



GROUNDWATER MONITORING DATA 2012 SAMPLING EVENT HARSHAW CHEMICAL COMPANY FUSRAP SITE

**U.S. Army Corps of Engineers
Buffalo District**

Building Strong®

July 2013

Formerly Utilized Sites Remedial Action Program (FUSRAP)

FUSRAP was initiated in 1974 to identify, investigate, and cleanup or control sites throughout the United States that were part of the Nation's early atomic weapons and energy programs during the 1940s, 1950s, and 1960s. When implementing FUSRAP, the Corps follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Site Description

The 55-acre former Harshaw Chemical Company Site is located at 1000 Harvard Avenue, approximately five miles southwest of downtown Cleveland in Cuyahoga County, Ohio. The site is in a low-lying area adjacent to the Cuyahoga River and Big Creek, is surrounded on three sides by industries and includes several developed and undeveloped land parcels.

Purpose

The purpose of groundwater monitoring is to determine the potential for contaminant movement. A subset of the on-site wells is sampled annually to supplement the Remedial Investigation (RI) results. The U.S. Army Corps of Engineers Buffalo District will use these groundwater data to monitor conditions at the site.

The Corps releases the groundwater monitoring data and the Corps' interpretation of these data annually on the Buffalo District webpage, in the environmental monitoring section, along with a description of the site's conceptual groundwater model.

Scope

Groundwater monitoring is performed annually at the Harshaw Site. Figure 1 shows the locations of the twenty-one (21) groundwater monitoring wells and two (2) surface-water locations sampled at the Harshaw Site in May 2012. The constituents of interest (COIs) for each location include isotopic radium (Ra-226, Ra-228), isotopic thorium (Th-228, Th-230, Th-232), isotopic uranium (U-234, U-235, U-238), and total uranium. Based on results from sampling events prior to 2009, wells with no impacts (i.e., similar to background conditions) were ruled out from further sampling. Figure 2 shows the locations of the groundwater and surface-water samples obtained between 2008 through 2012, and the number of years of data acquired by the Corps during that time period.

Groundwater flow at the Harshaw Site is controlled by the nature of the unconsolidated soil deposits, the topography of the underlying shale bedrock, the relative elevation of the Cuyahoga River and Big Creek, and the operation of the present owner's groundwater extraction system designed to control nickel inflows to site sewers. Table 1 lists the water levels collected from all accessible wells; these data are consistent with findings from the RI report that showed groundwater flow directions are predominantly west to east. A more

detailed description of hydrogeologic conditions and the site groundwater monitoring program is found in the Groundwater Conceptual Site Model fact sheet that is available on the Buffalo District's webpage.

Both filtered and unfiltered samples were collected from the groundwater wells. Field filtered surface-water samples were collected in April 2012, while unfiltered samples were collected in May 2012. Location 'IA09-SW0008' is a storm sewer outfall to the Cuyahoga River and 'IA09-SW0008-CR' is a river sample taken directly below the outfall. These surface-water sample results provide information on the potential for dilution in the Cuyahoga River, although they do not define an effluent mixing zone for the characterization of surface-water quality.

Results and Interpretation

Table 2 lists the unfiltered (total) and filtered (dissolved phase) analytical results for the 2012 monitoring event. Analytical results indicate that several locations have uranium concentrations that are greater than the range of data seen in the three sampled background wells BKG-MW0001, -MW0003, and -MW0005; the average total uranium in background groundwater is about 2.7 ug/L (micrograms per liter). The following 16 monitoring locations normally exhibit concentrations above this background average:

DM-14	DM-15
BKA48	IA10-MW0017
IA04-TP0001	IA10-MW0018
IA04- TW0004	RMW-39
IA10-MW0001	RMW-38
IA10-MW0004	IA10-MW0008
IA10-MW0005	IA10-MW0007
IA09-SW0008	IA09-SW0008-CR

Most of the locations are around Building G-1, known areas of soil contamination, or along the storm-water line that discharges at IA09-SW0008. Figure 3 shows the contaminated soil areas along with filtered total uranium results for 2012. Total uranium concentrations vary slightly from year to year, yet show generally stable concentrations that reflect conditions first identified in 2003. Although the current dataset is not sufficient to statistically define long-term concentration trends in the groundwater monitoring wells, the uranium, radium, and thorium concentrations are consistent with previously monitored results, which indicate radionuclide movement in groundwater is minimal.

The U.S Environmental Protection Agency maximum contaminant level for uranium in drinking water is 30 ug/L; only on-site wells BKA48, DM-15, and IA10-MW0001 have exceeded this value since 2008. All these wells are located near Building G-1 (BKA48 and DM-15) or contaminated soil areas (IA10-MW0001), indicating that contaminant migration is minimal. The surface-water discharge from IA09-SW0008 can be compared to Nuclear Regulatory Commission (NRC) criteria for uncontrolled discharges to surface-water bodies, or *10 Code of Federal Regulations (CFR) 20, Appendix B, Table 2, Column 2*. These citations state that up to 300 pCi/L (picocuries per liter) of uranium can discharge from NRC facilities to surface water bodies and not induce a radiologic dose above 50 millirem per year assuming 2 (two) liters of the discharge are consumed daily. The IA09-SW0008 results shown in Table 2 have not exceeded this NRC value. Since site groundwater and the surface-water discharge are presently not drinking water sources, the sampling results are protective of human health under current site conditions.

