Madison and Dane County Environmental Health Report Card – 2010

Public Health
MADISON & DANE COUNTY
Healthy people and places

TABLE OF CONTENTS

INTRODUCTION

Public Health Madison & Dane County is pleased to present the 2010 edition of the Environmental Health Report Card. This 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. Common examples of these issues relevant to our community include sodium in drinking water, fine particulates and ozone levels in the air, lead paint in homes, and the contamination of food with bacteria and viruses.

The data from this report has been faithfully 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 entire State of Wisconsin. Additional variables used to help assess this data have come from the Health People 2020 Objectives and Healthiest Wisconsin 2020 Objectives and Focus Areas. These documents are health promotion and disease prevention agendas established by the United States Department of Health and Human Services and the Wisconsin Department of Health and Family Services, respectively. Objectives listed in either document 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. The color-coded arrow system introduced in the previous 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 not notable change) for each environmental measure. Similar to previous editions of this report, new datasets and potential issues and concerns that have been identified since the publication of the last report are included in the appropriate section of this edition. In addition, the sustainability section of the report, also initiated in the last edition, 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 and places

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

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

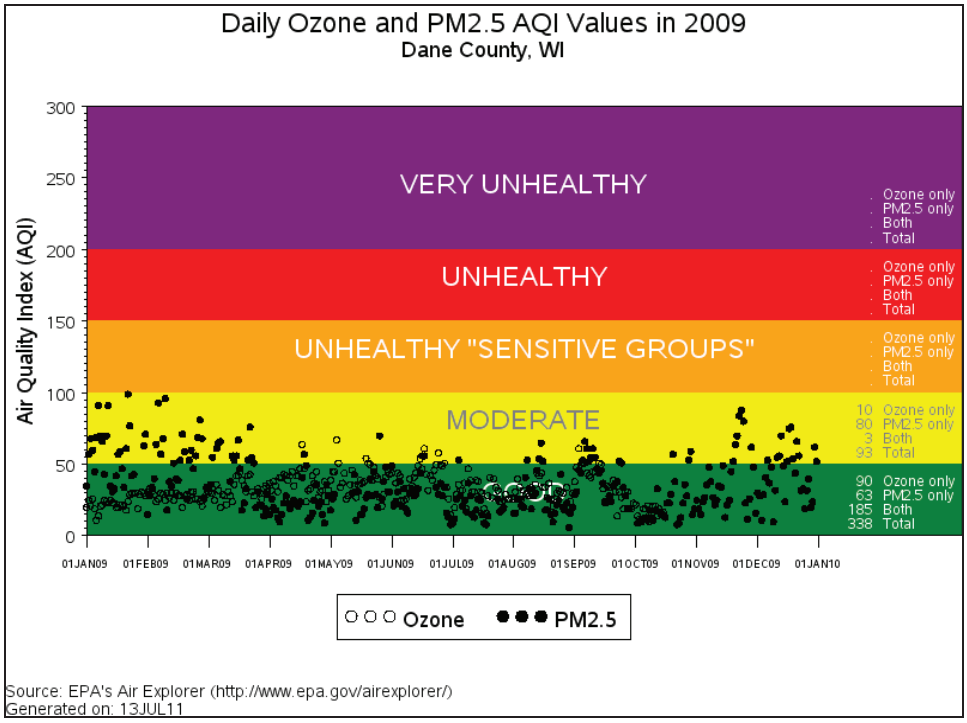
608 266-4821
608 266-4858 fax
www.publichealthmdc.com

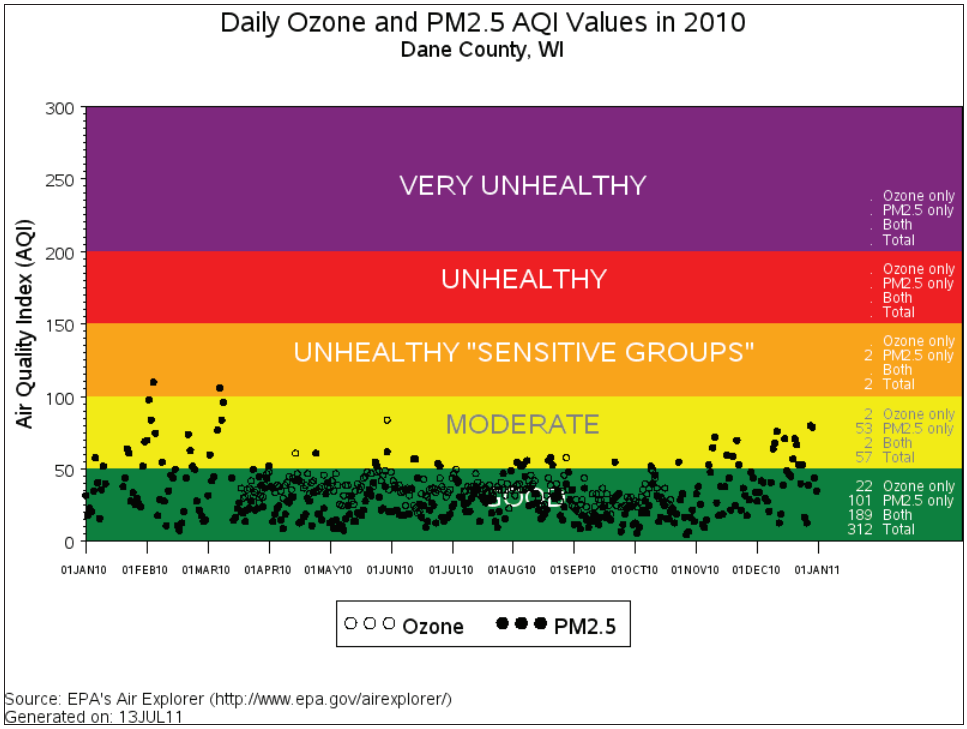
ENVIRONMENTAL MEASURES

AQI Data

The Air Quality Index (AQI) is an index for reporting daily air quality by the evaluation of the five major pollutants regulated by the Clean Air Act (ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide). However, the primary drivers of poor air quality days reported in Dane County are derived from particulate matter and ozone concentrations; due to this fact, these variables receive more attention in this report. The measurement values calculated by the AQI correspond to six color-coded health risk categories; "good" air quality representing the highest air quality scores and "hazardous" representing the most severe.[1] A more detailed description of these classifications is available at **www.airnow.gov/index.cfm?action=aqibasics.aqi**.

