Report on 2019 Water Quality Monitoring

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Executive Summary

Although Governor Evers declared 2019 as the Year of Clean Drinking Water, Madison Water Utility focuses on the delivery of clean, safe drinking water every day. However, that declaration combined with the detection of unregulated PFAS chemicals in multiple Madison wells led to heightened attention on the local drinking water supply. Nevertheless, 2019 marked another year of full compliance with all federal and state health-based drinking water standards.

To ensure drinking water safety, the utility collected nearly four thousand routine water samples; each was tested for coliform bacteria, which was not found in any sample. In addition, each well was tested at least once for a broad suite of both naturally occurring and man-made chemicals. Chloride, nitrate, sodium, and tetrachloroethylene results indicate human influence on ground and drinking water quality.

Despite the absence of regulatory standards, the utility tested each well for PFAS and strontium, and repeated tests for 1,4-dioxane and hexavalent chromium where these unregulated chemicals previously tested above a threshold level. Revised Water Quality Monitoring and Treatment Policies, adopted by the Water Utility Board in early 2019, provide guidance for this extra testing.

Elevated levels of chloride, iron and manganese can affect the taste or appearance of tap water. The utility's long-range Capital Improvement Plan includes treatment at some wells to reduce the level of these nuisance contaminants. Board-approved treatment policies and the Water Quality Watch List serve as important planning tools for Madison Water Utility as it evaluates long-term infrastructure and water treatment needs.

Introduction

The City of Madison drinking water system consists of 23 wells, 33 water storage tanks, and 900 miles of interconnected water distribution pipes. The water utility pumps groundwater out of a deep sandstone aquifer. Wells are 500-1200 feet deep and deliver water to localized regions of the city. The water distribution system is subdivided into ten pressure districts, based primarily on topography. The largest zone is split in two at the Yahara River, with zones 6E and 6W having seven and eight wells, respectively. Some zones do not contain any wells and are supplied water via a pump station.

The groundwater source of Madison's drinking water contributes to its quality. Soil filters out organic matter, particulates, and microbes such as bacteria, algae and protozoa as the water from rainfall, snowmelt, and runoff infiltrate soil to replenish the aquifer. However, the physical and chemical properties of water allow it to dissolve minerals from the underlying rock or to pick up man-made contaminants left behind from normal use, spills, or improper disposal as water moves from the surface down to the saturated zone. The application of agricultural chemicals, including nitrate and pesticides, and road salt can negatively affect groundwater and drinking water quality.

Other threats to groundwater include active or closed landfills, leaky storage tanks, and the use of PFAS-containing firefighting foam.

Madison drinking water contains significant amounts of hardness minerals and other dissolved solids. Consequently, area businesses and homeowners generally depend on water softening to prevent scale buildup on pipes and to promote longer life for water-using appliances. Naturally occurring trace metals are also present, to varying degrees, in Madison's water supply.

Madison Water Utility routinely collects and tests water samples for bacteria and chemicals that reasonably may be expected to be present in drinking water. Samples are taken at Water Utility facilities – wells, storage tanks, and pump stations – and locations within the distribution system (see Table 1 & Figure A-1). The frequency of monitoring varies by contaminant (see Table 2). Monitoring complies with the federal Safe Drinking Water Act, as enforced by the Department of Natural Resources (DNR). Additional testing follows the Water Utility Board-approved monitoring policies and enables staff to track trends to understand changes in distribution system and source water quality.

Table 1. Distribution sample locations tested twice weekly for coliform bacteria.

WEST SIDE SAMPLE LOCATIONS **Sampled Monday & Wednesday**	**EAST SIDE SAMPLE LOCATIONS** **Sampled Tuesday & Thursday**
Booster Station 128 (128)	Booster Station 213 (213)
Hawks Landing Golf Course (HLG)[1]	Dane County Airport (TRUAX)
High Service Reservoir (HSR)	East High School (EAST)
Hill Farms Steam Plant (HF)	East Madison Community Center (EMCC)
Jefferson Middle School (JMS)	Fire Station 5 (FS5)
Leopold School (LS)	Glendale School (GS)
Lincoln School (LN)	Isthmus Engineering (IEM)*
Midvale School (MS)	Lindbergh School (LBS)
Orchard Ridge School (ORS)	Maple Bluff Village Hall (MB)
Shorewood Hills Fire Dept (SH)	Mendota School (MDS)
Thoreau School (THS)	Reservoir 229 (229)*
Tower 120 (120)	Schenk School (SS)
Tower 126 (126)	Streets Department – East (ESD)
Tower 228 (228)	Tower 225 (225)
West High School (WEST)	Tower 315 (315)

[1] Tested seasonally (April through October) when course is actively maintained

* Tested quarterly for disinfection by-products (DBP) – trihalomethanes and haloacetic acids

Table 2. Frequency and locations of routine water quality monitoring.

Test Frequency	Contaminants Tested	Test Location
Daily	Chlorine, Fluoride	Wells
Twice Weekly	Coliform Bacteria, Chlorine	Distribution Sites
Monthly	Iron, Manganese	Some Wells
Quarterly	Coliform Bacteria (Raw Water) Iron, Manganese Volatile Organic Compounds	Wells Distribution Sites Some Wells
Annually	Inorganic Compounds, Nitrate Volatile Organic Compounds	Wells Wells
Less Than Annually	Radionuclides Synthetic Organic Compounds Unregulated Contaminants	Wells Wells Wells & Distribution Sites

Microbiological Testing – Coliform Bacteria

Coliform bacteria are an indicator of water safety; tests showing presence of the bacteria indicate that water may not be safe for human consumption. Most coliforms are harmless soil organisms that do not make people sick. However, some types of fecal coliforms, including *E. coli*, grow in the guts of animals and can cause nausea, diarrhea, or intestinal cramps. Coliform bacteria may also indicate the presence of other harmful bacteria or viruses that are not as easily detected. Samples are collected twice weekly from distribution locations (see Table 1) that represent each pressure zone and are tested for coliform bacteria. The absence of coliform bacteria indicates that the water is safe for consumptive use including for cooking and drinking.

Based on the population it serves, Madison Water Utility is required to collect a minimum of 150 distribution system water samples each month and have them tested for coliform bacteria. In a typical month, the utility collects over 250 water samples for bacteriological analysis, of which over 200 samples are from the distribution system (see Table 3). In addition, on a quarterly basis (once per three month period), the water utility must collect an untreated, non-chlorinated raw water sample from each operating well immediately after water is pumped from the ground, and test these source water samples for coliform bacteria.

Of 2,909 routine distribution samples collected in 2019, none tested positive for coliform bacteria. Maintaining an appropriate chlorine level keeps the distribution system free of coliforms and helps to ensure the safety of Madison drinking water.

Table 3. Monthly number of total coliform samples collected in 2019.

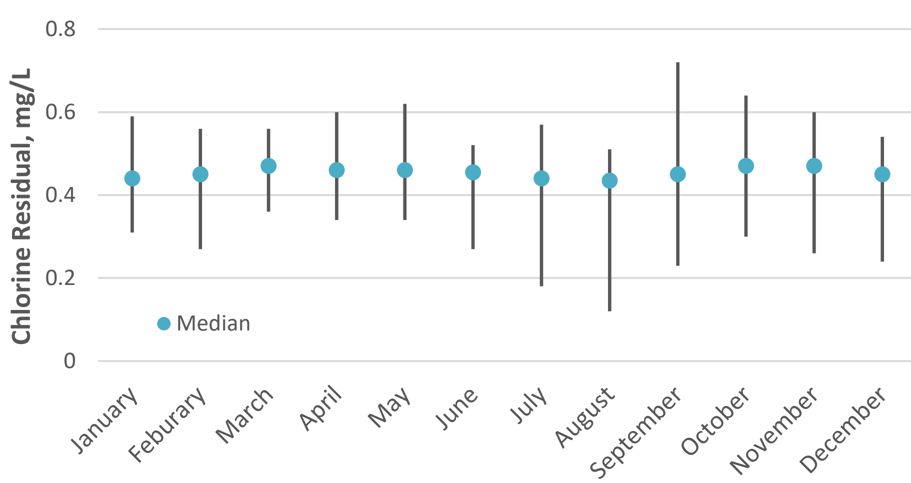
Month	Distribution	Wells	Raw Water	Total	Year to Date
January	231	73	19	323	323
February	236	63	0	299	622
March	222	58	0	280	902
April	250	65	19	334	1236
May	249	67	0	316	1552
June	231	56	1	288	1840
July	278	79	21	378	2218
August	245	58	0	303	2521
September	249	73	1	323	2844
October	262	73	20	355	3199
November	220	61	0	281	3480
December	236	42	0	278	3758

Chemical Treatment – Chlorine

Madison tap water comes from a high-quality aquifer that requires minimal treatment; however, chlorine is added to further reduce the risk from microbial contamination both at the source and in the distribution system. To achieve a minimum chlorine residual of 0.1 mg/L everywhere in the distribution system, the water utility must maintain a minimum chlorine level of 0.3 mg/L as the water leaves the pump house. Automated on-line chlorine analyzers continuously measure and report the chlorine level from each well and pump station and relay that information to the 24-hour pump operator. Water supply staff also perform daily chlorine checks to confirm the accuracy of the chlorine readings and to ensure the equipment is operating properly.

Figure 1 shows the range of chlorine results at the entry point to the distribution system for water tested at the time of coliform bacteria sampling. Each month the median value fell within the standard operating range of 0.20 to 0.55 mg/L free chlorine.

Figure 1. Monthly Range of Chlorine Samples at Entry Points.



A chlorine measurement is taken every time a coliform bacteria sample is collected. Nearly 3000 chlorine readings were made at routine distribution locations. Table 4 shows summary statistics of the test results at each of these 30 sampling locations. Typical values fall within the range of 0.2 to 0.4 mg/L of chlorine. The actual reading depends on the source water quality, proximity to the source well, water age, water temperature, service line size and length, and the water use at the specific location. For example, low chlorine residuals at Thoreau School (THS) and East Madison Community Center (EMCC) occur during school breaks when occupancy by students and staff is limited. Low residuals at Tower 315 reflect older water and the greater distance from the typical source, particularly during warm summer months, now that Well 15 is off-line due to PFAS. Few test results fell below the target level of 0.1 mg/L chlorine in the distribution system.

Table 4. Summary statistics for 2019 chlorine measurements, measured in mg/L, at routine distribution sample locations.

Location	Samples	# <0.1	Minimum	Mean	Maximum
West	102	1	< 0.1	0.36	0.48
HSR	103	0	0.23	0.35	0.47
SH	103	0	0.17	0.42	0.61
HF	103	2	< 0.1	0.38	0.65
JMS	102	0	0.18	0.35	0.46
128	102	1	< 0.1	0.36	0.49
228	35	0	0.25	0.30	0.35
HLG	46	3	< 0.1	0.21	0.41
126	101	0	0.28	0.43	0.56
120	102	0	0.40	0.47	0.54
ORS	104	0	0.31	0.43	0.52
MS	102	0	0.14	0.37	0.46
THS	102	8	< 0.1	0.27	0.42
LS	101	0	0.16	0.37	0.48
LN	102	0	0.12	0.39	0.59
East	101	0	0.15	0.33	0.47
MB	102	2	< 0.1	0.22	0.40
213	102	0	0.15	0.29	0.44
MDS	102	0	0.20	0.38	0.58
LBS	100	0	0.19	0.40	0.50
Truax	102	0	0.19	0.35	0.44
EMCC	96	13	< 0.1	0.20	0.46
ESD	100	0	0.29	0.41	0.56
315	100	11	< 0.1	0.21	0.34
229	102	0	0.20	0.29	0.37
225	99	0	0.25	0.34	0.44
SS	102	0	0.27	0.41	0.52
FS5	102	0	0.18	0.34	0.44
GS	102	0	0.19	0.36	0.50
IEM	102	0	0.13	0.37	0.51

Chemical Treatment – Fluoride

Fluoride is added to Madison tap water to improve dental health and reduce tooth decay. Water is tested daily at each well to achieve the target level of 0.7 mg/L fluoride. In 2019, the system-wide average concentration of 6,752 samples was 0.71 mg/L. Table 5 shows the number of tests and the typical range of fluoride for all Madison wells.

Table 5. Summary of 2019 fluoride results, measured in mg/L, at each Madison well.

Well	Number of Samples	5th Percentile	50th Percentile	95th Percentile
6	291	0.58	0.69	0.79
7	347	0.53	0.66	0.81
8	174	0.67	0.77	0.84
9	365	0.59	0.80	0.90
11	358	0.52	0.71	0.80
12	340	0.61	0.78	0.89
13	336	0.67	0.77	0.86
14	356	0.54	0.65	0.76
15	56	0.61	0.75	0.86
16	361	0.59	0.69	0.79
17	156	0.57	0.67	0.77
18	358	0.61	0.72	0.83
19	289	0.60	0.72	0.83
20	361	0.58	0.67	0.79
24	332	0.63	0.75	0.87
25	364	0.57	0.69	0.78
26	364	0.52	0.67	0.77
27	145	0.64	0.75	0.84
28	348	0.57	0.71	0.80
29	327	0.56	0.70	0.80
30	364	0.60	0.71	0.82
31	360	0.57	0.70	0.79
Total	6752	0.57	0.70	0.84

Note: the 5th percentile corresponds to the level at which 5% of the samples collected were below this value and 95% were above it; the 50th percentile equals the median or middle value

Chemical Testing

Inorganics – Inorganic compounds are rather simple chemicals. They can be described as mineral in nature and usually exist as ions – substances with a positive or negative charge – when dissolved in water. Familiar examples include calcium, chloride, sodium, iron, magnesium, manganese, nitrate, sulfate, and zinc. Many inorganics are naturally occurring minerals that are dissolved from the rock

Table 6. Summary of 2019 annual inorganic test results after any chemical treatment.

PARAMETER	UNITS	MCL	MINIMUM	MEDIAN	MAXIMUM
Alkalinity, $CaCO_3$	mg/l	--	273	315	365
Aluminum	µg/l	SMCL: 50	< 1.6	< 1.6	3.6
Antimony	µg/l	6	< 0.5	< 0.5	< 0.5
Arsenic	µg/l	10	< 0.5	< 0.5	0.6
Barium	µg/l	2000	7.3	19	61
Beryllium	µg/l	4	< 0.1	< 0.1	< 0.1
Cadmium	µg/l	5	< 0.5	< 0.5	< 0.5
Calcium	mg/l	--	53	65	100
Chloride	mg/l	SMCL: 250	< 2.0	21	170
Chromium, Total	µg/l	100	< 0.9	< 0.9	2.1 Should be 8.9
Conductivity	umhos / cm	--	467	655	1200
Copper	µg/l	1300	0.6	3.3	20
Fluoride	mg/l	4	0.6	0.7	0.8
Hardness, $CaCO_3$	mg/l	--	259	319	454
Iron	mg/l	SMCL: 0.3	< 0.01	0.02	0.54
Lead	µg/l	15	< 0.1	0.1	1.0
Magnesium	mg/l	--	31	39	50
Manganese	µg/l	SMCL: 50	< 1.1	2.8	49
Mercury	µg/l	2	< 0.03	< 0.03	< 0.03
Nickel	µg/l	100	1.0	3.6	5.3
Nitrogen - Nitrate	mg/l	10	< 0.1	0.8	3.8
Nitrogen - Nitrite	mg/l	1	< 0.01	< 0.01	< 0.02
pH (Lab)	standard unit	--	7.3	7.6	8.1
Selenium	µg/l	50	< 1.5	< 1.5	3.1
Silver	µg/l	SMCL: 100	< 0.1	< 0.1	< 0.1
Sodium	mg/l	--	2.1	7.3	52
Strontium	µg/l	--	48	77	100
Sulfate	mg/l	SMCL: 250	5.7	21	43
Thallium	µg/l	2	< 0.1	< 0.1	0.3
Total Solids	mg/l		122	328	684
Zinc	µg/l	SMCL: 5000	1.1	4.7	21

Shaded boxes correspond to regulated contaminants
MCL – Maximum Contaminant Level (health-based)
SMCL – Secondary Maximum Contaminant Level
< Means contaminant was not detected at this level

1 mg/l = 1 part per million (ppm)
1 µg/L = 1 part per billion (ppb)
1 mg/l = 1000 µg/L

which makes up the aquifer. However, some of these substances may be introduced to surface and ground water by human activities; nitrate (a component of fertilizer) and sodium chloride (road salt) are two examples. The utility annually tests all of the wells for thirty different inorganic substances including those previously named as well as arsenic, barium, cadmium, chromium, lead, mercury, selenium, and thallium.