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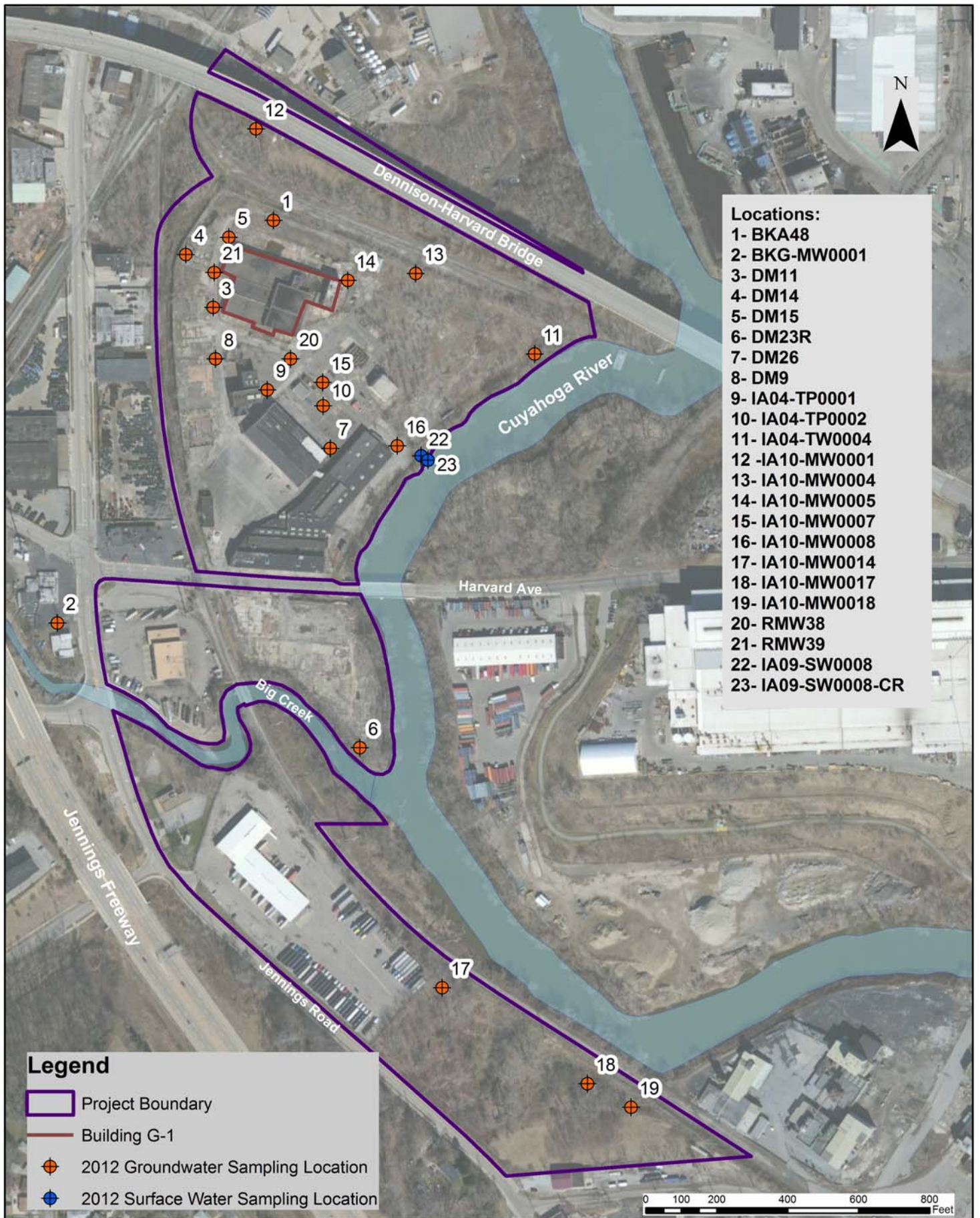


