Internal Monitoring Report

Policy #: O-2B Water Quality **Date**: October 24, 2017

I certify that the following information is true.

Policy Language:

Madison Water Utility consumers will receive high quality water that meets or is better than all primary and secondary drinking water standards, including their public notification requirements, and complies with board-adopted water quality goals, incorporated by attachment.

The Madison Water Utility recognizes that drinking water standards are subject to revision and that new compounds of concern will be determined. This dynamic is a result of health studies being conducted by health organizations and government agencies on the state, national and international level. The technology to quantify compounds at increasingly minute levels is constantly improving.

The Madison Water Utility shall maintain and promulgate a Watch List of compounds of concern by unit well of compounds that are increasing and may approach the primary and secondary drinking water standards. The Watch List shall identify which wells require action.

General Manager's interpretation and its justification:

Few things are more vital to a community than the availability of high quality drinking water. It promotes public health, public safety, and the economic interests of our community. To that end, the water utility will consistently deliver water that meets the primary, health-based drinking water standards, the secondary (aesthetic) standards, and the additional policy goals established by the Board.

Water Utility Board Procedural Guideline GUIDE 8 – Executive Summary of Water Quality Treatment Policies – establishes monitoring requirements and the utility's approach for responding to increasing contaminant levels. Generally, the policy establishes two thresholds – one when a contaminant exceeds 50% of a maximum contaminant level (MCL), secondary MCL, or other numerical guideline, and two when it surpasses 80% of this mark. The first triggers increased monitoring and an investigation into treatment

alternatives, operational changes, or other actions to reduce contaminant levels while the second leads to implementation of a mitigation strategy.

The policy applies to any contaminant, regulated or not, that is capable of impairing the health, safety, or aesthetic quality of drinking water. Utility staff will remain vigilant in following developments related to currently unregulated and emerging contaminants like pharmaceuticals, endocrine disruptors, and chromium-6 that may pose challenges in the future.

The utility will use multiple communication methods to adequately inform consumers of the safety and quality of their drinking water including the federally-required Consumer Confidence Report (CCR), the water utility website, e-mail distribution lists, neighborhood listservs, citizen meetings, and through direct staff contact in the field and office.

Data directly addressing the General Manager's interpretation:

Contaminants with a primary MCL, Action Level or Enforcement Standard

Coliform Bacteria - Between April and September, 1855 water samples were collected from routine monitoring points in the system including the entry point at the well houses (436 samples). No sample tested positive for coliform bacteria. Thirty-nine raw water samples were collected during this reporting period. All were found to be free of coliform bacteria.

Inorganic Compounds – Each well was tested in the monitoring period for a suite of water quality parameters (conductivity, alkalinity, hardness) and inorganic chemicals. None of the following contaminants was found at any well – antimony, beryllium, mercury, and nitrite. Except for barium and nitrate, detections of other contaminants were at low levels, often just above the level of detection. Cadmium was detected for the first time at several wells due to lower laboratory detection limits. The range of results for the regulated inorganic chemicals is shown in **Table 1** while complete results follow as an attachment.

Table 1. Summary of Regulated Inorganic Chemical Detections

Parameter	MCL	Detects	Minimum	Median	Maximum
Antimony	6	0	<0.16	<0.16	<0.5
Arsenic	10	20	0.1	0.3	0.8
Barium	2000	22	8.5	20	68
Beryllium	4	0	<0.09	<0.14	<0.14
Cadmium	5	14	<0.02	0.1	0.3
Chromium	100	22	0.7	1.4	2.9
Mercury	2	0	<0.02	<0.02	<0.02
Nickel	100	22	2.2	3.6	7.3
Nitrate	10	15	<0.1	0.8	4.2
Nitrite	1	0	<0.01	<0.01	<0.01
Selenium	50	2	<1.4	<1.4	2.0
Thallium	2	8	<0.07	<0.07	0.3

Note: The units are µg/L except for nitrate and nitrite which are measured in mg/L

Lead and Copper – Every three years, the water utility collects residential tap samples from 50 homes constructed in 1983 or 1984 to comply with the lead and copper rule. The purpose of the monitoring is to confirm that the leaching of lead and copper from internal plumbing has been controlled. Since the removal of all known lead water services, the monitoring has demonstrated that optimal corrosion control has been achieved. This year, the 90th percentile lead and copper levels were 3.3 and 174 µg/L compared to action levels (regulatory standards) of 15 and 1300 µg/L, respectively. The primary source of lead and copper in drinking water comes not from the source water but rather the corrosion of plumbing materials – pipes, fittings, fixtures, and solder – that contain these metals.

