



Tonawanda Landfill Vicinity Property

Environmental Monitoring Data Release

2014 Sampling Results

Tonawanda, NY

U.S. Army Corps of Engineers
Buffalo District

Building Strong®

August 2014

Formerly Utilized Sites Remedial Action Program

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was initiated in 1974 to identify, investigate, and clean up or control sites throughout the United States that were contaminated as the result of activities related to the nation's early atomic energy and weapons program in the 1940s, 1950s and 1960s. When implementing FUSRAP, the U.S. Army Corps of Engineers follows the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Tonawanda Landfill Vicinity Property was designated into FUSRAP in 1992.

Site Description

The Tonawanda Landfill Vicinity Property consists of two parcels owned by the Town of Tonawanda: the Town of Tonawanda Landfill (Landfill Operable Unit [OU]) and the North Youngmann Commerce Center, formerly known as the mudflats (Mudflats OU). In 2008 the Corps of Engineers issued a record of decision for the Mudflats OU, stating that no action is required under FUSRAP for that OU. The Landfill OU is currently in the feasibility study phase of the CERCLA investigation process. The Landfill OU covers approximately 55 acres in the Town of Tonawanda, Erie County, New York. The Landfill OU is bordered by a residential area within the City of Tonawanda to the north and northwest, a railroad line to the east, and a National Grid utility corridor to the south. Investigations by the Corps of Engineers have detected elevated levels of the FUSRAP-related constituents radium-226 (Ra-226), thorium-230 (Th-230) and uranium in soils in a portion of the Landfill OU.

Purpose

The purpose of this environmental data release is to provide groundwater and surface water monitoring data that were collected for the Landfill OU in 2014. Included in this data release are the environmental monitoring data, and the Corps of Engineers' interpretation of the results. The Corps of Engineers is posting this environmental data release on the Tonawanda Landfill Vicinity Property Web page at <http://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/TonawandaLandfill.aspx>, along with a fact sheet describing the annual environmental monitoring program.

Results and Interpretation

Groundwater and surface water samples were collected from the Landfill OU in April 2014 from the locations shown on Figure 1. Groundwater surface elevations were measured in the permanent monitoring well and temporary well point (TWP) locations sampled during the spring 2014 monitoring event and are presented in Table 1. These elevations were plotted as groundwater contours, shown in Figure 2. The data indicate that groundwater flow in the Landfill OU is generally towards the south or southwest, parallel to or away from the northwestern property boundary.

Groundwater Results

Unfiltered and filtered groundwater sample results for the April 2014 annual monitoring event are presented in Tables 2 and 3, respectively. Concentrations of Ra-226 and Th-230 have consistently been at or near background levels in groundwater samples from all permanent monitoring well and TWP sample locations.

Elevated levels of uranium were detected in groundwater samples from several of the permanent monitoring well and TWP locations. Figure 3 illustrates the total uranium concentrations in filtered groundwater samples collected by the Corps of Engineers over time. While groundwater at the Landfill OU is not a drinking water source, for comparison purposes the detected uranium concentrations were screened against the U.S. Environmental Protection Agency Maximum Contaminant Level (MCL) for total uranium of 30 micrograms per liter ($\mu\text{g/L}$). (The MCLs are the accepted regulatory contaminant guidelines for drinking water.) Uranium concentrations in groundwater samples collected in April 2014 from wells BM-4, BM-16, BM-19, TWP-6, TWP-7, and TWP-13 exceeded the MCL for uranium. However, since groundwater is not utilized for drinking water purposes, exceedances of the total uranium MCL do not indicate an impact to human health. Uranium concentrations in samples from wells BM-15, BM-17, BM-18, L-2, and TWP-10 were below the total uranium MCL, but appeared elevated above background levels. The remaining wells exhibited uranium concentrations at or near background levels. The two locations closest to and downgradient of the area with elevated uranium in soils, TWP-6 and TWP-7, have consistently exhibited the highest concentrations of uranium in groundwater.