Figure 1. Harshaw Monitoring Program Locations Sampled in 2012

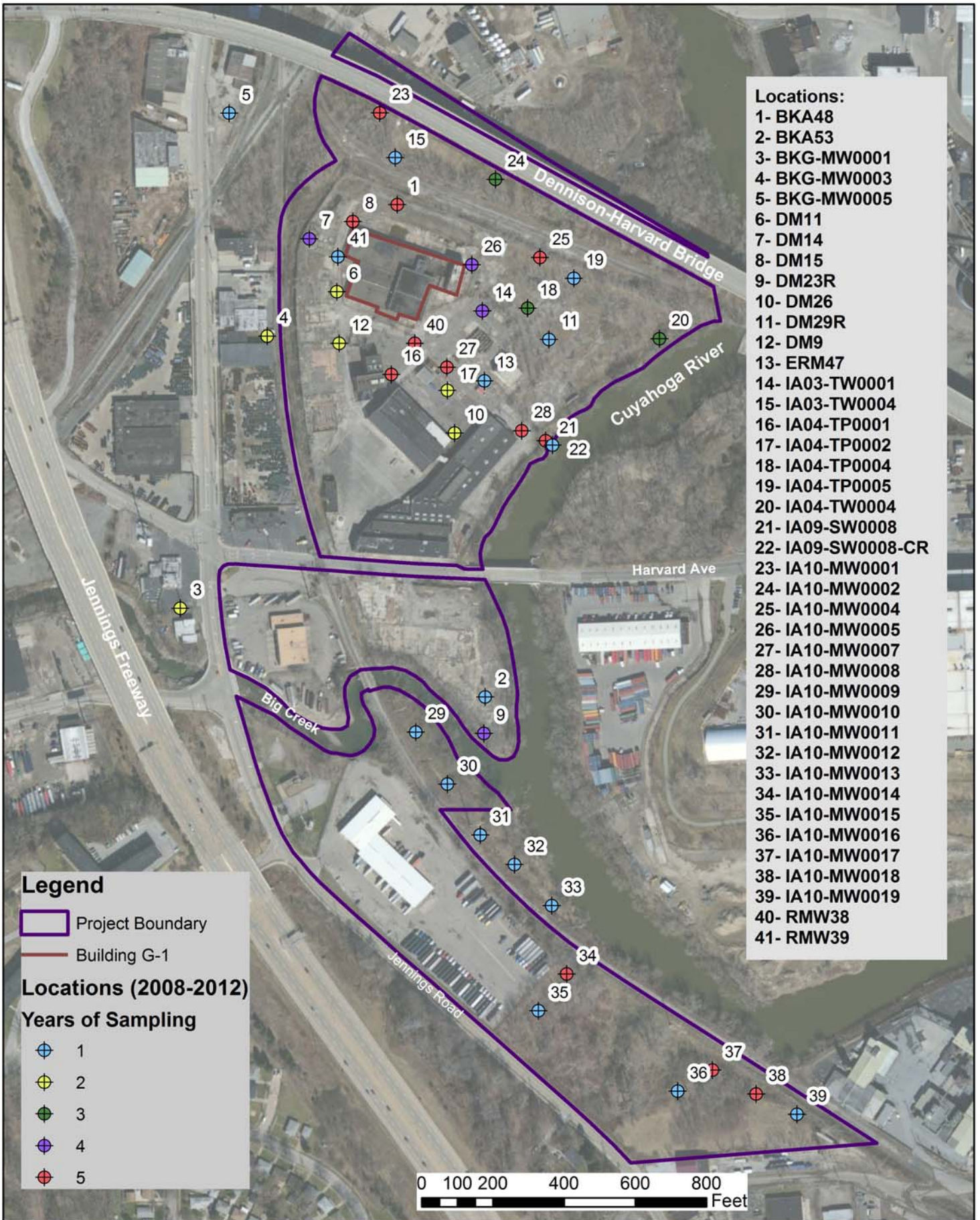


Figure 2. Harshaw Monitoring Program Locations Sampled Between 2008 and 2012

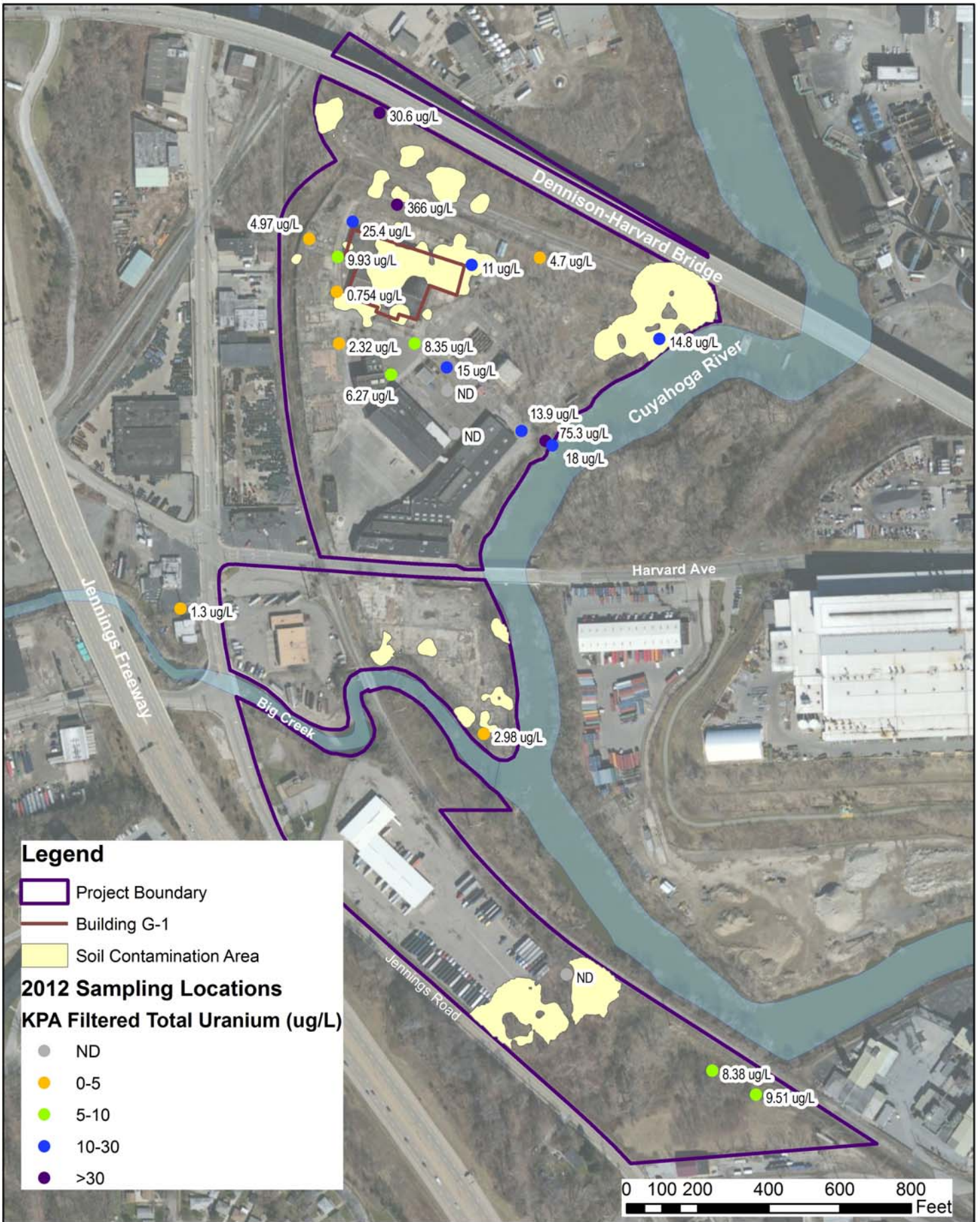


Figure 3. Harshaw 2012 Monitoring Locations Filtered Total Uranium Kinetic Phosphorescence Analysis (KPA) Results (ug/L)



Table 1
Harshaw FUSRAP Site
Groundwater Elevations (2008-2012)