Volatile Organic Compounds – Since January, thirty-two samples have been collected from twenty-one wells and tested for VOCs. PCE is the most commonly detected VOC; it is found at five wells with levels ranging from 0.5 to 2.2 µg/L. The maximum contaminant level (MCL) for PCE is 5 µg/L. Wells with previous VOC detections are sampled once a quarter. Maximum detections are shown in **Table 2**. None of the over forty VOCs

were found at sixteen wells, including treated water at Well 15. Table 2 does not include results for trihalomethanes – chemicals that form during the disinfection process.

Table 2. Summary of VOC Detections (in µg/L), January to September

	Samples	DCE, cis	PCE	TCFM
MCL		70	5	NA
Well 6	2	<0.30	**1.0-1.4**	<0.30
Well 9	3	<0.30	**1.2-1.9**	<0.30
Well 11	3	**0.39-0.57**	**0.54-0.70**	**0.65-1.1**
Well 14	3	<0.30	**0.46-0.64**	<0.30
Well 18	3	<0.30	**1.8-2.2**	<0.30
	TCFM = Trichlorofluoromethane			

Synthetic Organic Compounds – A group of man-made contaminants including pesticides and other industrial chemicals are tested once every six years. Twenty wells were free of all thirty-seven contaminants while atrazine and metolachlor were each found at one of the remaining wells, Well 29 and Well 14, respectively, at very low levels. Neither pesticide was found in previous testing; however, increasingly sensitive laboratory methods now enable detections at the nanogram per liter (ng/L) or part per trillion (ppt) level. Test results are summarized in **Table 3**.

Radium - In accordance with GUIDE 8, seven wells are tested quarterly for radium because previous tests show that combined radium (radium 226 + 228) exceeds 2.5 pCi/L, or one half the MCL. Compliance with the MCL is based on running annual average of quarterly samples rather than a single test result. Results for samples collected during the monitoring period are summarized in **Table 4**. Radium concentrations appear stable at each of these seven wells.

<u>Contaminants with a secondary MCL</u>

Iron and Manganese - Monthly well samples are collected when iron and manganese are elevated. During the period from April to September, one sample from Well 8 and two samples from Well 19 were at or exceeded the secondary MCL for manganese [50 µg/L], and all well samples collected at

Well 8 exceeded the standard for iron [0.3 mg/L]. Test results are shown in **Tables 5 and 6**. Filters at Well 7 and Well 29 continue to show iron and manganese reductions in excess of 95%.

Iron and manganese monitoring occurs in the distribution system at all coliform sample locations. Test results, summarized in the **Table 7**, show iron and manganese infrequently exceed the established benchmarks and over 95% of the samples are below one half the policy goals.

Chloride - Chloride levels have been steadily rising at a number of wells, especially those that are not cased through the Eau Claire shale layer. The increase has been attributed to road salt use on roadways and parking lots. Annual testing shows chloride exceeding 100 mg/L at two Madison wells (#14 and #23) and chloride between 60 and 100 mg/L at four other wells. Monthly chloride monitoring continues at Well 14. Six samples were collected between April and September; the chloride level ranged from 137 to 145 mg/L, compared to the secondary MCL – 250 mg/L.

An investigation into the sources of chloride contamination at Well 14 was completed in August. The study identified four potential sources: an uncurbed parking lot near the intersection of South Whitney Way and Old Middleton Road, uncurbed sections of Lake Mendota Drive and Merrill Springs Road, the Village of Shorewood Hills salt storage shed, and the storm sewer outlet to Lake Mendota at Spring Harbor. The storm sewer outlet is suspected as the most likely source of chloride contamination to Well 14. This outlet discharges storm water from a watershed extending to West Towne and portions of the Beltline. Winter meltwater is expected to contain high chloride concentrations from this drainage area dominated by heavily salted roadways and parking lots. In addition, model runs using the 2016 Groundwater Flow Model for Dane County Wisconsin suggest a two-year travel time from the storm sewer discharge to Well 14.

To investigate the potential contribution of the storm water discharge as a source of chloride contamination, the utility plans to install a temporary groundwater monitoring well located between the discharge point and Well 14. Regular sampling of the well would take place over a period of 15 to 18 months and include the next two winter seasons.

In addition, the storm water and water utilities are partnering with the US Geological Survey to install a monitoring station in the upstream drainage

network to track flows and chloride levels in storm water from detention ponds located on Mineral Point Road. Installation is planned for this fall and monitoring will occur over the next five years. The monitoring will complement a station currently operating near the Spring Harbor outlet.

Funding for an alternatives evaluation study was included in the Water Utility's 2018 Capital Budget request. The study will identify and compare treatment solutions to increasing chloride and sodium levels at Well 14.