Surface Water Results

Unfiltered surface water sample results for the April 2014 monitoring event are presented in Table 4. Surface water samples were collected from the Landfill OU northern drainage ditch, from a ditch that drains the adjacent National Grid utility corridor into the northern drainage ditch (locations SW/SD-12 and SW-17), and from Two Mile Creek in line with and downstream of the discharge from the northern drainage ditch (locations SW-18, SW-19 and SW-20). As with groundwater, concentrations of Ra-226 and Th-230 have consistently been at or near background levels in all surface water samples collected.

Elevated levels of uranium were detected in samples collected from the northern drainage ditch. Figure 4 illustrates the total uranium concentrations in surface water samples collected by the Corps of Engineers over time, shown in the direction of flow from the northern drainage ditch into Two Mile Creek. Surface water flow in the northern drainage ditch is temporary in nature, and it is not a viable drinking water source or habitat for aquatic life. However, for comparison purposes the uranium concentrations were again screened against the total uranium MCL, as well as the Canadian surface water quality guideline (CWQG) for protection of aquatic life of 15 $\mu\text{g/L}$ for total uranium. (The CWQG for protection of aquatic life, which includes aquatic plants, fish, and insects and other invertebrates which live in the water, was developed by the Canadian Council of Ministers of the Environment in 2011, and is used here for screening purposes to identify potential risks to aquatic life. No corresponding surface water quality criteria for uranium have been developed by the U.S. Environmental Protection Agency or individual states.) Uranium concentrations in samples collected in April 2014 from locations SW/SD-01, SW/SD-05, SW/SD-08, SW/SD-11, and SW/SD-09 in the northern drainage ditch exceeded both the MCL and CWQG, while concentrations in samples from locations SW/SD-06, SW/SD-07, SW/SD-10, and SW/SD-13 exceeded the CWQG only. However, since the northern drainage ditch is not a drinking water source or a viable aquatic habitat, these exceedances do not indicate a threat to human health or the environment. Also, uranium concentrations tend to decrease as surface water moves downstream along the length of the northern drainage ditch. Samples collected in April 2014 from the National Grid ditch, the portion of the northern drainage ditch between the National Grid ditch and Two Mile Creek, and from Two Mile Creek itself had uranium concentrations below the MCL and CWQG.

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Legend

- Monitoring Well
- Temporary Well Point
- Surface Water Sample
- Northern Drainage Ditch
- Landfill Operable Unit Boundary
- Mudflats Operable Unit Boundary



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

2014 GROUNDWATER AND SURFACE WATER
SAMPLE LOCATIONS

Document Name: 280414_WGWSLocations.mxd
Drawn By: H5TDESPM
Date Saved: 26 Jun 2014
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TONAWANDA LANDFILL
FUSRAP VICINITY PROPERTY
TONAWANDA, NEW YORK

FIGURE 1



Legend

- Monitoring Well
- Temporary Well Point
- Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- Landfill Operable Unit Boundary
- Mudflats Operable Unit Boundary

NOTES:
1) Groundwater elevations measured in ft amsl.



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

GROUNDWATER ELEVATION CONTOUR MAP
APRIL 7, 2014

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TONAWANDA LANDFILL
FUSRAP VICINITY PROPERTY
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FIGURE 2

Table 1: Groundwater Elevations for April 2014 Monitoring Event

Well ID¹	Top of Casing Elevation (ft AMSL)	Depth to Water (ft from TOC)	Groundwater Elevation (ft AMSL)
BM-4	621.60	2.71	618.89
BM-15	606.20	12.89	593.31
BM-16	613.86	12.28	601.58
BM-17	621.73	5.13	616.60
BM-18	619.51	10.66	608.85
BM-19	610.20	3.34	606.86
L-1	616.12	5.51	610.61
L-2	622.03	3.61	618.42
L-3	621.34	3.72	617.62
TWP-4	622.47	3.16	619.31
TWP-5	622.93	3.61	619.32
TWP-6	619.92	0.53	619.39
TWP-7	619.62	0.43	619.19
TWP-8	620.36	1.16	619.20
TWP-9	620.56	0.96	619.60
TWP-10	620.15	0.58	619.57
TWP-11	622.43	1.63	620.80
TWP-13	622.27	2.83	619.44

AMSL = Above Mean Sea Level

TOC = Top of Casing

1. A groundwater elevation is not provided for TWP-1, as the measured water levels in TWP-1 are inconsistent with the surrounding monitoring wells and TWPs.