Well	Top of Casing Elevation (ft AMSL)	Depth to Water (ft TOC)					Water Level Elevation (ft AMSL)					Monitoring Rationale	
		2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	Historic	2012
BKA48	594.87	12.65	11.33	9.72	8.25	11.68	582.22	583.54	585.15	586.62	583.19	Uranium Plume	Uranium Plume
BKA51	595.76	--	--	17.65	15.61	20.02	--	--	578.11	580.15	575.74	Water level	Water Level
BKA52	593.13	--	--	--	16.74	19.25	--	--	--	576.39	573.88	Water level	Water Level
BKA53	593.40	19.99	20.01	18.08	16.61	19.93	573.41	573.39	575.32	576.79	573.47	Water level	Water Level
BKG-MW0001	592.10	--	--	10.38	9.22	16.86	--	--	581.72	582.88	575.24	Baseline	Baseline
BKG-MW0003	591.98	9.94	8.62	--	--	--	582.04	583.36	--	--	--	Baseline	Unavailable
BKG-MW0005	592.20	--	--	7.81	6.69	--	--	--	584.39	585.51	--	Baseline	Unavailable
DM1	596.13	--	--	9.98	9.07	16.58	--	--	586.15	587.06	579.55	Water level	Water Level
DM10	592.71	--	--	9.47	7.64	11.81	--	--	583.24	585.07	580.90	Water level	Water Level
DM11	595.89	--	--	10.48	8.44	14.11	--	--	585.41	587.45	581.78	Uranium Plume	Uranium Plume
DM12	596.13	--	--	11.15	9.26	13.71	--	--	584.98	586.87	582.42	Water level	Water Level
DM14	596.33	13.95	12.68	10.77	8.86	13.32	582.38	583.65	585.56	587.47	583.01	Uranium Plume	Uranium Plume
DM15	596.46	16.48	13.32	12.66	8.69	13.73	579.98	583.14	583.80	587.77	582.73	Uranium Plume	Uranium Plume
DM22R	594.81	--	--	19.02	17.54	21.09	--	--	575.79	577.27	573.72	Water level	Water Level
DM23R	593.06	19.60	19.67	17.43	16.10	19.56	573.46	573.39	575.63	576.96	573.50	Impacts in IA05	Impacts in IA05
DM25R	592.84	--	--	17.39	15.45	19.63	--	--	575.45	577.39	573.21	Water level	Water Level
DM26	592.99	--	--	17.26	15.64	21.48	--	--	575.73	577.35	571.51	Water level	Uranium Plume
DM28R	595.09	--	--	20.53	18.35	21.95	--	--	574.56	576.74	573.14	Water level	Water Level
DM29R	595.49	22.51	22.08	20.70	18.81	22.46	572.98	573.41	574.79	576.68	573.03	Uranium Plume	Water Level
DM3	594.14	--	--	1.57	1.43	2.30	--	--	592.57	592.71	591.84	Water level	Water Level
DM30R	594.91	--	--	20.56	18.42	21.95	--	--	574.35	576.49	572.96	Water level	Water Level
DM4	593.84	--	--	3.98	3.13	5.15	--	--	589.86	590.71	588.69	Water level	Water Level
DM5	596.36	--	--	11.25	9.52	13.12	--	--	585.11	586.84	583.24	Water level	Water Level
DM9	598.01	--	--	11.97	9.30	14.89	--	--	586.04	588.71	583.12	Water level	Uranium Plume
ERM47	593.06	19.56	13.68	2.74	1.21	2.56	573.50	579.38	590.32	591.85	590.50	Uranium Plume	Water Level
IA03-TP0001	594.16	--	--	--	9.56	12.90	--	--	--	584.60	581.26	Uranium Plume	Water Level
IA03-TW0001	596.50	6.39	--	4.81	4.19	6.77	590.11	--	591.69	592.31	589.73	Uranium Plume	Water Level
IA03-TW0002	595.39	--	--	8.96	8.51	10.19	--	--	586.43	586.88	585.20	Water level	Water Level
IA03-TW0003	593.39	--	--	11.91	11.20	13.61	--	--	581.48	582.19	579.78	Water level	Water Level
IA03-TW0004	592.92	12.15	--	9.21	7.91	11.03	580.77	--	583.71	585.01	581.89	Uranium Plume	Water Level
IA04-TP0001	596.32	17.02	9.46	8.00	7.79	9.91	579.30	586.86	588.32	588.53	586.41	Uranium Plume	Uranium Plume
IA04-TP0002	595.74	--	--	19.79	18.30	22.60	--	--	575.95	577.44	573.14	Water level	Uranium Plume
IA04-TP0003	595.39	--	--	17.55	--	19.60	--	--	577.84	--	575.79	Water level	Water Level
IA04-TP0004	595.20	19.50	14.79	13.79	12.80	14.67	575.70	580.41	581.41	582.40	580.53	Uranium Plume	Water Level
IA04-TP0005	594.47	21.64	--	19.99	17.93	--	572.83	--	574.48	576.54	--	Uranium Plume	Unavailable
IA04-TW0001	595.16	--	--	20.81	17.86	--	--	--	574.35	577.30	--	Water level	Unavailable
IA04-TW0002	593.59	--	--	14.76	--	17.23	--	--	578.83	--	576.36	Water level	Water Level
IA04-TW0003	580.97	--	--	--	--	10.32	--	--	--	--	570.65	Water level	Water Level
IA04-TW0004	594.44	17.52	--	15.02	13.66	17.23	576.92	--	579.42	580.78	577.21	Uranium Plume	Uranium Plume
IA04-TW0005	593.23	--	--	--	7.98	21.44	--	--	--	585.25	571.79	Water level	Water Level
IA04-TW0006	589.71	--	--	17.34	14.82	18.26	--	--	572.37	574.89	571.45	Water level	Water Level
IA05-TW0001	598.64	--	--	21.13	19.66	22.73	--	--	577.51	578.98	575.91	Water level	Water Level
IA10-MW0001	593.86	11.81	10.31	9.96	7.69	--	582.05	583.55	583.90	586.17	--	Uranium Plume	Uranium Plume
IA10-MW0002	595.72	13.80	12.22	10.32	9.23	--	581.92	583.50	585.40	586.49	--	Uranium Plume	Unavailable
IA10-MW0003	584.05	--	--	--	--	14.11	--	--	--	--	569.94	To be Redeveloped	Water Level
IA10-MW0004	595.88	13.92	12.82	9.32	7.23	17.56	581.96	583.06	586.56	588.65	578.32	Uranium Plume	Uranium Plume
IA10-MW0005	594.83	--	5.69	0.00	4.64	--	--	589.14	594.83	590.19	--	Uranium Plume	Uranium Plume
IA10-MW0007	592.95	--	17.87	16.89	15.30	18.64	--	575.08	576.06	577.65	574.31	Uranium Plume	Uranium Plume
IA10-MW0008	592.57	--	18.98	17.25	15.31	19.32	--	573.59	575.32	577.26	573.25	Uranium Plume	Uranium Plume
IA10-MW0009	586.74	--	12.99	11.41	8.19	13.11	--	573.75	575.33	578.55	573.63	Water level	Water Level
IA10-MW0010	586.60	--	12.86	11.15	7.99	12.97	--	573.74	575.45	578.61	573.63	Water level	Water Level
IA10-MW0011	591.43	--	17.65	15.99	12.73	17.78	--	573.78	575.44	578.70	573.65	Water level	Water Level
IA10-MW0012	583.70	--	9.95	7.98	4.72	9.98	--	573.75	575.72	578.98	573.72	Water level	Water Level
IA10-MW0013	586.09	--	12.36	10.73	7.35	12.42	--	573.73	575.36	578.74	573.67	Water level	Water Level
IA10-MW0014	597.25	--	23.42	21.81	18.14	24.45	--	573.83	575.44	579.11	572.80	Impacts in IA07	Impacts in IA07
IA10-MW0015	598.56	--	24.60	22.70	19.00	25.57	--	573.96	575.86	579.56	572.99	Water level	Water Level
IA10-MW0016	594.71	--	17.54	14.82	7.81	16.48	--	577.17	579.89	586.90	578.23	Water level	Water Level