Finally, water utility staff have worked with regional partners to help raise awareness on the issue of chloride contamination of the lakes and our ground and drinking water resources. Recommended salt application rate guidelines have been developed for the Madison – Dane County region and the city is initiating a Voluntary Winter Salt Certification program that emphasizes training, equipment calibration, and record keeping. These initiatives aim to right-size our salt use by ensuring public safety without compromising the quality of our water resources – lakes, groundwater, and drinking water.

Unregulated and Emerging Contaminants

Sodium - In accordance with GUIDE 8, monthly sodium testing continued at Well 14. Six samples were collected between April and September with samples measuring between 47 and 51 mg/L sodium. The US EPA recommends that drinking water not exceed 20 mg/L. These guidelines are intended for high risk populations including individuals with high blood pressure or those on severe sodium-restricted diets. A total of six Madison wells produce water with sodium in excess of 20 mg/L: three in the 20-25 mg/L range, one between 25 and 30 mg/L, and the remaining two above 30 mg/L sodium.

Chromium (VI) - Testing for hexavalent chromium was conducted at four wells – Well 13, 14, 16, and 23. The range of results was 0.36 to 1.9 µg/L. These wells are tested annually because previous testing found chromium (VI) above 1 µg/L. The state of California had previously set an MCL for chromium (VI) at 10 µg/L, however, a court ruling in May struck down the MCL because, according to the court, the governing body failed to comply with one of the requirements in the SDWA (economic feasibility) for adopting an MCL.

Perfluorinated Compounds – A group of six perfluorinated compounds were twice monitored in 2015 at all Madison wells as part of the UCMR3 [Unregulated Contaminants Monitoring Regulation – Cycle 3] process. None of the six PFCs were detected at any Madison well. In 2016, US EPA issued a health advisory for PFOA and PFOS establishing 70 ng/L as the combined concentration of PFOA and PFOS above which drinking water systems should perform additional monitoring and take action to lower the levels of PFOA and PFOS in drinking water.

Because more sensitive analytical methods are now available and some research suggests that human health risks may occur at lower PFOA and PFOS concentrations, the Water Quality Technical Advisory Committee recommended that we test a subset of Madison wells for the group of six PFCs using the lower detection limits. Five wells were selected based on proximity to the airport and former landfills because these facilities have been identified among the principal sources of PFC contamination to groundwater. We completed the latest screening in August and found that three wells were clear of all six PFCs even at the low nanogram per liter or part per trillion level. A single PFC was detected at one well and five of the six PFCs were found in the fifth well. The combined concentration of all detected PFCs was well below the EPA Health Advisory Level. The complete test results can be found in **Table 8**.

Perfluorinated compounds are manufactured chemicals used in industrial and consumer applications. They are responsible for the non-stick, stain-resistant and fire-retardant properties of cookware, clothing, fabrics, food packaging, and foams. Once in the environment, these chemicals are very stable and slow to degrade due to the strong carbon-fluoride bonds that make them resistant to microbial degradation. Conventional drinking water treatment is mostly ineffective at removing or destroying these widespread and persistent chemicals. However, studies show that activated carbon and ion exchange are two promising technologies for removing PFCs from drinking water.

Water Quality Watch List

The Water Quality Watch List has been updated with current test results for inorganic, organic, radiological, and unregulated contaminants. New

detected substances added to the Watch List include atrazine, cadmium, metolachlor, and perfluorinated compounds including PFOA and PFOS. Action plans for various wells were updated to reflect the proposed 2018 Capital Budget and Capital Improvement Program (2019-2023).

Water Quality Technical Advisory Committee

This committee met twice (July 11 & October 19) since the last monitoring report. In July, the group evaluated a laboratory comparison on radium testing by three labs, received an update on the chloride study at Well 14, reviewed recent VOC and SOC results, and heard a brief presentation on private well surveys in wellhead protection areas. Additional details are provided in the meeting notes as an attachment. Last week, the group concluded a discussion comparing radium test results among three labs, reviewed the previous three years of radium test results at Wells 7, 24, 28, and 30, discussed recent detections of PFCs at Well 15, examined results of the sequential sampling for VOCs at Well 18, reviewed recent lead and copper monitoring results, and briefly discussed our disinfection practices and whether they should be modified to improve public health protection. Details will be provided in the meeting notes which are not yet available.

Annual Water Quality Report – Consumer Confidence Report

Water Utility staff prepared and released this year's consumer confidence report (CCR) in mid-May. The report had the same layout and format as in previous years. This year we added a section on the impact of road salt on Madison-area lakes and our aquifer. Water quality data for each well was also updated on our website.

Postcards were sent to all City of Madison mailing addresses directing water users to an electronic CCR posted on our website. A notice was also added to the Municipal Services Bill announcing the availability of the water quality report. Paper copies of the report are available at the Water Utility, branches of the Madison Public Library, and various community centers located throughout the city.