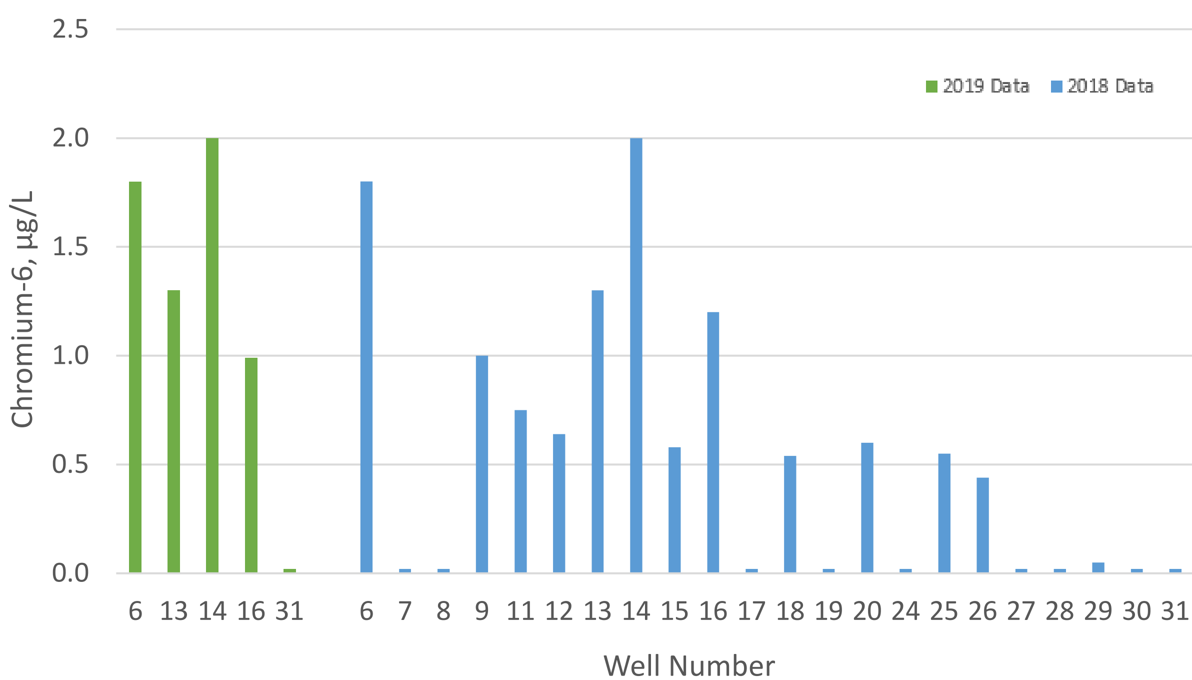
Table 6 summarizes the annual inorganic test results for well samples collected in 2019. With few exceptions, notably nitrate, the regulated inorganic contaminants (shaded in Table 6) that were detected are found at levels near the detection limit, generally < 1 µg/L [or part per billion], and well below the maximum contaminant level (MCL). The ranges of results are similar to those observed in previous years. Complete test results for all wells can be found in the appendix.

Chromium – Chromium is a metallic element naturally found in rocks, soil, plants, and animals including humans. It is used in many products and processes including stainless steel, textile dyes, wood preservation, leather tanning, and anti-corrosion coatings.

Hexavalent chromium, also called chromium (VI) or chrome-6, is the more harmful form of chromium. It can occur naturally but may also enter drinking water supplies from historic spills or industrial emissions. The current understanding about hexavalent chromium is that it commonly occurs in the upper bedrock aquifer – Tunnel City and Wonewoc formations. Water chemistry in the lower bedrock (Mt. Simon) aquifer appears not to favor chromium release into groundwater.

Figure 2 shows the 2018 and 2019 hexavalent chromium results for all Madison wells. All wells were tested in 2018 and any well with hexavalent chromium above 1 µg/L was retested in 2019, in accordance with the Water Quality Monitoring Policies. The highest levels of chrome-6 are found at Wells 6, 13, 14, and 16 where chrome-6 levels range between 1 and 2 µg/L. Wells that draw water only from the Mt Simon formation (Wells 7, 8, 19, 24, 27, 28,
And 31 29, and 30) do not have significant amounts (<0.1 µg/L) of hexavalent chromium.

Figure 2. Chromium-6 levels at Madison wells – 2018 & 2019 data.



Iron and Manganese – Accumulation and later re-suspension of iron and manganese sediment in water mains is the primary cause of discolored water at the consumer tap. Iron release from corroding cast iron pipes can also contribute to red, orange or brown colored water. Periodic flushing of hydrants helps to remove the accumulated sediment; however, the groundwater source of Madison drinking water continually introduces new iron and manganese into the distribution system. Revisions to the Water Quality Monitoring and Treatment Policies establish lower thresholds for implementation of wellhead treatment to reduce iron and manganese levels.

US EPA established secondary standards for iron and manganese as guidelines to protect against discolored water. These standards are 0.3 mg/L for iron and 50 µg/L for manganese although iron or manganese levels above 0.1 mg/L and 20 µg/L, respectively, also can contribute to customer complaints about colored water. Madison collects monthly samples at wells with iron or manganese levels consistently above these lower threshold limits. Six wells produce water with iron ranging from 0.10 to 0.25 mg/L; one – Well 8 – exceeds the secondary standard, see Table 7. Six wells have manganese levels above 20 µg/L; Well 8 and Well 19 occasionally exceed the secondary standard. Aesthetic concerns including the staining of laundry and plumbing fixtures or unpleasant tastes can occur if the secondary standard is exceeded. Complete iron and manganese test results are in the appendix.

Table 7. Summary statistics for wells with higher levels of iron and manganese.

Well	Number of Samples	Manganese (µg/L)		Iron (mg/L)	
		Average	Maximum	Average	Maximum
8*	6	48	49	0.54	0.58
17*	5	30	33	0.11	0.12
19	12	44	54	0.20	0.23
24	12	27	32	0.19	0.21
27*	6	32	34	0.12	0.16
28	12	22	23	0.17	0.19
30	12	14	14	0.20	0.22

* Seasonal well that typically operates during a period between April and September

Iron and manganese filtration was added to Wells 7, 29, and 31 to remove these nuisance contaminants and reduce incidences of colored water at customer taps. Table 8 compares the treated and untreated water quality at these three wells. Removal efficiencies above 80% are routine with iron and manganese frequently reduced to below the detection limit.

Table 8. Summary of treated and untreated water quality at wells with filters.

Well	Untreated Water		Filtered Water	
	Iron, mg/L	Manganese, µg/L	Iron, mg/L	Manganese, µg/L
7	0.6	29	0.06	2.9
29	0.3	58	0.05*	1.5
31	0.3	10	0.05*	0.7*

*Measured below the detection limit

In 2019, the Water Utility Board approved revisions to the Water Quality Monitoring and

Treatment Policies. One revision was to establish a uniform performance standard for the acceptable level of iron and manganese – 0.1 mg/L and 0.02 µg/L, respectively – delivered by each well. The policy language identified Well 8 and Well 19 as high priority wells and set a goal for the utility to install treatment at these wells by 2030. The policy established 2045 as a target date for implementation of treatment at the five other wells that currently exceed the performance standard, see Table 7.

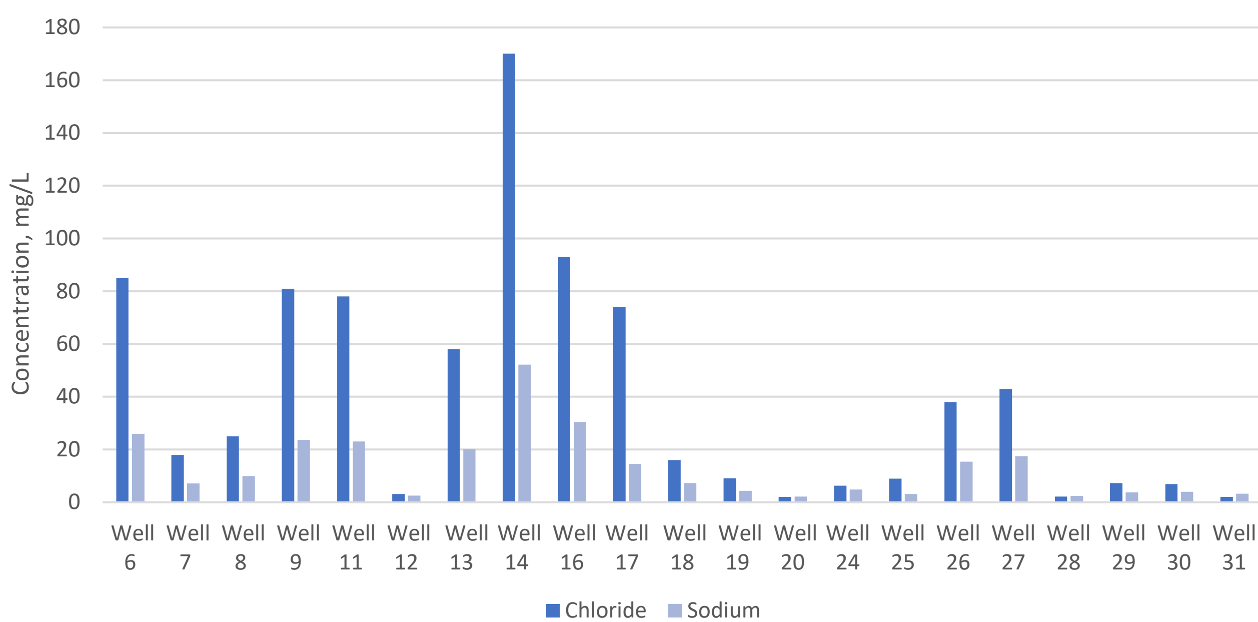
In addition to monitoring iron and manganese levels at the wells, the water utility collects quarterly samples at routine distribution sites (see Table 1). These locations correspond to the coliform bacteria sample locations and include at least one sample site in each pressure zone. Of the 118 samples collected in 2019, none exceeded the secondary standard for either iron or manganese. The average and 95th percentile levels were 0.03 and 0.13 mg/L for iron and 2.5 and 14 µg/L for manganese. Complete results are in the appendix.

Nitrate **–** Nitrate is an essential plant nutrient. Fertilizer application, barnyard runoff, and septic systems can increase the amount of nitrate in soil and groundwater. Shallow wells located adjacent to or downhill from farmland or septic fields may be more vulnerable to nitrate contamination. Municipal wells with short casing lengths can also be susceptible to contamination at the land surface.

Nitrate ranged from below detection (<0.1 mg/L) to 3.8 mg/L (see Table 6). Seven wells tested above 2 mg/L with the highest level found at Well 14. Madison's older wells with casings that do not extend through the Eau Claire shale have higher nitrate compared to more recently constructed wells. Most Madison wells constructed after 1968 have nitrate below 1 mg/L.

Sodium and Chloride **–** An elevated level of sodium and chloride in groundwater is often the result of salt use for winter deicing. Public Health Madison & Dane County has been documenting the increasing trends for these substances in Madison lakes and some wells for many years. Figure 3 shows the current sodium and chloride levels at Madison wells. Well 14, with 170 mg/L chloride and 52 mg/L sodium, has the highest levels. Six other wells have chloride over 50 mg/L and five of those wells have sodium above 20 mg/L.

Figure 3. Sodium and chloride measured at Madison municipal wells in 2019.



Two factors that influence the sodium and chloride levels at a well are length of the steel casing (well construction) and proximity to major roadways (salt routes). A well with a short casing draws proportionally more water from the upper aquifer where water quality is more impacted by surface activities including winter salt application.

There are no regulatory standards for either chemical. US EPA does recommend keeping chloride below 250 mg/L to avoid taste complaints. Sodium levels above 20 mg/L can be concerning for individuals on severe sodium-restricted diets. Health officials recommend these individuals account for sodium in drinking water when calculating their daily sodium intake.

Radionuclides – Radionuclides are unstable forms of an atom that give off radiation when they decay into more stable atoms. They may come from natural or man-made sources. Radium 226 and 228 form when uranium and thorium decay in the environment. Radium occurs naturally at low levels in almost all rock, soil, water, and plants. If higher levels of thorium or uranium are present in native rock or soil, then radium will also be present at higher levels.

Radionuclide testing in 2019 was limited to eight wells. Seven previously tested above a threshold that requires quarterly or annual testing; the eighth was a newly commissioned well with initial requirements for quarterly monitoring. Tests include combined radium (226 + 228) and other gross measures of radioactivity (alpha and beta decay). Radium is highest at Well 19 and Well 27 where combined radium at each well occasionally tests above 5 pCi/L. Compliance with the drinking water standard, however, requires that the running annual average (RAA) of quarterly samples for radium stays below 5 pCi/L. Table 9 summarizes the radionuclide results; complete test results are found in the appendix.

Table 9. Summary of 2019 radionuclide test results, measured in pCi/L.

Well	Samples	Gross Alpha	Gross Beta	Combined Radium, 226 + 228	Maximum RAA
7	1	5.3	6.1	3.3	n/a
8	2*	2.8 – 5.2	6.8 – 8.6	2.9 – 3.9	n/a
19	5*	< 2.0 – 10.1	2.6 – 7.2	4.1 – 5.9	4.8
24	1	8.8	8.0	2.1	n/a
27	5*	4.4 – 6.1	3.1 – 9.9	3.9 – 4.8	4.5
28	1	5.4	2.3	4.6	n/a
30	1	4.9	8.6	3.2	n/a
31	4*	2.2 – 8.1	3.0 – 7.9	0.9 – 1.9	1.7

*Includes duplicates RAA – Running Annual Average of Quarterly Samples

Volatile Organic Compounds – Volatile organic compounds (VOC) include chemical solvents, degreasers, dry cleaning chemicals, and petroleum-based products or their derivatives. They are man-made contaminants that arise from industrial processes. They can leach into groundwater from improper storage, chemical spills, or wastewater discharge from industrial plants. Others are found in landfill leachate. At high levels, some of these substances are known or suspected carcinogens. The utility annually tests all the wells for over 50 different VOCs including carbon tetrachloride, tetrachloroethylene (PCE), trichloroethylene (TCE), and a gasoline additive, methyl t-butyl ether (MTBE). Additional monitoring is triggered when the level of any VOC exceeds a threshold, typically one tenth of the maximum contaminant level (MCL).

The most frequently encountered VOC in Madison water is PCE. In 2019, PCE was found at seven wells, see Table 10. The amount found at most wells is around 1 µg/L or lower; the average at Well 9 was 1.9 µg/L while at Well 18 it ranged from 1.5 – 3.4 µg/L. These levels compare to an MCL of 5 µg/L.

A limited number of other VOCs are found in some Madison wells. These contaminants usually are detected in only one or two wells, and are found at very low levels. Table 10 identifies the VOC, the maximum amount detected, and the well in which each was found. Complete test results are found in the appendix.

Table 10. Summary of 2019 VOC detections, measured in µg/L, at Madison wells

Volatile Organic Compound	Well(s) Present	Maximum Level Found	MCL[1]	MCLG[2]
Chloromethane	18	0.72	--	--
1,2-Dichloroethylene (cis)	11	0.39	70	70
Ethylbenzene	9	0.54	700	700
Tetrachloroethylene (PCE)	6, 7, 9, 11, 14, 18, 27	3.4	5	zero
Trichloroethylene (TCE)	18	0.42	5	zero
Trichlorofluoromethane	11	0.64	---	---
Xylene, Total	9	3.0	10000	10000

[1] Maximum Contaminant Level (MCL) – maximum amount allowed in drinking water

[2] Maximum Contaminant Level Goal (MCLG) – level below which there is no known or expected risk to human health

Disinfection By-Products – These chemical by-products form when chlorine combines with impurities in groundwater. If organic matter is present, chlorine may react with it to form a variety of trihalomethanes or haloacetic acids. Because little organic matter is present in groundwater, the level of DBPs in Madison drinking water is low. Quarterly samples are collected at Reservoir #229 and a manufacturing plant located at the end of our distribution system. Previous testing found these locations to have the highest levels of disinfection by-products. Total trihalomethane levels ranged from 2 – 13 µg/L compared to the combined MCL of 80 µg/L. Similarly, total haloacetic acid levels ranged from 0.2 – 2.6 µg/L compared to a combined MCL of 60 µg/L. Higher levels are often observed at locations with higher water age including some towers and large reservoirs and at the farthest reaches of a distribution system. Complete results are in the appendix.

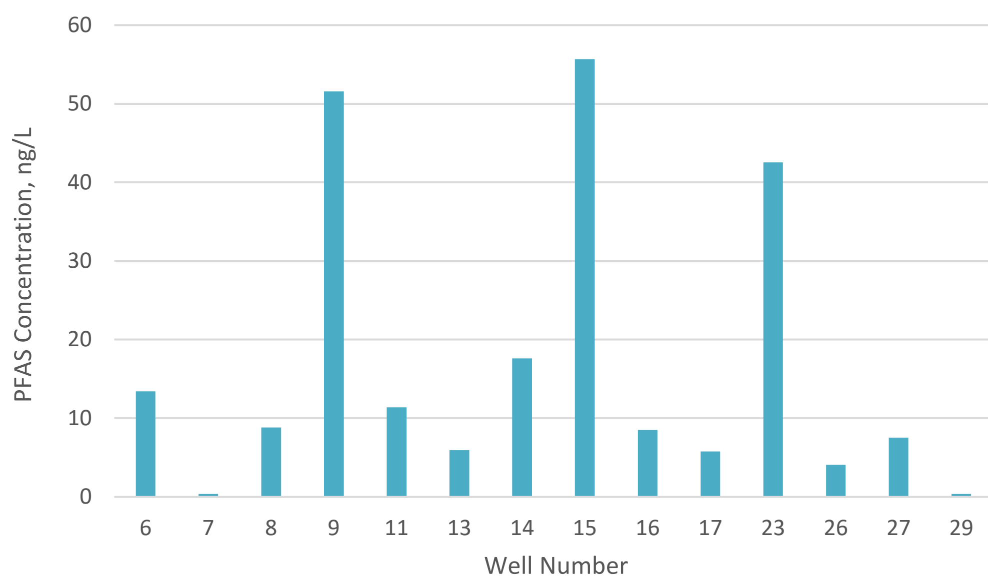
Unregulated Contaminants – Every five years the EPA identifies substances that may be present in drinking water but do not have health-based water quality standards set under the Safe Drinking Water Act. The EPA requires testing at the nation's largest water suppliers, including Madison, and at some smaller utilities. US EPA identified thirty contaminants for testing under the fourth Unregulated Contaminant Monitoring Rule (UCMR4). Madison tested for twenty of these potential chemical contaminants in 2018 and 2019. Ten cyanotoxins were included in the rule;

however, the monitoring requirement only applied to surface water systems.