Notes:
 AMSL Above Mean Sea Level
 ft foot (feet)
 -- No Reading Available
 TOC Top of Casing



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Table 1
Harshaw FUSRAP Site
Groundwater Elevations (2008-2012)

Well	Top of Casing Elevation (ft AMSL)	Depth to Water (ft TOC)					Water Level Elevation (ft AMSL)					Monitoring Rationale	
		2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	Historic	2012
IA10-MW0017	595.48	--	19.42	17.72	13.67	19.37	--	576.06	577.76	581.81	576.11	Impacts in IA07	Impacts in IA07
IA10-MW0018	592.21	--	13.64	10.69	3.02	13.21	--	578.57	581.52	589.19	579.00	Impacts in IA07	Impacts in IA07
IA10-MW0019	597.19	--	13.98	9.58	6.86	13.72	--	583.21	587.61	590.33	583.47	Water level	Water Level
RMW35	596.44	--	--	--	8.42	--	--	--	--	588.02	--	Water level	Unavailable
RMW38	596.76	12.33	10.93	9.51	8.82	11.11	584.43	585.83	587.25	587.94	585.65	Uranium Plume	Uranium Plume
RMW39	595.93	--	--	9.36	5.26	13.11	--	--	586.57	590.67	582.82	Water level	Uranium Plume

Notes:
 AMSL Above Mean Sea Level
 ft foot (feet)
 -- No Reading Available
 TOC Top of Casing



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Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
*BKG-MW0001										
Total										
May-2011	0.877	1.23	0.22	ND	0.027	1.32	1.295	0.765	0.054	0.476
May-2012	0.38	ND	0.159	ND	ND	1.27	1.338	0.748	ND	0.59
Filtered										
May-2011	0.685	1.58	ND	0.246	ND	1.49	1.054	0.564	0.021	0.469
May-2012	0.288	0.805	ND	ND	ND	1.3	1.318	0.451	0.166	0.701
*BKG-MW0003										
Total										
Aug-2008	0.89	ND	--	ND	ND	5	3.77	2.07	ND	1.7
Aug-2009	ND	2.69	ND	ND	ND	5.17	3.77	2.02	ND	1.75
*BKG-MW0005										
Total										
Jun-2010	0.927	ND	ND	0.45	ND	1.54	1.856	1.01	0.215	0.631
Filtered										
Jun-2010	ND	ND	ND	ND	ND	1.8	0.86	0.436	ND	0.424
BKA48										
Total										
Aug-2008	ND	ND	--	0.389	ND	271	233.82	115	3.82	115
Aug-2009	0.713	ND	ND	0.0533	ND	457	293.1	139	10.1	144
Jun-2010	ND	ND	ND	ND	ND	270	216.22	105	1.22	110
May-2011	ND	2.73	ND	0.113	ND	254	172.68	83.7	4.48	84.5
May-2012	ND	ND	ND	ND	ND	300	178.45	85.5	5.05	87.9
Filtered										
Jun-2010	ND	ND	ND	ND	ND	298	225.7	103	0.7	122
May-2011	0.285	0.58	ND	0.178	ND	253	160.28	79.1	4.48	76.7
May-2012	ND	0.31	0.11	ND	ND	366	225	108	6	111
BKA53										
Total										
Aug-2008	1.15	1.64	--	ND	ND	ND	ND	ND	ND	ND
DM11										
Total										
May-2011	0.855	0.885	ND	0.322	0.062	0.199	0.774	0.348	0.026	0.4
May-2012	0.463	0.898	0.11	ND	ND	0.976	1.228	0.595	0.151	0.482
Filtered										
May-2011	ND	0.806	ND	ND	0.112	ND	ND	ND	ND	ND
May-2012	ND	1.04	0.267	ND	ND	0.754	0.955	0.459	ND	0.496

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
DM14										
Total										
Aug-2009	ND	ND	0.901	0.567	0.421	17.2	15.207	6.94	0.547	7.72
Jun-2010	ND	ND	0.403	0.516	0.325	7.58	7.146	3.81	0.316	3.02
May-2011	0.262	1.55	0.974	ND	0.366	2.08	4.18	2.43	ND	1.75
May-2012	ND	1.37	1.77	ND	ND	7.41	6.9	3.59	ND	3.31
Filtered										
Jun-2010	ND	0.583	0.278	ND	ND	4.99	5.922	2.85	0.502	2.57
May-2011	ND	2.05	ND	ND	0.131	1.27	3.416	1.96	0.276	1.18
May-2012	ND	1.18	2.05	ND	0.336	4.97	2.17	ND	ND	2.17
DM15										
Total										
Aug-2008	1.72	0.987	--	ND	ND	34.6	23.8	12.7	ND	11.1
Aug-2009	ND	ND	ND	ND	ND	28.1	21.407	10.3	0.707	10.4
Jun-2010	0.298	ND	ND	0.77	0.25	49.8	38.983	19.7	0.283	19
May-2011	0.876	1.07	0.334	ND	ND	42.2	32.13	15.1	1.03	16
May-2012	ND	0.789	ND	0.031	ND	29	22.394	11.4	0.794	10.2
Filtered										
Jun-2010	0.281	ND	ND	0.437	0.546	47.8	41.612	20	0.712	20.9
May-2011	ND	ND	ND	ND	ND	41.7	28.386	14.1	0.786	13.5
May-2012	0.89	1.4	ND	ND	ND	25.4	17.752	8.5	0.292	8.96
DM23R										
Total										
Aug-2009	0.774	ND	0.108	ND	ND	2.78	2.44	1.25	ND	1.19
Jun-2010	1.43	ND	0.192	ND	ND	2.53	1.311	0.843	ND	0.468
May-2011	0.789	1.49	ND	ND	ND	1.77	1.253	0.611	0.107	0.535
May-2012	0.384	1.54	0.253	ND	ND	2.39	1.631	0.764	ND	0.867
Filtered										
Jun-2010	0.832	0.84	0.702	0.331	0.798	2.98	1.455	0.629	ND	0.826
May-2011	0.298	1.56	0.26	ND	ND	1.74	0.983	0.478	ND	0.505
May-2012	0.587	0.732	0.133	ND	ND	2.98	2.069	1.15	ND	0.919
DM26										
Total										
May-2011	0.956	1.28	0.076	0.18	-0.005	0.044	0.074	0.05	-0.008	0.032
May-2012	0.92	1.29	0.188	ND	ND	ND	ND	ND	ND	ND
Filtered										
May-2011	0.771	1.85	0.08	0.212	0.015	0.013	0.095	0.03	ND	0.065
May-2012	1.15	0.909	0.114	ND	ND	ND	ND	ND	ND	ND
DM29R										
Total										
Aug-2008	1.01	2.75	--	ND	ND	ND	0.388	0.388	ND	ND