Table 4. Combined Radium Results (226+228) measured in pCi/L

	Feb 2017	May 2017	Aug 2017	Annual Average of Quarterly Samples
Well 7	2.2	2.4	2.3	**2.1**
Well 8	Inactive	Inactive	3.2	**NA**
Well 19	3.8	2.7	3.5	**3.4**
Well 24	3.4	2.7	2.5	**2.8**
Well 27	Inactive	4.0	2.9	**3.5**
Well 28	3.2	2.6	2.5	**2.8**
Well 30	2.3	1.05	2.3	**2.1**

Table 5. Monthly Iron Test Results, in mg/L

Source	Apr	May	Jun	Jul	Aug	Sep
Well 7 - filtered	<0.02	<0.02	0.16	<0.02	<0.02	<0.02
Well 8	n/s	n/s	n/s	**0.60**	**0.57**	**0.58**
Well 17	n/s	0.07	0.11	0.12	n/s	0.12
Well 19	0.23	0.22	0.22	0.21	0.21	0.23
Well 23	n/s	n/s	n/s	n/s	0.06	n/s
Well 24	0.20	0.27	0.20	0.22	0.21	0.22
Well 26 – deep well	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Well 27	n/s	0.14	0.15	0.15	0.15	0.16
Well 28	0.15	0.15	0.17	0.17	0.17	0.14
Well 29 - filtered	<0.02	<0.02	0.01	<0.02	**0.34**	<0.02
Well 30	0.20	0.21	0.23	0.21	0.21	0.21

Table 6. Monthly Manganese Test Results, in µg/L

Source	Apr	May	Jun	Jul	Aug	Sep
Well 7 - filtered	<1.0	1.1	6.2	<1.0	<1.0	<1.0
Well 8	n/s	n/s	n/s	49	**51**	46
Well 17	n/s	40	34	30	n/s	30
Well 19	**51**	46	45	46	47	**50**
Well 23	n/s	n/s	n/s	n/s	28	n/s
Well 24	33	40	26	29	30	32
Well 26 – deep well	6.0	15	13	7.8	11	13
Well 27	n/s	32	32	32	29	32
Well 28	22	20	22	22	22	19
Well 29 - filtered	3.4	<1.0	0.6	1.8	**64**	2.1
Well 30	14	14	15	14	15	14

Table 7. Summary of iron and manganese levels in the distribution system.

Manganese, µg/L

	Apr - Sep	2017
Policy Goal	**50**	**50**
Median	1.6	1.6
Average	3.5	3.3
95th Percentile	***10***	***10***
Maximum	52	52
Number of Samples	171	253
>50	1	1

Iron, mg/L

	Apr - Sep	2017
Policy Goal	**0.3**	**0.3**
Median	<0.02	<0.02
Average	0.03	0.03
95th Percentile	***0.06***	***0.08***
Maximum	0. 26	0.31
Number of Samples	171	253
>0.3	0	1

Table 8. Perfluorinated compounds test results.

2017	MRL	EP 07	EP 15	DW 15	DW 16		DW 18	EP29
Perfluorinated Compounds	(ng/L)	8/1	8/1	8/1	8/1	8/1	8/1	8/1
perfluorooctanoic acid (PFOA)	0.43	ND	**4.9**	**5.3**	ND	ND	ND	ND
perfluorooctanesulfonic acid (PFOS)	0.45	ND	**5.4**	**5.1**	ND	ND	ND	ND
perfluorohexanesulfonic acid (PFHxS)	0.63	ND	**19**	**20**	**2.4**	**2.7**	ND	ND
perfluorobutanesulfonic acid (PFBS)	0.32	ND	**2.4**	**2.5**	ND	ND	ND	ND
perfluoroheptanoic acid (PFHpA)	0.65	ND	ND	**2.2**	ND	ND	ND	ND
perfluorononanoic acid (PFNA)	0.69	ND	ND	ND	ND	ND	ND	ND
Combined PFC Concentration	--	ND	32	35	2.4	2.7	ND	ND

Notes: MRL - method reporting limit
EP - entry point to distribution system; after treatment
DW - deep well; untreated well water
ng/L – nanogram per liter; equivalent to one part per trillion

Attachments:

Tables 3-8
Annual Inorganics Test Results
Water Quality Watch List
Water Quality Technical Advisory Committee Meeting Notes