As demonstrated in the accompanying figures, the vast majority of AQI measurements for 2009 and 2010 reported "good" air quality. In 2009, approximately 78% of the AQI measurements were reported as "good" while remaining measurements were "moderate"; approximately 89% of these moderate levels were due to high concentrations of particulate matter and the remainder due to ozone. Similar, in 2010, approximately 84% of measurements were reported as "good" and 15% were "moderate"; two measurements were identified as unhealthy for sensitive populations (0.5%) and were both due to particulate matter concentrations. No measurements were identified during 2010 that were considered "unhealthy", "very unhealthy" or "hazardous."





The findings for 2009 and 2010 further demonstrate the consistency of Dane County air quality. During the past decade (data not shown), approximately 78% of AQI measurements for Dane County were reported as "good"; the remaining measurements were classified as "moderate" (20%) or "unhealthy for sensitive groups (2%). No measurements reported for Dane County retrieved from the United States Environmental Protection Agency (US EPA) Air Explorer data were classified as "very unhealthy" or "hazardous" over the past decade.[2]

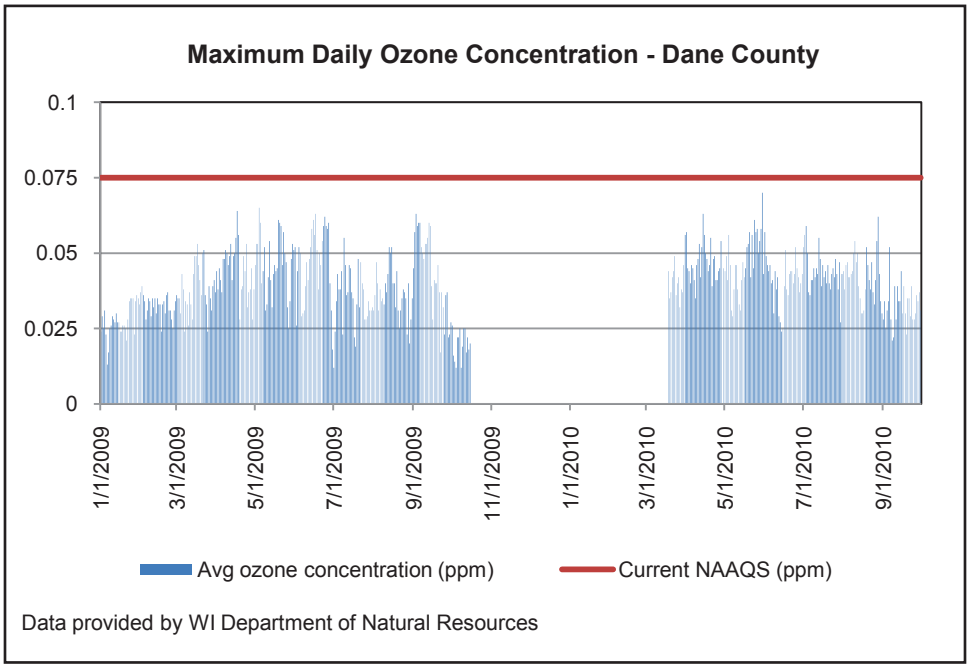
GRADE: NO SIGNIFICANT CHANGE

Air quality has been generally consistent over the past decade; the vast majority of recorded days demonstrating "Good" AQI scores.

Ozone Concentrations

High levels of ozone (O_3) can lead to days with unhealthy air quality. Prolonged exposure to ozone has been linked to an increased risk of respiratory symptoms, decreased lung function, and the irritation of the eyes, nose, and throat.[3,4] A National Ambient Air Quality Standard (NAAQS) of 0.075 ppm (eight hour average) has been established to improve ambient air quality and reduce the risk of human health effects related to ozone, especially among sensitive populations such as asthmatics, children, and the elderly.[5] The current NAAQS for ozone are under review for possible revision to a stricter standard; the new proposed standard will be lowered to a level between 0.060 to 0.070 ppm.[6]

During the summer months, warmer temperatures and prolonged sunlight lead to higher levels of ozone compared to levels reported in other seasons. Therefore, the bulk of the data collection used to monitor ozone trends in Dane County occur during warmer months; limited data was available for October 2009 through February 2010 and October 2010 through December 2010. As demonstrated in the following figure, there were no maximum daily ozone concentrations that reached or exceeded the NAAQS recorded during 2009 and 2010 reporting period. However, twelve days were recorded with a maximum concentration 60 ppm; a level that would exceed the lowest level under consideration for the revised NAAQS for ground-level ozone.[7]