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
DM9										
Total										
May-2011	ND	0.89	ND	0.228	0.087	2.98	2.231	1.33	0.08	0.821
May-2012	0.305	ND	ND	ND	ND	1.96	2.021	1.21	ND	0.811
Filtered										
May-2011	0.47	1.14	ND	ND	0.054	2.92	2.489	1.24	0.139	1.11
May-2012	ND	0.358	0.168	ND	ND	2.32	2.22	1.18	ND	1.04
ERM47										
Total										
Aug-2008	1.25	1.46	0.906	ND	ND	ND	0.127	ND	ND	0.127
IA03-TW0001										
Total										
Aug-2008	ND	0.909	1.03	0.262	0.332	2.53	1.399	0.723	ND	0.676
Aug-2009	ND	2.5	0.391	0.242	0.301	1.93	1.7505	0.868	0.0685	0.814
Jun-2010	ND	ND	ND	ND	ND	1.88	1.88	1.44	ND	0.44
May-2011	ND	1.16	0.365	0.153	0.036	0.758	0.594	0.398	ND	0.196
Filtered										
Jun-2010	ND	ND	0.192	0.619	ND	2.18	2.426	1.32	0.244	0.862
May-2011	ND	0.821	ND	0.113	0.061	0.701	0.439	0.245	ND	0.194
IA03-TW0004										
Total										
Aug-2008	1.05	1.53	--	ND	ND	ND	0.47	0.313	ND	0.157
IA04-TP0001										
Total										
Aug-2008	0.582	1.73	--	ND	ND	7.16	6.713	3.17	0.233	3.31
Aug-2009	ND	ND	ND	0.0304	ND	14.8	6.903	3.53	0.143	3.23
Jun-2010	ND	ND	ND	ND	0.275	5.41	4.576	2.36	0.406	1.81
May-2011	0.382	1.16	1.01	ND	0.459	26	26.342	13.2	0.842	12.3
May-2012	ND	0.399	0.119	ND	ND	7.13	5.441	2.87	0.121	2.45
Filtered										
Jun-2010	ND	ND	0.149	0.656	0.156	5.01	4.09	2.39	ND	1.7
May-2011	ND	1.22	ND	ND	ND	2.9	2.301	1.37	0.029	0.902
May-2012	0.41	ND	0.099	ND	ND	6.27	4.988	2.6	0.148	2.24
IA04-TP0002										
Total										
May-2011	0.311	1.13	ND	ND	ND	0.449	0.832	0.521	0.031	0.28
May-2012	0.451	ND	0.332	ND	ND	ND	0.316	0.178	0.138	ND
Filtered										
May-2011	0.334	1.9	ND	ND	ND	0.361	0.747	0.324	0.031	0.392
May-2012	0.255	1.12	0.113	ND	ND	ND	0.154	0.154	ND	ND

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA04-TP0004										
Total										
Aug-2008	0.615	ND	--	ND	0.0823	ND	0.472	0.297	ND	0.175
Aug-2009	1.2	3.51	1.1	0.522	0.667	14	7.851	4.17	0.171	3.51
Jun-2010	0.24	ND	0.169	ND	--	2.35	2.066	1.34	ND	0.726
Filtered										
Jun-2010	0.429	ND	ND	ND	ND	2.01	2.247	1.52	ND	0.727
IA04-TP0005										
Total										
Aug-2008	0.75	0.875	--	ND	ND	ND	ND	ND	ND	ND
IA04-TW0004										
Total										
Aug-2008	0.671	0.96	--	ND	ND	11.1	7.78	3.26	ND	4.52
May-2011	0.465	1.46	0.324	ND	0.054	4.86	5.337	2.6	0.067	2.67
May-2012	0.255	0.79	0.134	0.237	ND	18.1	16.015	8.13	0.325	7.56
Filtered										
May-2011	0.529	1.38	0.235	ND	ND	3.55	3.69	1.62	ND	2.07
May-2012	ND	1.17	0.127	ND	ND	14.8	12.417	5.67	0.407	6.34
IA10-MW0001										
Total										
Aug-2008	0.751	1.32	--	0.25	ND	21.2	13.58	7.16	0.55	5.87
Aug-2009	0.427	ND	ND	ND	ND	25.4	19.297	9.28	0.497	9.52
Jun-2010	0.358	ND	ND	ND	ND	28.7	23.242	10.9	0.342	12
May-2011	0.352	1.36	0.176	ND	0.028	32.2	22.175	10.9	0.475	10.8
May-2012	0.769	ND	0.103	ND	ND	28.2	18.858	9.45	0.528	8.88
Filtered										
Jun-2010	ND	ND	ND	ND	ND	31.8	21.1	10.9	ND	10.2
May-2011	0.411	0.752	0.194	0.116	0.052	33.9	22.776	11.2	0.576	11
May-2012	1.32	0.387	ND	ND	0.008	30.6	20.066	10	0.636	9.43
IA10-MW0002										
Total										
Aug-2008	1.2	1.21	--	0.0416	ND	ND	ND	ND	ND	ND
Aug-2009	ND	3.9	0.142	0.0342	ND	ND	ND	ND	ND	ND
Jun-2010	2.39	0.439	0.639	1.06	0.35	1.02	1.866	1.41	ND	0.456
Filtered										
Jun-2010	0.343	ND	ND	0.895	0.292	1.31	1.25	1.25	ND	ND

