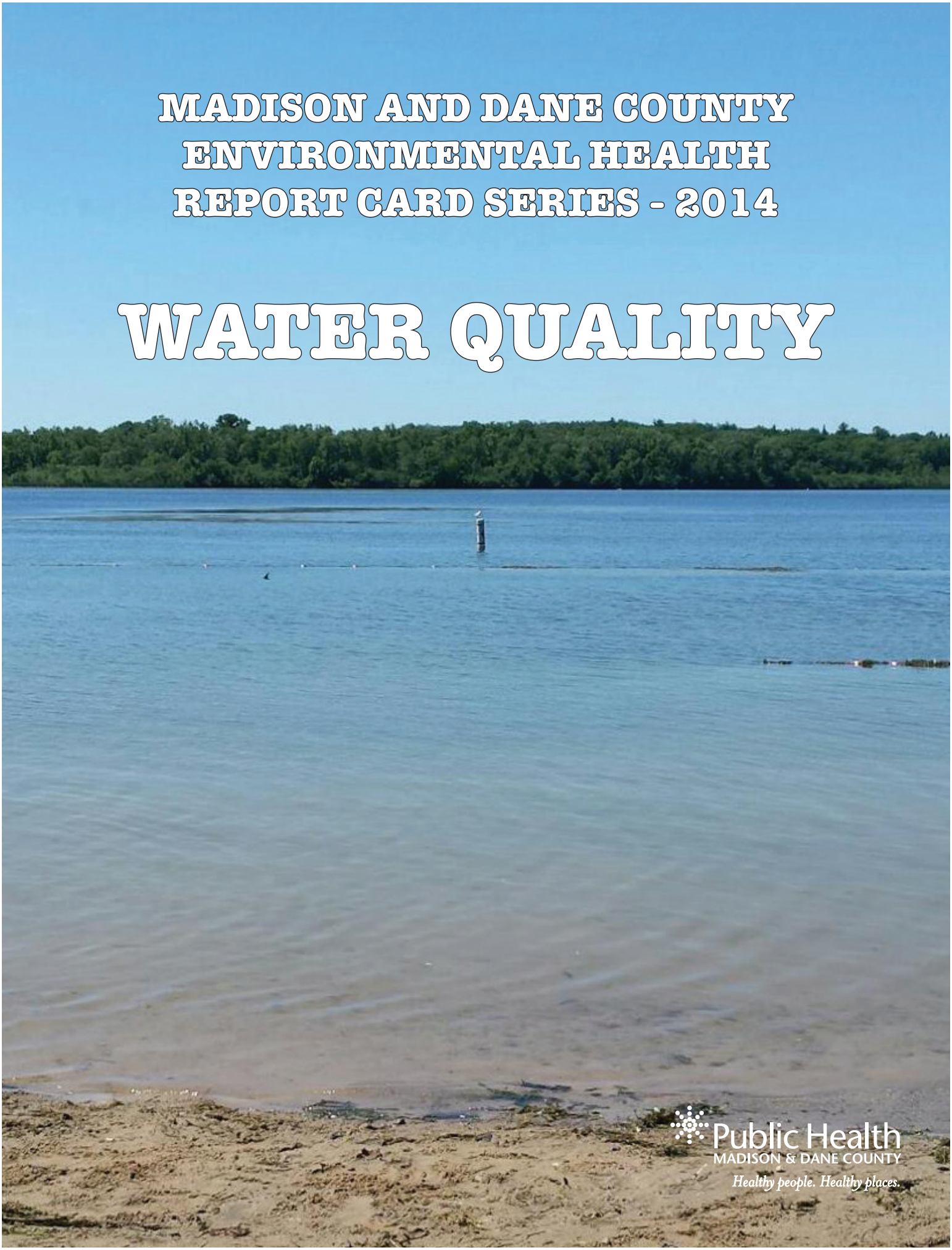
MADISON AND DANE COUNTY ENVIRONMENTAL HEALTH REPORT CARD SERIES - 2014

WATER QUALITY



Public Health
MADISON & DANE COUNTY
Healthy people. Healthy places.

INTRODUCTION

Public Health Madison & Dane County is pleased to present the Water Quality section of the 2014 edition of the Environmental Health Report Card series. The Environmental Report Card provides the most recent data analysis available of Dane County health issues that involve the interaction and subsequent impact between environmental quality and human health. The data presented in this report builds upon prior editions of the Environmental Health Report Card and provides a review of environmental health topics relevant to Dane County and the City of Madison.

The data from this report has been collected from a wide variety of stake holders including academia, private industry, and public health professionals and agencies throughout the county, state, and federal levels. When possible, the report compares the data collected for the City of Madison and Dane County to established standards, desired goals and objectives, and average values of other communities or the State of Wisconsin. Additional resources used to help assess this data have come from the Health People 2020 Objectives and Healthiest Wisconsin 2020 Objectives and Focus Areas. Objectives listed in these documents focus on several areas of public health including environmental issues. Although these objectives are not always measurable at the local level, they provide a solid foundation to effectively assess the environmental issues that impact public health in Dane County.

The Environmental Public Health Report Card continues to evolve with each new edition. In the current edition, each section of the report (Air Quality, Water Quality, Food Protection, Healthy Homes and Communities, and Sustainability) will be released separately, approximately one section each quarter of the year, and followed by a full Executive Summary when each of the reports in the series have been released. The reasoning behind this change in the schedule of publication is to provide the information more efficiently and rapidly to the community. Although the primary focus of this edition of the report will focus on data from 2013 and 2014, at least five years of data will be provided (if available) and discussed to allow a better review of the current environmental health trends in our community.

Despite these changes to the report, this edition continues to utilize features from prior editions that have become useful in the presentation of the information and the understanding of the information by the community. For example, the color-coded arrow system introduced in the 2008 edition continues to be utilized in this report; the direction of the arrow indicative of the level of progress and the color (green, red, and yellow) demonstrating the type of change (positive, negative, or no significant change) for each environmental measure. In addition, potential issues and concerns that have been identified since the publication of the last report continue to be included in the appropriate section of this edition. The sustainability section of the report continues to be refined to more accurately evaluate sustainability efforts in the City of Madison and Dane County to protect our community, our environment, and preserve our rich environmental resources.

This edition of the Environmental Health Report Card is the result of the collaboration of many individuals and organizations that have allowed the compilation of a wide variety of data and information that would not otherwise be possible without their assistance. References to these individuals and organizations are made in the text of this report and compiled at the end to acknowledge these efforts. We greatly appreciate their efforts on this document and apologize if any names have been inadvertently omitted.

Public Health
MADISON & DANE COUNTY
Healthy people. Healthy places.