Table 2: Groundwater Analytical Results for Unfiltered Samples

Well	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
BM-4	Sep-01	1.50	0.300	14.4	0.400	12.3	30.1
	Jul-09	0.312	0.248	13.1	1.31	14.2	28.0
	Apr-12	0.000	0.00100	11.2	0.733	9.74	32.1
	Apr-13	ND	ND	14.2	0.766	11.9	31.8
	Apr-14	0.342	-0.0200	12.8	0.592	10.1	34.4
BM-15	Sep-01	0.600	0.100	7.40	0.400	6.00	14.8
	Jul-09	NC	NC	NC	NC	NC	NC
	Apr-12	0.356	0.157	7.84	0.201	5.95	16.1
	Apr-13	0.672	ND	7.23	0.243	4.25	16.5
	Apr-14	0.0555	-0.0380	6.53	0.299	4.49	15.4
BM-16	Sep-01	0.400	0.000	13.2	0.600	9.90	27.0
	Jul-09	0.712	0.170	14.3	0.940	11.3	26.5
	Apr-12	0.315	0.0660	13.6	0.499	12.0	36.3
	Apr-13	ND	ND	11.3	0.496	9.47	27.1
	Apr-14	0.238	0.0260	11.2	0.712	9.60	31.8
BM-17	Sep-01	1.50	0.300	9.20	0.700	8.00	22.5
	Jul-09	1.62	0.351	9.58	0.340	8.08	20.2
	Apr-12	0.470	0.0370	5.96	0.400	5.97	17.2
	Apr-13	0.331	ND	5.97	0.195	4.80	13.6
	Apr-14	0.128	-0.0860	4.48	0.0350	3.65	10.7
BM-18	Sep-01	2.20	0.400	12.2	0.600	10.0	30.7
	Jul-09	0.994	0.138	10.0	0.792	7.57	47.1
	Apr-12	0.0550	0.276	10.5	0.548	8.74	25.2
	Apr-13	0.353	ND	7.85	0.259	7.28	19.3
	Apr-14	0.215	-0.106	6.63	0.397	6.64	22.2
BM-19	Sep-01	0.700	0.100	12.1	0.700	10.6	34.8
	Jul-09	0.338	0.0779	12.0	0.610	10.6	27.1
	Apr-12	0.118	0.506	9.98	0.360	9.28	27.6
	Apr-13	ND	ND	10.4	0.649	9.38	28.3
	Apr-14	0.487	-0.0450	10.9	0.437	9.66	28.4
L-1	Sep-01	0.300	0.300	1.80	0.100	1.40	3.60
	Jul-09	0.873	0.172	0.571	0.130	0.568	1.01
	Apr-12	0.0560	0.0770	0.744	0.036	0.921	1.43
	Apr-13	ND	ND	0.935	ND	1.02	3.41
	Apr-14	-0.193	0.0540	1.290	-0.0580	1.35	3.21
L-2	Sep-01	0.700	1.10	1.10	0.100	1.60	4.50
	Jul-09	0.453	0.124	2.75	0.361	1.78	6.40
	Apr-12	0.349	0.201	11.1	0.723	9.48	29.8
	Apr-13	ND	ND	9.04	0.547	10.0	31.4
	Apr-14	0.191	0.109	7.47	0.447	7.96	24.2
L-3	Sep-01	0.900	3.00	58.2	2.50	58.3	175
	Jul-09	1.35	0.261	3.54	0.272	2.99	7.37
	Apr-12	0.148	0.112	1.62	0.0800	1.61	5.13
	Apr-13	ND	ND	2.25	ND	2.65	6.78
	Apr-14	0.261	0.0120	1.64	0.0290	1.83	5.49

pCi/L = picocuries per liter
µg/L = micrograms per liter
NC = Not collected
ND = Not detected

1. Unless stated otherwise, total uranium was analyzed for separately via kinetic phosphorescence analysis (KPA).

Table 2: Groundwater Analytical Results for Unfiltered Samples (continued)