UCMR4 **–** Two alcohols (1-butanol and 2-methoxyethanol) were each detected at one well during the initial round of testing. The second round of testing did not show the presence of either chemical at any well. Except for manganese, bromide, and unregulated disinfection by-products in the haloacetic acid class, none of the other contaminants was found. Manganese ranged from below detection to 50 µg/L, consistent with results previously found at Madison wells. Bromide, a precursor of some haloacetic acids, was detected at six of seven wells tested. The haloacetic acids measured in the low single-digit microgram per liter (µg/L) range. Full 2018 & 2019 test results are found in the appendix.

Per and Polyfluoroalkyl Substances (PFAS) **–** The shutdown of Well 15 over elevated levels of a wide range of PFAS raised concern about the potential presence of PFAS in other City wells and prompted additional testing. Comprehensive results have been reported elsewhere and are summarized in Figure 4. Fourteen of twenty-three wells showed the presence of at least one PFAS; nine wells were free of all PFAS tested. The highest combined PFAS levels were observed at Wells 9, 15, and 23 where total PFAS ranged from 43 to 56 ng/L. Combined PFOA + PFOS at these three wells ranged from 5 to 12 ng/L compared to the US EPA health advisory level of 70 ng/L and the proposed Wisconsin groundwater standard of 20 ng/L. The remaining wells with measurable PFAS had between <1 to 18 ng/L of total PFAS. The most commonly found PFAS include PFBA, PFHxS, PFOA, and PFOS. Eleven different PFAS have been confirmed to be present with two additional PFAS potentially present. Finally, individual PFAS rarely occur in isolation; a mixture of six or more PFAS often were found in Madison wells.

Figure 4. Combined PFAS levels in Madison wells.



1,4-Dioxane **–** This unregulated contaminant was monitored at all Madison wells in 2015 under UCMR3. Dioxane was found at six wells at levels ranging from 0.10 to 0.43 µg/L. These six wells were retested in 2018 when five tested between <0.07 and 0.13 µg/L; the sixth well (Well 11) tested at 0.31 µg/L. Well 11 was retested in 2019 and dioxane measured 0.4 µg/L. The one-in-a-million cancer risk level for dioxane in drinking water is estimated at 0.35 µg/L.

Water Quality Monitoring and Treatment Policies

In 2019, the Water Utility Board revised the Water Quality Monitoring and Treatment Policies. The changes update the testing requirements for radium, dioxane, PFAS, and any other emerging or unregulated contaminant; establish a uniform performance standard for iron and manganese; and establish water quality treatment targets when wellhead treatment is implemented. Details about the revised policy can be found in the Water Utility Board Policy Book, which is available on our website at www.madisonwater.org. These policies guide and inform decision-making about capital improvement investments, supply utilization, and monitoring plans for the utility.

Water Quality Watch List

Water utility staff maintain a Water Quality Watch List to identify contaminants that exceed some threshold, typically the Preventative Action Limit specified in NR 140 (which is a fraction of the Maximum Contaminant Level), or show a history of increasing concentrations over time. The actions identified on the watch list include increased monitoring, a groundwater investigation, an analysis into potential treatment option alternatives, or implementation of the preferred treatment alternative. For example, the action plan calls for the installation of iron and manganese filtration at several wells and increased monitoring for chloride, dioxane, radium, sodium, and VOC at other wells. The complete watch list and accompanying action plan can be found in the appendix.

Conclusions

Madison drinking water meets all federal and state health-based drinking water standards.

Madison Water Utility collects many more bacteriological samples than are required each month for regulatory compliance. These tests rarely show the presence of coliform bacteria, reflecting the high-quality water source and effective disinfection practices.

Daily testing of treatment chemicals – chlorine and fluoride – confirms that levels are within the standard operating range. Otherwise, the chemical feed equipment is adjusted to restore levels to the normal range.

Similar to other metallic ions, chromium in groundwater is influenced by aquifer water chemistry. Naturally occurring hex chrome is the predominant form of chromium in Madison drinking water. Madison continues to annually test for chromium-6 at wells where it exceeds 1 µg/L. A significant amount of hexavalent chromium is not present in water pumped from the lower Mt. Simon aquifer.

Several wells produce water with elevated levels of iron and manganese, minerals that can discolor the water. Iron-manganese filtration is effectively removing these nuisance chemicals from the source water at Wells 7, 29, and 31, improving the quality of water delivered to our customers. Filtration is planned for several additional wells including Well 8 and Well 19.

Sodium, chloride, and nitrate concentrations in groundwater are influenced by human activities including the application of road salt (sodium chloride) and fertilizer (nitrate). Nitrate levels are stable while sodium and chloride levels are rising at several wells. Well 14 is on the water utility's Water Quality Watch List due to rising levels of both sodium and chloride.

At least one volatile organic compound was detected at seven wells. These substances come from historic spills and improper storage at current and former commercial or industrial sites. Routine monitoring tracks trends over time and provides data to determine when treatment is needed.

Testing in conjunction with UCMR4 confirmed previous manganese test results and low levels of disinfection by-products. Two contaminants each detected at one well in 2018 were not confirmed present during testing in 2019. Under this program, none of thirteen other unregulated chemicals were detected at any Madison well.

Using non-standard methods with low detection limits, multiple PFAS were detected at fourteen Madison wells. Levels of PFOA + PFOS, the most well-studied PFAS, are below the EPA health advisory level and proposed Wisconsin groundwater standard at all wells. Additional testing will take place in 2020.

The Water Utility Board revised the Water Quality Monitoring and Treatment Policies to update test requirements, establish a uniform performance standard for iron and manganese, and establish treatment targets for water quality when treatment is implemented.

Water utility staff maintain a Water Quality Watch List to identify contaminants that exceed a threshold or have an increasing trend over time and may require additional action such as wellhead treatment or a groundwater investigation. The list includes action plans for iron, manganese, radium, chloride, sodium, and tetrachloroethylene (PCE) as well as unregulated contaminants including 1,4-dioxane and PFAS.

APPENDIX

Table A-1. Annual Inorganic Test Results for Samples Collected in 2019

PARAMETER	UNITS	MCL	Well 06	Well 07	Well 08	Well 09	Well 11	Well 12	Well 13	Well 14	Well 16	Well 17	Well 18
Sample Date			6/12	6/13	8/15	6/13	6/13	6/12	6/13	6/12	6/12	6/13	6/12
Alkalinity ($CaCO_3$)	mg/l		315	339	316	354	352	285	345	337	285	295	286
Aluminum	µg/L		< 1.62	< 1.62	3.55	< 1.62	< 1.62	< 1.62	< 1.62	< 1.62	< 1.62	< 1.62	< 1.62
Antimony	µg/L	6	< 0.5	< 0.5	< 0.24	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Arsenic	µg/L	10	< 0.5	< 0.5	0.53	< 0.5	0.55	< 0.5	< 0.5	0.59	< 0.5	< 0.5	< 0.5
Barium	µg/L	2000	26	37	35	37	19	16	37	61	20	20	15
Beryllium	µg/L	4	< 0.09	< 0.09	< 0.04	< 0.09	< 0.09	<0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Cadmium	µg/L	5	< 0.5	< 0.5	< 0.11	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Calcium	mg/l		87	73	65	84	81	58	77	100	71	62	62
Chloride	mg/l		85	18	25	81	78	3.1	58	170	93	74	21
Chromium	µg/L	100	2.0	< 0.9	< 0.9	1.2	0.9	1.1	1.7	2.1	1.2	8.9	< 0.9
Conductivity	umhos /cm		931	689	655	853	888	530	806	1200	828	661	617
Copper	µg/L	1300	13	2.7	5.5	18	2.3	3.3	3.6	7.1	6.9	2.6	5.0
Fluoride	mg/l	4	0.62	0.56	0.84	0.64	0.60	0.75	0.76	0.60	0.71	0.64	0.67
Hardness ($CaCO_3$)	mg/l		396	355	319	392	401	274	370	454	335	314	298
Iron	mg/l		0.005	0.041	0.538	0.014	0.025	0.003	0.019	0.003	0.004	0.119	0.010
Lead	µg/L	15	< 0.10	< 0.10	0.17	0.20	0.21	< 0.10	0.21	< 0.10	< 0.10	0.15	0.20
Magnesium	mg/l		44	42	38	45	48	31	43	50	39	39	35
Manganese	µg/L		< 1.1	1.7	49	1.5	12	< 1.1	1.4	< 1.1	< 1.1	28	2.8
Mercury	µg/L	2	< 0.025	< 0.025	< 0.019	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Nickel	µg/L	100	4.9	4.0	1.0	4.4	5.0	3.3	4.6	5.3	3.7	3.6	3.4
Nitrogen-Nitrate	mg/l	10	3.3	< 0.095	< 0.089	2.2	2.5	1.7	3.7	3.8	2.8	< 0.095	1.1
Nitrogen-Nitrite	mg/l	1	< 0.012	< 0.012	< 0.015	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
pH (Lab)	standard unit		7.7	7.5	7.8	7.3	7.5	7.6	7.4	8.0	8.0	7.4	7.8
Selenium	µg/L	50	2.96	< 1.53	< 1.66	2.26	2.67	1.61	1.66	3.06	1.85	< 1.53	< 1.53
Silver	µg/L		< 0.1	< 0.1	< 0.09	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Sodium	mg/l		26	7.2	10	24	23	2.6	20	52	31	15	7.3
Strontium	µg/L		77	92	75	77	90	54	78	88	65	80	81
Sulfate	mg/l		31	35	21	25	30	5.7	21	29	14	38	21
Thallium	µg/L	2	< 0.1	< 0.1	< 0.01	< 0.1	0.28	< 0.1	< 0.1	< 0.1	< 0.1	0.12	< 0.1
Total Solids	mg/l		508	374	388	476	510	200	392	684	454	404	266
Zinc	µg/L		3.2	5.4	9.3	2.1	5.6	15	4.3	3.2	14	21	4.7

MCL – Maximum Contaminant Level

Table A-1, continued. Annual Inorganic Test Results for Samples Collected in 2019

PARAMETER	UNITS	MCL	Well 19	Well 20	Well 24	Well 25	Well 26	Well 27	Well 28	Well 29	Well 30	Well 31
Sample Date			6/12	6/12	6/13	6/13	6/12	8/16	6/12	6/13	6/12	6/12
Alkalinity ($CaCO_3$)	mg/l		281	297	286	337	314	316	273	335	275	365
Aluminum	µg/L		< 1.62	< 1.62	< 1.62	< 1.62	< 1.62	< 1.68	< 1.62	< 1.62	< 1.62	< 1.62
Antimony	µg/L	6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.24	< 0.5	< 0.5	< 0.5	< 0.5
Arsenic	µg/L	10	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.43	< 0.5	< 0.5	0.56	< 0.5
Barium	µg/L	2000	17	9.7	12	7.3	19	26	14	50	16	18
Beryllium	µg/L	4	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.04	< 0.09	< 0.09	< 0.09	< 0.09
Cadmium	µg/L	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.11	< 0.5	< 0.5	< 0.5	< 0.5
Calcium	mg/l		62	53	54	59	65	74	61	69	56	60
Chloride	mg/l		9.1	< 2.0	6.3	9.0	38	43	2.2	7.3	6.9	2.1
Chromium	µg/L	100	< 0.9	1.0	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Conductivity	umhos /cm		559	507	467	584	675	749	546	613	534	631
Copper	µg/L	1300	9.3	1.9	1.7	0.6	2.5	4.2	1.4	2.7	1.5	20
Fluoride	mg/l	4	0.71	0.68	0.76	0.69	0.64	0.83	0.72	0.74	0.67	0.72
Hardness ($CaCO_3$)	mg/l		282	259	268	311	307	345	281	320	270	325
Iron	mg/l		0.198	0.003	0.156	0.052	0.027	0.143	0.171	0.015	0.194	0.006
Lead	µg/L	15	0.98	0.11	< 0.10	< 0.10	0.12	0.10	0.21	< 0.10	< 0.10	< 0.10
Magnesium	mg/l		31	31	32	40	35	39	31	36	32	43
Manganese	µg/L		37	< 1.1	17	2.9	4.2	32	21	1.6	13	< 1.1
Mercury	µg/L	2	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	<0.019	< 0.025	< 0.025	< 0.025	< 0.025
Nickel	µg/L	100	3.4	2.8	2.7	2.9	4.3	2.5	3.7	3.8	3.0	3.3
Nitrogen-Nitrate	mg/l	10	< 0.095	0.39	< 0.095	0.76	2.4	0.24	< 0.095	1.3	< 0.095	< 0.095
Nitrogen-Nitrite	mg/l	1	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.015	< 0.012	< 0.012	< 0.012	< 0.012
pH (Lab)	standard unit		8.1	7.6	7.6	7.7	7.5	7.4	7.8	7.4	7.7	7.9
Selenium	µg/L	50	< 1.53	< 1.53	< 1.53	< 1.53	< 1.53	< 1.66	< 1.53	< 1.53	< 1.53	< 1.53
Silver	µg/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.09	< 0.1	< 0.1	< 0.1	< 0.1
Sodium	mg/l		4.4	2.1	4.8	3.2	15	18	2.4	3.8	4.0	3.3
Strontium	µg/L		88	52	69	62	58	92	48	75	100	71
Sulfate	mg/l		9.7	9.5	15	6.7	16	43	25	12	23	7.3
Thallium	µg/L	2	0.12	< 0.1	< 0.1	< 0.1	< 0.1	0.15	< 0.1	< 0.1	< 0.1	< 0.1
Total Solids	mg/l		328	122	258	288	258	364	208	316	246	280
Zinc	µg/L		3.1	2.6	6.5	2.5	13	4.6	8.6	4.4	5.7	1.1

MCL - Maximum Contaminant Level

Table A-2. Monthly Well Samples – Manganese Levels (µg/L)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Well 6	n/s	n/s	n/s	n/s	n/s	<1.1	n/s	n/s	n/s	n/s	n/s	<2.0
Well 7	16	n/s	1.5	1.4	1.1	<0.7	<0.7	<0.7	1.2	<0.7	n/s	n/s
Well 8	n/s	n/s	n/s	n/s	n/s	n/s	49	49	47	48	49	48
Well 9	n/s	n/s	n/s	n/s	n/s	1.5	n/s	n/s	n/s	n/s	n/s	6.2
Well 11	n/s	n/s	n/s	n/s	n/s	12	n/s	n/s	n/s	n/s	n/s	2.8
Well 12	n/s	n/s	n/s	n/s	n/s	<1.1	n/s	n/s	n/s	n/s	n/s	<2.0
Well 13	n/s	n/s	n/s	n/s	n/s	1.4	n/s	n/s	n/s	n/s	n/s	2.1
Well 14	n/s	n/s	n/s	n/s	n/s	<1.1	n/s	n/s	n/s	n/s	n/s	<2.0
Well 16	n/s	n/s	n/s	n/s	n/s	<1.1	n/s	n/s	n/s	n/s	n/s	<2.0
Well 17	n/s	n/s	n/s	n/s	33	29	30	30	29	n/s	n/s	n/s
Well 18	n/s	n/s	n/s	n/s	n/s	2.8	n/s	n/s	n/s	n/s	n/s	3.2
Well 19	50	54	46	46	39	37	40	41	37	46	42	47
Well 20	n/s	n/s	n/s	n/s	n/s	<1.1	n/s	n/s	n/s	n/s	n/s	<2.0
Well 24	30	32	28	30	24	17	28	28	26	29	28	22
Well 25	n/s	n/s	n/s	n/s	n/s	2.9	n/s	n/s	n/s	n/s	n/s	2.6
Well 26	<3.9	8.4	<3.9	<3.9	<3.9	12	14	24	18	<3.9	<3.9	11
Well 27	n/s	n/s	n/s	n/s	n/s	34	32	32	31	33	n/s	33
Well 28	21	22	22	21	21	21	22	22	21	23	22	22
Well 29	<0.7	n/s	<0.7	<0.7	<0.7	<0.7	4.6	0.8	3.2	<0.7	n/s	n/s
Well 30	14	14	14	13	13	13	14	14	13	14	13	13
Well 31	<0.7	n/s	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	n/s	n/s

Table A-3. Monthly Well Samples – Iron Levels (mg/L)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Well 6	n/s	n/s	n/s	n/s	n/s	0.005	n/s	n/s	n/s	n/s	n/s	<0.007
Well 7	0.140	n/s	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	n/s	n/s
Well 8	n/s	n/s	n/s	n/s	n/s	n/s	0.54	0.54	0.51	0.56	0.58	0.53
Well 9	n/s	n/s	n/s	n/s	n/s	0.014	n/s	n/s	n/s	n/s	n/s	0.010
Well 11	n/s	n/s	n/s	n/s	n/s	0.025	n/s	n/s	n/s	n/s	n/s	<0.007
Well 12	n/s	n/s	n/s	n/s	n/s	0.003	n/s	n/s	n/s	n/s	n/s	<0.007
Well 13	n/s	n/s	n/s	n/s	n/s	0.019	n/s	n/s	n/s	n/s	n/s	0.017
Well 14	n/s	n/s	n/s	n/s	n/s	0.003	n/s	n/s	n/s	n/s	n/s	<0.007
Well 16	n/s	n/s	n/s	n/s	n/s	0.004	n/s	n/s	n/s	n/s	n/s	<0.007
Well 17	n/s	n/s	n/s	n/s	0.094	0.114	0.113	0.119	0.117	n/s	n/s	n/s
Well 18	n/s	n/s	n/s	n/s	n/s	0.010	n/s	n/s	n/s	n/s	n/s	<0.007
Well 19	0.199	0.228	0.204	0.198	0.187	0.198	0.191	0.196	0.180	0.223	0.215	0.21
Well 20	n/s	n/s	n/s	n/s	n/s	0.003	n/s	n/s	n/s	n/s	n/s	<0.007
Well 24	0.203	0.211	0.192	0.188	0.174	0.156	0.211	0.201	0.197	0.212	0.212	0.15
Well 25	n/s	n/s	n/s	n/s	n/s	0.052	n/s	n/s	n/s	n/s	n/s	0.035
Well 26	0.005	0.005	0.005	0.007	0.009	<0.004	0.007	0.005	0.006	0.005	0.010	<0.007
Well 27	n/s	n/s	n/s	n/s	n/s	0.093	0.104	0.143	0.132	0.161	n/s	0.11
Well 28	0.162	0.181	0.172	0.165	0.166	0.171	0.171	0.177	0.167	0.193	0.184	0.17
Well 29	<0.052	n/s	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	n/s	n/s
Well 30	0.199	0.208	0.197	0.188	0.181	0.194	0.190	0.196	0.184	0.217	0.205	0.19
Well 31	<0.052	n/s	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	<0.052	n/s	n/s