Jeffery S. Lafferty, PhD — Environmental Epidemiologist
John S. Hausbeck, MS, RS — Environmental Health Supervisor
Doug Voegeli, BS — Director of Environmental Health and Labs
Janel Heinrich, MPH, MA — Director of Public Health Madison & Dane County

City-County Building, Room 507
210 Martin Luther King, Jr. Boulevard
Madison, WI 53703

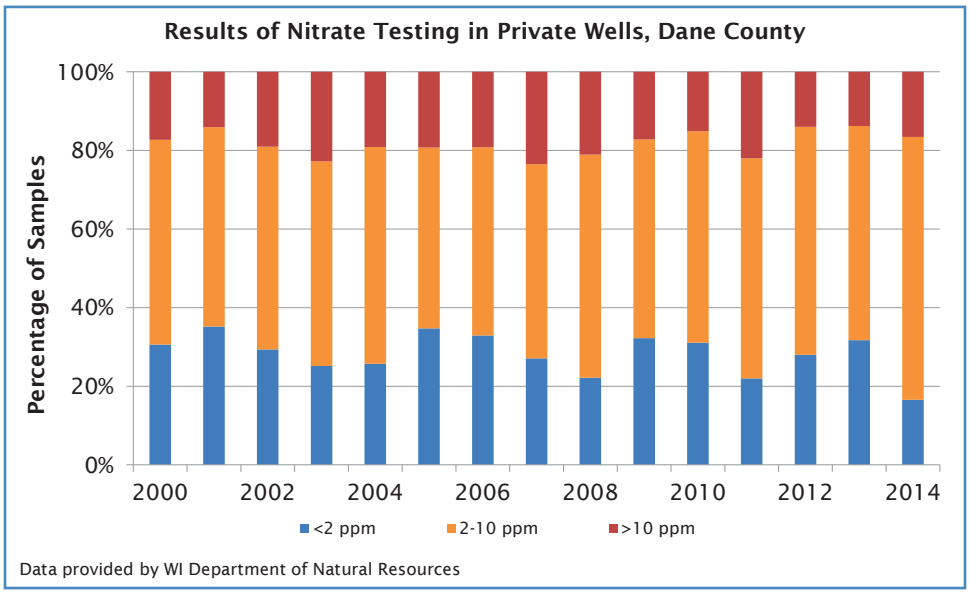
608 266-4821
608 266-4858 fax
www.publichealthmdc.com

ENVIRONMENTAL MEASURES

Nitrate Levels: Private Wells

Nitrate contamination continues to be a significant problem in private wells in Dane County households; this is especially the case for shallow wells which typically have higher nitrate levels than deeper drinking water wells. Over the past decade, several thousand private well water samples have been tested for nitrate levels to evaluate the safety and quality of drinking water; typically, the total number of wells that are tested varies from year to year.

The results reported from the available data show that approximately 18% of the samples over the past fifteen year period exceeded the water quality standard of 10 ppm established for nitrate for public water systems; approximately 54% had nitrate levels between 2 to 10ppm. All other samples were below 2ppm. The sampling years since the publication of the previous report, 2013 and 2014, also displayed similar results to the overall totals (since 2000). In 2013, approximately 14% of annual samples exceeded the 10 ppm standard; approximately 17% of annual samples exceeded the standard in 2014. All other samples during both years were less than 10 ppm. Well nitrate tests conducted by private laboratories are not available for surveillance purposes and are not included in this report.



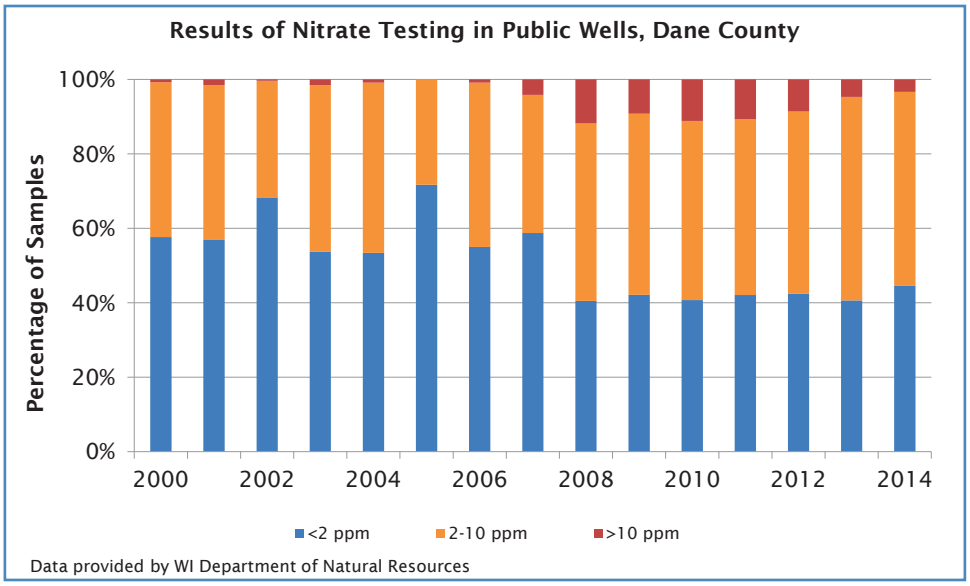
GRADE: NO SIGNIFICANT CHANGE

The percentage of private wells with high nitrate has remained relatively consistent during the past decade.

Nitrate Levels: Public Wells

Nitrate concentrations exceeding regulatory standards are less prevalent in public drinking water samples in Dane County compared to private wells. Over the past decade (the years 2000 – 2014) several thousand samples have been tested for nitrate; approximately 6% were found with concentrations greater than 10 ppm. The remaining samples were within acceptable levels; approximately 45% had levels between 2 to 10 ppm while all others were below 2 ppm (approximately 48%). However, since the year 2007 there have been notable increases in the annual percentage of samples with concentrations of nitrate greater than 10 ppm and decreases in the percentage of samples lower than 2 ppm compared to the year 2000 – 2006 time range; this trend began to improve in 2012 and current data from 2014 are similar levels prior to 2007.

As shown in the following figure, nitrate levels were improved compared to the levels reported in the previous edition of this report; approximately 5% and 3%, of public water samples collected in 2013 and 2014, respectively, tested higher than 10 ppm. This is compared to the 11% reported in 2011 and 9% in 2012 that exceeded the standard.



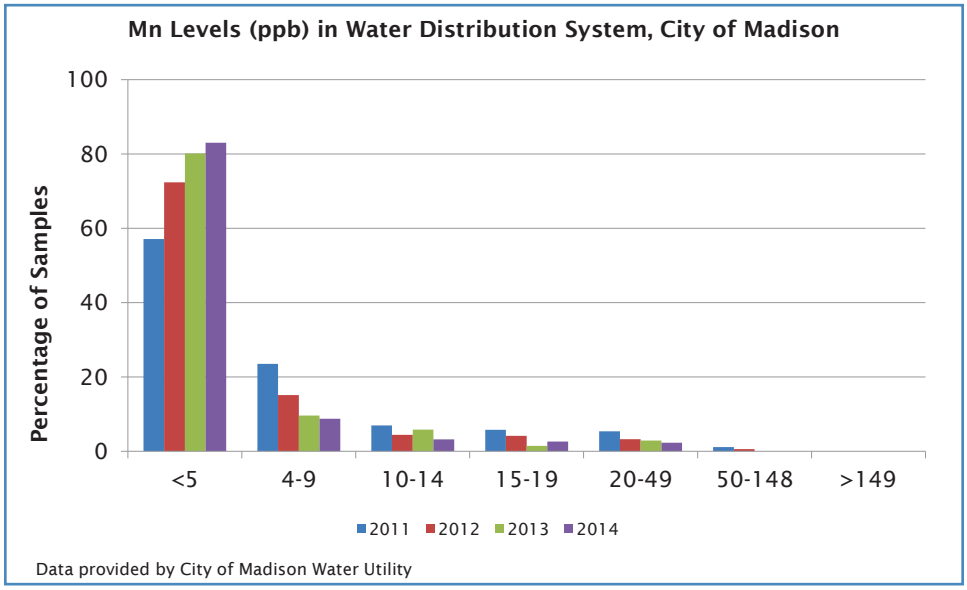
GRADE: IMPROVED

A decreased number of nitrate samples in public drinking water that exceed the 10 ppm standard has been reported since 2012.