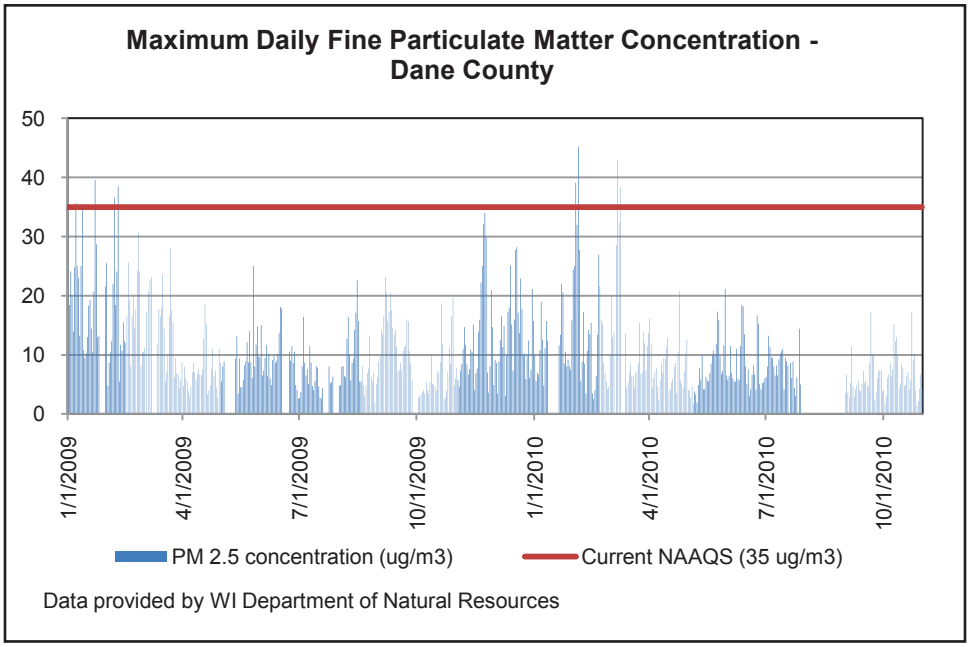
Recently, Dane County earned a grade of "C" in the 2010 and 2011 editions of the State of the Air Report from the American Lung Association; a report that utilizes three years of data (2006 - 2008 data in the 2010 edition and 2007 - 2009 data in the 2011 edition) to calculate an average daily 8-hour maximum concentration. Although the data utilized in the two most current editions of the State of the Air Report does not include both time periods evaluated in this edition of the Environmental Health Report Card, the data demonstrates continued improvement of the ozone levels recorded in 2009 and 2010 compared levels reported from the previous three years.[7,8] During the time period evaluated in the State of the Air Report the United States Environmental Protection Agency (US EPA) lowered the reporting standard from 0.084 ppm to the current 0.075 ppm; resulting in ozone concentrations that exceeded the updated standard in Dane County.[7-9] As previously indicated, no ozone levels recorded in 2009 and 2010 reporting periods exceeded the 0.075 ppm standard.

GRADE: NO SIGNIFICANT CHANGE

Daily maximum concentrations of ground-level ozone have generally improved but will likely exceed the updated NAAQS when released by the US EPA.

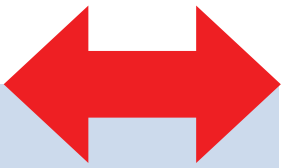
Fine Particulate Matter (PM 2.5)

Fine particulate matter (PM 2.5) describes particulate matter that is 2.5 micrometers or less in diameter; approximately 1/30th the diameter of a human hair. The size of the material poses a barrier to removal by the human body's natural defenses and settling in the lungs; exposure has been associated to a variety of human respiratory and cardiovascular diseases that increases the risk for premature death.[10]



PM 2.5 is less dependent on outdoor temperature than is ozone; therefore, unhealthy levels of fine particulate matter may occur at any time of the year. However, similar to previous years, the highest reported concentrations occurred during the winter months; a trend readily observed in the figure depicting maximum daily concentrations in Dane County in 2009 and 2010. During these two reporting periods, a total of 9 days (five days in 2009 and four in 2010) exceeded the current NAAQS for PM 2.5 established in 2006 by the US EPA and are a primary driving factor of an increased AQI.[5] Due to the impact of PM 2.5 on Dane County air quality, continued diligence is needed in efforts aimed at reducing PM 2.5 concentrations; these efforts include but are not limited to initiatives to reduce the burning of coal, improve ride sharing participation and mass transit usage, lower emissions on days forecasted to have poor air quality, and decrease PM 2.5 emissions from school buses and non-road construction equipment such as bulldozers, end loaders, and graders.

Recorded levels of PM 2.5 earned Dane County a grade of "F" in the 2010 and 2011 editions of the State of the Air Report from the American Lung Association; a report that utilized three years of data (2006 - 2008 for the 2010 edition and 2007-2009 for the 2011 edition) to calculate levels of 24-hour PM 2.5 for reporting purposes. The grade from this report for PM 2.5 concentrations was derived from a weighted average of the Air Quality Index categories. This grading scale assigned greater weighted value to increasing levels of severity multiplied by the number of days the range was recorded; the total of each recorded range (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous) was subsequently added to achieve county totals then divided by three to determined the weighted average utilized to determine the final grade awarded.[7,8] Due to the similarity of number of reported days with high PM 2.5 in the current reporting period (2009 and 2010) compared to 2007 and 2008, the grade reported by the State of the Air Report is not expected to improve in the next edition of the report.



GRADE: NO SIGNIFICANT CHANGE

Dane County continues to report days with PM 2.5 concentrations that exceed regulatory standards and received a poor grade from the American Lung Association State of the Air Report.

Other Pollutants

Similar to previous years, measurements of carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) indicate that the level of these air pollutants is much lower than the current NAAQS during 2009 and 2010.

Another air pollutant of interest, carbon dioxide (CO_2), has developed into a community and global concern due to its identified role in climate change. Due to the focus on this pollutant in efforts to improve Dane County sustainability efforts, CO_2, is described in greater detail in the Sustainability section of this report.

Hazardous air pollutants (HAPs), also called air toxics, are chemicals in the air that are either known or suspected to cause a variety of adverse human health conditions including cancer, reproductive effects, respiratory effects, and birth defects. Similar to other areas of the country, Dane County does not routinely measure these chemicals in outdoor air but does monitor the release of these chemicals as emissions from industrial sources.

Examples of air toxics include benzene, formaldehyde, acetaldehyde, mercury, and 1, 3-butadiene. Mercury is further described in great detail in the Water Quality section of this report due to its impact on surface and ground water quality.

SOURCES

VOCs, NOX, PM 2.5, and SO_2 Emissions

Ozone is the principal component formed in ambient air when nitrogen oxides (NOX) and volatile organic compounds (VOC) chemically react during warm, sunny weather conditions. Atmospheric PM 2.5 and SO_2 also contribute to poor air quality and are chiefly derived from emissions; additional sources of PM 2.5 include dust, dirt, smoke, liquid droplets, and other industrial emissions and natural sources.[10]

Mobile sources (i.e. cars and trucks) are the largest contributor of NOX and significant contributor of VOCs to Dane County air; constituents that increase the probability of ozone and PM 2.5 formation. Off-road sources including farm tractors, construction vehicles, and other non-road vehicles and equipment are also significant sources of NOX, PM 2.5, and VOCs but typically much less than on-road vehicles.[11]