Table A-4. Monthly Distribution Samples – Manganese Levels (µg/L)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave	95th
WEST	2.0	n/s	n/s	0.2	n/s	n/s	0.5	n/s	n/s	0.5	n/s	n/s	0.8	1.8
HSR	2.1	n/s	n/s	0.3	n/s	n/s	1.7	n/s	n/s	0.5	n/s	n/s	1.2	2.0
SH	<0.2	n/s	n/s	<0.2	n/s	n/s	<0.2	n/s	n/s	0.2	n/s	n/s	0.2	0.2
HF	0.6	n/s	n/s	0.5	n/s	n/s	0.5	n/s	n/s	0.8	n/s	n/s	0.6	0.7
JMS	1.6	n/s	n/s	1.5	n/s	n/s	1.3	n/s	n/s	1.7	n/s	n/s	1.5	1.7
128	13	n/s	n/s	19	n/s	n/s	20	n/s	n/s	18	n/s	n/s	18	20
228	n/s	n/s	n/s	16	n/s	n/s	14	n/s	n/s	22	n/s	n/s	17	21
HLG	n/s	n/s	n/s	n/s	n/s	<3.9	0.7	n/s	n/s	1.0	n/s	n/s	1.8	3.6
126	1.5	n/s	n/s	3.4	n/s	n/s	4.2	n/s	n/s	7.6	n/s	n/s	4.2	7.1
120	1.0	n/s	n/s	1.0	n/s	n/s	0.9	n/s	n/s	1.2	n/s	n/s	1.0	1.2
ORS	<0.2	n/s	n/s	<0.2	n/s	n/s	<0.2	n/s	n/s	1.0	n/s	n/s	0.4	0.9
MS	<0.2	n/s	n/s	<0.2	n/s	n/s	1.2	n/s	n/s	0.4	n/s	n/s	0.5	1.1
THS	0.6	n/s	n/s	<0.2	n/s	n/s	0.6	n/s	n/s	1.7	n/s	n/s	0.7	1.5
LS	<0.2	n/s	n/s	<0.2	n/s	n/s	<0.2	n/s	n/s	0.5	n/s	n/s	0.2	0.4
LN	17	n/s	n/s	4.2	n/s	n/s	2.7	n/s	n/s	3.0	n/s	n/s	6.7	15
IEM	<0.2	n/s	n/s	0.3	n/s	n/s	0.3	n/s	n/s	0.4	n/s	n/s	0.3	0.4
EAST	0.3	n/s	n/s	0.7	n/s	n/s	0.6	n/s	n/s	5.2	n/s	n/s	1.7	4.5
MB	0.2	n/s	n/s	0.4	n/s	n/s	0.9	n/s	n/s	7.5	n/s	n/s	2.3	6.5
213	0.8	n/s	n/s	1.7	n/s	n/s	0.7	n/s	n/s	1.1	n/s	n/s	1.1	1.6
MDS	0.7	n/s	n/s	1.2	n/s	n/s	0.8	n/s	n/s	1.2	n/s	n/s	1.0	1.2
LBS	1.4	n/s	n/s	1.3	n/s	n/s	1.0	n/s	n/s	1.6	n/s	n/s	1.3	1.6
TRUAX	0.3	n/s	n/s	0.4	n/s	n/s	0.5	n/s	n/s	1.0	n/s	n/s	0.5	0.9
EMCC	0.6	n/s	n/s	1.0	n/s	n/s	2.6	n/s	n/s	5.2	n/s	n/s	2.3	4.8
ESD	1.6	n/s	n/s	0.2	n/s	n/s	0.5	n/s	n/s	1.6	n/s	n/s	1.0	1.6
315	0.9	n/s	n/s	1.5	n/s	n/s	2.3	n/s	n/s	5.2	n/s	n/s	2.5	4.8
229	0.8	n/s	n/s	2.2	n/s	n/s	0.7	n/s	n/s	1.6	n/s	n/s	1.3	2.1
SS	1.0	n/s	n/s	3.2	n/s	n/s	2.7	n/s	n/s	4.7	n/s	n/s	2.9	4.5
FS-5	0.9	n/s	n/s	2.3	n/s	n/s	1.3	n/s	n/s	4.0	n/s	n/s	2.1	3.7
225	1.8	n/s	n/s	2.1	n/s	n/s	1.7	n/s	n/s	1.9	n/s	n/s	1.9	2.1
GS	1.6	n/s	n/s	0.2	n/s	n/s	0.2	n/s	n/s	0.9	n/s	n/s	0.7	1.5
Ave	1.9	n/s	n/s	2.3	n/s	<3.9	2.2	n/s	n/s	3.4	n/s	n/s		
Max	17	n/s	n/s	19	n/s	<3.9	20	n/s	n/s	22	n/s	n/s		

Table A-5. Monthly Distribution Samples – Iron Levels (mg/L)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave	95th
WEST	0.010	n/s	n/s	0.018	n/s	n/s	0.010	n/s	n/s	<0.005	n/s	n/s	0.011	0.017
HSR	0.011	n/s	n/s	0.019	n/s	n/s	0.034	n/s	n/s	0.007	n/s	n/s	0.018	0.032
SH	0.010	n/s	n/s	0.024	n/s	n/s	0.015	n/s	n/s	<0.005	n/s	n/s	0.014	0.023
HF	0.006	n/s	n/s	0.020	n/s	n/s	0.014	n/s	n/s	<0.005	n/s	n/s	0.011	0.019
JMS	0.014	n/s	n/s	0.026	n/s	n/s	0.016	n/s	n/s	0.012	n/s	n/s	0.017	0.025
128	0.13	n/s	n/s	0.17	n/s	n/s	0.18	n/s	n/s	0.15	n/s	n/s	0.16	0.18
228	n/s	n/s	n/s	0.16	n/s	n/s	0.15	n/s	n/s	0.18	n/s	n/s	0.16	0.18
HLG	n/s	n/s	n/s	n/s	n/s	0.010	0.014	n/s	n/s	<0.005	n/s	n/s	0.010	0.014
126	0.010	n/s	n/s	0.024	n/s	n/s	0.021	n/s	n/s	0.011	n/s	n/s	0.016	0.024
120	<0.005	n/s	n/s	0.018	n/s	n/s	0.005	n/s	n/s	<0.005	n/s	n/s	0.008	0.016
ORS	<0.005	n/s	n/s	0.011	n/s	n/s	<0.005	n/s	n/s	<0.005	n/s	n/s	0.007	0.010
MS	<0.005	n/s	n/s	0.011	n/s	n/s	0.026	n/s	n/s	<0.005	n/s	n/s	0.012	0.024
THS	0.011	n/s	n/s	0.012	n/s	n/s	0.015	n/s	n/s	<0.005	n/s	n/s	0.011	0.015
LS	<0.005	n/s	n/s	0.011	n/s	n/s	0.007	n/s	n/s	<0.005	n/s	n/s	0.007	0.010
LN	0.053	n/s	n/s	0.018	n/s	n/s	0.014	n/s	n/s	0.024	n/s	n/s	0.027	0.049
IEM	0.020	n/s	n/s	0.041	n/s	n/s	0.025	n/s	n/s	<0.005	n/s	n/s	0.023	0.039
EAST	0.007	n/s	n/s	0.024	n/s	n/s	0.013	n/s	n/s	0.067	n/s	n/s	0.028	0.061
MB	0.008	n/s	n/s	0.026	n/s	n/s	0.024	n/s	n/s	0.089	n/s	n/s	0.037	0.080
213	0.014	n/s	n/s	0.034	n/s	n/s	0.012	n/s	n/s	0.009	n/s	n/s	0.017	0.031
MDS	0.012	n/s	n/s	0.035	n/s	n/s	0.012	n/s	n/s	0.010	n/s	n/s	0.017	0.032
LBS	0.011	n/s	n/s	0.030	n/s	n/s	0.011	n/s	n/s	0.012	n/s	n/s	0.016	0.027
TRUAX	0.007	n/s	n/s	0.021	n/s	n/s	0.018	n/s	n/s	0.007	n/s	n/s	0.013	0.021
EMCC	0.005	n/s	n/s	0.024	n/s	n/s	0.056	n/s	n/s	0.053	n/s	n/s	0.035	0.056
ESD	<0.005	n/s	n/s	0.014	n/s	n/s	0.020	n/s	n/s	0.008	n/s	n/s	0.012	0.019
315	<0.005	n/s	n/s	0.021	n/s	n/s	0.033	n/s	n/s	0.046	n/s	n/s	0.026	0.044
229	<0.005	n/s	n/s	0.019	n/s	n/s	0.018	n/s	n/s	0.012	n/s	n/s	0.014	0.019
SS	<0.005	n/s	n/s	0.021	n/s	n/s	0.019	n/s	n/s	0.013	n/s	n/s	0.015	0.021
FS-5	<0.005	n/s	n/s	0.023	n/s	n/s	0.017	n/s	n/s	0.012	n/s	n/s	0.014	0.022
225	0.024	n/s	n/s	0.048	n/s	n/s	0.042	n/s	n/s	0.024	n/s	n/s	0.035	0.047
GS	0.010	n/s	n/s	0.019	n/s	n/s	0.018	n/s	n/s	<0.005	n/s	n/s	0.013	0.019
Ave	0.015	n/s	n/s	0.032	n/s	0.010	0.029	n/s	n/s	0.027	n/s	n/s		
Max	0.13	n/s	n/s	0.17	n/s	0.010	0.18	n/s	n/s	0.18	n/s	n/s		

Table A-6. Radionuclide test results – 2019.

Sample Point	Sample Date	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Radium-226 (pCi/L)	Radium-228 (pCi/L)	Combined Radium (226 + 228)	Uranium (ug/L)
MCL		15	50	5*	5*	5	30
Well #7	8/27	5.3	6.1	1.4	1.9	3.3	ns
Well #8	8/27	2.8	8.6	1.9	2.0	3.9	ns
	8/27	5.2	6.8	2.0	0.92	2.9	ns
Well #19	3/12	10.1	7.2	2.2	1.9	4.1	ns
	5/20	*1.1*	4.7	2.1	2.8	4.9	0.95
	8/28	8.9	4.4	1.9	4.0	5.9	ns
	11/20	5.8	3.4	2.1	2.0	4.1	ns
	11/20	3.6	2.6	2.1	2.4	4.5	ns
Well #24	3/12	8.8	8.0	1.4	0.72	2.12	ns
Well #27	6/24	4.9	5.0	2.1	2.2	4.3	ns
	6/24	6.1	3.1	1.6	2.4	4.0	ns
	8/28	6.0	9.9	2.2	2.6	4.8	ns
	12/2	4.4	4.4	2.0	1.9	3.9	ns
	12/2	6.0	3.6	2.1	2.2	4.3	ns
Well #28	11/20	5.4	2.3	1.8	2.8	4.6	ns
Well #30	8/28	4.9	8.6	1.4	1.8	3.2	ns
Well #31	3/12	8.1	6.7	0.75	0.32	1.07	0.33
	5/20	*1.8*	3.0	0.87	*0.06*	0.93	0.34
	8/28	2.2	7.9	0.83	1.1	1.93	0.37
	8/28	2.6	4.2	0.55	1.0	1.51	0.37

* MCL for combined radium (226+228) is 5 pCi/L
MCL – Maximum Contaminant Level
Note: Italicized results are below the method reporting level; ns = not sampled

Table A-7. UCMR4 test results – Manganese and Bromide.

Sample Year	Manganese, ug/L 2018	Manganese, ug/L 2019	Bromide, ug/L 2018	Bromide, ug/L 2019	Sample Year
Well 06	0.512	0.923	n/s	n/s	Well 06
Well 07	< 0.4	0.631	36.9	34.4	Well 07
Well 08	50.2	46.6	n/s	n/s	Well 08
Well 09	< 0.4	< 0.4	44.3	56.2	Well 09
Well 11	6.04	2.33	56.3	59.7	Well 11
Well 12	0.466	0.924	n/s	n/s	Well 12
Well 13	2.57	1.55	29	39.4	Well 13
Well 14	< 0.4	< 0.4	n/s	n/s	Well 14
Well 15	3.20	3.16	55.1	58.1	Well 15
Well 16	< 0.4	2.89	n/s	n/s	Well 16
Well 17	30.4	29.2	n/s	n/s	Well 17
Well 18	11.1	14.4	n/s	n/s	Well 18
Well 19	45.2	39.2	n/s	n/s	Well 19
Well 20	1.00	1.24	n/s	n/s	Well 20
Well 24	28.1	28	n/s	n/s	Well 24
Well 25	4.36	3.05	n/s	n/s	Well 25
Well 26	15.7	4.42	n/s	n/s	Well 26
Well 27	34.3	31.1	n/s	n/s	Well 27
Well 28	22.1	21.9	n/s	n/s	Well 28
Well 29	1.89	0.425	< 20	21.9	Well 29
Well 30	14.1	14.2	n/s	n/s	Well 30
Well 31	4.11	0.421	< 20	< 20	Well 31

n/s - not sampled

Table A-8. Summary of UCMR4 test results.

Monitoring Period 1: July - December 2018

Unregulated Contaminant	Detection Limit	Facilities Tested	Number of Detections	Locations With Detections	Results
Germanium	0.3	All Wells	0	none	n/a
Manganese	0.4	All Wells	18	All except #7, #9, #14, and #16	See Table A-7
alpha-Hexachlorocyclohexane	0.01	All Wells	0	None	n/a
Chlorpyrifos	0.03	All Wells	0	None	n/a
Dimethipin	0.2	All Wells	0	None	n/a
Ethoprop	0.03	All Wells	0	None	n/a
Oxyfluorfen	0.05	All Wells	0	None	n/a
Profenofos	0.3	All Wells	0	None	n/a
Tebuconazole	0.2	All Wells	0	None	n/a
Permethrin, cis & trans	0.04	All Wells	0	None	n/a
Tribufos	0.07	All Wells	0	None	n/a
Butylated hydroxyanisole	0.03	All Wells	0	None	n/a
o-Toluidine	0.007	All Wells	0	None	n/a
Quinoline	0.02	All Wells	0	None	n/a
1-Butanol	2.0	All Wells	1	Well 28	8.04
2-Methoxyethanol	0.4	All Wells	1	Well 26	0.537
2-Propen-1-ol	0.5	All Wells	0	None	n/a
HAA5	varies	IEM, 229	2	IEM, 229	See Table A-9
HAA6	varies	IEM, 229	2	IEM, 229	See Table A-9
HAA9	varies	IEM, 229	2	IEM, 229	See Table A-9
Total Organic Carbon (TOC)	1000	#7, #9, #11, #13, #15, #29, #31	0	none	n/a
Bromide	20	#7, #9, #11, #13, #15, #29, #31	5 of 7	#7, #9, #11, #13, #15	See Table A-7

* All measurements reported in µg/L or parts per billion (ppb)

Table A-8, continued. Summary of UCMR4 test results.

Monitoring Period 2: February - August 2019

Unregulated Contaminant	Detection Limit	Facilities Tested	Detections	Locations	Results
Germanium	0.3	All Wells	0	none	n/a
Manganese	0.4	All Wells	20	All except #9 and #14	See table A-7
alpha-Hexachlorocyclohexane	0.01	All Wells	0	None	n/a
Chlorpyrifos	0.03	All Wells	0	None	n/a
Dimethipin	0.2	All Wells	0	None	n/a
Ethoprop	0.03	All Wells	0	None	n/a
Oxyfluorfen	0.05	All Wells	0	None	n/a
Profenofos	0.3	All Wells	0	None	n/a
Tebuconazole	0.2	All Wells	0	None	n/a
Permethrin, cis & trans	0.04	All Wells	0	None	n/a
Tribufos	0.07	All Wells	0	None	n/a
Butylated hydroxyanisole	0.03	All Wells	0	None	n/a
o-Toluidine	0.007	All Wells	0	None	n/a
Quinoline	0.02	All Wells	0	None	n/a
1-Butanol	2.0	All Wells	0	None	n/a
2-Methoxyethanol	0.4	All Wells	0	None	n/a
2-Propen-1-ol	0.5	All Wells	0	None	n/a
HAA5	varies	IEM, 229	1	229	See table A-9
HAA6	varies	IEM, 229	1	229	See table A-9
HAA9	varies	IEM, 229	1	229	See table A-9
Total Organic Carbon (TOC)	1000	#7, #9, #11, #13, #15, #29, #31	0	none	n/a
Bromide	20	#7, #9, #11, #13, #15, #29, #31	6 of 7	#7, #9, #11, #13, #15, #29	See table A-7

* All measurements reported in µg/L or parts per billion (ppb)

Table A-9. UCMR4 test results – Haloacetic Acid (HAA) Group.