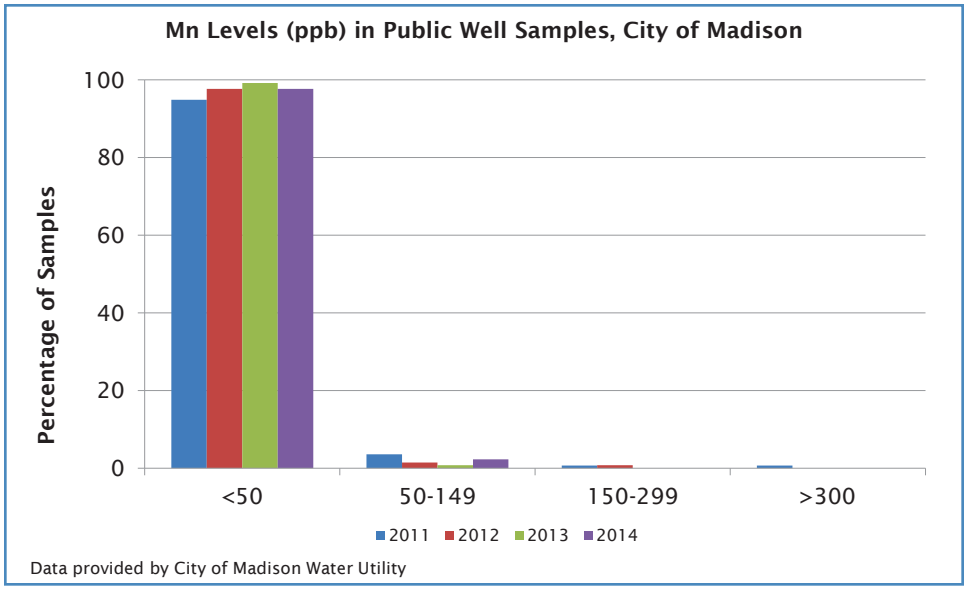
Manganese

An enforceable Maximum Containment Level (MCL) standard at the state and/or federal level has not been established for manganese. A non-enforceable secondary guidance level (SDWR) of 50 ppb has been established to protect against reduced aesthetic water qualities (taste, odor, and/or color), discoloration of clothing, and impacts to household fixtures and appliances.[1-3] An additional lifetime health advisory guideline of 300 ppb has also been used to guide water quality efforts and protect against concerns of potential neurological effects from manganese exposure. However, the US EPA advises that for infants younger than 6 months of age, the lifetime health advisory of 300 ppb be used even for acute exposures of 10 days due to the possibility of a higher absorption and lower excretion in young infants.[1]

Water quality in the City of Madison is evaluated at various representative locations in the distribution system including the entry point of water resources from each active well. During the current reporting period, the vast majority of water quality samples continue to demonstrate levels of manganese below the SDWR standard of 50 ppb. Although the distribution system samples are considered to better reflect "typical" water quality, both measures are reported below. For convenience, the figures are separated by distribution samples and well entry samples.



- In the two most current years, 2013 and 2014, all distribution system samples were below the SDWR; no samples during these years were found to exceed 50 ppb.
- In 2011 and 2012, approximately 99% of the distribution system samples were below the SDWR; a total of 5 samples (3 in 2011 and 2 samples in 2012) exceeded 50 ppb and no samples exceeded 300 ppb.



- In all years shown in the figure above, the majority of water samples collected at the entry point of the well into the distribution system were below the SDWR; ranging from 95 to 99% of samples.
- Only fourteen samples in this time from exceeded 50 ppb; with half of these exceedances occurring in 2011.
- In 2011, one sample exceeded 300 ppb; no other sample in the hundreds of samples collected during this four year period was found to exceed this level of elevation.

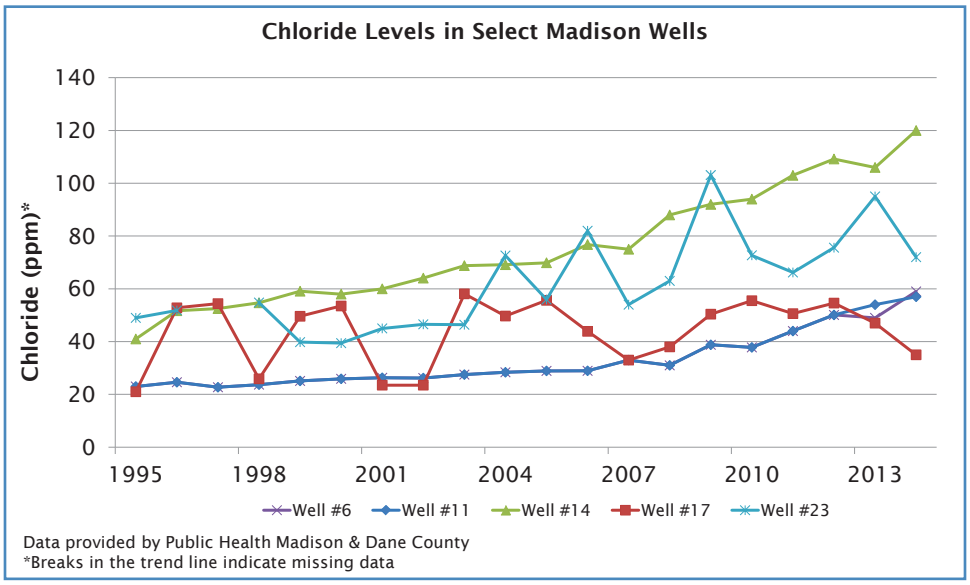
GRADE: NO SIGNIFICANT CHANGE

The vast majority of water quality samples continue to demonstrate levels below state and federal guidelines.

