 10 was dry.

Summary of Cobalt (Co-60) Results of IEMA Samples

General Description	IEMA Sample ID	Sample Date	Co-60 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
St. James Church Well	120227	3/19/2013	-0.514	1.045	2.892
St. James Church Well	120227	6/27/2013	-1.123	1.251	3.454
St. James Church Well	120227	9/18/2013	-0.700	1.530	3.990
St. James Church Well	120227	12/11/2013	1.040	1.670	2.700
Sag Slough East Well #5021	120209	3/19/2013	2.763	1.230	4.049
Sag Slough East Well #5021	120209	6/27/2013	-0.061	1.007	2.967
Sag Slough East Well #5021	120209	9/18/2013	-0.799	1.070	2.960
Sag Slough East Well #5021	120209	12/11/2013	1.860	1.270	4.000
Red Gate Woods Well #5160	120229	3/19/2013	1.407	1.406	4.217
Red Gate Woods Well #5160	120229	6/27/2013	0.204	1.060	3.170
Red Gate Woods Well #5160	120229	9/18/2013	0.375	1.160	3.410
Red Gate Woods Well #5160	120229	12/11/2013	-0.506	1.770	2.540
Henry de Tonte Woods Well #5159	120205	3/19/2013	1.077	1.099	3.293
Henry de Tonte Woods Well #5159	120205	6/27/2013	1.452	0.964	3.144
Henry de Tonte Woods Well #5159	120205	9/18/2013	-0.640	0.942	2.650
Maple Lake East Well #5153	120238	6/27/2013	0.022	1.270	3.720
Maple Lake East Well #5153	120238	9/18/2013	0.689	0.920	2.890
Maple Lake East Well #5153	120238	12/11/2013	-0.369	0.895	2.570
Bullfrog Lake Well #5031	120210	3/19/2013	-1.308	1.016	2.748
Bullfrog Lake Well #5031	120210	6/27/2013	0.103	0.997	2.984
Bullfrog Lake Well #5031	120210	9/18/2013	-1.540	0.926	2.410
Bullfrog Lake Well #5031	120210	12/11/2013	0.223	1.050	3.160
Rain Barrel Slough Well #5162	120213	3/19/2013	3.673	1.078	3.901
Rain Barrel Slough Well #5162	120213	6/27/2013	-0.339	0.997	2.890
Rain Barrel Slough Well #5162	120213	9/18/2013	1.350	1.150	3.650
Rain Barrel Slough Well #5162	120213	12/11/2013	-2.780	1.470	3.460
S&S Canal Downstream	120224	3/19/2013	-1.527	1.187	3.141
S&S Canal Downstream	120224	9/18/2013	-0.224	0.906	2.630
S&S Canal Downstream	120224	12/11/2013	1.280	0.880	2.810
S&S Canal Upstream	120221	3/19/2013	-1.894	1.456	3.667
S&S Canal Upstream	120221	6/27/2013	-1.974	1.418	3.489
S&S Canal Upstream	120221	9/18/2013	-0.432	1.240	3.580
S&S Canal Upstream	120221	12/11/2013	-0.794	1.080	2.990
I&M Canal Downstream	120223	3/19/2013	-0.270	0.981	2.873
I&M Canal Downstream	120223	6/27/2013	-1.709	1.308	3.532
I&M Canal Downstream	120223	9/18/2013	0.327	1.060	3.210
I&M Canal Upstream	120220	3/19/2013	-0.015	1.280	3.540
I&M Canal Upstream	120220	6/27/2013	0.108	1.060	3.150
I&M Canal Upstream	120220	9/18/2013	0.290	1.080	3.180

Summary of Cesium (Cs-137) Results of Split Samples from Argonne

General Description	IEMA Sample ID	Sample Date	Cs-137 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
Red Gate Well 5160	120229	3/28/2013	-1.332	0.943	2.738
Red Gate Well 5160	120229	6/4/2013	0.828	1.021	3.243
Red Gate Well 5160	120229	9/4/2013	-0.422	1.080	3.260
Red Gate Well 5160	120229	10/22/2013	-1.490	1.270	3.470
Dolomite Well D10	120266	3/27/2013	1.873	1.054	3.258
Dolomite Well D10	120266	6/4/2013	-0.594	1.030	3.098
Dolomite Well D10	120266	9/4/2013	-0.614	1.350	3.800
Dolomite Well D10	120266	11/1/2013	0.639	0.860	2.740
Dolomite Well D13	120269	3/27/2013	1.717	1.046	3.470
Dolomite Well D13	120269	6/4/2013	-0.408	1.281	3.642
Dolomite Well D13	120269	9/4/2013	-1.170	0.900	2.620
Dolomite Well D13	120269	11/1/2013	0.700	1.010	3.200
Borehole 4	120275	3/27/2013	-1.245	1.073	3.145
Borehole 4	120275	6/4/2013	1.429	1.290	3.916
Borehole 4	120275	9/4/2013	0.849	1.280	3.800
Borehole 4	120275	10/22/2013	2.360	0.935	3.110
Borehole 10	120278	3/27/2013	0.324	1.528	2.446
Borehole 10	120278	6/4/2013	-0.785	1.053	3.128
Borehole 10	120278	9/4/2013	0.485	0.908	2.840
Borehole 6 *	120276	10/22/2013	0.011	0.978	3.020
Borehole 54	120285	3/23/2013	-0.499	1.031	3.102
Borehole 54	120285	6/4/2013	-0.392	1.132	3.397
Borehole 54	120285	9/4/2013	-1.140	1.050	2.970
Borehole 54	120285	10/22/2013	-1.630	1.740	2.490