Haloacetic Acids/Groups	Detection Limit	Results by Location & Year			
		IEM		229	
		2018	2019	2018	2019
Bromochloroacetic acid^	0.3	0.658	ND	0.629	0.912
Bromodichloroacetic acid^	0.5	0.665	ND	0.665	0.586
Chlorodibromoacetic acid^	0.3	ND	ND	0.374	0.446
Dibromoacetic acid*^	0.3	0.702	ND	0.446	0.367
Dichloroacetic acid*	0.2	0.359	ND	0.466	0.944
Monobromoacetic acid*^	0.3	ND	ND	ND	ND
Monochloroacetic acid*	2	ND	ND	ND	ND
Tribromoacetic acid^	2	ND	ND	ND	ND
Trichloroacetic acid*	0.5	ND	ND	0.628	0.558
HAA5 Group*		1.061	0	1.54	1.869
HAA6Br Group^		2.025	0	2.114	2.311
HAA9 Group		2.384	0	3.208	3.813

All measurements reported in µg/L or parts per billion (ppb)

ND - not detected (below the detection limit)

Samples collected 7/17/2018 and 2/21/2019

Table A-10. Test Results for Disinfection By-Products, in µg/L, at Distribution System Locations.

Compound	MCL	IEM	IEM	IEM	IEM	229	229	229	229
		1/16	**4/16**	**7/16**	**10/15**	**1/16**	**4/16**	**7/16**	**10/15**
Bromodichloromethane	--	0.89	0.58	0.77	1.4	2.6	2.2	4.7	2.8
Bromoform	--	0.28	<0.21	<0.21	<0.21	0.41	0.36	0.57	0.59
Chloroform	--	0.84	0.67	0.57	1.5	2.5	1.9	4.6	2.2
Dibromochloromethane	--	0.85	0.35	0.53	0.76	2.0	1.7	3.5	2.4
Total Trihalomethanes	**80***	**2.9**	**1.6**	**1.9**	**3.7**	**7.5**	**6.2**	**13.4**	**8.0**
Dibromoacetic Acid	--	0.23	<0.21	<0.21	0.24	0.60	0.59	0.65	0.86
Dichloroacetic Acid	--	0.62	0.48	0.23	0.84	1.4	1.1	1.2	1.0
Monobromoacetic Acid	--	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
Monochloroacetic Acid	--	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93
Trichloroacetic Acid	--	<0.22	<0.22	<0.22	0.23	0.51	0.58	0.72	0.48
Total Haloacetic Acid	**60***	**0.85**	**0.48**	**0.23**	**1.31**	**2.5**	**2.3**	**2.6**	**2.3**

KEY:

Sample locations: IEM = Isthmus Engineering & Manufacturing; 229 = Reservoir 229

MCL = maximum contaminant level, the highest level that is allowed in drinking water

* MCL for Total Trihalomethanes and Total Haloacetic Acids are cumulative; levels of individual trihalomethanes or haloacetic acids must not add up to more than the collective MCL

Table A-11. Water Quality Watch List

Organics - Regulated

Contaminant	Maximum*	Units	MCLG	PAL	MCL	Detects Below PAL%	Watch List	Action Plan	Reference
Atrazine	0.03	µg/L	3	0.3	3	#29	none		NR 809.20
1,2-Dichloroethane	0.1	µg/L	zero	0.5	5	#17	none		NR 809.24
1,2-Dichloroethylene (cis)	0.6	µg/L	70	7	70	#8, #9, #11, #27	none		NR 809.24
Ethylbenzene	0.7	µg/L	700	140	700	#9	none		NR 809.24
Tetrachloroethylene [PCE]	3.5	µg/L	zero	0.5	5	#27	#6, #7, #9, #11, #14, #18	Quarterly Monitoring	NR 809.24
Toluene	0.2	µg/L	1000	160	1000	#9, #31	none		NR 809.24
1,1,1-Trichloroethane	0.3	µg/L	200	40	200	#9, #18	none		NR 809.24
Trichloroethylene [TCE]	0.4	µg/L	zero	0.5	5	#11, #14, #18	none		NR 809.24
Xylene, Total	4.5	µg/L	10000	400	10000	#9, #31	none		NR 809.24

* Maximum detection observed at any Madison well from 2015 through 2019

% Detected in at least one sample collected from 2015 through 2019

Organics - Unregulated

Contaminant	Maximum*	Units	HAL	PAL	ES	Detects Below PAL%	Watch List	Action Plan	Reference
1,1-Dichloroethane	0.08	µg/L	n/a	85	850	#9	none		NR 140.10
1,4-Dioxane	0.43	µg/L	0.35~	0.3	3	#9, #14, #15, #17, #18	#11	Semi-Annual Monitoring	NR 140.10
Metolachlor	0.01	µg/L	n/a	10	100	#14	none		NR 140.10
PFAS: PFOA, PFOS, PFHxS, PFHxA, PFBS, PFBA, PFHpA, PFHpS, PFPeA, PFPeS, FOSA, N-Et FOSA, 6:2 FTSA	0.06	µg/L	0.07^	n/a	n/a	#6, #7, #8, #9, #11, #13, #14, #16, #17, #23, #26, #27, #29	#15	Monthly Monitoring	US EPA
Trichlorofluoromethane	1.1	µg/L	n/a	698	3490	#11	none		NR 140.10

* Maximum detection observed at any Madison well from 2015 through 2019 % Detected in at least one sample collected from 2015 through 2019 ~ 10^{-6} Cancer Risk Level ^ PFOA + PFOS

Radionuclides (2018 & 2019)

Contaminant	Maximum	Units	MCLG	Watch	MCL	Wells with Detects	Watch List	Action Plan	Reference
Gross alpha	12	pCi/L	zero	5	15	All Except Well #14	#7, #8, #19, #24 #27, #28, #30	Annual or Quarterly Monitoring	NR 809.50
Gross beta	13	pCi/L	zero	10	50	All Except Well #14	#19, #28		NR 809.50
Combined Radium	5.9	pCi/L	zero	2.5	5	All Wells	#7, #8, #19, #24 #27, #28, #30	Annual or Quarterly Monitoring	NR 809.50

ES - Enforcement Standard (NR 140 - Groundwater Quality) **HAL** - Health Advisory Level **MCL** - Maximum Contaminant Level Legal Limit **MCLG** - MCL Goal (Public Health Goal) **PAL** - Preventive Action Limit (NR 140 - Groundwater Quality)

Table A-11, continued. Water Quality Watch List

Inorganics - Regulated

Substance	Maximum*	Units	MCLG	PAL	MCL	Detects Below PAL	Watch List	Action Plan	Reference
Arsenic	0.6	µg/l	zero	1	10	#8, #11, #14, #30	none		NR 809.11
Barium	61	µg/l	2000	400	2000	All Wells	none		NR 809.11
Chromium, Total	14	µg/l	100	10	100	All Wells	none		NR 809.11
Nickel	5.3	µg/l	100	20	100	All Wells	none		NR 809.11
Nitrogen-Nitrate	4.8	mg/l	10	2	10	#12, #18, #20, #25, #27, #29	#6, #9, #11, #13, #14, #16, #23, #26	Annual Monitoring	NR 809.11
Selenium	3.1	µg/l	50	10	50	#6, #9, #11, #12, #13, #14, #16	none		NR 809.11
Thallium	0.3	µg/l	0.5	0.4	2	#11, #17, #19, #27	none		NR 809.11

* Based on 2019 annual test data

Inorganics - Unregulated

Substance	Maximum*	Units	MCLG	Watch	SMCL	Wells with Detects	Watch List	Action Plan	Reference
Aluminum	6.5	µg/l	n/a	50	200	#6, #14, #20, #25, #26	none		NR 809.70
Chloride	170	mg/l	n/a	125	250	#6, #8, #9, #11, #13, #16, #17, #18, #26, #27	#14	GW Investigation; Mitigation (2028)	NR 809.70
Iron	0.54	mg/l	n/a	0.15	0.3	All Wells	#8, #19, #24, #28 #30	Install Filtration: Well #8 (2032) Well #19 (2025) Well #24 (2030) Well #28 (2026) Well #30 (2027)	NR 809.70
Manganese	49	µg/l	n/a	25	50	All Except Wells #6, #12, #14, #16, #20, #31	#8, #17, #19, #24, #27, #28		NR 809.70
Sodium	52	mg/l	n/a	20	n/a	All Wells	#6, #9, #11, #13, #14, #16	Annual Monitoring	EPA DWEL
Sulfate	43	mg/l	n/a	125	250	All Wells	none		NR 809.70
Zinc	21	µg/l	n/a	2500	5000	All Wells	none		NR 809.70

* Based on 2019 annual test data

DWEL - Drinking Water Equivalency Level **MCL** - Maximum Contaminant Level (Legal Limit) **MCLG** - MCL Goal Public Health Goal **PAL** - Preventive Action Limit (NR 140 - Groundwater Quality) **SMCL** - Secondary MCL (Aesthetic Guideline)

Table A-12. Volatile Organic Compound (VOC) Test Results - 2019

Volatile Organic Compounds	Units	MCL	MCLG	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	11	11	11	11	12	13	14	14	14	14	15	16	17	18	18	18	18	19	20	24	25	26	27	28	29	30	31	31	31	Volatile Organic Compounds
	Sample Date			3/11	4/16	7/15	10/14	1/16	4/16	7/18	10/15	7/16	8/27	9/27	10/15	1/16	4/16	7/16	10/15	1/16	4/16	7/18	10/15	4/16	1/16	3/11	4/16	7/15	10/14	1/16	4/16	7/16	3/11	4/16	7/15	10/14	4/16	4/16	4/16	4/16	4/16	7/15	4/16	4/16	4/16	3/11	4/16	7/15	
Benzene	ppb	5	zero	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.19	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	Benzene
Bromobenzene	ppb	--	--	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.20	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	Bromobenzene
Bromodichloromethane*	ppb	80	zero	<0.23	<0.23	<0.23	**0.29**	**1.9**	**1.1**	**1.5**	**1.9**	**0.71**	**0.39**	**0.41**	**0.40**	**0.69**	**0.55**	**1.0**	**1.1**	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	**1.2**	<0.23	<0.23	<0.23	<0.23	**1.6**	<0.23	**1.1**	<0.23	**0.27**	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	**0.26**	**Bromodichloromethane***
Bromoform*	ppb	80	zero	<0.21	<0.21	**0.24**	**0.39**	**0.40**	**0.26**	**0.29**	**0.39**	<0.21	<0.13	<0.21	<0.21	**0.49**	**0.58**	**0.85**	**0.77**	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	**0.23**	**0.40**	**0.21**	**0.21**	<0.21	**0.34**	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	**Bromoform***
Bromomethane	ppb	--	--	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.12	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	Bromomethane
Carbon Tetrachloride	ppb	5	zero	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.19	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	Carbon Tetrachloride
Chloroethane	ppb	--	--	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.4	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	Chloroethane
Chloroform*	ppb	80	--	<0.25	<0.25	<0.25	<0.25	**1.6**	**0.94**	**1.2**	**1.5**	**0.91**	**0.43**	**0.49**	**0.57**	**0.31**	<0.25	**0.45**	**0.38**	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	**0.79**	<0.25	<0.25	<0.25	<0.25	**2.4**	<0.25	**0.84**	<0.25	<0.25	<0.25	<0.25	**0.39**	<0.25	<0.25	**0.38**	<0.25	**Chloroform***
Chloromethane	ppb	--	--	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.15	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	**0.72**	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	**Chloromethane**
o-Chlorotoluene	ppb	--	--	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.19	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	o-Chlorotoluene
p-Chlorotoluene	ppb	--	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.18	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	p-Chlorotoluene
Dibromochloromethane*	ppb	80	60	<0.17	<0.17	**0.34**	**0.55**	**1.9**	**1.1**	**1.2**	**1.8**	**0.55**	<0.20	<0.17	**0.21**	**0.94**	**1.0**	**1.7**	**1.5**	<0.17	<0.17	**0.25**	**0.27**	<0.17	<0.17	**0.19**	**0.22**	**0.31**	**0.23**	**0.18**	<0.17	**1.2**	<0.17	**0.24**	**0.19**	**0.26**	**0.85**	<0.17	**1.1**	<0.17	**0.43**	**0.18**	<0.17	**0.37**	<0.17	<0.17	**0.19**	**0.27**	**Dibromochloromethane***
Dibromomethane	ppb	--	--	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.16	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	Dibromomethane
m-Dichlorobenzene (1,3)	ppb	--	--	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.18	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	m-Dichlorobenzene (1,3)
o-Dichlorobenzene (1,2)	ppb	600	600	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.18	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	o-Dichlorobenzene (1,2)
p-Dichlorobenzene (1,4)	ppb	75	75	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.16	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	p-Dichlorobenzene (1,4)
Dichlorodifluoromethane	ppb	--	--	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.16	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	Dichlorodifluoromethane
1,1-Dichloroethane	ppb	--	--	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.18	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	1,1-Dichloroethane
1,2-Dichloroethane	ppb	5	zero	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.17	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	1,2-Dichloroethane
1,1-Dichloroethylene	ppb	7	7	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.21	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	1,1-Dichloroethylene
1,2-Dichloroethylene (cis)	ppb	70	70	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.20	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**0.38**	**0.31**	**0.39**	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**1,2-Dichloroethylene (cis)**
1,2-Dichloroethylene (trans)	ppb	100	100	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.16	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	1,2-Dichloroethylene (trans)
Dichloromethane	ppb	5	zero	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.12	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	Dichloromethane
1,2-Dichloropropane	ppb	5	zero	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.18	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	1,2-Dichloropropane
1,3-Dichloropropane	ppb	--	--	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.17	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	1,3-Dichloropropane
2,2-Dichloropropane	ppb	--	--	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.11	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	2,2-Dichloropropane
1,1-Dichloropropene	ppb	--	--	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.19	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	1,1-Dichloropropene
1,3-Dichloropropene	ppb	--	--	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.38	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	1,3-Dichloropropene
Ethylbenzene	ppb	700	700	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.18	<0.22	<0.22	<0.22	<0.22	**0.54**	**0.27**	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	**Ethylbenzene**
Hexachlorobutadiene	ppb	--	--	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	Hexachlorobutadiene
Isopropylbenzene	ppb	--	--	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.19	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	Isopropylbenzene
p-Isopropyltoluene	ppb	--	--	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.16	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	p-Isopropyltoluene
Methyl t-butyl ether	ppb	--	--	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.19	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	Methyl t-butyl ether
Monochlorobenzene	ppb	100	100	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.20	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	Monochlorobenzene
Naphthalene	ppb	--	--	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.19	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	Naphthalene
Styrene	ppb	100	100	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.17	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	Styrene
1,1,1,2-Tetrachloroethane	ppb	--	--	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.17	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane	ppb	--	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.11	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	1,1,2,2-Tetrachloroethane
Tetrachloroethylene	ppb	5	zero	**1.2**	**1.2**	**1.5**	**0.97**	**0.45**	**0.47**	**0.73**	**0.64**	<0.28	<0.19	<0.28	<0.28	**2.0**	**1.7**	**2.2**	**1.8**	**0.62**	**0.53**	**0.75**	**0.61**	<0.28	<0.28	**0.41**	**0.35**	**0.48**	**0.37**	<0.28	<0.28	<0.28	**1.5**	**1.9**	**2.1**	**3.4**	<0.28	<0.28	<0.28	<0.28	**0.34**	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	**Tetrachloroethylene**
Toluene	ppb	1000	1000	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.21	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	Toluene
1,2,4-Trichlorobenzene	ppb	70	70	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.16	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	1,2,4-Trichlorobenzene
1,1,1-Trichloroethane	ppb	200	200	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.18	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	1,1,1-Trichloroethane
1,1,2-Trichloroethane	ppb	5	3	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.15	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	1,1,2-Trichloroethane
Trichloroethylene	ppb	5	zero	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.18	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**0.42**	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**Trichloroethylene**
Trichlorofluoromethane	ppb	--	--	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.20	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**0.56**	<0.30	<0.30	**0.64**	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	**Trichlorofluoromethane**
1,2,3-Trichloropropane	ppb	--	--	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.18	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	1,2,3-Trichloropropane
Trichlortrifluoroethane	ppb	--	--	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.16	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	Trichlortrifluoroethane
1,2,4-Trimethylbenzene	ppb	--	--	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.19	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene	ppb	--	--	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.18	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	1,3,5-Trimethylbenzene
Vinyl Chloride	ppb	0.2	zero	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.17	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	Vinyl Chloride
Xylene, Total	ppb	10000	10000	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.48	<0.68	<0.68	<0.68	**1.1**	**3.0**	**1.6**	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	<0.68	**Xylene, Total**

* Disinfection By-Products - 80 parts per billion (ppb) is the Maximum Contaminant Level (MCL) for the combined concentrations of these four substances

MCLG - Maximum Contaminant Level Goal, a public health goal

NOTE: Numbers preceded by a < symbol indicate the substance was not detected; for example, <0.15 means the substance was not found at the 0.15 ppb detection level