Chloride: Drinking Water

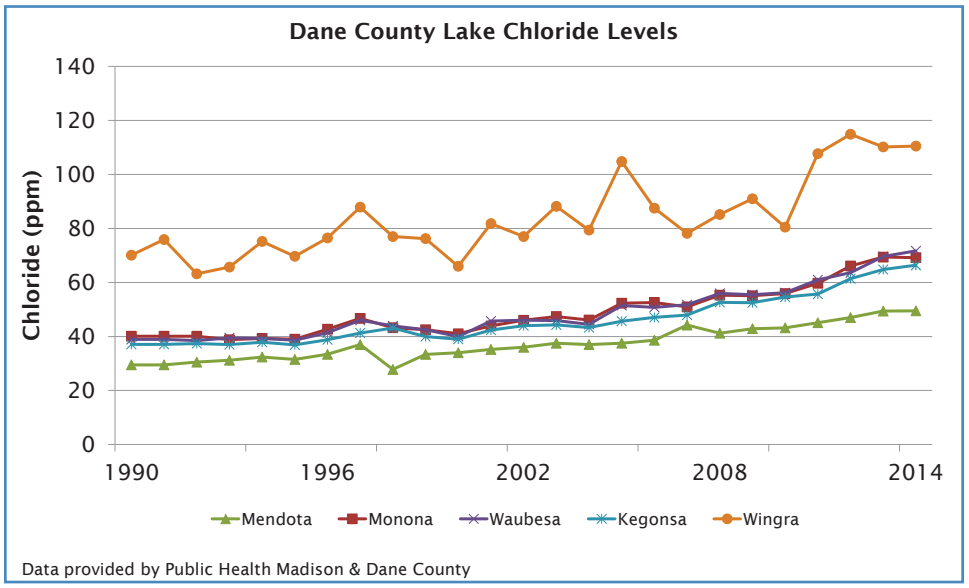
Similar to manganese, chloride also does not have an enforceable standard. A secondary SDWR of 250 ppm has been established by the US EPA and the Wisconsin Department of Natural Resources (WI DNR) for chloride to provide guidance to protect drinking water quality.[3,4] The five wells with the highest currently reported levels of chloride in the City of Madison (Wells 6, 11, 14, 17, and 23) are shown in the following table. Wells 14 and 23 continue to demonstrate the largest increases among wells that are routinely monitored; all other municipal wells consistently report lower concentrations of chloride. However, Wells 15 and 16 display similar but slightly lower levels compared to Wells 6 and 11 (data not shown).

The well that continues to have the highest annual average concentration of chloride, Well 14, had a reported chloride level of 120 ppm in 2014; an approximate increase of 10% since 2012 (the last edition of this report), a 193% increase since 1995, and an increase of 900% since 1975 (data not shown). Well 23 has shown a similar pattern with an approximate 47% increase in chloride levels since 1995 and an 800% increase since 1975.



Chloride: Surface Water

Similar trends in chloride levels have also been reported in Dane County surface waters. As shown in the following figure, these levels have been steadily increasing over the past four decades (data from 1970 – 1980 not shown). Although the average chloride levels reported in each of the sampled lakes do not pose an immediate risk to human health these levels may impact the ecology of Dane County lakes. This is especially true for Lake Wingra, which consistently displays higher levels of chloride than any other Yahara chain lake and continues to increase. The levels of chloride in this specific lake has increased approximately 67% since the year 2000 and over 175% since 1970 when compared to 2014 levels.



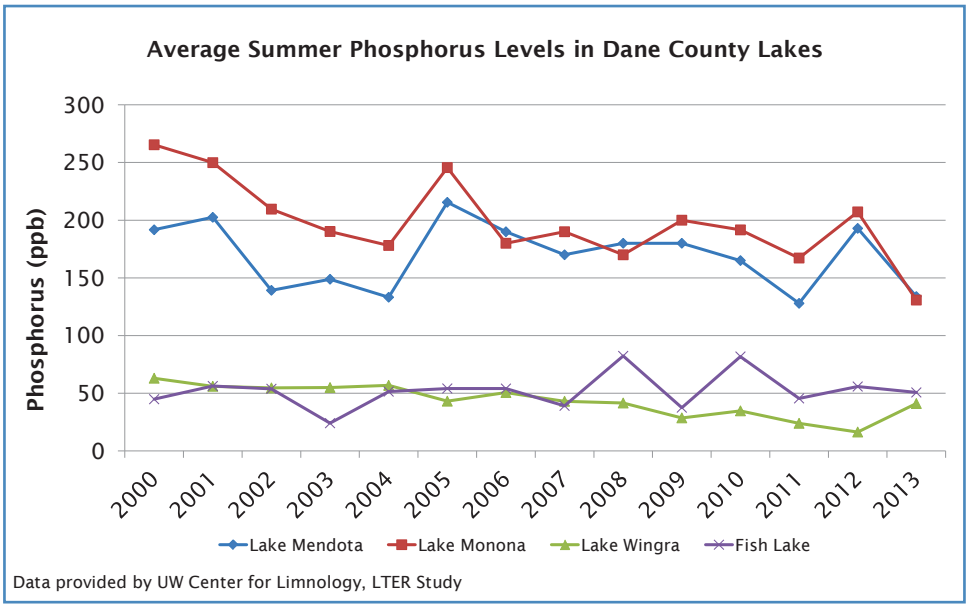
GRADE: NEEDS IMPROVEMENT

Dane County surface and drinking water resources continue to demonstrate increases in chloride levels.

Phosphorus: Surface Waters

High levels of phosphorus in surface water leads to an increase in the growth of harmful algal blooms and excessive plant growth. Blue-green algae (cyanobacteria) blooms continue to be a nuisance throughout Dane County resulting in beach closure, decreased surface water quality, and illness in humans and animals following exposure.[5,6] Algal blooms are common at phosphorus levels higher than 50 ppb but can also occur at levels above 30 ppb; levels that are typically reported in Dane County lakes.

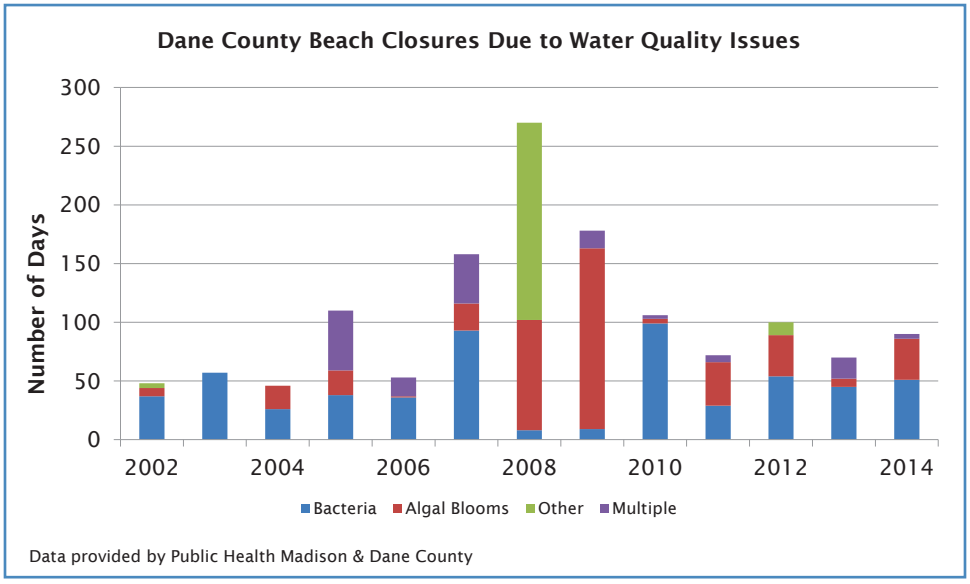
As shown in the accompanying figure, the average phosphorus levels reported in the larger lakes of the Yahara chain, Lakes Monona and Mendota, are considerably higher in comparison to smaller lakes such as Lake Wingra and Fish Lake. Lakes Mendota and Lake Monona have both demonstrated decreased phosphorus levels since the year 2000; a decline of approximately 30% and 50%, respectively, when compared to reported levels in 2013 (latest year available) with a consistent decrease in both lakes after 2005 potentially the result of improved agricultural practices combined and the passage and implementation of phosphorus fertilizer regulations in Dane County.[7] Of the smaller lakes, a reported decrease in phosphorus levels has also been reported in Lake Wingra; a decline of approximately 35% since the year 2000. An increase of approximately 13% was reported in Fish Lake but the levels recorded in both Lake Mendota and Fish Lake have been more variable compared to the larger lakes. Phosphorus levels displayed in the figure were sampled near the center of the lake; conditions near the shore where most algal blooms occur might be very different and may vary widely from day to day.