*Note: Borehole 6 was used in October because Borehole 10 was dry.

Summary of Cesium (Cs-137) Results of IEMA Samples

General Description	IEMA Sample ID	Sample Date	Cs-137 Result (pCi/L)	Uncertainty (pCi/L)	MDA (pCi/L)
St. James Church Well	120227	3/19/2013	0.160	0.949	2.922
St. James Church Well	120227	6/27/2013	1.469	1.093	3.513
St. James Church Well	120227	9/18/2013	-1.630	1.240	3.360
St. James Church Well	120227	12/11/2013	1.100	1.550	2.550
Sag Slough East Well #5021	120209	3/19/2013	-1.140	1.336	3.683
Sag Slough East Well #5021	120209	6/27/2013	-0.232	0.953	2.899
Sag Slough East Well #5021	120209	9/18/2013	-1.200	0.969	2.820
Sag Slough East Well #5021	120209	12/11/2013	-0.173	1.020	3.120
Red Gate Woods Well #5160	120229	3/19/2013	-1.996	1.070	2.950
Red Gate Woods Well #5160	120229	6/27/2013	0.124	0.969	2.970
Red Gate Woods Well #5160	120229	9/18/2013	0.152	0.983	3.040
Red Gate Woods Well #5160	120229	12/11/2013	-0.089	1.600	2.500
Henry de Tonte Woods Well #5159	120205	3/19/2013	0.411	1.044	3.076
Henry de Tonte Woods Well #5159	120205	6/27/2013	0.807	0.876	2.791
Henry de Tonte Woods Well #5159	120205	9/18/2013	-0.982	0.894	2.620
Maple Lake East Well #5153	120238	6/27/2013	1.230	1.030	3.320
Maple Lake East Well #5153	120238	9/18/2013	0.871	0.974	3.050
Maple Lake East Well #5153	120238	12/11/2013	1.340	0.863	2.770
Bullfrog Lake Well #5031	120210	3/19/2013	-0.370	0.907	2.756
Bullfrog Lake Well #5031	120210	6/27/2013	-0.025	0.914	2.814
Bullfrog Lake Well #5031	120210	9/18/2013	-0.013	0.901	2.760
Bullfrog Lake Well #5031	120210	12/11/2013	-0.245	0.986	3.010
Rain Barrel Slough Well #5162	120213	3/19/2013	1.206	1.095	3.502
Rain Barrel Slough Well #5162	120213	6/27/2013	-1.070	0.918	2.700
Rain Barrel Slough Well #5162	120213	9/18/2013	-0.170	1.080	3.320
Rain Barrel Slough Well #5162	120213	12/11/2013	0.235	1.030	3.210
S&S Canal Downstream	120224	3/19/2013	-0.388	1.120	3.387
S&S Canal Downstream	120224	9/18/2013	0.169	0.812	2.510
S&S Canal Downstream	120224	12/11/2013	-1.010	0.843	2.400
S&S Canal Upstream	120221	3/19/2013	-0.508	1.392	3.905
S&S Canal Upstream	120221	6/27/2013	0.805	1.246	3.718
S&S Canal Upstream	120221	9/18/2013	0.592	1.010	3.180
S&S Canal Upstream	120221	12/11/2013	1.140	0.905	2.940
I&M Canal Downstream	120223	3/19/2013	0.615	0.985	3.100
I&M Canal Downstream	120223	6/27/2013	-1.264	1.157	3.407
I&M Canal Downstream	120223	9/18/2013	0.304	0.937	2.930
I&M Canal Upstream	120220	3/19/2013	-0.056	1.048	3.007
I&M Canal Upstream	120220	6/27/2013	1.130	0.902	2.910
I&M Canal Upstream	120220	9/18/2013	0.102	0.999	3.070