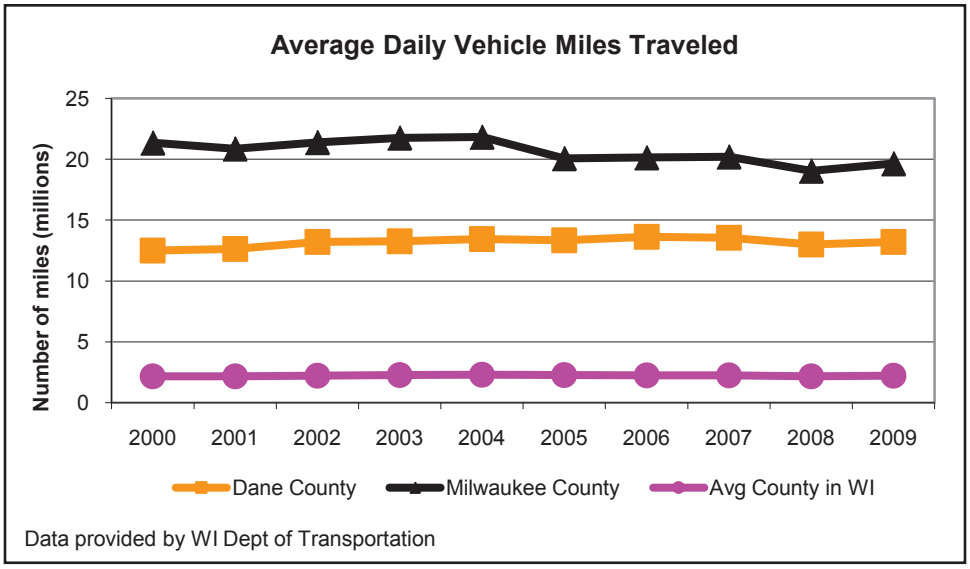
Area and points sources of air pollutants are also significant sources of reduced air quality in our communities. Area sources include activities such as painting, fueling vehicles and machines, and lawn mowing; while individually these activities do not create a significant amount of pollution but when viewed as a cumulative source these activities constitute a major sources of VOCs and particulate matter. Point sources (industries and other distinct sources of emissions) are a primary source of SO_2 and an important source of VOCs, NOX, and particulate matter.[11]

Vehicular Traffic

Cars and trucks (mobile sources of exposure) have a significant impact on Dane County air quality. Despite this fact, the numbers of vehicles on state highways continue to increase; a reported increase of approximately 22% since 2000. However, traffic volumes on arterial roadways have demonstrated a slight decline of approximately 12% since 2002. Overall average weekday traffic volumes (highway and arterial counts combined) have increased approximately 13% since 2000. The amount of increase is consistent with the rate of population growth for the county; an estimated 15% in the past decade.[12] This reported increase continues to pose a challenge to Dane County air quality and requires additional efforts to curb this trend and reduce the levels of pollutants that are derived from this source.

As shown in the figure on page 8, the average daily vehicle miles traveled (VMT) in Dane County has risen slightly since 2000; an increase of approximately 6%. In addition, similar to previous years, the average daily VMT reported in Dane County were considerably lower than averages reported in Milwaukee County. However, this difference is related to the larger population of Milwaukee County compared to that of Dane County and the availability of public transportation options; not the average driving habits of the cities' respective populations.

The average VMT per person (per capita VMT) demonstrates that, on average, Dane County residents consistently drive more miles than their counterparts in Milwaukee County. Similar to previous years, the 2009 per capita VMT (the most current year available) reported that Dane County had more average vehicles mile per person (26.9) than Milwaukee County (20.5). Despite this current trend, a small but consistent reduction of average daily VMT has been observed since 2006 and overall decline of over 8% since 2000; a reduction from 29.3 in 2000 to the current level reported of 26.9.

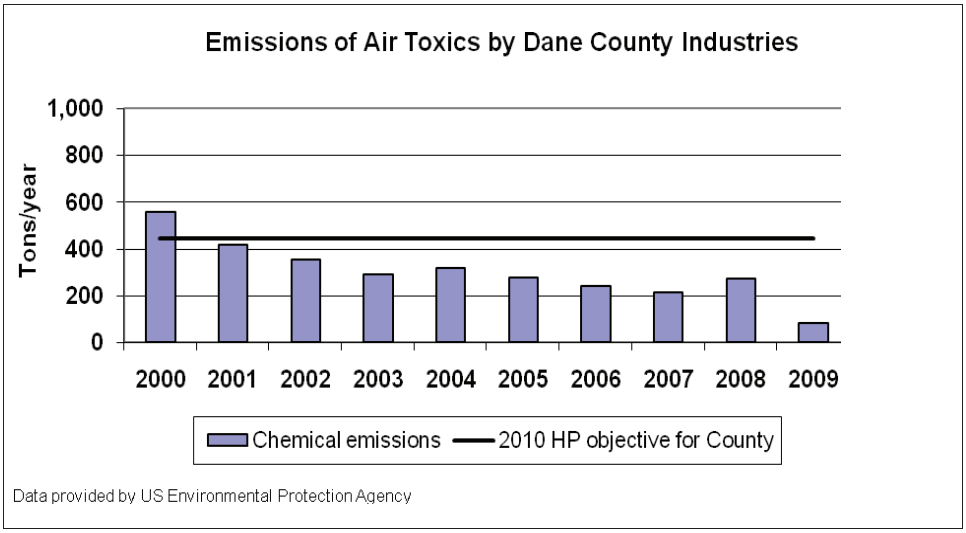


GRADE: NO SIGNIFICANT CHANGE

Slight decreases have been observed in average daily vehicle miles traveled and average per capita VMT in Dane County.

Industry

Industry remains a significant contributor of air pollutants in Dane County. However over the past decade the amount of industrial toxic air pollutant emissions (HAPs) continues to decrease and has allowed Dane County to achieve the Healthy People 2010 objective to decrease emissions to 25% of 1993 levels; for Dane County, this goal translates into 447 tons annually. The figure presents data from the years 2000 to 2009 (most recent data available). During this timeframe reported emissions levels have steadily decreased; only emissions reported during 2004 and 2008 are exceptions to the trend depicting a 9% and 28% increase, respectively, from levels reported the previous year. Despite these increases, industrial emissions have been reduced by over 80% since the year 2000.