To protect the health of beach users, Dane County beaches are closed to the public when elevated levels of cyanobacteria and/or *E. coli* are detected. There are approximately 1,500 beach days in Dane County (15 beaches x 100 days between Memorial Day and Labor Day).

As depicted in the following figure, the number of beach closures is variable by year but continues to be lower since the number of days reported in 2007 - 2009 but still remains higher than the number of reported closures earlier in the decade (2002 – 2004 and 2006). The two primary contributing factors leading to beach closures over the past decade are harmful algal blooms (HABs) and high levels of bacteria that threaten the health and safety of beach users and swimmers. HABs are primarily derived from excess nutrients such as phosphorus and nitrogen from urban and agricultural sources. Contaminated storm water runoff is also a direct cause of high levels of bacteria such as *E. coli* but, in this case, fecal waste from large populations of waterfowl and other wildlife and pets also plays a contributing role to an increased risk of high bacteria levels and beach closures.

In 2013, a total of 70 beach days were lost due to closure; a loss of approximately 5% of total beach days in Dane County. Of these closures, approximately 64% were due to bacteria and 10% from HABs. However, in 2014, the majority of lost days (approximately 57%) were due to bacteria; the remaining closures were due to HABs (approximately 39%) or other sanitary causes.



GRADE: NO SIGNIFICANT CHANGE

The number of beach closures in 2013 and 2014 continue to be less than the high number of closures in 2008 but remain higher than numbers reported earlier in the decade.

Heavy Metals

In addition to nutrients, storm water run-off washes other pollutants, such as heavy metals, into Dane County lakes, rivers, and streams. High levels of these metals in surface waters may cause human health problems such as neurological, gastrointestinal, and cardiovascular effects; long term exposure to these metals at high levels may also increase the risk of heart disease, kidney disease, and cancer.[8-12] The tables below provide an example of the concentration of heavy metals found in Dane County surface waters for selected metals during the past two years since the publication of the previous edition of this report.

Dane County surface water continues to demonstrate heavy metal levels that are not detected or very low and are significantly below surface water quality standards; changes in concentrations from 2013 were negligible and have been consistently low during the past 5 years (data not shown).

Median Pollutant Levels in Selected Dane County Surface Waters, 2013 (ppb)*						
Site	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Zinc**
Dunn's Marsh	3.4	<0.2	0.3	<1.0	<1.6	2.6
Lake Kegonsa	0.5	<0.2	<0.2	<1.0	<1.6	1.5
Lake Mendota	<0.2	<0.2	<0.2	<1.0	<1.6	0.9
Lake Monona	<0.2	<0.2	<0.2	<1.0	<1.6	1.8
Lake Waubesa	0.9	<0.2	<0.2	<1.0	<1.6	1.4
Lake Wingra	0.4	<0.2	<0.2	<1.0	<1.6	1.6
Yahara River	0.7	<0.2	0.8	<1.0	<1.6	1.5
Surface Water Quality Standard	**148#**	**9.65^**	**152.1**	**18.73**	**54.71**	**220.70**

Data provided by Public Health Madison & Dane County
* In 2013, the minimum detection level used for water sample analysis for heavy metals were as follows: As 0.2, Cd 0.2, Cu 1, Pb 1.6, and Zn 0.4 ppb, respectively. Analytical method ICP/MS was used for this analysis year.
# The standard for As is a cold water chronic standard, all others are surface water quality standards that represents chronic toxicity criteria at a water hardness of 200 ppm unless otherwise indicated.
^ The standard for Cd is a surface water quality standard that represents acute toxicity criteria at a water hardness of 200 ppm.

Median Pollutant Levels in Selected Dane County Surface Waters, 2014 (ppb)*						
Site	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Zinc**
Dunn's Marsh	<2.3	<0.2	0.5	1.6	<1.6	6.7
Lake Kegonsa	<2.3	<0.2	<0.2	<1.0	<1.6	5.0
Lake Mendota	<2.3	<0.2	<0.2	<1.0	<1.6	3.0
Lake Monona	<2.3	<0.2	<0.2	<1.0	<1.6	3.5
Lake Waubesa	<2.3	<0.2	<0.2	<1.0	<1.6	3.4
Lake Wingra	<2.3	<0.2	<0.2	<1.0	<1.6	3.7
Yahara River	<2.3	<0.2	0.6	1.4	<1.6	5.8
Surface Water Quality Standard	**148#**	**9.65^**	**152.1**	**18.73**	**54.71**	**220.70**

Data provided by Public Health Madison & Dane County
* In 2013, the minimum detection level used for water sample analysis for heavy metals were as follows: As 0.2, Cd 0.2, Cu 1, Pb 1.6, and Zn 0.4 ppb, respectively. Analytical method ICP/MS was used for this analysis year.
# The standard for As is a cold water chronic standard, all others are surface water quality standards that represents chronic toxicity criteria at a water hardness of 200 ppm unless otherwise indicated.
^ The standard for Cd is a surface water quality standard that represents acute toxicity criteria at a water hardness of 200 ppm.

Low levels of hexavalent chromium (Cr VI) is also found in the Dane County drinking water resources and has led to concern from residents about water quality issues due to the association of the metal with an increased risk of stomach cancer. However, research supporting an association between drinking water exposures to Cr VI and cancer risk is very limited, heavily disputed, and based upon high concentrations of the contaminant.[13-15] In fact, to date, the study most often cited to demonstrate this association in humans was based upon data derived from individuals that had consumed drinking water for decades with a concentration of approximately 20 ppm of Cr VI (equivalent to 20,000 ppb).[14-15] As demonstrated by the continued testing by the City of Madison Water Utility, the concentration of Cr VI found in the city's municipal water supply in 2014 (latest data available) continues to be extremely low; thousands of times lower than levels proposed to increase the risk of stomach cancer.[15] The highest concentration of hexavalent chromium was less than 2 ppb; most of the other City of Madison wells had concentrations of less than 1 ppb or below.[16] Since monitoring of Cr VI began in 2011, previous monitoring efforts from 2011 – 2013 demonstrated similar results.[13] Therefore, any potential human health risk derived from the consumption of drinking water from our community that contains trace amounts of Cr VI is very unlikely.