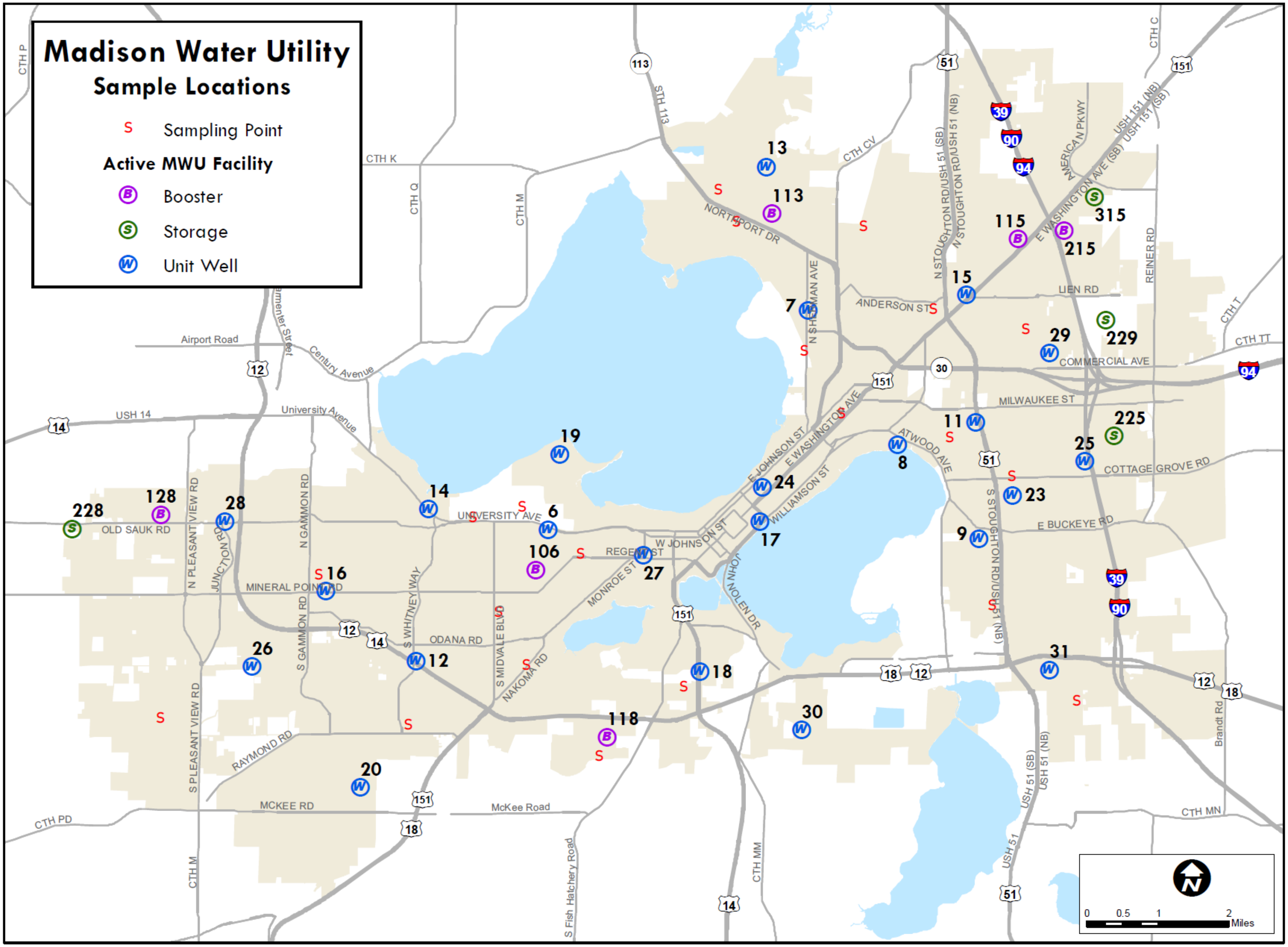


Figure A-1. Water quality monitoring locations – wells, reservoirs, water towers, and distribution sites.

MADISON WATER UTILITY
Annual Water Quality Report

A SUMMARY OF WATER TESTING CONDUCTED IN 2019

PARA ESPAÑOL HAGA CLIC AQUÍ

This annual report complies with federal and state drinking water regulations, which require us to provide water quality information to our customers each year. Unless otherwise noted, results are based on testing conducted in 2019. We are pleased to report that we continue to supply high quality water that meets or exceeds all federal and state standards for health and safety. Test results are summarized on page 3. Visit our website, **madisonwater.org,** to learn about water utility programs and projects.

Quality & Reliability since 1882

WHICH WELL SERVES MY ADDRESS?

The Madison water system consists of 23 wells and over 900 miles of interconnected pipes. Most locations receive water from one to three wells. Our website has an application that can tell you which wells supply water to your home or business. There are links to detailed reports with the latest water quality test results. For more information, call the Water Utility or go to **madisonwater.org/myWells.**

WHAT KEEPS OUR WATER SAFE?

The high quality aquifer supplying our drinking water requires little treatment. Madison Water Utility disinfects the water with chlorine to reduce the risk of microbial contamination. A small amount of chlorine kills bacteria and viruses that can be present in groundwater. Chlorine also travels with the water and is ready to kill microbes that it might encounter in the system. Our goal is to maintain a chlorine residual above 0.1 milligrams per liter (mg/L) at all points in the distribution system. Typical concentrations range from 0.2 to 0.4 mg/L.

HOW ELSE IS THE WATER TREATED?

Fluoride is added to Madison drinking water to improve dental health and reduce tooth decay. The US Centers for Disease Control and Prevention (CDC) and Wisconsin Department of Health Services recommend maintaining an average fluoride level of 0.7 mg/L. Water from each well is tested daily to achieve this target. In 2019, the system-wide average of 6,752 tests was 0.71 mg/L.

Three wells have iron and manganese filters. A fourth is outfitted with a low-profile air stripper to remove volatile organic compounds (VOC) including PCE and TCE. After air stripping, an additive adjusts the pH to limit chemical scales that can clog water pipes.

Do Your Part To Protect Groundwater

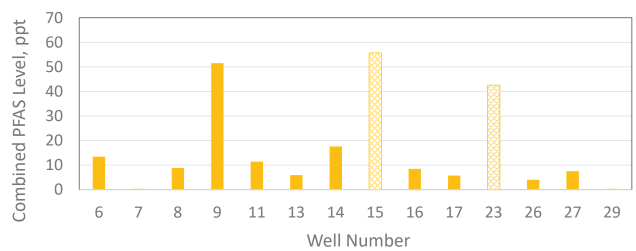
- Use no more than the recommended amount of road salt on sidewalks and driveways, **wisaltwise.com**
- Properly dispose of household hazardous chemicals through Clean Sweep, **danecountycleansweep.com**
- Promote healthy lawns and gardens without the use of harmful chemicals, **clean-water.uwex.edu/pubs**
- Use non-toxic or biodegradable cleaning products

PERFLUORINATED COMPOUNDS / PFAS

In 2019, Madison Water Utility tested all 23 drinking water wells for up to 30 chemicals collectively known as "PFAS" or per- and polyfluoroalkyl substances. This testing is not required by US EPA or the State of Wisconsin.

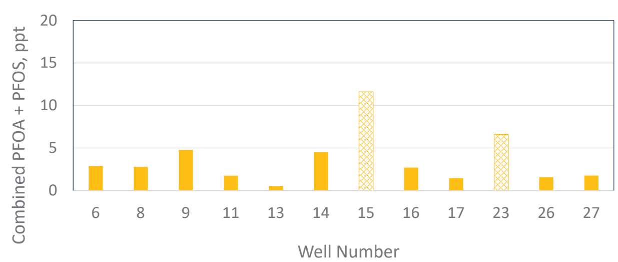
PFAS are a widely-used class of chemicals found in non-stick cookware, food packaging, water-resistant clothing, upholstery, carpeting, and firefighting foams. Thousands of types of PFAS have been manufactured and many are still used. These chemicals are not regulated under the Safe Drinking Water Act.

Testing results show that every well operating in Madison meets every PFAS standard set by any state in the U.S., including New Hampshire and Vermont, which have the toughest standards. At least one PFAS was found in 14 Madison wells (see chart below). NOTE: Well 15 was taken out of service in March 2019. Well 23 has not been used since 2017.



In 2019, the Wisconsin Department of Health Services recommended a health-based, groundwater standard of 20 parts per trillion (ppt) for combined PFOA + PFOS.

Testing shows PFOA or PFOS is present at twelve wells. Levels of PFOA + PFOA range from an estimated concentration of <1 part per trillion to 12 parts per trillion.



Testing of all Madison wells will be repeated in 2020. Find more information about PFAS, including current and most up-to-date test results, on our website at **madisonwater.org/PFAS.**

POTENTIAL CONTAMINANTS IN DRINKING WATER AND THEIR LIKELY SOURCES

Sources of drinking water, both tap water and bottled water, include rivers, lakes, springs, and wells. As water travels over the surface of the land and through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Types of potential contaminants and their likely sources include:

- **Microbial contaminants,** such as viruses and bacteria, may come from leaky sewer pipes, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic contaminants,** including metals, minerals, nutrients, and salts, can occur naturally or they may result from urban stormwater runoff, industrial wastewater discharges, mining, or farming activities.
- **Organic contaminants,** including synthetic and volatile organic compounds, are by-products of industrial processes that can come from chemical spills, gas stations, urban stormwater runoff, and septic systems.
- **Pesticides and herbicides** may come from a variety of sources such as agriculture, urban stormwater runoff, and residential use.
- **Radioactive substances** may occur naturally in rock formations and groundwater.

In order to ensure that tap water is safe, EPA prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. Routine monitoring helps to ensure that drinking water concentrations of any substance remain at safe levels.

THE EPA ON DRINKING WATER CONTAMINANTS

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's (EPA) Safe Drinking Water Hotline, 800-426-4791.

MICROBIOLOGICAL TESTING

Bacteria – To ensure drinking water safety, routine bacteriological tests are conducted. Over 200 distribution samples are collected each month from representative locations. Samples are tested for coliform bacteria, indicators of potential contamination. In 2019, the Water Utility collected 2,909 distribution samples. None tested positive for coliform bacteria. The absence of coliform positive samples reflects good source water quality and adequate disinfection maintained in the distribution system.

Lead and Copper

The landmark Lead Service Replacement program helped our community remove or replace nearly 8,000 lead pipes between 1995 and 2011. Water quality tests conducted in 2017 (see table) show that lead and copper corrosion have been minimized. The next round of testing will take place in 2020.

	Ideal Goal (MCLG)	Action Level (AL)	90th Percentile	Range	Samples Above AL
Lead (ppb)	zero	15	**3.2**	0.2 - 26	1 of 54
Copper (ppb)	1300	1300	**169**	75 - 242	0 of 54

Elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water primarily comes from lead service pipes and household plumbing components. While Madison Water Utility has removed all known lead services, we cannot control the materials found in household plumbing components. Some faucets, fixtures, and pipes in your house could still contain lead. The longer water has been standing in the plumbing system, the more lead it may contain. You can minimize the potential for lead exposure by running water from a faucet for 2 to 3 minutes before using it for drinking or cooking. For more information on lead safety, go to **www.epa.gov/safewater/lead.**

Are you concerned about lead? Test your water. Contact a certified lab to get lead testing information: **Public Health Madison & Dane County,** 608-266-4821; **State Laboratory of Hygiene,** 608-224-6202.

How to Read the Water Quality Data Table

The EPA and Wisconsin Department of Natural Resources (WDNR) establish the safe drinking water regulations that limit the amount of contaminants allowed in drinking water. The table shows the concentrations of detected substances in comparison to the regulatory limits. Substances not detected are not included in the table.

Maximum Contaminant Level (MCL)

The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available technology.

Maximum Contaminant Level Goal (MCLG)

The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Action Level (AL)

The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a public water system shall follow.

Units in the Table

- One milligram per liter (mg/L) equals one part per million (ppm)
- One microgram per liter (µg/L) equals one part per billion (ppb)
- One milligram per liter equals 1,000 micrograms per liter
- One part per billion is equal to 1,000 parts per trillion (ppt)
- One ppb is analogous to one second in 32 years
- Picocurie per liter (pCi/L) is a measure of radioactivity
- nd = non-detect

IMPORTANT NOTE ABOUT THE TABLE: The table reports the maximum and minimum concentrations for each substance found in at least one well. Several substances are found only in a few wells. Contaminant levels reported in the table may not be representative of the water quality at your home. Visit **madisonwater.org** or call 608-266-4654 to get more information about water quality for the well that serves your home or business.

Water Quality Table

Substance Detected (units)	Ideal Goal (MCLG)	Highest Level Allowed (MCL)	Median Level Found	Range of Results	Violation (Yes/No)	Wells with Detections	Typical Source of Substance
Regulated Substances							
Arsenic (ppb)	zero	10	non-detect	nd - 0.6	NO	8, 11, 14, 30	Erosion of natural deposits; Glass & electronics production
Atrazine (ppb) - 2017 data	3	3	non-detect	nd - 0.03	NO	Well 29	Runoff from herbicide used on row crops
Barium (ppb)	2000	2000	19	7.3 - 61	NO	All wells	Erosion of natural deposits; Discharge from metal refineries
Chromium, Total (ppb)	100	100	non-detect	nd - 8.9	NO	6,9,11,12,13,14,16,17,20	Erosion of natural deposits; Discharge from steel and pulp mills
1,2-Dichloroethylene, cis (ppb)	70	70	non-detect	nd - 0.4	NO	Well 11	Discharge from industrial chemical factories; Biodegradation of PCE and TCE
Ethylbenzene (ppb)	700	700	non-detect	nd - 0.5	NO	Well 9	Discharge from petroleum refineries
Fluoride (ppm)	4	4	0.7	0.6 - 0.8	NO	All wells	Erosion of natural deposits; Added to promote strong teeth
Nickel (ppb)	n/a	100	3.6	1.0 - 5.3	NO	All wells	Erosion of natural deposits; Electroplating, stainless steel and alloy products
Nitrate (ppm)	10	10	0.8	nd - 4.8	NO	Fourteen wells	Fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Selenium (ppb)	50	50	non-detect	nd - 3.1	NO	6,9,11,12,13,14,16	Erosion of natural deposits; Petroleum and metal refineries
Tetrachloroethylene [PCE] (ppb)	zero	5	non-detect	nd - 3.4	NO	6,7,9,11,14,18,27	Discharge from factories, dry cleaners, and auto shops
Thallium (ppb)	0.5	2	non-detect	nd - 0.3	NO	11,17,19,27	Ore processing sites; Electronics, glass, and drug factories
Trichloroethylene [TCE] (ppb)	zero	5	non-detect	nd - 0.4	NO	Well 18	Discharge from metal degreasing sites, other factories
Xylene, Total (ppb)	10000	10000	non-detect	nd - 3.0	NO	Well 9	Discharge from petroleum and chemical factories
Radionuclides							
Gross Alpha (pCi/L)	zero	15	5.4	1.1 - 10	NO	Each well sampled: 7,8,19,24,27,28,30,31	Erosion of natural deposits
Radium, 226+228 (pCi/L)	zero	5	3.4	0.9 - 5.9	NO		Erosion of natural deposits
Gross Beta (pCi/L)	zero	50	6.0	2.3 - 9.9	NO		Decay of natural and man-made deposits
Uranium (ppb)	zero	30	0.3	0.3 - 0.4	NO	Only Well 31 sampled	Erosion of natural deposits
Disinfection By-Products (Distribution)							
Haloacetic Acids [HAA5] (ppb)	60	60	1.6	0.2 - 2.6	NO	n/a	By-product of drinking water chlorination
Haloacetic Acids [HAA9] (ppb)	n/a	n/a	non-detect	nd - 3.8	NO	n/a	By-product of drinking water chlorination
Total Trihalomethanes [TTHM] (ppb)	zero	80	4.9	1.6 - 13.4	NO	n/a	By-product of drinking water chlorination
Unregulated Substances							
Bromide (ppb)	n/a	n/a	39	nd - 60	NO	7,9,11,13,15,29	Erosion of natural deposits
Chloromethane (ppb)	n/a	n/a	non-detect	nd - 0.7	NO	Well 18	Discharge from chemical factories, Refrigerant; Organic combustion
Chromium, Hexavalent (ppb) - 2018 data	n/a	n/a	0.5	nd - 2.0	NO	Thirteen wells	Erosion of natural deposits; Chrome plating, leather tanning, wood preservation
1,4-Dioxane (ppb) - 2018/2019 data	n/a	n/a	0.1	nd - 0.4	NO	9,11,14,15,18	Discharge from chemical factories; Cosmetics and detergents
Metolachlor (ppb) - 2017 data	n/a	n/a	non-detect	nd - 0.01	NO	Well 14	Runoff from herbicide used on row crops
PFOA & PFOS (ppt)	n/a	n/a	<1	nd - 12	NO	Twelve wells	Firefighting foam; Landfills, food packaging, clothing, fabrics, upholstery
Strontium (ppb)	n/a	n/a	77	48 - 100	NO	All wells	Erosion of natural deposits
Trichlorofluoromethane (ppb)	n/a	n/a	non-detect	nd - 0.6	NO	Well 11	Discharge from industrial chemical factories; Degreaser, propellant, refrigerant
Other Substances	**Aesthetic Goal**						
Chloride (ppm)	250		21	nd - 170	NO	Twenty wells	Erosion of natural deposits; Road salt application
Iron (ppm)	0.3		0.02	<0.01 - 0.54	NO	All wells	Erosion of natural deposits
Manganese (ppb)	50		3.1	nd - 49	NO	All except Well 14	Erosion of natural deposits
Sodium (ppm)	n/a		7.3	2.1 - 52	NO	All wells	Erosion of natural deposits; Road salt application
Sulfate (ppm)	250		21	5.7 - 43	NO	All wells	Erosion of natural deposits

Your Water Source

Madison's drinking water comes from a deep sandstone aquifer that sits hundreds of feet below the city. The water originates as rain or snow that slowly soaks into the ground and is filtered through layers of soil and rock. This natural filtration process produces excellent water for us to enjoy.

Unregulated Substances

Once every five years, US EPA prepares a list of unregulated contaminants for required testing by large utilities. In 2018 and 2019, twenty-two Madison wells were tested for 20 of these chemicals. Results for manganese, bromide, and the haloacetic acid group are reported in the Water Quality Table. In 2018, two other chemicals were found in one well—2-methoxyethanol (Well 26: 0.5 ppb) and 1-butanol (Well 28: 8.0 ppb). Later testing did not find either chemical at any well. Madison regularly tests for other unregulated substances including 1,4-dioxane, hexavalent chromium, PFAS (see page one), and strontium. Results of these tests are included in the Water Quality Table.

Do I need to take special precautions?

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as those with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Environmental Protection Agency's Safe Drinking Water Hotline at 800-426-4791.