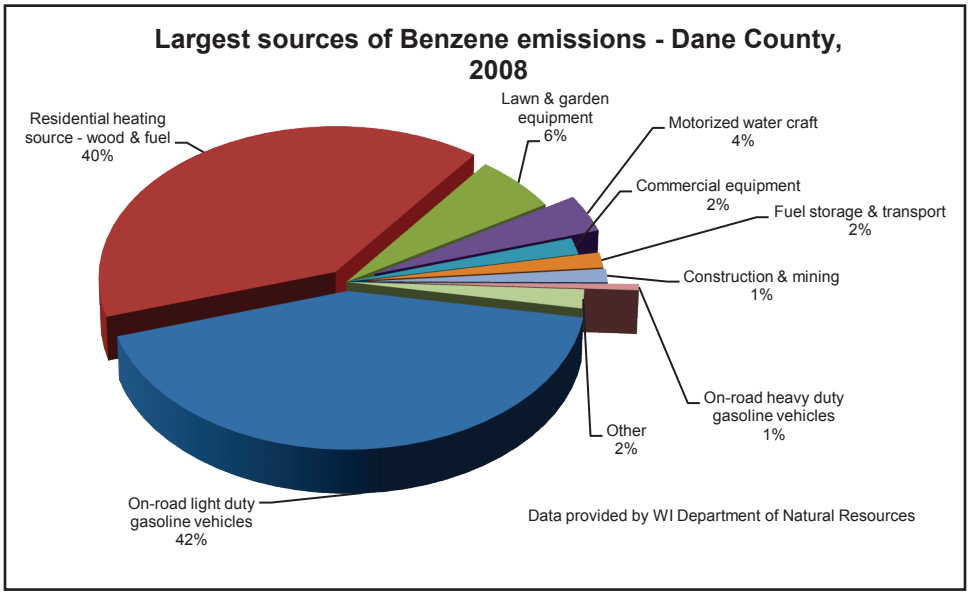
- A total of 42 facilities reported air toxic emissions in Dane County during the 2000 to 2009 timeframe presented in the figure above. Of these facilities, only 23 reported emissions in 2009. A facility will stop reporting if it ceases to operate or release emissions during a given year totaling less than the US EPA reporting limits. During the past decade, a total of 27 facilities stopped reporting emissions for a least one year.

In Dane County and other communities across the country, industrial releases of mercury emissions is a significant public health challenge due to its potential impact on the environment and human health via biomagnifications in the food chain. According to the US EPA, coal-fired power plants are the largest source of mercury air emissions in the United States followed by municipal waste combustion and medical waste incineration; these three sources alone composed over two-thirds of mercury emissions derived from anthropogenic activity (human caused emissions). Other large sources include industrial boilers, hazardous waste incineration, and chlorine production. However, regulatory efforts targeting the mercury emissions have resulted in a reduction of approximately 45% in reported levels of emissions.[13]

Other Sources

In addition to vehicular traffic and industrial contributions to the levels of air pollution experienced in Dane County other significant sources of air toxics include construction and mining equipment, commercial landscaping equipment, lawn and garden equipment, residential burning and heating, and motorized water craft. However, light duty gasoline vehicles continue to be the largest source of these air pollutants.

Benzene, formaldehyde, acetaldehyde, and 1, 3-butadiene are chemical compounds that are also listed by the US EPA as potential risk to public health and welfare.[14] The largest sources of benzene are shown below to demonstrate the variety of sources that led to the release of air toxics into the ambient air of Dane County.



In addition to the sources outlined in the figures above, air pollutants emitted from outside Dane County in neighboring communities and states also impact our air quality. Many air toxics can travel long distances and cause ozone and/or fine particulate problems in areas with limited local sources of air pollution.

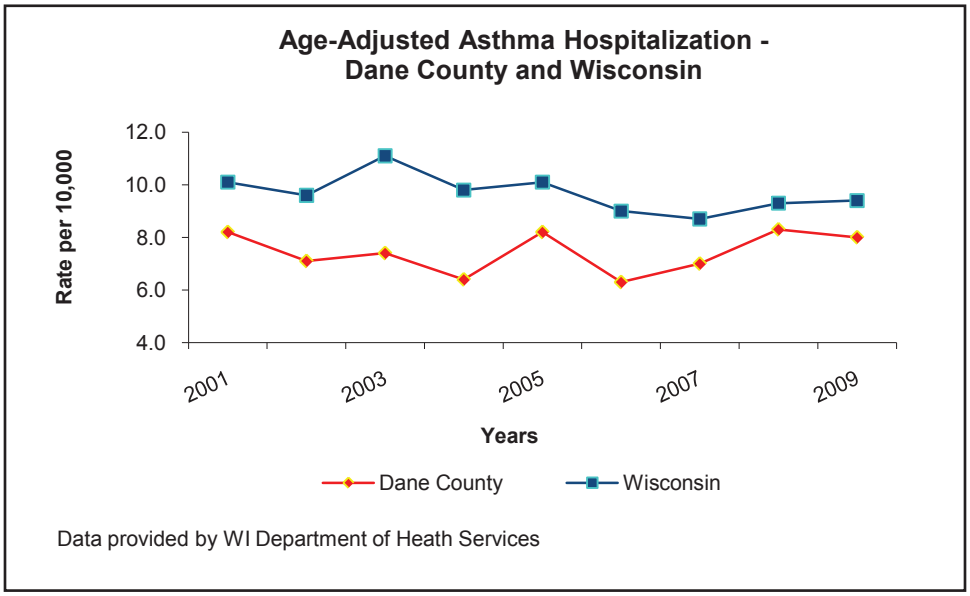
HUMAN HEALTH IMPACTS

Asthma

Exposure to air pollution (both indoor and outdoor) can trigger and/or exacerbate asthma symptoms; a potential causative role that pollution may play in the initiation of asthma is still under investigation but may involve a complex interaction between indoor and outdoor environmental conditions and genetic susceptibility.[15,16] In Dane County, asthma continues to be a challenge for individual and community health, regardless of age group. For example:

- On average, approximately 9% of children aged 0 to 17 years are reported to "have been diagnosed" with asthma (lifetime prevalence) in Dane County; approximately 7% of this population is reported to have current asthma.
- In adults (aged 18 years or older), approximately 13% annually report the occurrence of asthma during their lifetime while nearly 10% report current asthma symptoms.
- Over the past decade, the prevalence of lifetime and current asthma reported in Dane County has not shown a statistically significant difference in comparison to State levels. This is primarily due to the small number of survey respondents and the variability of annual levels of prevalence for both asthma surveillance measurements.