GRADE: NO SIGNIFICANT CHANGE

Heavy metal levels continue to be reported well below water quality standards in Dane County surface waters.

SOURCES

Nitrate

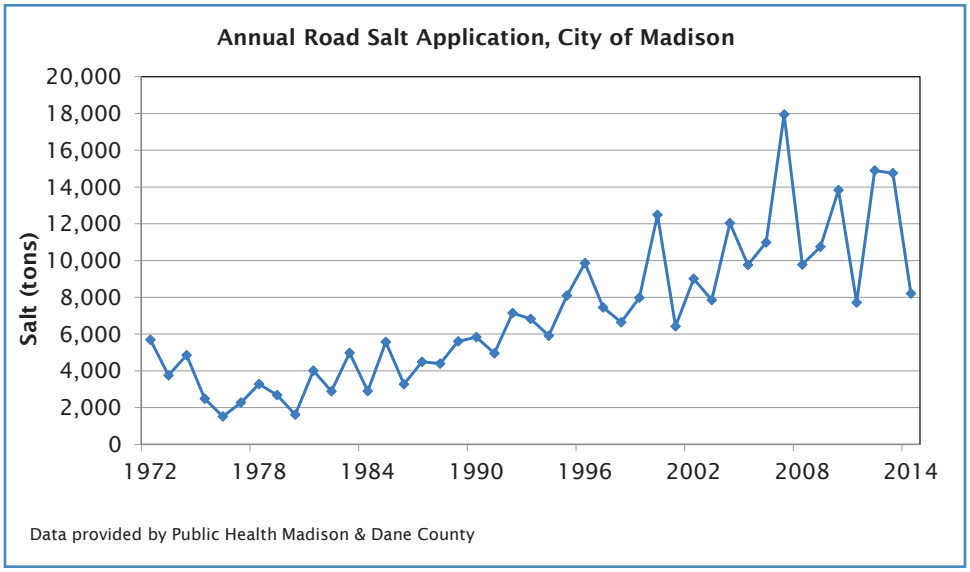
An estimated 200 million pounds of nitrate/ nitrogen enter Wisconsin groundwater resources annually; up to 90% from agricultural operations such as fertilizer and manure spreading.[17-19] Additional sources of nitrogen contamination include septic and municipal sewer systems, lawn fertilizers, and decaying plant debris.[18,19] Nitrate reaches surface waters primarily through storm water runoff derived from rains and snow melts; entering ground water either leaching into soils or groundwater discharging into surface water. A portion of the nitrate from the soil surface is absorbed by plant root systems; however, once it passes the root zone, the soil does not bind a significant amount of nitrate facilitating its entry into ground water.

Manganese

Manganese is a naturally occurring component of the deep-aquifer beneath Dane County. This metal can unevenly accumulate as sediment in water distribution pipes and fixtures, especially in large municipal systems. In municipal systems, the sediment may be resuspended with changes in the hydrostatic pressure and ultimately arrive in households in high concentrations. Additional sources of manganese include foods such as grains, beans, nuts, and tea and industrial sources such as welding and steel manufacturing.[20]

Chloride

The Wisconsin Department of Transportation (WI DOT) began using rock salt as a deicer in the 1950s; by 1956 the state initiated a “bare pavement” policy to improve driving conditions in the winter months. The City of Madison began salting three years later in a similar fashion.[21] This routine application of road salt (sodium chloride) has continued for decades by Dane County and the City of Madison to maintain road safety. Despite the reported effectiveness of this strategy in the maintenance of safe driving conditions, the application of road salt and runoff during snow melt are the primary cause of increased chloride concentrations in surface and groundwater supplies.



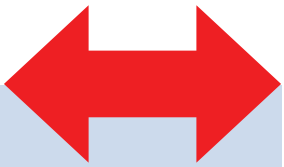
The figure above demonstrates the trend of salt use from 1972 to 2014 in the City of Madison; the largest single year increase in this three decade sample period occurred in 2012 due to a near doubling of snowfall compared to the previous year (approximately 31 inches in 2011 season to over 70 inches in 2012). A similar, but slightly smaller, increase was also recorded in 2007 following a record snowfall of over 100 inches.

A road salt application goal was established in 1973 to reduce the annual road salt use to half of the salt application during the 1971 – 1972 winter season; this goal equated to approximately 5.6 tons of salt per mile of road. However, the amount of street miles has increased over 300% since the adoption of this guideline causing the goal to be unrealistic and routinely exceeded each year since 1984 (data not shown) due to the need to maintain safe driving conditions during the winter months.

Since the publication of the 2012 version of this report, the past two winters of Dane County have been highly variable in terms of snowfall. The winter of 2013 – 2104 delivered approximately 60 inches of snowfall to the county; well above the seasonal of average of approximately 45 inches. In response, the city used over 14,500 tons of salt for 734 line miles receiving salt along the application route. For all of Dane County, over 63,000 tons of road salt was applied on roads, highways, and interstates.

The winter of 2014 – 2015 was milder; delivering approximately 35 inches of snowfall. During this season the city used over 8,000 tons of road salt for the same amount of line miles reported during the previous year.

Additional salt used in water softeners and salt applications to parking lots, sidewalks, and private property also provide a significant source of chloride in our surface and ground water. Currently no data is available quantifying the amount of salt used in these situations.



GRADE: NO SIGNIFICANT CHANGE

Variable but steady increases in salt application levels over the past few decades continues to leading to increases in surface and ground water chloride levels.

Phosphorus

Phosphorus is carried from agricultural fields, lawns, streets, sidewalks, and deposited into surface waters by floodwaters and storm water run-off. Overuse and misuse of fertilizer is an important source of phosphorus in addition to soil erosion and poor handling and disposal of leaves, grass clippings, and other lawn debris. Increased levels of phosphorus in Dane County lakes contribute to harmful algae blooms and weed growth that continue to be a nuisance in our community. Algae blooms are also a human health concern; especially at beaches and other locations that people, pets, and other animals have contact with surface water.

A statewide ban on phosphorus containing lawn fertilizers went into effect in the spring of 2010 to reduce the amount of phosphorus that reach and potential impact Wisconsin surface waters. A similar ordinance was initiated in 2005 by the City of Madison and Dane County.[7,23]

Heavy Metals and PCBs

Heavy metals in surface and ground water are derived from a variety of potential sources; the most common is the release of these materials (intentional and unintentional) from industrial sites into the air, soil, and/or water. Additional sources include household waste, landfills, chemical and material spills, and illegal or inappropriate dumping of materials containing metals and polychlorinated biphenyls (PCBs).[8-12] Airborne material releases deposit over time into surface waters and soils; materials that will enter surface water resources via erosion and storm water run-off. Metals, including mercury, and other chemicals such as PCBs may persist in the environment long after their release providing a potential for bioaccumulation and magnification. PCB contamination is discussed in greater detail in the following section.