Well	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
TWP-1	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.273	-0.0100	2.97	0.160	2.78	8.72
	Apr-13	ND	ND	1.31	0.0950	1.75	5.30
	Apr-14	0.112	0.0310	2.41	0.321	2.05	7.73
TWP-4	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.304	0.218	0.159	0.00900	0.110	0.386
	Apr-13	ND	ND	0.345	ND	0.289	0.800
	Apr-14	0.605	-0.00900	0.0370	0.143	0.0490	0.470
TWP-5	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.174	0.181	0.113	-0.0100	0.0640	0.434
	Apr-13	ND	ND	ND	ND	0.382	0.816
	Apr-14	0.237	-0.0340	0.177	0.000	0.240	0.603
TWP-6	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.208	0.0390	44.3	2.80	45.2	128
	Apr-13	0.688	ND	39.5	1.90	39.1	118
	Apr-14	0.507	-0.0840	28.4	1.77	32.1	89.9
TWP-7	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.422	0.175	30.2	1.53	32.0	91.7
	Apr-13	ND	ND	70.0	3.39	69.7	216
	Apr-14	0.0629	-0.00700	51.9	2.83	54.5	183
TWP-8	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.145	0.219	5.03	0.238	4.77	13.5
	Apr-13	ND	ND	9.61	0.576	10.3	30.4
	Apr-14	-0.217	-0.00700	0.782	0.0700	0.902	2.96
TWP-9	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	-0.0500	0.0530	3.35	0.170	2.92	9.17
	Apr-13	ND	ND	2.93	ND	2.91	6.93
	Apr-14	0.185	0.0640	1.96	0.0770	1.98	4.49
TWP-10	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	NC	NC	NC	NC	NC	NC
	Apr-13	ND	ND	5.21	0.345	4.42	14.8
	Apr-14	0.247	-0.0450	11.6	0.143	6.16	18.6
TWP-11	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	-0.120	0.234	2.68	0.109	2.42	3.23
	Apr-13	ND	ND	3.28	ND	2.75	7.82
	Apr-14	0.127	0.0600	3.88	0.115	2.38	8.56
TWP-13	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	0.149	0.0240	15.5	0.488	15.9	57.5
	Apr-13	ND	ND	16.3	1.13	16.1	45.5
	Apr-14	0.118	-0.0290	16.7	0.697	16.0	53.6

pCi/L = picocuries per liter
µg/L = micrograms per liter
NC = Not collected
ND = Not detected

1. Unless stated otherwise, total uranium was analyzed for separately via KPA.

Table 3: Groundwater Analytical Results for Filtered Samples

Well	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
BM-4	Sep-01	0.700	0.100	12.2	0.800	11.6	32.1
	Jul-09	0.800	0.247	13.0	0.504	11.8	26.7
	Apr-12	0.423	0.161	12.3	0.196	10.6	30.9
	Apr-13	ND	ND	14.0	0.654	11.8	32.6
	Apr-14	0.192	-0.0410	11.6	0.539	9.82	33.9
BM-15	Sep-01	0.600	0.100	6.30	0.400	5.10	15.4
	Jul-09	NC	NC	NC	NC	NC	NC
	Apr-12	0.108	0.111	7.98	0.209	5.14	16.5
	Apr-13	ND	ND	7.07	ND	4.21	16.4
	Apr-14	0.327	-0.0710	7.14	0.127	4.08	15.8
BM-16	Sep-01	0.400	0.100	13.3	0.900	9.60	27.0
	Jul-09	0.548	0.107	12.3	1.31	11.9	29.3
	Apr-12	0.201	-0.0100	15.2	0.455	12.2	34.1
	Apr-13	ND	ND	11.1	0.551	8.79	29.7
	Apr-14	0.0583	-0.0420	12.9	0.530	10.3	31.2
BM-17	Sep-01	1.00	0.100	9.30	0.600	7.90	24.0
	Jul-09	0.360	0.184	6.71	0.645	6.95	18.4
	Apr-12	0.695	0.0740	6.15	0.402	6.38	19.9
	Apr-13	ND	ND	6.08	ND	5.43	14.2
	Apr-14	0.369	0.0120	4.70	0.308	3.03	10.5
BM-18	Sep-01	0.900	0.000	10.4	0.700	8.90	31.0
	Jul-09	0.898	0.229	10.5	0.609	9.46	35.4
	Apr-12	0.159	0.180	9.30	0.492	8.33	23.9
	Apr-13	ND	ND	9.50	0.400	9.25	23.4
	Apr-14	0.000	-0.0100	6.27	0.403	6.98	22.2
BM-19	Sep-01	0.400	0.100	13.0	0.600	10.4	31.6
	Jul-09	0.440	0.265	14.5	0.554	10.8	25.4
	Apr-12	0.162	0.0840	10.9	0.569	9.57	14.9
	Apr-13	ND	ND	11.5	0.587	10.3	27.6
	Apr-14	0.730	-0.00100	10.2	0.474	10.2	30.8
L-1	Sep-01	0.500	0.100	1.80	0.100	2.00	2.90
	Jul-09	0.990	0.291	1.94	0.0864	0.481	0.915
	Apr-12	-0.170	0.137	0.298	0.0410	0.750	1.58
	Apr-13	ND	ND	1.24	ND	0.888	3.31
	Apr-14	0.248	0.0130	1.36	0.0420	0.930	3.22
L-2	Sep-01	0.500	0.100	0.500	0.000	0.600	1.60
	Jul-09	1.33	0.231	3.88	0.260	4.46	49.5
	Apr-12	0.000	0.150	10.8	0.632	9.89	29.7
	Apr-13	ND	ND	9.71	0.406	9.46	30.3
	Apr-14	0.0639	0.0100	8.10	0.246	8.27	24.6
L-3	Sep-01	0.500	0.500	46.8	3.40	46.9	133
	Jul-09	1.18	0.217	2.19	0.279	2.85	6.61
	Apr-12	0.0500	-0.0100	1.85	0.075	2.09	5.73
	Apr-13	ND	ND	2.38	ND	2.03	6.97
	Apr-14	0.942	-0.0390	1.50	0.109	1.38	5.74