However, distinct trends can be observed between Dane County and State levels for asthma-related hospitalizations. Over the past decade, these levels have been consistently lower in Dane County but recent increases since 2006 has nearly erased this gap. Despite this observed increase, the annual rate of age-adjusted hospitalizations has consistently achieved the Healthiest Wisconsin 2010 objective of 8.5 hospitalizations or less per 10,000 population during each of the displayed reporting periods.



GRADE: NO SIGNIFICANT CHANGE

The rate of asthma-related hospitalizations has increased in Dane County since 2007 but still meets the Healthiest Wisconsin 2010 objective.

Heart Disease, Stroke, and Lung Cancer Risk

Prolonged exposure to poor air quality, chiefly the result of incomplete combustion of fossil fuels, has also been associated with an increased risk of heart disease, stroke, and/or lung cancer development.[17,18] Elderly members of our community, individuals with underlying heart or lung disease, individuals with lower socioeconomic status, and patients suffering from diabetes are particularly at risk.[18]

Exposure to particulates has been repeatedly cited as a contributing factor to the development of these health conditions. For example, short-term exposure to elevated levels of particulate matter is associated with a higher risk of death due to a cardiovascular event; prolonged exposure to elevated levels is associated with a reduction in life expectancy by a few years.[18] Particulate matter has also been implicated as a contributing factor in lung cancer risk; however, other pollutants found in indoor and outdoor air including benzo[a]pyrene, benzene, chromium, and radionuclides also contribute, both individually and potentially in combination with other pollutants, to this increased risk. The US EPA has estimated that 0.2% of all cancers and approximately 1% of lung cancer diagnoses can be attributed to outdoor air pollution.[17] In Dane County, poor air quality would contribute approximately 17 additional cases of cancer diagnoses (all sites) and, specifically approximately 10 additional cases of lung cancer, each year.[19] This number is significantly larger when indoor air pollution sources such as environmental tobacco smoke are considered.[17,20,21]

LOCAL RESPONSE

Individual Actions

- Whenever possible walk, bike, carpool, or use available mass transit systems instead of driving your personal vehicle. Additional information about the City of Madison Rideshare program including carpools, vanpools, park-n-ride lots, and mass transit options can be found at: **www.cityofmadison.com/rideshare**.
- Participate in and/or initiate a neighborhood EnAct team in your community. EnAct is an organization that is devoted to the reduction the environmental impact derived from households, neighborhoods, and communities by reducing waste, improving energy conservation, and expanding awareness of environmental issues and community resources.[22] More information can be found at: **www.enactwi.org**.
- Consider a more fuel-efficient and/or hybrid vehicle during your next purchase of a new or used vehicle.
- Practice energy conservation at your home and place of employment, and shop at businesses that promote and use green sources of energy and/or green technology for energy conservation. A partial list is available from Madison Gas and Electric (MGE) at: **www.mge.com/environment/green/bizprofiles**.
- Purchase Energy Star approved products including appliances, electronics, and a vast variety of other products that are more energy efficient (**www.energystar.gov**)
- Use Green Building techniques when building or remodeling your home or business to reduce air toxic emissions, conserve energy, and improve individual air quality.[23]
- Stay informed about air quality conditions in your community. Changes in air quality can be viewed from the Wisconsin Partners for Clean Air (**www.cleanairwisconsin.org**), US EPA air quality forecast (**www.airnow.gov**), and from the homepage of Public Health Madison & Dane County (**www.publichealthmdc.com**).

Community Actions

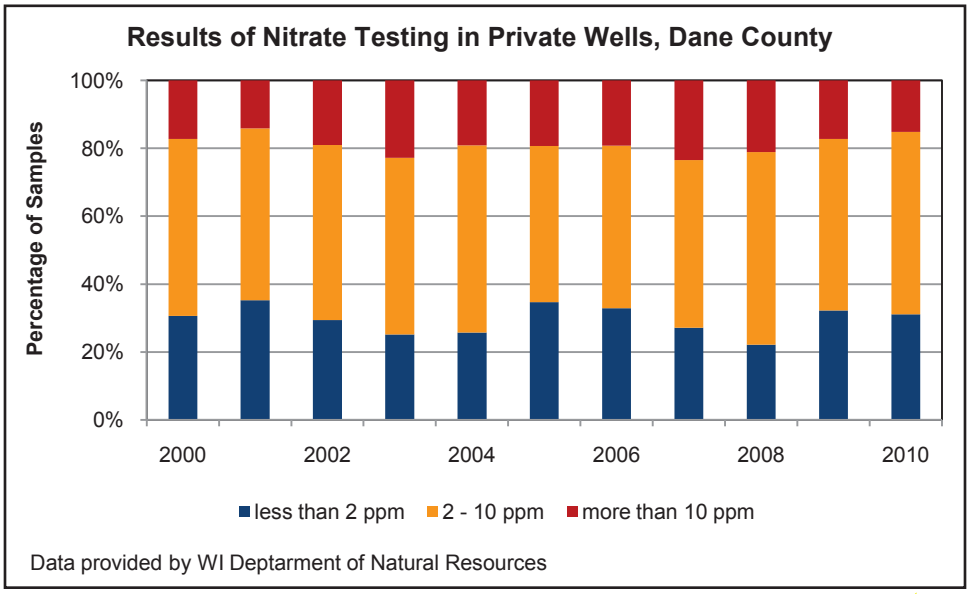
- Dane County Clean Air Action Days are used to inform our community of the immediate need to reduce VOCs, nitrogen-oxide, and other polluted emissions in order to decrease ozone and fine particulate matter pollution.
  - When ground-level air pollution is forecast to reach levels potentially unhealthy for sensitive populations, this program alerts area residents, employers, and the media.
  - On days designated as Clean Air Action Days, the community is urged to drive less, conserve energy, and alter the use of solvent-based products or refueling of gasoline powered equipment and vehicles to reduce emissions.
  - Additional information is available at: **www.healthyairdane.org/cleanAirAction.aspx**.
- The support, promotion, improvement, and expansion of mass transit and other alternative modes of transportation will reduce the number of individual vehicles on Dane County highways and reduce vehicular-related air emissions.
- Improve and expand bike lanes and trails to better accommodate alternatives to motor vehicle usage such as bicycles, walking, and rollerblading.
- Increase the availability and promote the use of energy from renewable sources.
  - Manure digesters in Dane County improve air quality by reducing methane emissions from manure and provide opportunities for energy production to power homes in the community.[24]
  - The two main power companies in Dane County, Madison Gas and Electric (MGE) (**www.mge.com**) and Alliant Energy (**www.alliantenergy.com**) continue to develop, expand, and promote the use of cleaner sources of energy including wind, solar, landfill gases, and anaerobic digesters and decrease the use of coal for electricity production.