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA10-MW0004										
Total										
Aug-2008	0.908	0.884	--	ND	ND	6.26	5.69	3.58	ND	2.11
Aug-2009	ND	3.05	ND	ND	ND	6.21	4.5724	2.46	0.0624	2.05
Jun-2010	ND	ND	ND	0.425	ND	6.39	6.618	3.56	0.448	2.61
May-2011	0.222	0.495	0.315	ND	ND	6.79	4.431	2.56	0.141	1.73
May-2012	0.521	ND	ND	ND	ND	5.84	5.608	3.25	0.098	2.26
Filtered										
Jun-2010	ND	ND	ND	ND	ND	6.33	5.398	3.15	0.208	2.04
May-2011	ND	0.631	ND	ND	0.033	6.15	4.694	2.75	0.064	1.88
May-2012	ND	0.956	ND	ND	ND	4.7	5.113	2.96	0.163	1.99
IA10-MW0005										
Total										
Aug-2009	0.984	ND	0.205	0.284	0.281	17.3	18.485	9.84	0.505	8.14
Jun-2010	ND	ND	ND	ND	ND	14.8	11.188	6.01	0.178	5
May-2011	ND	1.15	0.256	0.317	0.131	15.3	13.078	7.05	0.458	5.57
May-2012	ND	0.758	0.271	ND	ND	11.6	8.734	4.92	0.154	3.66
Filtered										
Jun-2010	ND	ND	ND	ND	ND	16	10.74	5.87	ND	4.87
May-2011	0.833	0.655	ND	0.091	0.03	17.2	13.925	7.42	0.165	6.34
May-2012	0.296	1.02	ND	0.11	ND	11	7.972	4.12	0.252	3.6
IA10-MW0007										
Total										
Sep-2008	0.486	1.46	ND	ND	ND	--	7.93	7.93	ND	ND
Aug-2009	ND	ND	ND	0.0464	ND	21.3	18.271	9.67	0.511	8.09
Jun-2010	ND	ND	ND	ND	--	20.3	16.134	8.33	0.234	7.57
May-2011	0.224	ND	ND	ND	ND	25.3	19.894	10.7	0.704	8.49
May-2012	0.526	ND	0.691	ND	ND	19.7	15.01	8.13	0.36	6.52
Filtered										
Sep-2008	0.966	0.827	ND	--	ND	--	6.82	6.82	ND	ND
Jun-2010	ND	ND	ND	ND	ND	17.3	13.09	7.32	ND	5.77
May-2011	0.348	1.18	0.282	ND	ND	22.9	20.559	11	0.539	9.02
May-2012	0.25	ND	0.572	ND	ND	15	13.845	8.34	0.495	5.01

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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**Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)**

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA10-MW0008										
Total										
Sep-2008	0.722	ND	ND	ND	ND	--	2.02	2.02	ND	ND
Aug-2009	0.605	ND	ND	0.065	ND	9.53	5.372	2.54	0.192	2.64
Jun-2010	ND	ND	0.312	ND	0.134	21.7	16.283	7.53	0.293	8.46
May-2011	ND	0.519	ND	ND	ND	23.4	22.864	11.6	0.564	10.7
May-2012	ND	1.67	ND	ND	ND	11	12.369	6.29	0.279	5.8
Filtered										
Sep-2008	0.464	--	ND	ND	ND	--	2.04	2.04	ND	ND
Jun-2010	ND	ND	ND	ND	ND	21	17.958	9.39	0.368	8.2
May-2011	ND	1.1	0.272	0.128	ND	21.4	22.455	10.4	0.955	11.1
May-2012	0.343	0.866	ND	ND	ND	13.9	12.411	6.35	0.401	5.66
IA10-MW0009										
Total										
Sep-2008	1.14	2.16	ND	ND	ND	--	ND	ND	ND	ND
Filtered										
Sep-2008	0.685	0.673	ND	ND	ND	--	ND	ND	ND	ND
IA10-MW0010										
Total										
Sep-2008	1.24	2.46	ND	ND	ND	--	ND	ND	ND	ND
Filtered										
Sep-2008	0.818	--	ND	ND	ND	--	ND	ND	ND	ND
IA10-MW0011										
Total										
Sep-2008	--	2.61	ND	ND	ND	--	0.236	0.236	ND	ND
Filtered										
Sep-2008	0.759	3.45	ND	ND	ND	--	ND	ND	ND	ND
IA10-MW0012										
Total										
Sep-2008	--	2.8	--	--	ND	--	ND	ND	ND	ND
Filtered										
Sep-2008	0.926	ND	ND	ND	ND	--	ND	ND	ND	ND
IA10-MW0013										
Total										
Sep-2008	2.25	2.78	ND	ND	ND	--	ND	ND	ND	ND
Filtered										
Sep-2008	2.31	ND	ND	--	ND	--	0.532	0.532	ND	ND

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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**Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)**