pCi/L = picocuries per liter
µg/L = micrograms per liter
NC = Not collected
ND = Not detected

1. Unless stated otherwise, total uranium was analyzed for separately via KPA.

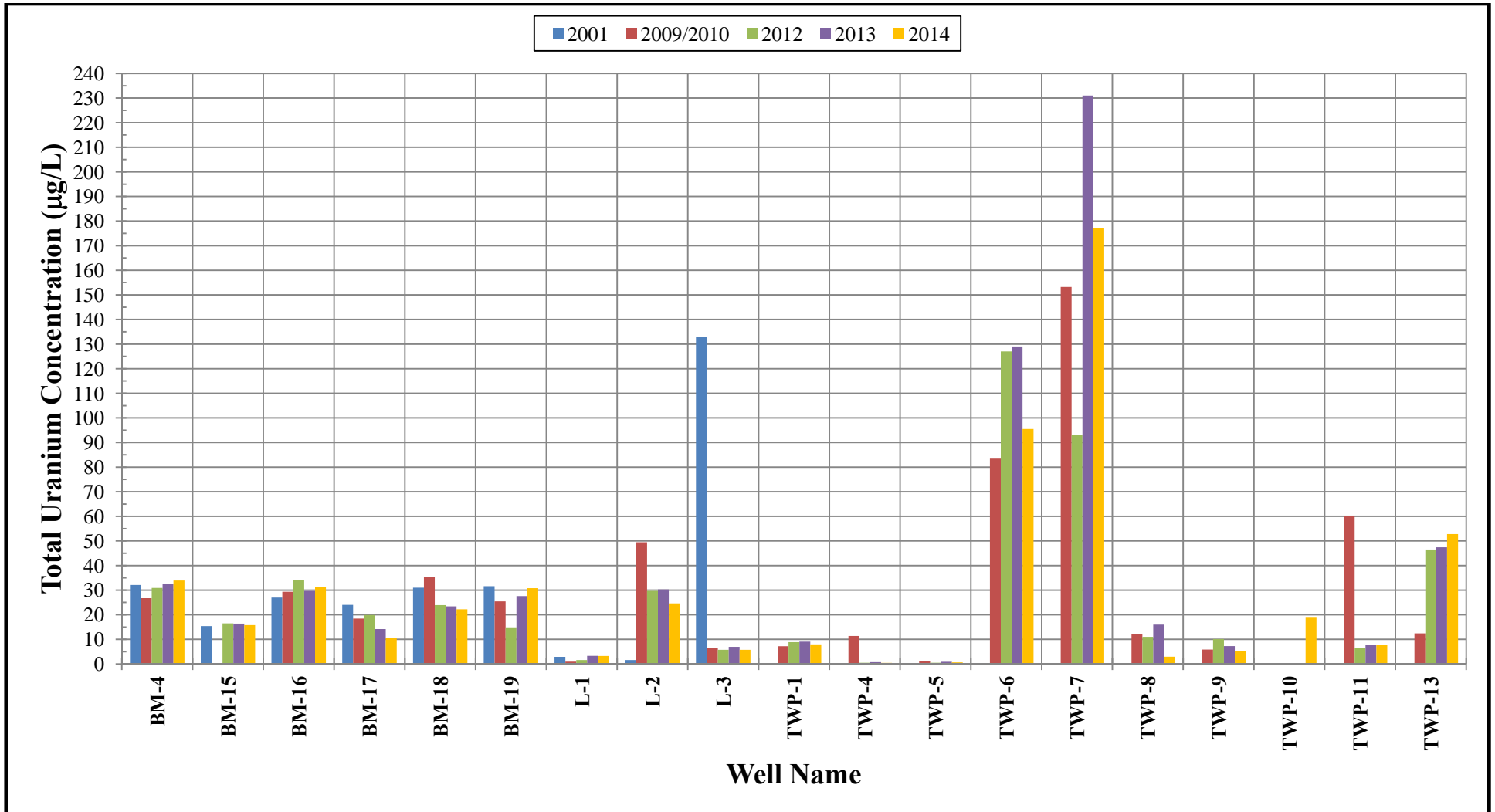
Table 3: Groundwater Analytical Results for Filtered Samples (continued)