Table 3. 2017 Synthetic Organic Compound Test Result Summary

Synthetic Organic Compound	MCL	Detection Limit	Units	Detections	EPA Method
Chlordane	2	0.033	ppb	None	505
PCB Total	0.5	0.1	ppb	None	505
Toxaphene	3	0.33	ppb	None	505
2,4-D	70	0.093	ppb	None	515.3
Dalapon	200	0.56	ppb	None	515.3
Dicamba	--	0.21	ppb	None	515.3
Dinoseb	7	0.079	ppb	None	515.3
Pentachlorophenol	1	0.03	ppb	None	515.3
Picloram	500	0.086	ppb	None	515.3
2,4,5-TP (Silvex)	50	0.15	ppb	None	515.3
Alachlor	2	0.015	ppb	None	525.2
Aldrin	--	0.015	ppb	None	525.2
Atrazine	3	0.024	ppb	**Well 29 - 0.027**	525.2
Butachlor	--	0.025	ppb	None	525.2
Dieldrin	--	0.02	ppb	None	525.2
Endrin	2	0.009	ppb	None	525.2
Heptachlor	0.4	0.019	ppb	None	525.2
Heptachlor epoxide	0.2	0.015	ppb	None	525.2
Hexachlorobenzene	1	0.019	ppb	None	525.2
Hexachlorocyclopentadiene	50	0.036	ppb	None	525.2
Lindane (BHC Gamma)	0.2	0.0075	ppb	None	525.2
Methoxychlor	40	0.016	ppb	None	525.2
Metolachlor	--	0.011	ppb	**Well 14 - 0.012**	525.2
Metribuzin	--	0.019	ppb	None	525.2
Propachlor	--	0.014	ppb	None	525.2
Simazine	4	0.049	ppb	None	525.2
Aldicarb	3	0.5	ppb	None	531.1
Aldicarb sulfone	2	0.51	ppb	None	531.1
Aldicarb sulfoxide	4	0.57	ppb	None	531.1
Carbaryl	--	0.58	ppb	None	531.1
Carbofuran	40	0.55	ppb	None	531.1
3-Hydroxycarbofuran	--	0.51	ppb	None	531.1
Methomyl	--	0.49	ppb	None	531.1
Oxamyl	200	0.45	ppb	None	531.1
Glyphosate	700	3.0/4.9	ppb	None	547
Endothall	100	0.51	ppb	None	548.1
Diquat	20	0.22	ppb	None	549