ENVIRONMENTAL MEASURES

Nitrate Levels: Private Wells

Nitrate contamination continues to be a significant problem in private wells in Dane County. An estimated 100,000 county residents rely on private wells as their primary source of drinking water; approximately 22,000 active private wells are located across the county serving these households. Over the last decade, over 3000 private well samples have been tested for nitrate levels to evaluate water quality and safety; however, the total number of wells tested varies from year to year.

The results reported from the available data show that approximately 19% of the samples exceeded the water quality standard of 10ppm for nitrate during the past decade; approximately 51% had nitrate levels between 2 to 10 ppm. All other samples were below 2 ppm. The time periods evaluated in the current report, 2009 and 2010, displayed results similar to overall decade totals. In 2009, approximately 17% of annual reported samples exceeded the water quality standard of 10 ppm established for public water systems; approximately 15% of annual samples exceeded 10 ppm in 2010. Private well nitrate tests conducted by private laboratories are not available for surveillance purposes and are not included in the reported data of this document.



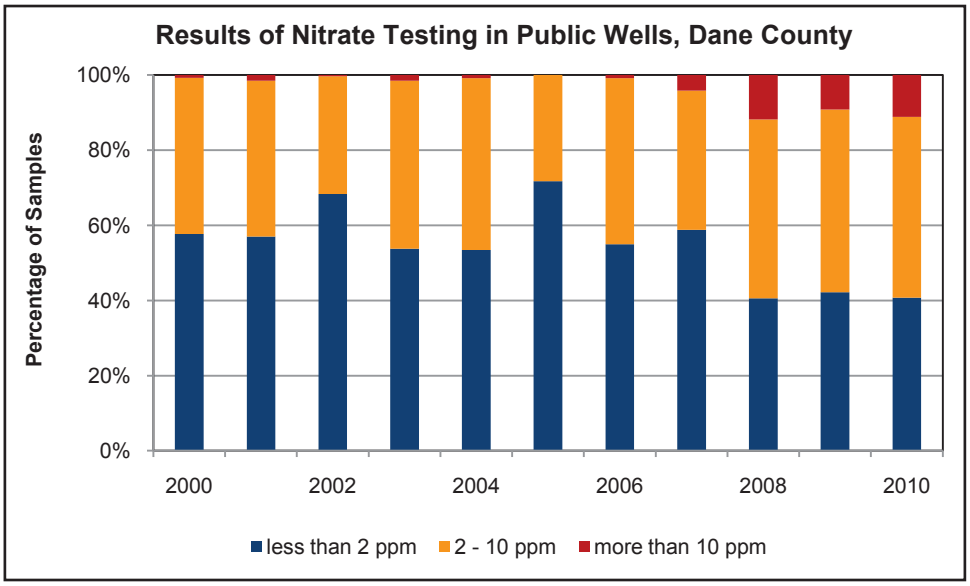
GRADE: NO SIGNIFICANT CHANGE

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

Nitrate Levels: Public Wells

Reported drinking water samples with nitrate concentrations exceeding regulatory standards are less prevalent in public well tests. During the past decade over 2400 samples have been tested for nitrate; approximately 6% were found with concentrations greater than 10 ppm. The remaining samples were within acceptable levels; approximately 43% had concentrations between 2 to 10 ppm while all others were below 2 ppm. However, since 2000 there have been notable increases in the annual percentage of samples with concentrations of nitrate greater than 10 ppm and decreases in the number of samples with concentrations lower than 2 ppm.

As demonstrated in the figure below, nitrate levels reported in 2008 were higher than previous years with approximately 11% of the wells tested higher than 10 ppm; levels reported during the 2009 and 2010 sampling periods were similar to 2008 levels (9% and 11%, respectively).



GRADE: NEEDS IMPROVEMENT

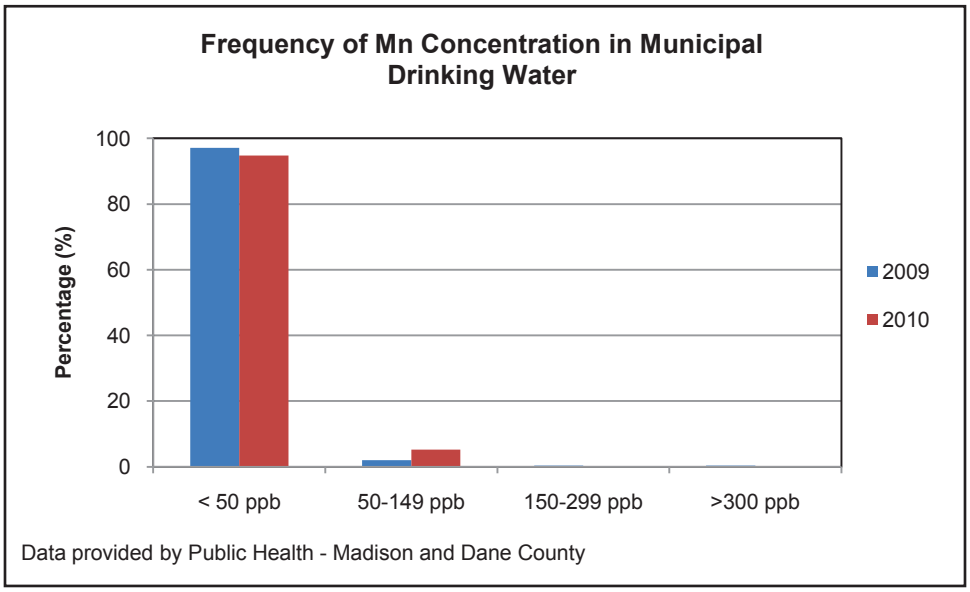
Increased number of nitrate samples in public well water that exceed the 10 ppm standard compared to the year 2000 but similar to levels reported in 2008.