Well	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
TWP-1 ²	Apr-10	0.230	0.0800	2.87	0.110	2.43	7.20
	Apr-12	0.112	0.158	3.48	0.111	3.02	8.87
	Apr-13	ND	ND	4.09	ND	3.35	9.07
	Apr-14	0.111	0.0270	2.78	0.147	2.40	7.95
TWP-4 ²	Apr-10	0.270	0.110	3.20	0.170	3.84	11.4
	Apr-12	0.515	0.000	0.151	0.000	0.097	0.461
	Apr-13	ND	ND	0.288	ND	0.182	0.723
	Apr-14	0.0578	-0.00600	0.168	0.0190	0.0750	0.402
TWP-5 ²	Apr-10	ND	ND	0.370	ND	0.380	1.12
	Apr-12	0.617	0.0420	0.0550	-0.0100	0.104	0.462
	Apr-13	ND	ND	0.347	ND	ND	0.897
	Apr-14	0.207	0.0560	0.151	-0.0170	0.0870	0.633
TWP-6 ²	Apr-10	0.280	0.150	28.1	0.850	28.2	83.4
	Apr-12	0.487	0.174	49.3	2.52	46.7	127
	Apr-13	ND	ND	39.2	1.87	37.5	129
	Apr-14	0.0560	0.00200	28.5	1.59	28.1	95.5
TWP-7 ²	Apr-10	ND	ND	50.7	1.99	51.8	153
	Apr-12	0.100	0.174	29.1	2.17	30.4	93.2
	Apr-13	ND	ND	71.4	5.40	73.4	231
	Apr-14	0.0578	0.0070	62.5	3.11	60.6	177
TWP-8 ²	Apr-10	0.170	0.0700	4.21	0.240	4.10	12.2
	Apr-12	-0.160	0.175	3.88	0.0400	6.74	11.0
	Apr-13	ND	ND	5.61	0.227	5.89	16.0
	Apr-14	0.0627	0.0080	0.632	0.0270	1.06	2.95
TWP-9 ²	Apr-10	ND	0.440	2.14	0.220	1.95	5.84
	Apr-12	0.231	0.0770	3.43	0.234	2.83	10.1
	Apr-13	ND	ND	2.83	ND	2.40	7.25
	Apr-14	0.253	0.00200	1.69	0.0370	1.49	5.18
TWP-10	Apr-10	NC	NC	NC	NC	NC	NC
	Apr-12	NC	NC	NC	NC	NC	NC
	Apr-13	NC	NC	NC	NC	NC	NC
	Apr-14	0.231	-0.0460	8.95	0.325	4.98	18.8
TWP-11 ²	Apr-10	0.260	0.0800	70.2	0.950	20.3	60.0
	Apr-12	0.169	0.134	2.29	0.0570	2.42	6.47
	Apr-13	ND	ND	3.17	ND	2.87	7.91
	Apr-14	-0.0640	0.00200	3.65	0.236	2.54	7.83
TWP-13 ²	Apr-10	0.230	0.0900	4.52	0.170	4.19	12.4
	Apr-12	0.146	0.123	13.7	0.865	13.1	46.5
	Apr-13	ND	ND	14.4	0.591	15.5	47.4
	Apr-14	0.369	-0.0240	16.1	0.898	17.3	52.8