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA10-MW0014										
Total										
Sep-2008	ND	1.52	ND	--	ND	--	0.496	0.496	ND	ND
Aug-2009	0.848	3.36	0.101	0.0326	ND	ND	0.299	0.146	ND	0.153
Jun-2010	ND	1	ND	ND	0.366	1.03	0.242	ND	0.242	ND
May-2011	1.35	2.64	ND	ND	ND	0.185	0.114	0.081	0.033	ND
May-2012	0.749	2.8	1.05	ND	ND	ND	0.147	ND	ND	0.147
Filtered										
Sep-2008	1.21	--	ND	--	ND	--	1.64	1.64	ND	ND
Aug-2009	1.14	2.87	ND	0.0401	ND	ND	0.306	0.185	ND	0.121
Jun-2010	0.695	1.43	ND	ND	0.088	1.11	ND	ND	ND	ND
May-2011	0.588	3.63	ND	ND	ND	0.169	0.074	ND	ND	0.074
May-2012	0.923	2.3	0.211	ND	ND	ND	0.169	ND	ND	0.169
IA10-MW0015										
Total										
Sep-2008	1.11	2.5	ND	ND	ND	--	0.889	0.889	ND	ND
Filtered										
Sep-2008	0.996	1.78	ND	ND	ND	--	1.12	1.12	ND	ND
IA10-MW0016										
Total										
Sep-2008	ND	ND	ND	ND	ND	--	ND	ND	ND	ND
Filtered										
Sep-2008	ND	--	--	--	ND	--	ND	ND	ND	ND
IA10-MW0017										
Total										
Sep-2008	--	ND	--	ND	ND	--	6.88	6.88	ND	ND
Aug-2009	0.428	ND	ND	ND	ND	14.7	7.855	4.16	0.215	3.48
Jun-2010	0.376	1.34	ND	ND	ND	2.04	1.808	0.83	ND	0.978
May-2011	0.343	2.06	0.232	ND	ND	0.96	3.009	1.43	0.169	1.41
May-2012	ND	1.54	0.532	ND	ND	7.38	10.82	6.01	ND	4.81
Filtered										
Sep-2008	ND	3.32	ND	ND	ND	--	6.08	6.08	ND	ND
Aug-2009	0.817	3.34	0.0248	ND	ND	13.3	7.13	3.67	0.22	3.24
Jun-2010	0.503	1.36	ND	0.372	ND	1.8	1.875	1.07	ND	0.805
May-2011	ND	2.04	0.235	ND	ND	0.968	2.429	1.32	0.059	1.05
May-2012	ND	1.73	0.294	ND	ND	8.38	10.58	5.64	ND	4.94

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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**Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)**

GROUNDWATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA10-MW0018										
Total										
Sep-2008	--	2.12	ND	ND	ND	--	2.52	2.52	ND	ND
Aug-2009	ND	1.59	ND	ND	ND	5.15	3.95	2.1	ND	1.85
Jun-2010	ND	ND	ND	0.536	ND	7.42	6.121	2.98	0.371	2.77
May-2011	0.23	1.12	ND	ND	0.048	11.2	9.965	5.17	0.185	4.61
May-2012	0.384	ND	0.394	ND	ND	9.45	9.73	5.31	ND	4.42
Filtered										
Sep-2008	ND	4.7	ND	ND	ND	--	2.26	2.26	ND	ND
Aug-2009	ND	3.73	ND	ND	ND	6.49	4.098	2.14	0.118	1.84
Jun-2010	0.365	ND	ND	0.483	0.206	7.59	5.69	3.12	ND	2.57
May-2011	ND	ND	ND	ND	ND	14.6	11.099	5.67	0.369	5.06
May-2012	ND	0.708	0.493	ND	ND	9.51	9.75	5.27	ND	4.48
IA10-MW0019										
Total										
Sep-2008	--	1.42	4.45	--	ND	--	2.6	2.6	ND	ND
Filtered										
Sep-2008	ND	--	ND	ND	ND	--	2.15	2.15	ND	ND
RMW38										
Total										
Aug-2008	ND	0.915	ND	ND	ND	4.39	3.14	1.79	ND	1.35
Aug-2009	0.573	ND	ND	ND	ND	2.66	2.1938	1.13	0.0438	1.02
Jun-2010	ND	ND	0.3	ND	0.211	3.71	3.34	1.68	0.39	1.27
May-2011	ND	0.517	0.193	0.087	ND	11.5	8.405	3.95	0.205	4.25
May-2012	0.348	ND	ND	ND	ND	8.47	6.709	3.42	0.189	3.1
Filtered										
Jun-2010	ND	ND	0.189	ND	0.325	3.58	3.3	1.87	ND	1.43
May-2011	0.372	1.03	ND	0.088	ND	8.92	6.442	3.23	0.152	3.06
May-2012	ND	4.52	ND	0.081	ND	8.35	5.653	2.97	0.083	2.6
RMW39										
Total										
May-2012	0.448	0.223	ND	ND	0.023	10.1	7.369	3.75	0.279	3.34
Filtered										
May-2012	0.176	0.245	ND	ND	ND	9.93	6.263	2.73	0.133	3.4

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)



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**Table 2
Harshaw FUSRAP Site
Monitoring Program Analytical Results (2008-2012)**

SURFACE WATER										
Parameter	Ra-226	Ra-228	Th-228	Th-230	Th-232	Total Uranium (KPA)	Total Uranium (Alpha)	U-234	U-235	U-238
Units	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(ug/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
US EPA MCLs	5	5	15	15	15	30	27	-	-	-
Location/Date										
IA09-SW0008										
Total										
Aug-2008	ND	ND	--	ND	ND	21.3	14.465	6.87	0.685	6.91
Aug-2009	ND	ND	ND	0.054	ND	178	128.5	62	3.5	63
Jun-2010	ND	ND	0.385	0.461	0.348	18.9	13.55	7.2	ND	6.35
May-2011	ND	0.72	ND	0.126	0.027	206	141.65	68.4	3.75	69.5
Apr-2012	--	--	--	--	--	73.9	--	--	--	--
May-2012	ND	0.984	ND	ND	ND	63.3	43.18	21.3	1.38	20.5
Filtered										
May-2011	ND	0.644	ND	0.086	0.038	215	148.73	73.1	4.23	71.4
Apr-2012	--	--	--	--	--	75.3	--	--	--	--
IA09-SW0008-CR										
Total										
Apr-2012	--	--	--	--	--	41	--	--	--	--
May-2012	0.316	1.09	0.089	ND	0.065	3.62	2.28	1.04	ND	1.24
Filtered										
Apr-2012	--	--	--	--	--	18	--	--	--	--

Notes:

-- Not Analyzed or Rejected, pCi/L = picocuries per liter, ug/L = micrograms per liter. ND = Not Detected

* - Background Well

(1) MCL Refers to the sum of Ra-226 and Ra-228 (MCL = 5 pCi/L)

(2) Gross alpha MCL includes thorium isotopes, and excludes radon and uranium. Th-230 refers specifically to alpha radiation.

(3) MCL refers to the sum of uranium isotopes (MCL = 27 pCi/L or 30 ug/L)