Cryptosporidium and *Giardia,* two organisms commonly linked to water-borne illness, are found primarily in surface waters such as lakes and rivers. Because Madison's drinking water comes from a deep groundwater aquifer, these organisms do not pose a significant health risk in Madison tap water.

Get a $100 Bill Credit

There is still funding left for Madison Water Utility's Toilet Rebate Program. Replace your old toilet with a high-efficiency EPA WaterSense model & get a $100 bill credit! Businesses, non-profits, single-family homes, condos & apartments are all eligible.

HOW TO SIGN UP

Visit **madisonwater.org** and click the "Sustainability" tab. You will need to fill out a Toilet Rebate Application and mail it in with the original purchase receipt. Buy a new, high-efficiency WaterSense toilet and start saving water and money today.

Information You Can Use

Madison Water Utility
119 E. Olin Avenue
Madison, WI 53713
608-266-4651

Water Utility General Manager: Tom Heikkinen
Water Utility Board President: Eugene McLinn

Water Quality Dept. or questions about this report . . . 608-266-4654

Certified Drinking Water Laboratories in Madison, WI:
Public Health Madison & Dane County 608-266-4821
Wisconsin State Laboratory of Hygiene. 608-224-6202

GET THE LATEST MADISON WATER NEWS ONLINE

- Visit our website: **madisonwater.org**
- Find us on Facebook: **facebook.com/madisonwater**
- Follow us on Twitter: **twitter.com/MadWaterUtility** and Instagram: **instagram.com/madison_water**
- Get updates on drinking water quality or water main flushing: sign-up at **my.cityofmadison.com**

LANGUAGE SERVICES

- Usted tiene derecho a recibir servicio gratuito de intérprete. Por favor llame al teléfono 608-266-4651 para mayor información.
- Koj muaj tvoj cai tau kev pab txhais lus pub dawb. Thov hu rau 608-266-4651.
- You have the right to free language services. Please call 608-266-4651 for more information.

GET INVOLVED

- Visit our **Project** web page to learn about Madison Water Utility public works projects and provide input.
- Water Utility Board: Monthly meetings held at 119 E. Olin Avenue, starting at 4:30 p.m.

2020 dates:*

June 23	September 22
July 28	October 27
August 25	November 24

*Meeting dates are subject to change; check the calendar at **madison.legistar.com/Calendar.aspx**

On the web at MadisonWater.org

» **Online Conservation Tool** – Track your weekly, daily, even hourly water use online.

» **Toilet Rebate Program** – Find out how to get a $100 bill credit for installing a water-efficient toilet!

» **Inside MWU** – News about your water and the people who keep it flowing.

MADISON WATER UTILITY

Informe Anual Sobre La Calidad Del Agua

RESUMEN DE LOS ANÁLISIS DEL AGUA HECHOS EN 2019

Este informe anual cumple con las normas federales y estatales relativas al agua potable, que nos exigen brindar información sobre la calidad del agua a nuestros clientes cada año. A menos que se especifique lo contrario, los resultados se basan en pruebas realizadas en 2019. Nos complace anunciar que continuamos ofreciendo agua de alta calidad que cumple y supera todos los estándares federales y estatales de salud y seguridad. En la página 3 se resumen los resultados de las pruebas. Para obtener más información sobre los programas y proyectos relativos al servicio público del agua, visite nuestro sitio web, **madisonwater.org.**

Calidad y seguridad desde 1882

¿DE DÓNDE PROVIENE EL AGUA DE MI DIRECCIÓN?

El sistema de agua de Madison se compone de 23 pozos y 900 millas de tuberías interconectadas. La mayoría de los lugares reciben agua de uno a tres pozos. Para saber qué pozos le brindan agua a su hogar o negocio, consulte la aplicación de nuestro sitio web. Hay vínculos a informes detallados con los últimos resultados de prueba de calidad del agua. Para obtener más información, llame a Servicio de agua o vaya a **madisonwater.org/myWells** (sitio en inglés).

¿QUÉ MANTIENE SEGURA NUESTRA AGUA?

El acuífero que suministra nuestra agua potable es de una calidad tan alta que el agua necesita poco tratamiento. La Empresa de Servicio de Agua de Madison desinfecta el agua potable con cloro para reducir el riesgo de contaminación microbiana en nuestro sistema de agua. Una pequeña cantidad de cloro mata las bacterias y los virus que pueden estar presentes en el agua subterránea. Una ventaja del cloro es que produce un cloro residual libre que viaja con el agua y mata toda bacteria o virus que pudiera encontrarse en el sistema. Nuestro objetivo es mantener un mínimo de cloro residual libre de 0.1 miligramos por litro (mg/l) en todo el sistema de distribución. Las concentraciones típicas están en el rango de 0.2 a 0.4 mg/L.

¿QUÉ TRATAMIENTO ADICIONAL RECIBE EL AGUA?

Se agrega flúor al agua potable de Madison para mejorar la salud dental y reducir las caries. El agua de todos los pozos en operación en el sistema se evalúa diariamente para alcanzar un nivel objetivo de 0.7 mg/l de flúor. En 2019, la concentración promedio de cerca de 6,752 mediciones fue de 0.71 mg/l.

Tres de los pozos tienen filtros de hierro y manganeso. Un cuarto pozo está provisto de un separador de aire de bajo perfil para retirar los componentes orgánicos volátiles (VOC), como percloroetileno (PCE) y tricloroetileno (TCE). Después de separar el aire, un aditivo ajusta el pH para limitar el sarro químico que pueda obstruir las tuberías de agua.

Nuestra página web en español

madisonwater.org/espanol

- **Noticias** - Artículos sobre el agua y las personas que lo mantienen.
- **Tarifas y facturación** - Información sobre su factura mensual de servicios municipales de Madison.
- **Preguntas frecuentes** - Respuestas a las preguntas frecuentes sobre la calidad del agua.

COMPUESTOS PERFLUORADOS / PFAS

En 2019, Madison Water Utility analizó los 23 pozos de agua potable para detectar hasta 30 productos químicos conocidos colectivamente como “sustancias perfluoroalquiladas y polifluoroalquiladas” (per- and polyfluoroalkyl substances, PFAS). Ni la Agencia de Protección Ambiental de Estados Unidos (United States Environmental Protection Agency, US EPA) ni el Estado de Wisconsin exigen estos análisis.

Las PFAS son una clase de sustancias químicas muy utilizada que está en utensilios de cocina antiadherentes, envases de comida, ropa impermeable, tapicería, alfombras y espuma contra incendios. Se han fabricado miles de tipos de PFAS, y muchos de ellos se siguen usando. Estas sustancias químicas no están reguladas según la Ley de Agua Potable Segura (Safe Drinking Water Act).

Los resultados de los análisis indican que los pozos que operan en Madison cumplen todos los estándares sobre las PFAS establecidos por todos los estados de los Estado Unidos, incluyendo New Hampshire y Vermont, que tienen los estándares más estrictos. Se encontró al menos una PFAS en 14 pozos de Madison (vea el cuadro de abajo). NOTA: El pozo 15 dejó de estar en servicio en marzo de 2019. El pozo 23 no se ha usado desde 2017.

En 2019, el Departamento de Servicios de Salud de Wisconsin (Wisconsin Department of Health Services) recomendó un estándar saludable para aguas subterráneas de 20 partes por billón (ppb) para ácido perfluorooctanoico (PFOA, perfluorooctanoic acid) y sulfonato de perfluorooctano (perfluorooctane sulfonate, PFOS) combinados.

Los análisis indican que hay PFOA o PFOS en 12 pozos. Los niveles de PFOA + PFOS van desde una concentración aproximada de <1 parte por billón a 12 partes por billón.

Los análisis de todos los pozos de Madison se repetirán en 2020. Para obtener más información sobre las PFAS, incluyendo los resultados de los análisis más recientes y actualizados, visite nuestro sitio web en **madisonwater.org/PFAS.**

CONTAMINANTES POTENCIALES EN EL AGUA POTABLE Y SUS FUENTES PROBABLES

Entre las fuentes de agua potable (tanto el agua de la llave como la embotellada) se encuentran ríos, lagos, manantiales y pozos. A medida que el agua viaja sobre la superficie de la tierra y a través del suelo, es posible que disuelva los minerales naturales, incluido el material radioactivo; y puede arrastrar sustancias que se originan por la presencia de animales o por la actividad humana. Los tipos de contaminantes posibles y sus fuentes probables incluyen los siguientes:

- **Los contaminantes microbianos,** como los virus y las bacterias, pueden provenir de tuberías de alcantarillas perforadas, sistemas sépticos, operaciones ganaderas o vida silvestre.
- **Los contaminantes inorgánicos,** (metales, minerales, nutrientes y sales) pueden estar presentes naturalmente o pueden ser el resultado del escurrimiento urbano del agua de las lluvias, agua de residuos industriales y actividades agrícolas
- **Los contaminantes orgánicos,** incluidos los compuestos orgánicos volátiles hechos por el hombre, son subproductos de procesos industriales que posiblemente se originan por derrames de sustancias químicas, estaciones de combustible, escurrimiento del agua de lluvia urbana y sistemas de tanques sépticos.
- **Los pesticidas y herbicidas** provienen principalmente de las actividades agrícolas, pero también pueden provenir de escurrimientos urbanos del agua de las lluvias y del uso residencial.
- **Las sustancias radioactivas** pueden estar presentes naturalmente en las formaciones rocosas y el agua subterránea.

La EPA (Agencia de Protección Ambiental, EPA) establece las regulaciones para el agua potable segura que limita la cantidad de contaminantes permitidos en el agua potable. Monitorización de rutina asegura que concentraciones de sustancias se quedan a niveles seguros en el agua potable.

LA EPA HABLA SOBRE LOS CONTAMINANTES DEL AGUA POTABLE

Se espera razonablemente que toda el agua potable, incluida el agua embotellada, pueda contener, al menos, pequeñas cantidades de algunos contaminantes. La presencia de contaminantes no necesariamente indica que el agua posee más riesgo para la salud. Para obtener más información sobre los contaminantes y los efectos potenciales en la salud puede llamar a la Línea Directa de Agua Potable Segura de la Environmental Protection Agency (Agencia de Protección Ambiental, EPA) al 800-426-4791.

PRUEBA MICROBIOLÓGICA

Las bacterias – Para garantizar agua potable segura, realizamos pruebas bacteriológicas de rutina. Se detectaron más de 200 muestras de los lugares representativos y se realizan pruebas de detección de bacterias coliformes, que son los indicadores de contaminación potencial. En 2019, la empresa recogió 2,909 muestras de distribución. Ninguno dio un resultado positivo de bacterias coliformes en las pruebas. La ausencia de muestras con resultado positivo de coliformes refleja la buena calidad de la fuente de agua y la adecuada desinfección en el sistema de distribución.

Plomo y cobre

Nuestro emblemático programa de reemplazo de cañerías de plomo de la red ayudó a nuestra comunidad a retirar o reemplazar casi 8 000 cañerías de agua de plomo de la red entre 1995 y 2011. Las pruebas de calidad del agua realizadas en 2017 (vea la tabla) muestran que el plomo y la corrosión por cobre se han minimizado. La próxima serie de pruebas se hará en 2020.

	Objetivo ideal (MCLG)	Nivel de acción (AL)	Percentil 90º	Rango	Muestras por encima de AL
Plomo (ppb)	cero	15	3.2	0.2 - 26	1 de 54
Cobre (ppb)	1300	1300	169	75 - 242	0 de 54

Los niveles elevados de plomo pueden provocar problemas graves de salud, en particular en mujeres embarazadas y niños pequeños. La presencia de plomo en el agua para consumo tiene como origen principal las tuberías de servicio y los componentes de plomería en el hogar que tengan plomo. Si bien Madison Water Utility ha quitado todas las tuberías de plomo conocidas, no es posible que controlemos todos los materiales que se encuentran en los componentes de plomería en los hogares. Algunos grifos, artefactos y tuberías de su vivienda pueden contener plomo. Mientras más tiempo haya transcurrido el agua en el sistema de plomería, más contenido de plomo puede acumular. Puede reducir las posibilidades de exposición al plomo si deja correr el agua del grifo durante 2 o 3 minutos antes de usarla para beber o cocinar. Para mayor información sobre la seguridad con respecto al plomo, visite **www.epa.gov/safewater/lead** (sitio en inglés).

¿Todavía tiene dudas? Pruebe su agua. Póngase en contacto con un laboratorio certificado para obtener información sobre las pruebas de detección de plomo: **Salud Pública, Condado de Madison y Dane,** 608-266-4821; **Laboratorio Estatal de Wisconsin,** 608-224-6202.

Cómo entender la tabla de datos de calidad del agua

La EPA y el Wisconsin Department of Natural Resources (Departamento de Recursos Naturales de Wisconsin, WDNR) establecen las regulaciones para el agua potable segura que limita la cantidad de contaminantes permitidos en el agua potable. La tabla muestra las concentraciones de las sustancias detectadas comparadas con los límites regulatorios. Las sustancias que no están detectadas en el agua potable de Madison no se incluyen en las tablas.

Nivel máximo de contaminante (MCL) - Es el nivel más alto de un contaminante que se permite en el agua potable. Los MCL se establecen lo más cercano posible a los MCLG mediante la mejor tecnología disponible.

Nivel objetivo máximo de contaminante (MCLG) - Es el nivel de un contaminante en el agua potable por debajo del cual no se conocen o no se esperan riesgos para la salud. Los MCLG permiten un margen de seguridad.

Nivel de acción (AL) - La concentración de un contaminante que, en caso de superar los límites previstos, acciona el tratamiento o los demás requisitos que debe seguir el sistema de agua pública.

Units in the Table

- Un miligramo por litro (mg/l) es igual a una parte por millón (ppm)
- Un microgramo por litro (µg/l) es igual a una parte por mil millones (ppb)
- Un miligramo por litro es igual a 1,000 microgramos por litro
- Una parte por mil millones equivale a 1,000 partes por billón (ppt)
- Un ppb es análogo a un segundo en 32 años
- Un picocurio por litro (pCi/L) es una unidad de radiactividad
- nd = niveles no detectables

NOTA IMPORTANTE ACERCA DE LA TABLA: En la tabla se informan las concentraciones máximas y mínimas para cada sustancia que se encuentra en al menos un pozo. Varias sustancias químicas solamente se encontraron en pocos pozos. Los niveles de contaminantes que se informan en la tabla podrían no representar la calidad del agua de su hogar. Visite nuestro sitio web **madisonwater.org** o comuníquese con Water Utility al 608-266-4654 para obtener más información sobre la calidad del agua del pozo que llega a su hogar o empresa.

Tabla de Calidad del Agua

Sustancia Detectada (Unidades)	Objetivo Ideal (MCLG)	Cantidad Máxima Permitida (MCL)	Nivel Mediano Hallado	Rango de Resultados	Violación (Sí/No)	Pozos con Detecciones	Origen Típico de la Sustancia
Sustancia Regulatos							
Arsénico (ppb)	cero	10	no detectado	nd - 0.6	NO	8, 11, 14, 30	Erosión de los depósitos naturales; Productos electrónicos y de vidrio
Atrazina (ppb) - 2017 datos	3	3	no detectado	nd - 0.03	NO	Pozo 29	Aquas contaminadas por la aplicación de herbicidas cultivos
Bario (ppb)	2000	2000	19	7.3 - 61	NO	Todos los pozos	Erosión de los depósitos naturales; Descarga de refinerías de metales
Total de cromo (ppb)	100	100	no detectado	nd - 8.9	NO	6,9,11,12,13,14,16,17,20	Erosión de los depósitos naturales; Descarga de fábricas productoras de acero y pulpa
1,2-Dicloroetileno, cis (ppb)	70	70	no detectado	nd - 0.4	NO	Pozo 11	Descarga de fábricas de químicos industriales; Biodegradación de PCE, TCE
Etilbenceno (ppb)	700	700	no detectado	nd - 0.5	NO	Pozo 9	Descarga de refinerias de petroleo
Fluororo (ppm)	4	4	0.7	0.6 - 0.8	NO	Todos los pozos	Erosión de los depósitos naturales; Aditivo que se añade al agua para fortalecer los dientes
Niquel (ppb)	n/a	100	3.6	1.0 - 5.3	NO	Todos los pozos	Se produce naturalmente en el suelo y el agua; Se utiliza en el electrolaminado del acero inoxidable y los productos de aleación
Nitrato (ppm)	10	10	0.8	nd - 4.8	NO	Catorce pozos	Descargas del uso de fertilizantes, filtración de tanques sépticos o desagües; Erosión de los depósitos naturales
Selenio (ppb)	50	50	no detectado	nd - 3.1	NO	6,9,11,12,13,14,16	Erosión de los depósitos naturales; Refinerías de petróleo y metales
Tetracloroetileno [PCE] (ppb)	cero	5	no detectado	nd - 3.4	NO	6,7,9,11,14,18,27	Descarga de fábricas, tintorerías, y talleres de limpieza de automóviles
Talio (ppb)	0.5	2	no detectado	nd - 0.3	NO	11, 17, 19, 27	Fábricas de procesamiento de minerales, electrónica, vidrio, medicamentos
Tricloroetileno [TCE] (ppb)	cero	5	no detectado	nd - 0.4	NO	Pozo 18	Descarga de sitios de desengrase de metales y otras fábricas
Total de xilenos (ppb)	10000	10000	no detectado	nd - 3.0	NO	Pozo 9	Descarga de refinerias de petroleo y fábricas de químicos
Radionúclidos							
Alfa bruta (pCi/L)	cero	15	5.4	1.1 - 10	NO	Pozos muestreados: 7,8,19,24,27,28,30,31	Erosión de los depósitos naturales
Radio, 226+228 (pCi/L)	cero	5	3.4	0.9 - 5.9	NO		Erosión de los depósitos naturales
Beta bruta (pCi/L)	cero	50	6.0	2.3 - 9.9	NO		Deterioro de depósitos naturales y hecho por el hombre
Uranio (ppb)	cero	30	0.3	0.3 - 0.4	NO	Pozo 31	Erosión de los depósitos naturales
Subproductos de desinfección (Distribution)							
Acidos haloacéticos [HAA5] (ppb)	60	60	1.6	0.2 - 2.6	NO	n/a	Producto derivado del agregado de cloro al agua
Acidos haloacéticos [HAA9] (ppb)	n/a	n/a	no detectado	nd - 3.8	NO	n/a	Producto derivado del agregado de cloro al agua
Total trihalometanos [TTHM] (ppb)	cero	80	4.9	1.6 - 13.4	NO	n/a	Producto derivado del agregado de cloro al agua
Sustancia no Regulatos							
Bromuro (ppb)	n/a	n/a	39	nd - 60	NO	7,9,11,13,15,29	Erosión de los depósitos naturales
Clorometano (ppb)	n/a	n/a	no detectado	nd - 0.7	NO	Pozo 18	Descarga de fábricas de químicos; Refrigerantes; Combustión orgánica
Cromo, Hexavalente (ppb) - 2018 datos	n/a	n/a	0.5	nd - 2.0	NO	Trece pozos	Erosión de los depósitos naturales; Laminado en cromo, curtido del cuero, preservación de la madera
1,4-Dioxano (ppb) - 2018/2019 datos	n/a	n/a	0.1	nd - 0.4	NO	9,11,14,15,18	Descarga de fábricas de químicos; Cosméticos y detergentes
Metolacloro (ppb) - 2017 datos	n/a	n/a	no detectado	nd - 0.01	NO	Pozo 14	Aquas contaminadas por la aplicación de herbicidas cultivos
PFOA & PFOS (ppt)	n/a	n/a	< 1	nd - 12	NO	Doce pozos	Espuma contra incendios; Vertederos, envasado de alimentos, telas, tapicería
Estroncio (ppb)	n/a	n/a	77	48 - 100	NO	Todos los pozos	Erosión de los depósitos naturales
Triclorofluorometano (ppb)	n/a	n/a	no detectado	nd - 0.6	NO	Pozo 11	Descarga de fábricas de químicos industriales; Desengrasantes, propelentes, refrigerantes
Otra Sustancias	**Objetivo Estético**						
Cloruro (ppm)	250		21	nd - 170	NO	Veinte pozos	Erosión de los depósitos naturales; Aplicación de sal en las calles
Hierro (ppm)	0.3		0.02	< 0.01 - 0.54	NO	Todos los pozos	Erosión de los depósitos naturales
Manganeso (ppb)	50		3.1	nd - 49	NO	Todos salvo pozo 31	Erosión de los depósitos naturales
Sodio (ppm)	n/a		7.3	2.1 - 52	NO	Todos los pozos	Erosión de los depósitos naturales; Aplicación de sal en las calles
Sulfato (ppm)	250		21	5.7 - 43	NO	Todos los pozos	Erosión de los depósitos naturales