MCL - Maximum Contaminant Level; maximum amount allowed in drinking water

ppb - parts per billion or µg/L

2017 Annual Inorganics Analysis

PARAMETER	UNITS	MCL	Well 6	Well 7	Well 8	Well 9	Well 11	Well 12	Well 13	Well 14	Well 15	Well 16	Well 17	Well 18	Well 19	Well 20	Well 23	Well 24	Well 25	Well 26	Well 27	Well 28	Well 29	Well 30
Sample Date			6/7	6/6	8/14	6/6	6/6	6/7	6/6	6/7	6/6	6/7	9/25	6/7	6/7	6/7	8/14	6/6	6/6	6/7	8/14	6/7	6/6	6/7
Alkalinity ($CaCO_3$)	mg/L		322	332	322	341	342	278	326	346	315	276	270	285	286	266	376	288	320	276	314	273	320	257
Aluminum	µg/L		<1.3	<1.3	<1.6	<1.3	<1.3	<1.3	<1.3	3.0	<1.3	<1.3	<1.6	<1.3	<1.3	<1.3	3.2	1.9	<1.3	<1.3	<1.6	<1.3	<1.3	<1.3
Antimony	µg/L	6	< 0.16	< 0.16	<0.5	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	<0.5	< 0.16	< 0.16	< 0.16	<0.5	< 0.16	< 0.16	< 0.16	<0.5	< 0.16	< 0.16	< 0.16
Arsenic	µg/L	10	0.54	0.17	0.59	0.22	0.32	0.18	0.20	0.81	0.23	0.44	<0.5	0.19	0.37	0.16	0.58	0.20	0.08	0.23	<0.5	0.38	0.19	0.51
Barium	µg/L	2000	27	36	32	31	20	14	37	61	9.5	20	21	15	18	11	68	13	8.5	19	27	16	51	18
Beryllium	µg/L	4	< 0.14	< 0.14	<0.09	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	<0.09	< 0.14	< 0.14	< 0.14	<0.09	< 0.14	< 0.14	< 0.14	<0.09	< 0.14	< 0.14	< 0.14
Cadmium	µg/L	5	0.06	0.14	<0.5	0.27	0.17	<0.024	0.14	0.05	0.23	0.04	<0.5	<0.024	0.05	<0.024	<0.5	0.20	0.31	0.06	<0.5	<0.024	0.19	0.03
Calcium	mg/L		84	72	65	76	77	57	73	96	77	67	63	58	59	52	100	54	57	61	75	59	66	54
Chloride	mg/L		67	<20	21	51	63	<20	43	150	60	67	40	<20	<20	<20	120	<20	<20	<20	43	<20	<20	<20
Chromium	µg/L	100	2.91	0.98	1.77	1.74	1.78	1.33	2.07	2.94	1.24	2.04	0.73	1.24	0.99	1.43	2.87	0.72	1.42	1.31	1.49	0.85	0.96	0.79
Conductivity	µmhos / cm		882	679	619	789	858	516	758	1130	804	757	674	560	540	494	1060	525	573	572	740	528	597	515
Copper	µg/L	1300	1.8	3.7	4.7	13	4.8	1.8	3.0	4.5	2.3	2.3	2.7	2.1	7.9	3.5	3.3	31	2.7	5.0	4.9	1.9	2.4	3.4
Fluoride	mg/L	4	0.76	0.78	0.88	0.85	0.82	0.85	0.90	0.69	0.82	0.78	0.84	0.88	0.71	0.88	0.80	1.00	0.74	0.83	0.84	0.82	0.83	0.72
Hardness ($CaCO_3$)	mg/L		386	347	321	364	380	265	348	436	362	318	323	281	271	256	458	265	300	283	348	272	303	260
Iron	mg/L		0.03	0.16	0.58	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.13	0.01	0.22	0.00	0.06	0.20	0.04	0.02	0.15	0.17	0.01	0.23
Lead	µg/L	15	1.21	<0.06	<0.1	<0.06	0.14	<0.06	<0.06	<0.06	<0.06	0.22	0.18	<0.06	0.22	0.18	<0.1	<0.06	<0.06	1.53	<0.1	0.27	<0.06	<0.06
Magnesium	mg/L		43	41	39	42	46	30	41	48	42	37	40	33	30	31	50	32	39	32	39	30	34	31
Manganese	µg/L		0.6	6.2	47	2.8	5.2	8.6	1.9	16	2.6	0.1	28	1.8	45	0.7	28	26	2.9	6.5	29	22	0.6	15
Mercury	µg/L	2	< 0.022	< 0.022	<0.025	< 0.022	< 0.022	< 0.022	< 0.022	< 0.022	< 0.022	< 0.022	<0.025	< 0.022	< 0.022	< 0.022	<0.025	< 0.022	< 0.022	< 0.022	<0.025	< 0.022	< 0.022	< 0.022
Nickel	µg/L	100	3.52	4.15	3.64	4.04	4.51	3.62	3.82	3.96	4.41	3.05	2.28	2.29	2.91	2.48	7.25	2.70	3.15	3.76	5.51	2.84	3.73	2.21
Nitrogen-Nitrate	mg/L	10	3.36	<0.10	<0.10	1.86	2.88	0.80	3.87	3.73	2.42	2.76	<0.10	0.67	<0.10	0.32	4.15	<0.10	0.78	1.92	0.35	<0.10	1.30	<0.10
Nitrogen-Nitrite	mg/L	1	< 0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
pH (Lab)	s.u.		8.07	8.01	7.79	7.34	7.40	8.17	8.07	8.06	7.86	8.10	7.86	8.12	8.06	8.52	7.79	7.75	8.05	7.67	7.85	8.06	7.44	8.17
Selenium	µg/L	50	1.96	<1.4	<1.5	<1.4	<1.4	<1.4	<1.4	1.48	<1.4	<1.4	<1.5	<1.4	<1.4	<1.4	<1.5	<1.4	<1.4	<1.4	<1.5	<1.4	<1.4	<1.4
Silver	µg/L		< 0.06	< 0.06	<0.1	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	<0.1	< 0.06	< 0.06	< 0.06	<0.1	< 0.06	< 0.06	< 0.06	<0.1	< 0.06	< 0.06	< 0.06
Sodium	mg/L		26	7.5	9.4	19	22	2.4	17	49	21	25	15	5.8	4.3	2.3	36	5.3	3.3	7.6	18	2.5	3.7	3.9
Sulfate	mg/L		31	38	18	22	32	12	21	29	43	14	38	19	8.8	9.5	34	17	8.6	15	37	24	12	23
Thallium	µg/L	2	< 0.07	< 0.07	<0.1	< 0.07	0.16	0.15	< 0.07	< 0.07	0.13	< 0.07	0.21	< 0.07	0.16	< 0.07	0.28	< 0.07	< 0.07	0.08	0.15	< 0.07	< 0.07	< 0.07
Total Solids	mg/L		492	400	402	434	494	274	442	636	494	428	402	302	278	238	678	272	294	320	498	304	324	286
Zinc	µg/L		8.1	2.6	6.3	2.4	4.1	11	3.0	2.0	3.3	9.3	2.3	4.6	10	2.3	6.3	5.1	<1.8	24	4.3	8.6	5.1	3.0