HUMAN HEALTH IMPACTS

Fortunately, Dane County has not had a significant disease outbreak associated with drinking or recreational water in recent history but individual cases are reported. The following discussion provides data on selected illness reports and examples of human disease risks that are relevant to the information presented in this section of the Environmental Health Report Card.

Surface and Recreational Waters

Human illness derived from recreational water use occurs occasionally, either from ingestion of contaminated water or exposure to harmful algal blooms during recreational activities. Dependent upon the disease agent (viral, bacterial, or parasitic), symptom may include fatigue, nausea, vomiting, cramps, diarrhea, and fever. Symptoms derived from exposure to algal blooms include rash, sore throat, eye irritation, breathing problems, nausea, vomiting, diarrhea, numbness, joint/muscle pain, headache, and fatigue. However, illnesses from recreational water are largely unreported and can lead to the under representation of surveillance data.

- In 2013, there were 2 cases of illness suspected cercarial dermatitis reported to PHMDC; also known as "swimmer's itch" this rash is an allergic reaction from exposure to parasites that typically live on waterfowl.[23] No recreational illnesses associated with exposure to bacteria or harmful algal blooms were reported.
- In 2014, two illnesses likely related to exposure to harmful algal blooms and two cases from likely bacterial related exposure in recreational waters were reported to PHMDC.

Drinking Water

- The maximum containment level (MCL) for nitrate is 10 ppm to monitor levels in drinking water to prevent an increased risk of adverse health effects resulting from exposure.[19] Nitrate levels of 2 ppm or greater exceed the Wisconsin non-enforceable ground water Prevention Action Limit (< 2ppm) and suggest that action is needed.[19,25]
  - The presence of nitrate at levels above 10 ppm places infants at risk for a serious illness called methemoglobinemia; also referred to as "Blue Baby Syndrome" due to the appearance of the patient caused by the reduction of the blood's ability to carry oxygen.[24]
  - Research has also suggested that consuming nitrate contaminated water may increase the risk of thyroid disease, diabetes, and certain types of cancer.
  - People with heart and lung disease, certain inherited enzyme defects, or cancer are more susceptible to the toxic effects of nitrate than healthy individuals.
- Lead is rarely found in drinking water resource in concentrations that would cause concern; however, the metal can enter tap water in potentially dangerous levels through corrosion of plumbing materials. The use of lead water pipes and solder was banned in 1986 but homes built before this ban have an increased likelihood of lead plumbing; this is especially true of older homes in the area. Modern plumbing fixtures containing brass fixtures and/or galvanized pipe still contain small amounts of lead that can leach into drinking water; therefore, childhood lead testing remains an important method to determine exposure (if any). Childhood exposure to lead in drinking water can cause delays in physical and mental development; in adults exposure can increase blood pressure and kidney problems.[26,27]

- Excess sodium in the diet can increase the risk of hypertension, heart disease, and stroke. Although the vast majority of sodium intake is derived from food, sodium is also typically found in drinking water at low levels. The US EPA has established a guidance level of 20 ppm for individuals on restricted sodium diets; all but four of municipal wells in the City of Madison meet this criteria.[28,29] The wells that exceeded the guidance level ranged from equal to the level or slightly above (Wells 16, 15, and 23, respectively) to concentrations above the lowest value (Well 14) for the taste threshold value range of 30 – 60 ppm.[30] All wells are considered "very-low sodium" by US EPA sodium classifications.[28,29]

Contaminants in Fish

- The persistence and potential biomagnification of mercury and PCBs in fish due to surface water contamination has resulted in human exposure to high levels of these contaminants. The consumption of methylmercury-contaminated food may result in a multitude of reported symptoms including loss of feeling, vision, and motor coordination; at very high doses seizures, severe neurological impairment, and death have been recorded. Methylmercury can also cause birth defects that range from mild neurological effects if consumed in significant amounts during pregnancy.[31]
- Research of the potential impact of PCB-contaminated foods includes toxic effects to the liver, gastrointestinal tract, reproductive system, endocrine and immune systems, and developmental impairment. The occurrence of cancer, severe acne, and other health conditions in research efforts are not fully understood.[32,33]
- Fish consumption advisories available from the Wisconsin Department of Natural Resources (**http://dnr.wi.gov/topic/fishing/consumption**) and Public Health Madison & Dane County (**www.publichealthmdc.com/environmental/water/fish.cfm**) provide additional information and guide appropriate consumption.

LOCAL RESPONSE

Individual Actions

- Households that receive water from a public water system receive and should review an annual Consumer Confidence Report that describes the results of local water quality monitoring (**http://dnr.wi.gov/topic/drinkingwater/ccr.html**).
- Individuals and households that are supplied by private wells should test their water annually for nitrate and bacteria.
  - Although a concern for everyone in our community, annual nitrate testing is especially important for families with infants, small children, and/or pregnant women.
- Report spills or discharges of potentially hazardous materials to PHMDC or WI DNR.
- Individuals and households that receive water from the public water system should report any potential problems (poor odor, taste, discoloration, etc) to the local water utility or PHMDC.
- Increase the amount of water that soaks into the soil (infiltrate) to reduce run-off by diverting storm water into rain gardens, installing rain barrels, and/or infiltration devices. However, conservation efforts should not create additional problems; for example rain barrels should be closed and rain garden appropriately screened to prevent access to and breeding of mosquitoes.
- Reduce or eliminate the use of chemicals and lawn care products on your property.
  - The use of salt for melting ice, lawn fertilizers, and pesticides should only be used when necessary.
  - Dispose of oils, fuels, solvents, and cleaning chemicals properly. Madison/Dane County Clean Sweep is one option of appropriate disposal; more information about this program is available at the following website: **www.danecountycleansweep.com**.
- If your residence has a septic system make sure the system is regularly maintained and working properly.
- Keep yard waste and leaves out of street gutters.
- Review and follow the guidance for fish consumption to reduce individual exposure potentially harmful contaminants such as mercury and PCBs.
- Report harmful algal blooms to PHMDC or WI DNR to assist in the safety our recreational waters.

Community Actions

- Monitor public drinking water supplies and surface waters to ensure the continued safety of these resources and take action when water quality problems are identified.
  - » Outside of the City of Madison, lead service lines exist in many communities across Dane County. The local utilities that manage these systems must take actions to ensure water pipes are not releasing lead into the drinking water.
  - » Madison-area swimming areas are sampled frequently during May to September. The beaches are routinely closed or access restricted if bacteria counts are found to be elevated and/or harmful algae blooms are present as a precaution to protect the health of the users of these facilities.
- Prevent pollution in our lakes, rivers, and streams by implementing comprehensive watershed management plans.
- Update fish consumption advisory (as needed) based on measured levels of PCBs and mercury in fish tissue and changes in state and/or federal regulatory standards.
- Reduce salt use on Dane County roadways, parking lots, and sidewalks in order to lower the amount of this material reaching surface and ground waters.
- Continue to provide information to the public about water quality issues to improve the understanding of these issues among Dane County residents.

Section Note:

[A] The topic descriptions that reference the Health Dane.Org website were accurate at the time of the publication of this section of the 2014 version of the Environmental Health Report Card. However, it must be noted that the Healthy Dane.Org website is updated periodically as new data is made available and may cause the text included in this report describing the data available at this resource to be inaccurate.