Su Fuente de Agua

El agua potable de Madison proviene de un profundo acuífero de una formación arenisca que yace a cientos de pies por debajo de la ciudad. El agua se origina en forma de lluvia o nieve, que lentamente penetra la tierra y se filtra a través de las capas de suelo y rocas. Este proceso de filtración natural produce un agua de excelente calidad que nosotros podemos disfrutar.

Sustancias no reguladas

Una vez cada cinco años, la EPA de los EE. UU. arma una lista de contaminantes no regulados para que las empresas de servicios públicos más importantes hagan los análisis de detección necesarios. En 2018 y 2019, se analizaron 22 pozos en Madison en busca de 20 de estas sustancias químicas. En la Tabla de calidad del agua, se informan resultados positivos para manganeso, bromuro, y grupo de ácidos haloacéticos. En 2018, también se hallaron otras dos sustancias químicas: 2-metoxietanol (Pozo 26: 0.5 ppb) y 1-butanol (Pozo 28: 8.0 ppb). Posteriormente, no se halló ninguna de las dos sustancias en los pozos. Madison hace análisis periódicos para detectar otras sustancias no reguladas, como 1,4-dioxano, cromo hexavalente, PFAS (ver página 1) y estroncio. Los resultados de estos análisis se incluyen en la Tabla de calidad del agua.

¿Necesito tomar precauciones especiales?

Algunas personas pueden ser más vulnerables a los contaminantes del agua potable que la población general. Las personas con el sistema inmunológico comprometido, como las personas con cáncer que están siendo tratadas con quimioterapia, aquellas que han tenido transplantes de órganos, aquellas con VIH/SIDA u otras enfermedades del sistema inmunológico, algunas personas mayores o bebés pueden estar particularmente en riesgo de infecciones. Estas personas deben buscar asesoramiento sobre el agua potable por parte de sus proveedores de atención médica. Los lineamientos de la EPA/Centro para el Control de Enfermedades (Center for Disease Control, CDC) de los medios apropiados para disminuir los riesgos de infección por *Cryptosporidium* y otros contaminantes microbianos están disponibles en la Línea Directa de Agua Potable Segura al 800-426-4791.

El Cryptosporidium y la *Giardia,* dos organismos vinculados generalmente con enfermedades de transmisión por el agua, se encuentran principalmente en las aguas superficiales. Debido a que el agua potable de Madison proviene de un acuífero profundo, estos organismos no representan un riesgo importante para la salud.

Obtenga hasta $100 por reemplazar su inodoro

Madison Water Utility aún dispone de los fondos de su Toilet Rebate Program (Programa de Reembolso en Inodoros) de 2019. Reemplace su antiguo inodoro por un modelo WaterSense de alta eficacia de la EPA y obtenga un crédito de $100 en sus facturas. Esta oportunidad está disponible para empresas, organizaciones sin fines de lucro, viviendas unifamiliares, condominios y apartamentos.

CÓMO INSCRIBIRSE

Visite **madisonwater.org** y haga clic en la pestaña "Sustainability" (Sustentabilidad). Deberá llenar una solicitud de reembolso en inodoros y enviarla junto con el recibo de compra original. Compre un nuevo inodoro WaterSense de alta eficacia y empiece a ahorrar agua y dinero hoy mismo.

Information You Can Use

Madison Water Utility
119 E. Olin Avenue
Madison, WI 53713
608-266-4651

Gerente general de la Empresa de Servicio de Agua: Tom Heikkinen
Consejo de la Empresa de Servicio de Agua: Eugene McLinn

Calidad del agua y este informe. 608-266-4651

Laboratorios certificados para evaluación de agua potable:
Salud Pública, Condado de Madison y Dane . . 608-266-4821
Laboratorio Estatal de Wisconsin 608-224-6202

SERVICIOS DE IDIOMA

- Usted tiene derecho a recibir servicio gratuito de intérprete. Por favor llame al teléfono 608-266-4651 para mayor información.
- Koj muaj tvoj cai tau kev pab txhais lus pub dawb. Thov hu rau 608-266-4651.
- You have the right to free language services. Please call 608-266-4651 for more information.

REUNIONES DEL CONCEJO DE LA EMPRESA DE SERVICIO DE AGUA

- Se realizan mensualmente en 119 E. Olin Avenue, a las 4:30 p.m.

Fechas 2020:

23 de junio	22 de septiembre
28 de julio	27 de octubre
25 de agosto	24 de noviembre

Colabore para proteger el agua subterránea

» Utilice no más que la cantidad recomendada de sal para carreteras en aceras y entradas para automóviles, **wisaltwise.com**

» Deseche los químicos peligrosos domésticos a través de Clean Sweep, **danecountycleansweep.com**

» Mantenga patios y jardines saludables sin el uso de químicos perjudiciales, **clean-water.uwex.edu/pubs**

» Use productos de limpieza no tóxicos o biodegradables

MADISON WATER UTILITY
WATER QUALITY WATCH LIST

Organics - Regulated

Contaminant	Maximum*	Units	MCLG	PAL	MCL	Detects Below PAL%	Watch List	Action Plan	Reference
Atrazine	0.04	µg/L	3	0.3	3	#14, #29	none		NR 809.20
1,2-Dichloroethane	0.1	µg/L	zero	0.5	5	#17	none		NR 809.24
1,2-Dichloroethylene (cis)	0.6	µg/L	70	7	70	#8, #9, #11, #27	none		NR 809.24
Ethylbenzene	0.7	µg/L	700	140	700	#9	none		NR 809.24
Tetrachloroethylene [PCE]	3.4	µg/L	zero	0.5	5	#27	#6, #7, #9, #11, #14, #18	Quarterly Monitoring	NR 809.24
Toluene	0.2	µg/L	1000	160	1000	#9, #31	none		NR 809.24
1,1,1-Trichloroethane	0.1	µg/L	200	40	200	#9, #18	none		NR 809.24
Trichloroethylene [TCE]	0.4	µg/L	zero	0.5	5	#11, #14, #18	none		NR 809.24
Xylene, Total	4.5	µg/L	10000	400	10000	#9, #31	none		NR 809.24

* Maximum detection observed at any Madison well from 2016 through 2020   % Detected in at least one sample collected from 2016 through 2020

Organics - Unregulated

Contaminant	Maximum*	Units	HAL	PAL	ES	Detects Below PAL%	Watch List	Action Plan	Reference
Chloromethane	0.72	µg/L	n/a	3	30	#18	none		NR 140.10
1,4-Dioxane	0.43	µg/L	0.35~	0.3	3	#9, #14, #15, #17, #18	#11	Semi-Annual Monitoring	NR 140.10
Metolachlor	0.01	µg/L	n/a	10	100	#14	none		NR 140.10
PFAS: PFOA, PFOS, PFHxS, PFHxA, PFBS, PFBA, PFHpA, PFHpS, PFPeA, PFPeS	0.06	µg/L	0.07^	0.002^#	0.02^#	#6, #7, #8, #9, #11, #13, #14, #16, #17, #23, #26, #27, #29	#6, #8, #9, #14, #15, #16, #23	Annual Monitoring; Feasibility Study - #15	US EPA
Trichlorofluoromethane	1.1	µg/L	n/a	698	3490	#11	none		NR 140.10

* Maximum detection observed at any Madison well from 2016 through 2020   % Detected in at least one sample collected from 2016 through 2020   ~ 10^{-6} Cancer Risk Level   ^ PFOA + PFOS   # Proposed

Radionuclides (2018 - 2020)

Contaminant	Maximum	Units	MCLG	Watch	MCL	Wells with Detects	Watch List	Action Plan	Reference
Gross alpha	12	pCi/L	zero	5	15	All Except Well #14	#7, #8, #19, #24 #27, #28, #30, #31	Annual or Quarterly Monitoring	NR 809.50
Gross beta	13	pCi/L	zero	10	50	All Except Well #14	#19, #28		NR 809.50
Combined Radium	5.9	pCi/L	zero	2.5	5	All Wells	#7, #8, #19, #24 #27, #28, #30	Annual or Quarterly Monitoring	NR 809.50

ES - Enforcement Standard (NR 140 - Groundwater Quality)   **HAL -** Health Advisory Level   **MCL -** Maximum Contaminant Level Legal Limit   **MCLG -** MCL Goal (Public Health Goal)   **PAL -** Preventive Action Limit (NR 140 - Groundwater Quality)

MADISON WATER UTILITY
WATER QUALITY WATCH LIST

Inorganics - Regulated

Substance	Maximum*	Units	MCLG	PAL	MCL	Detects Below PAL	Watch List	Action Plan	Reference
Arsenic	0.6	µg/l	zero	1	10	#8, #11, #14, #30	none		NR 809.11
Barium	61	µg/l	2000	400	2000	All Wells	none		NR 809.11
Chromium, Total	14	µg/l	100	10	100	All Wells	none		NR 809.11
Nickel	5.3	µg/l	100	20	100	All Wells	none		NR 809.11
Nitrogen-Nitrate	4.8	mg/l	10	2	10	#12, #18, #20, #25, #27, #29	#6, #9, #11, #13, #14, #16, #23, #26	Annual Monitoring	NR 809.11
Selenium	3.1	µg/l	50	10	50	#6, #9, #11, #12, #13, #14, #16	none		NR 809.11
Thallium	0.3	µg/l	0.5	0.4	2	#11, #17, #19, #27	none		NR 809.11

* Based on 2019 annual test data

Inorganics - Unregulated

Substance	Maximum*	Units	MCLG	Watch	SMCL	Wells with Detects	Watch List	Action Plan	Reference
Aluminum	6.5	µg/l	n/a	50	200	#6, #14, #20, #25, #26	none		NR 809.70
Chloride	170	mg/l	n/a	125	250	#6, #8, #9, #11, #13, #16, #17, #18, #26, #27	#14	GW Investigation; Mitigation (20XX)	NR 809.70
Iron	0.54	mg/l	n/a	0.15	0.3	All Wells	#8, #19, #24, #28 #30	Install Filtration: Well #8 (2028) Well #19 (2023) Well #24 (20XX) Well #28 (20XX) Well #30 (20XX)	NR 809.70
Manganese	49	µg/l	n/a	25	50	All Except Wells #6, #12, #14, #16, #20, #31	#8, #17, #19, #24, #27, #28		NR 809.70
Sodium	52	mg/l	n/a	20	n/a	All Wells	#6, #9, #11, #13, #14, #16	Annual Monitoring	EPA DWEL
Sulfate	43	mg/l	n/a	125	250	All Wells	none		NR 809.70
Zinc	21	µg/l	n/a	2500	5000	All Wells	none		NR 809.70

* Based on 2019 annual test data

DWEL - Drinking Water Equivalency Level **MCL -** Maximum Contaminant Level (Legal Limit) **MCLG -** MCL Goal Public Health Goal **PAL -** Preventive Action Limit (NR 140 - Groundwater Quality) **SMCL -** Secondary MCL (Aesthetic Guideline)

Water Quality Technical Advisory Committee - DRAFT

Meeting Notes
Olin Avenue Conference Room
January 13, 2020 – 5:00 p.m.

Attending: Henry Anderson, Joseph Grande, Greg Harrington, Jocelyn Hemming, Gary Krinke, Al Larson, Amy Deming, Isabel Marrah, Jeff Lafferty (PHMDC), Marsha Rummel, Adam DeWeese (DNR), Sarah Yang (DHS), Bruce Rheineck (DNR)

Absent: Tom Heikkinen, Amy Barrilleaux, Janet Battista, Sharon Long

Guests: Fourteen members of the public

1. Agenda Repair/Announcements/Administration

- Next meeting is Monday, April 13th @ 5 p.m.

2. Review of Meeting Notes

- No changes recommended to the October 14, 2019 meeting notes; adopted as final.

3. PFAS Discussion with DHS & DNR Staff

- Joe Grande provided a brief history of PFAS testing in Madison and displayed results for PFAS detected in municipal wells. (See power point)
    - PFAS detection limits continue to decrease and the range of PFAS that can tested has expanded over the last 5 years. These developments are responsible for the first low detections of PFAS in Madison Wells in 2017.
- Sarah Yang (WI Dept of Health Services) gave a presentation explaining the process used for developing the 20 part per trillion (ppt) proposed groundwater standard for PFOA and PFOS (see PowerPoint).
    - State code sets many of the parameters that DHS must use when developing an enforcement standard. DHS must assume 100% of exposure comes from ground water – the relative source contribution. The standard must be health-based and set based on either a Federal number, a State number, an EPA number, other technical information, and/or cancer risk.
    - DHS considered technical information not available when the EPA set the guideline at 70 ppt for PFOA and PFOS.
    - The target population (or the vulnerable population) used in the calculation were young children. (See handout for specific parameters used).
    - Differences in standards from state to state are mainly a result of differences in target population and relative source contribution.
    - DHS decided to combine PFOA and PFOS when recommending a standard because the two PFAS have similar health effects, similar half-lives, and may interact with each other.
    - Sarah was also prepared to give a presentation about standards for chrome VI and 1, 4 dioxane, however, time ran out and she is willing to return to a future meeting for those contaminants.
- Questions from the committee, staff, and the public
    - What are some other sources of PFAS besides drinking water?
        - Fish, dust, food packaging (short-chain), and other consumer products (non-stick pans, athletic wear, carpets, etc.)
    - Should elected officials be concerned about PFAS concentrations at the action level (10% of the enforcement standard)?

        - DNR response – The action level is intended to be proactive for monitoring. The purpose is to ensure that the level in groundwater does not rise to the enforcement standard. The enforcement level is the health-based standard and it is the level below which you should see little or no health effects.
    - "I'm a breastfeeding mother in the Well 9 area should I filter my tap water?"
        - "I am a pediatrician and I would say yes."
        - DNR response – studies have shown that activated carbon is less effective, granular activated carbon is better, and reverse osmosis is most effective
        - MWU – Filters certified for PFAS removal are capable of reducing PFOA & PFOS levels to less than the EPA health advisory level of 70 ppt. Their effectiveness has not been demonstrated at PFAS levels comparable to those observed in Madison water. Filter effectiveness decreases with sustained use, and small chain PFAS are harder to filter than longer chain PFAS.
    - Any plans to turn off Well 9?
        - There has not been discussion about this at this time.
    - DNR statement – State agencies are waiting to get approval from the Natural Resources Board to start the rule making process (to make the proposed advisory a rule)
    - DHS is currently working to develop standards for other PFAS compounds; these are expected by the end of next year.

6. Future Agenda Items

- DHS/DNR Staff may attend a future meeting to discuss other contaminants for which a groundwater enforcement standard was proposed – i.e. chromium (VI) and 1,4 dioxane.

7. Adjournment

The next meeting will be on Monday, April 13th from 5 to 6:30 p.m. at the Water Utility, 119 E. Olin Avenue.