MADISON WATER UTILITY
WATER QUALITY WATCH LIST

Organics - Regulated

Contaminant	Maximum*	Units	MCLG	PAL	MCL	Detects Below PAL%	Watch List	Action Plan	Reference
Atrazine	0.027	µg/L	3	0.3	3	#29	none		NR 809.20
1,2-Dichloroethane	0.20	µg/L	zero	0.5	5	#17	none		NR 809.24
1,2-Dichloroethylene (cis)	0.57	µg/L	70	7	70	#8, #11	none		NR 809.24
Tetrachloroethylene [PCE]	3.5	µg/L	zero	0.5	5	#27	#6, #9, #11, #14, #18	Quarterly Monitoring	NR 809.24
1,1,1-Trichloroethane	0.28	µg/L	200	40	200	#18	none		NR 809.24
Trichloroethylene [TCE]	0.40	µg/L	zero	0.5	5	#11, #14, #18, #27	none		NR 809.24
Xylene, Total	1.3	µg/L	10000	400	10000	#225	none		NR 809.24

* Maximum detection observed at any Madison well from 2013 through 2017 % Detected in at least one sample collected from 2013 through 2017

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	0.63	µg/L	0.35~	0.3	3	#9, #14, #15, #17, #18	#11	Monitor	NR 140.10
Metolachlor	0.012	µg/L	n/a	10	100	#14	none		NR 140.10
Perfluorinated Compounds: PFOA, PFOS, PFHxS, PFBS, PFHpA	0.035	µg/L	0.07^	n/a	n/a	#15, #16	none		US EPA
Trichlorofluoromethane	1.1	µg/L	n/a	698	3490	#11	none		NR 140.10

* Maximum detection observed at any Madison well from 2013 through 2017 % Detected in at least one sample collected from 2013 through 2017 ~ 10^{-6} Cancer Risk Level ^ PFOA + PFOS

Radionuclides (2017)

Contaminant	Maximum	Units	MCLG	Watch	MCL	Wells with Detects	Watch List	Action Plan	Reference
Gross alpha	9.4	pCi/L	zero	5	15	All Except Well#14	#7, #8, #19, #27, #28, #30	Monitor	NR 809.50
Gross beta	7.1	pCi/L	zero	10	50	All Except Well#14	none		NR 809.50
Combined Radium	4.0	pCi/L	zero	2.5	5	All Wells	#8, #19, #24 #27, #28	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	0.8	µg/l	zero	1	10	All Except #17 & #27	none		NR 809.11
Barium	68	µg/l	2000	400	2000	All Wells	none		NR 809.11
Cadmium	0.3	µg/l	5	0.5	5	All Except #8, #12, #17, #18, #20, #23, #27, #28	none		NR 140.10
Chromium, Total	2.9	µg/l	100	10	100	All Wells	none		NR 809.11
Nickel	7.3	µg/l	100	20	100	All Wells	none		NR 809.11
Nitrogen-Nitrate	4.2	mg/l	10	2	10	#9, #12, #18, #20, #25, #26, #27, #29	#6, #11, #13, #14, #15, #16, #23	Monitor	NR 809.11
Selenium	2.0	µg/l	50	10	50	#6, #14	none		NR 809.11
Thallium	0.3	µg/l	0.5	0.4	2	#11, #12, #15, #17, #19, #23, #26, #27	none		NR 809.11

* Based on 2017 annual test data

Inorganics - Unregulated

Substance	Maximum*	Units	MCLG	Watch	SMCL	Wells with Detects	Watch List	Action Plan	Reference
Aluminum	3.2	µg/l	n/a	50	200	#14, #23, #24	none		NR 809.70
Chloride	150	mg/l	n/a	125	250	All Wells	#14	GW Investigation	NR 809.70
Iron	0.58	mg/l	n/a	0.15	0.3	All Wells	#8, #19, #24, #27, #28 #30	Install Filtration: Well #8 (2026) Well #19 (2018) Well #28 (2021) Well #30 (2022)	NR 809.70
Manganese	47	µg/l	n/a	25	50	All Wells	#8, #17, #19, #23, #24, #27		NR 809.70
Sodium	49	mg/l	n/a	20	n/a	All Wells	#6, #11, #14, #15, #16, #23	Monitor	EPA DWEL
Sulfate	43	mg/l	n/a	125	250	All Wells	none		NR 809.70
Zinc	24	µg/l	n/a	2500	5000	All Except #25	none		NR 809.70

* Based on 2017 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

Meeting Notes
Olin Avenue Conference Room
July 11, 2017 – 1:00 p.m.