ACKNOWLEDGEMENTS

Many thanks to the individuals and organizations that provided data, reviewed the report sections, and provided suggestions to improve the final report. This report would not have been possible without their efforts. The following individuals, organizations, and databases provided the information presented in the Water Quality report of the Environmental Health Report Card series.

Brian Austin, Wisconsin Department of Natural Resources
Centers for Disease Control and Prevention
Chemical Limnology of North Temperature Primary Study Lakes: Nutrients, North Temperature Lakes Long Term Ecological Research Program (NTL-LTER) program, **https://lter.limnology.wisc.edu**
Joe Grande, City of Madison Water Utility
Kirsti Sorsa, Glenn Hyland, & Rick Wenta, Public Health Madison & Dane County
United States Environmental Protection Agency

REFERENCES

[1] United States Environmental Protection Agency. (2012). 2012 edition of the drinking water standards and health advisories. Retrieved from: http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf.

[2] United States Environmental Protection Agency. (2004). Drinking water health advisory for manganese. Retrieved from: www.epa.gov/safewater/ccl/pdfs/reg_determine1/support_cc1_magnese_dwreport.pdf.

[3] United States Environmental Protection Agency. (2013). Secondary drinking water regulations: Guidance for nuisance chemicals. Retrieved from: http://water.epa.gov/drink/contaminants/secondarystandards.cfm.

[4] Wisconsin Department of Natural Resources. (2011). Drinking water & ground water quality standards/advisory levels. Retrieved from: http://dnr.wi.gov/topic/drinkingwater/documents/haltable.pdf.

[5] Wisconsin Department of Health Services. (2015). Blue green algae. Retrieved from: https://www.dhs.wisconsin.gov/water/bg-algae/index.htm.

[6] Public Health Madison & Dane County. (2015). Beaches and your health. Retrieved from: www.publichealthmdc.com/environmental/water/beaches/beachHealth.cfm.

[7] Dane County Lakes and Watershed Commission. (n.d.). Phosphorus control in Dane County. Retrieved from: www.danewaters.com/management/phosphorus.aspx.

[8] Agency for Toxic Substances and Disease Registry. (2015). Toxic substances portal – Arsenic. Retrieved from: www.atsdr.cdc.gov/toxfaqs/TF.asp?id=19&tid=3.

[9] Agency for Toxic Substances and Disease Registry. (2015). Toxic substances portal – lead. Retrieved from: www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22.

[10] Agency for Toxic Substances and Disease Registry. (2011). Toxic substances portal – copper. Retrieved from: www.atsdr.cdc.gov/toxfaqs/TF.asp?id=205&tid=37.

[11] Agency for Toxic Substances and Disease Registry. (2015). Toxic substances portal – cadmium. Retrieved from: www.atsdr.cdc.gov/toxprofiles/tp.asp?id=48&tid=15.

[12] Agency for Toxic Substances and Disease Registry. (2015). Toxic substances portal – chromium. Retrieved from: www.atsdr.cdc.gov/toxprofiles/tp.asp?id=62&tid=17.

[13] City of Madison Water Utility. (2015). Chromium in water. Retrieved from: www.cityofmadison.com/water/water-quality/water-quality-testing/chromium-in-water.

[14] Zhang, J, & Li, X. (1987). Chromium pollution of soil and water in Jinzhou. *Chinese Journal of Prevention Medicine, 21*(5), 262-264.

[15] Smith, AH. (2008). Hexavalent chromium, yellow water, and cancer: a convoluted saga. *Epidemiology, 19*(1), 24-26.

[16] City of Madison Water Utility. (2015). Hexavalent chromium monitoring – 2014. Retrieved from: www.cityofmadison.com/sites/default/files/city-of-madison/water-utility/documents/Chromium_2014_0915.pdf.

[17] University of Wisconsin – Madison Water Resource Institute. (2009). Nitrate in groundwater. Retrieved from: http://aqua.wisc.edu/publications/pdfs/NitrateInGroundwaterWISWR1203.pdf.

[18] Wisconsin Department of Natural Resources. (2009). Nitrate in groundwater. Retrieved from: http://aqua.wisc.edu/publications/pdfs/nitratefactsheet.pdf.

[19] Wisconsin Department of Natural Resources. (2014). Nitrate in drinking water. Retrieved from: http://dnr.wi.gov/files/pdf/pubs/dg/dg0001.pdf

[20] Agency for Toxic Substances and Disease Registry. (2012). Toxicological profile for manganese. Retrieved from: www.atsdr.cdc.gov/toxprofiles/tp151.pdf.

[21] Public Health Madison and Dane County. (2014). Road salt report – 2014. Retrieved from: www.publichealthmdc.com/publications/documents/RoadSaltRpt2014.pdf.

[22] Wisconsin Department of Agriculture, Trade, and Consumer Protection. (2015). Fertilizer. Retrieved from: http://datcp.wi.gov/Environment/Fertilizer.

[23] Mayo Clinic. (2014). Swimmer's itch. Retrieved from: www.mayoclinic.org/diseases-conditions/swimmers-itch/basics/definition/con-20030150.

[24] United States Environmental Protection Agency. (2014). Basic information about nitrate in drinking water. Retrieved from: http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm.

[25] Wisconsin Legislative Documents. (2012). Chapter NR 140 – Ground water quality. Retrieved from: https://docs.legis.wisconsin.gov/code/admin_code/nr/100/140.pdf#page=12.

[26] Public Health Madison & Dane County. (2015). Drinking water – Common water quality concerns. Retrieved from: www.publichealthmdc.com/environmental/water/concerns.cfm.

[27] United States Environmental Protection Agency. (2015). Lead in drinking water. Retrieved from: http://water.epa.gov/drink/info/lead.

[28] City of Madison Water Utility. (2014). Annual inorganic analysis – 2014. Retrieved from: https://www.cityofmadison.com/sites/default/files/city-of-madison/water-utility/documents/IOC_2014_Final.pdf.

[29] United States Environmental Protection Agency. (2012). Sodium in drinking water. Retrieved from: http://water.epa.gov/scitech/drinkingwater/dws/ccl/sodium.cfm.

[30] United States Environmental Protection Agency. (2003). Drinking water advisory: Consumer acceptability advice and health effects analysis on sodium. Retrieved from: http://water.epa.gov/action/advisories/drinking/upload/2003_03_05_support_cc1_sodium_dwreport.pdf.

[31] United States Environmental Protection Agency. (2013). What you need to know about mercury in fish and shellfish. Retrieved from: http://water.epa.gov/scitech/swguidance/fishshellfish/outreach/advice_index.cfm.

[32] Wisconsin Department of Health Services. (2014). Polychlorinated biphenyls (PCBs) and your health. Retrieved from: www.dhs.wisconsin.gov/environmental/pcb-fish.htm.

[33] Agency for Toxic Substances and Disease Registry. (2000). Toxicological profile for polychlorinated biphenyls (PCBs). Retrieved from: www.atsdr.cdc.gov/toxprofiles/tp17.pdf.