pCi/L = picocuries per liter
µg/L = micrograms per liter
NC = Not collected
ND = Not detected

1. Unless stated otherwise, total uranium was analyzed for separately via KPA.
2. April 2010 Total U result for these locations calculated using the specific activities for each uranium isotope from 10CFR71, Appendix A.

Figure 3: Total Uranium Concentrations in Filtered Groundwater Samples Over Time



NOTE: 2014 was the first year that a filtered groundwater sample was able to be collected from location TWP-10.

Table 4: Surface Water Analytical Results for Unfiltered Samples

Location	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
SW/SD-01	Jul-09	0.608	0.0889	57.8	4.74	56.9	144
	Apr-12	0.249	0.107	70.8	3.71	68.3	252
	Apr-13	ND	ND	46.9	2.65	43.9	127
	Nov-13	NA	NA	20.8	1.15	23.1	76.6
	Apr-14	0.414	-0.00600	10.0	0.559	11.8	35.2
SW/SD-02	Jul-09	0.342	0.311	19.9	1.49	19.6	44.3
	Apr-12	0.112	0.168	2.91	0.133	2.81	9.08
	Apr-13	ND	ND	3.21	ND	2.87	8.48
	Nov-13	NA	NA	2.53	0.0740	2.31	8.55
	Apr-14	0.329	-0.0250	2.05	0.0850	1.71	6.31
SW/SD-05	Jul-09	1.51	0.164	61.4	6.44	61.9	162
	Apr-12	0.597	0.173	49.8	2.46	48.2	145
	Apr-13	ND	ND	38.9	2.12	37.9	117
	Nov-13	NA	NA	10.6	0.622	10.8	36.9
	Apr-14	0.119	0.00200	12.0	0.491	11.5	37.1
SW/SD-06	Jul-09	0.436	0.104	27.6	1.86	28.5	76.1
	Apr-12	0.0830	0.206	8.40	0.514	8.98	24.2
	Apr-13	0.171	ND	6.76	0.609	7.10	16.7
	Nov-13	NA	NA	52.9	3.44	51.9	179
	Apr-14	0.291	0.0350	5.77	0.270	6.05	20.0
SW/SD-07	Jul-09	1.21	0.0579	6.49	0.989	5.56	23.4
	Apr-12	0.217	0.224	7.87	0.423	7.47	24.5
	Apr-13	ND	ND	6.03	0.460	5.02	16.6
	Nov-13	NA	NA	49.3	2.65	46.5	154
	Apr-14	0.315	0.0510	5.87	0.335	5.85	17.5
SW/SD-08	Jul-09	0.603	0.170	5.93	0.565	5.53	19.3
	Apr-12	-0.130	0.331	7.64	0.415	8.65	25.6
	Apr-13	ND	ND	12.8	0.697	12.3	39.6
	Nov-13	NA	NA	20.9	1.54	21.5	72.2
	Apr-14	0.301	-0.0140	14.5	0.819	15.5	50.5
SW/SD-09	Jul-09	0.363	0.0722	7.30	0.289	6.23	108
	Apr-12	0.0460	0.271	9.19	0.499	8.55	30.3
	Apr-13	ND	ND	18.7	0.719	19.1	54.9
	Nov-13	NA	NA	22.1	1.25	20.4	72.3
	Apr-14	0.131	-0.0270	11.4	0.643	11.6	38.8
SW/SD-10	Jul-09	1.90	0.157	7.98	0.269	8.02	49.2
	Apr-12	0.346	0.170	4.34	0.344	4.99	15.7
	Apr-13	0.338	ND	17.2	0.472	16.3	42.7
	Nov-13	NA	NA	6.95	0.596	6.75	20.7
	Apr-14	0.0729	0.0220	7.64	0.472	7.37	24.9
SW/SD-11	Jul-09	0.741	0.325	5.44	0.485	4.70	19.2
	Apr-12	0.333	0.124	9.83	0.548	8.74	31.3
	Apr-13	ND	ND	17.1	1.22	18.7	50.8
	Nov-13	NA	NA	22.2	1.30	20.3	70.6
	Apr-14	0.450	0.0390	12.5	1.27	12.7	40.9