Attending: Janet Battista, Greg Harrington, Jocelyn Hemming, Gary Krinke, Henry Anderson, Sharon Long, Joseph Grande, Al Larson, Amy Barrilleaux, Joe DeMorett

Absent: Tom Heikkinen

1. Agenda Repair/Announcements

2. Review of Meeting Notes - No changes to the January 17, 2017 notes were proposed.

3. Well 31 Wellhead Protection Plan & WHPP Supplement

The feedback received from the TAC has been incorporated into the Well 31 WHP Plan. The Wisconsin DNR conditionally approved the plan pending construction and a final inspection of the unit well facility.

4. Radium Study – Lab Comparison

A laboratory comparison was conducted in December 2016 and involved sending duplicate split samples to three different laboratories. The objectives of the study were to:

- Compare radium results among three labs - Lab A, Lab B and WSLH,
- Examine the variability of radium results of two commercial labs, and
- Evaluate the impact of iron and manganese removal on radium levels

Considerable variability among duplicate samples was often observed. These observations were especially true for radium-226 analysis by Lab B. Radium-226 results were consistently higher compared to results of the other two laboratories. Results from the latter two labs were not significantly different. Lab B had not previously been used by the utility. Due to the wide variability among the results, the committee recommended against using Lab B for future radium analysis.

Although radium appears to decrease as water moved from the well, through the filter, and ultimately out to the distribution system, any differences in radium between raw and treated water were not statistically significant. Anecdotal evidence was presented suggesting that lower pumping rates achieved by installing variable speed drives may also reduce overall radium levels pumped from the well.

The committee recommended (1) updating the data table to include the detection limits, method uncertainties, and laboratory method used in order for Gary to review the data; (2) redoing the statistical analysis using the detection limit in place of reported values that are below the method detection limit; and (3) collecting a duplicate for approximately every ten non-compliance samples. Duplicate sampling was suggested for each compliance sample collected in the future.

5. Well 14 – Chloride Study Update

Chloride and sodium levels continue to increase at Well 14. At the current pace, chloride may exceed the secondary MCL within fifteen years. Chloride monitoring occurs monthly at the well.

The results of the recent borehole study were presented. Two primary fractures were detected; one immediately below the casing (127') and a second fracture directly above the Eau Claire shale. Each fracture is believed to contribute about 50% of the flow to the well. The lower fracture is believed to occur throughout Dane County. Determining whether sealing off the upper aquifer was a viable alternative to reduce chloride levels in water pumped from the well was not part of the scope of this study.

Preliminary findings of an on-going chloride source assessment were also presented. Potential sources of chloride contamination include:

- An uncurbed parking lot near the intersection of Whitney Way and Old Middleton Road,
- Uncurbed sections of Lake Mendota Drive and Merrill Springs Drive,
- The Village of Shorewood Hills salt storage shed, and
- The storm water outfall to Lake Mendota at Spring Harbor. The outfall receives storm water from a discharge area including West Towne and portions of the Beltline Highway.

Two initiatives were presented to the committee: 1) installation of a shallow monitoring well between the storm water outfall and Well 14 and 2) installation of a USGS monitoring station near the detention ponds on Mineral Point Road to track storm water flows and conductivity (surrogate for chloride). The group briefly discussed the possibility of discharging storm water further out into Lake Mendota. The committee was also briefed on the development of the Voluntary Winter Salt Certification program.

6. Water Quality Monitoring Results – VOC

VOC test results for 2016 & 2017 were presented. PCE remains present at five wells: 6, 9, 11, 14 and 18. The level of PCE at Well 6 continues to gradually trend upwards; the most recent result was 1.4 ppb. Concentrations appear stable at other wells.

Synthetic Organic Compounds (SOC) are monitored on a six-year cycle. The majority of the wells have been sampled, however, many results are still outstanding. To date, metolachlor was detected at Well 14 at 12 ppt, the detection limit is 11 ppt, and atrazine was detected at Well 29 at 27 ppt, the detection limit is 24 ppt.

Plans for the testing of perfluorinated compounds at five wells were discussed. Collection of replicate samples was recommended due to the low detection levels. A second round of sampling is planned for later this year.

7. Private Well Surveys – Wellhead Protection Areas

Surveys for unused and improperly abandoned private wells have been conducted in ten of the twenty-three wellhead areas. In the Well 31 WHPA, 86 parcels were surveyed resulting in the abandonment of eleven private wells. To date, over 200 private wells have been confirmed as abandoned or have been properly abandoned due to these efforts.

8. Future Agenda Items

- MWU Master Plan & Capital Improvement Plan
- Annexations – Town of Madison; Town of Blooming Grove
- Lead Monitoring & Mitigation

9. Adjournment

Next meeting: Tuesday, October 10, 2017 at 1 p.m. in the Olin Avenue Conference Room.