pCi/L = picocuries per liter
µg/L = micrograms per liter
ND = Not detected
NA = Not analyzed

1. Unless stated otherwise, total uranium was analyzed for separately via KPA.

Table 4: Surface Water Analytical Results for Unfiltered Samples (continued)

Location	Month & Year	Ra-226 (pCi/L)	Th-230 (pCi/L)	U-234 (pCi/L)	U-235 (pCi/L)	U-238 (pCi/L)	Total U (µg/L) ¹
SW/SD-12	Nov-11	0.177	0.118	0.195	0.0330	0.0680	0.289
	Apr-12	-0.0900	0.234	-0.0700	0.0120	0.143	0.356
	Apr-13	ND	ND	10.5	0.702	9.75	27.4
	Nov-13	NA	NA	1.32	0.159	1.86	4.92
	Apr-14	0.211	-0.0100	1.60	0.0580	1.39	4.51
SW/SD-13	Nov-11	-0.0890	0.107	6.29	0.112	6.05	18.7
	Apr-12	-0.0900	0.238	4.82	0.369	4.77	14.6
	Apr-13	0.344	ND	14.8	0.490	13.3	42.7
	Nov-13	NA	NA	6.46	0.421	5.79	21.9
	Apr-14	-0.0840	-0.00700	5.81	0.310	5.71	17.2
SW/SD-14	Nov-11	0.147	0.0740	0.0890	0.000	0.096	0.292
	Apr-12	0.0920	0.127	0.0540	0.0330	0.311	0.395
	Apr-13	ND	ND	6.34	ND	6.10	19.1
	Nov-13	NA	NA	6.68	0.366	7.92	22.0
	Apr-14	0.784	0.00200	3.95	0.122	2.42	9.71
SW/SD-15	Nov-11	-0.0440	0.0690	0.261	0.0670	0.231	0.905
	Apr-12	-0.130	0.251	4.99	0.317	4.43	1.02
	Apr-13	ND	ND	6.09	0.194	5.69	16.6
	Nov-13	NA	NA	5.38	0.218	4.67	15.4
	Apr-14	0.405	0.00100	3.50	0.132	3.52	13.2
SW/SD-16	Nov-11	0.198	0.0270	0.247	0.0590	0.239	0.634
	Apr-12	-0.160	0.0360	0.193	0.0110	0.298	0.902
	Apr-13	ND	ND	5.75	0.413	5.34	16.6
	Nov-13	NA	NA	4.52	0.298	5.20	15.2
	Apr-14	0.08	-0.01	4.27	0.207	3.91	12.4
SW-17	Nov-13	NA	NA	2.19	0.131	1.63	4.16
	Apr-14	0.502	0.0240	0.912	0.0910	0.662	2.86
SW-18	Nov-13	NA	NA	1.46	0.0920	1.21	3.77
	Apr-14	0.382	-0.0100	1.14	0.000	0.954	2.55
SW-19	Nov-13	NA	NA	1.58	0.0730	1.49	4.11
	Apr-14	0.198	0.00200	1.25	0.0570	1.06	3.95
SW-20	Nov-13	NA	NA	1.15	0.0530	1.16	3.44
	Apr-14	0.000	-0.0920	2.40	0.0840	2.41	6.11

pCi/L = picocuries per liter
µg/L = micrograms per liter
ND = Not detected
NA = Not analyzed

1. Unless stated otherwise, total uranium was analyzed for separately via KPA.

Figure 4: Total Uranium Concentrations in Unfiltered Surface Water Samples Over Time