Manganese

Enforceable water quality standards at the state and/or federal level have not been established for manganese. However, a non-enforceable secondary maximum contaminant level (SMCL) of 50 ppb has been established to protect against discolored water; an additional health advisory guideline for manganese of 300 ppb has also been established to guide water quality efforts.[1]

Similar to nitrate, the number of samples that are tested varies from year to year. During the current reporting period, the vast majority of water quality samples continue to demonstrate levels of manganese below the SMCL standard of 50 ppb. As demonstrated in the accompanying figure:

- Approximately 97% of samples were below the SMCL in 2009; thirteen samples were found to exceed 50 ppb. Of these drinking water samples, only 2 exceed the health advisory level of 300 ppb.
- In 2010, approximately 95% of samples were below the SMCL; only six exceed 50 ppb and no sample exceeded 300 ppb.

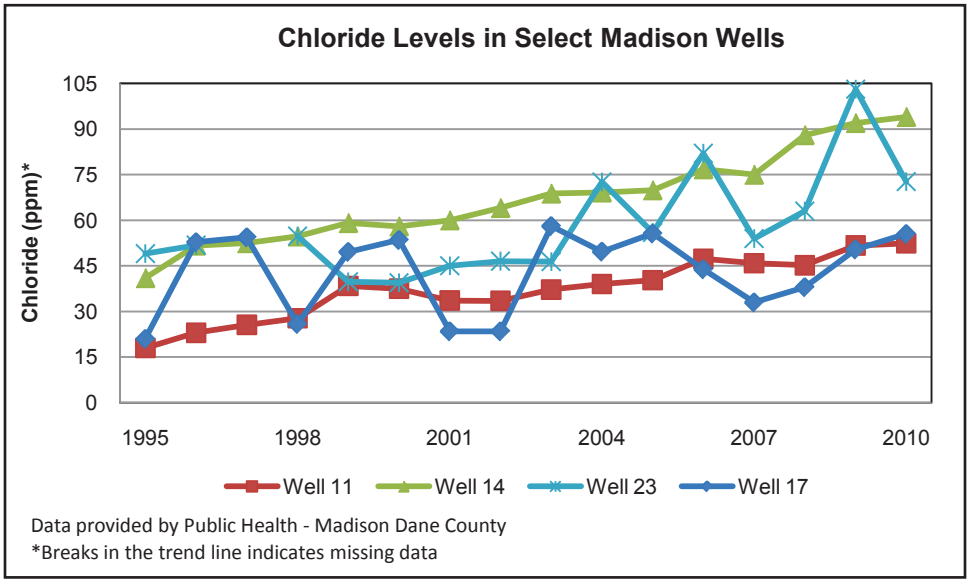


GRADE: NO SIGNIFICANT CHANGE

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

Chloride: Drinking Water

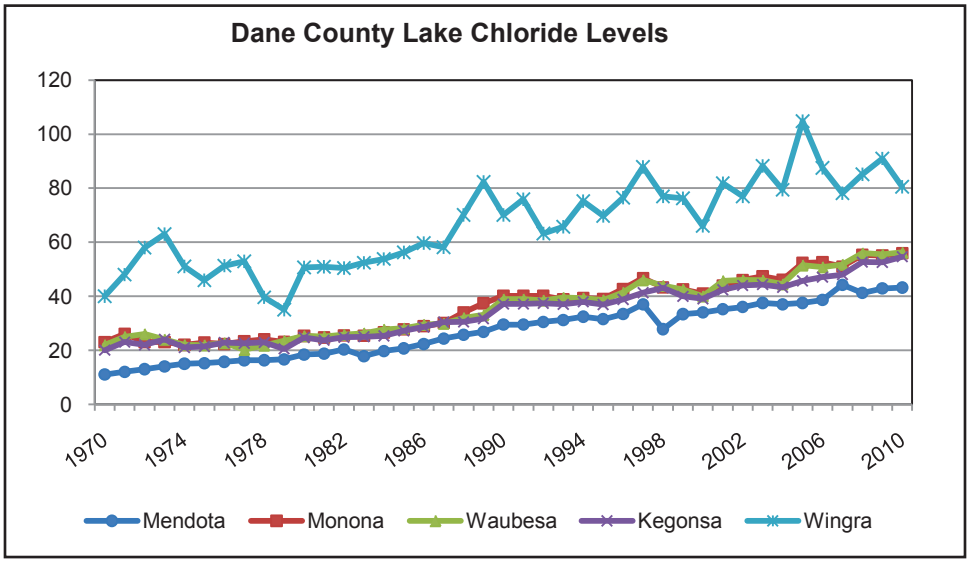
Chloride does not have enforceable federal or state drinking water quality standards. However, a secondary standard of 250 ppm has been established by the US EPA and the WI DNR for chloride in drinking water. The four wells with the highest reported levels of chloride in the City of Madison (Wells 11, 14, 17, and 23) are depicted in the accompanying figure. Wells 14 and 23, have routinely demonstrated the largest increases among wells that are routinely monitored; all other municipal wells consistently report lower levels of chloride. The well with the current highest levels of chloride, Well 14, had a recorded chloride level of 94 ppm in 2010; an approximate 129% increase since 1995 and a 683% increase since 1975 (data not shown). Similarly, Well 23 has shown an approximate increase of 49% since 1995 and an 812% increase in chloride levels since 1975.



Data provided by Public Health - Madison Dane County
*Breaks in the trend line indicates missing data

Chloride: Surface Water

Similar trends chloride levels have also been observed in Dane County surface waters. As shown in the subsequent figure these levels have also been steadily increasing over the past four decades. Although the average chloride levels reported in each of the sampled lakes do not pose an immediate risk these levels may impact the ecology of Dane County lakes. This is especially true for Lake Wingra, which consistently displays higher chloride levels than any other Yahara chain lake.



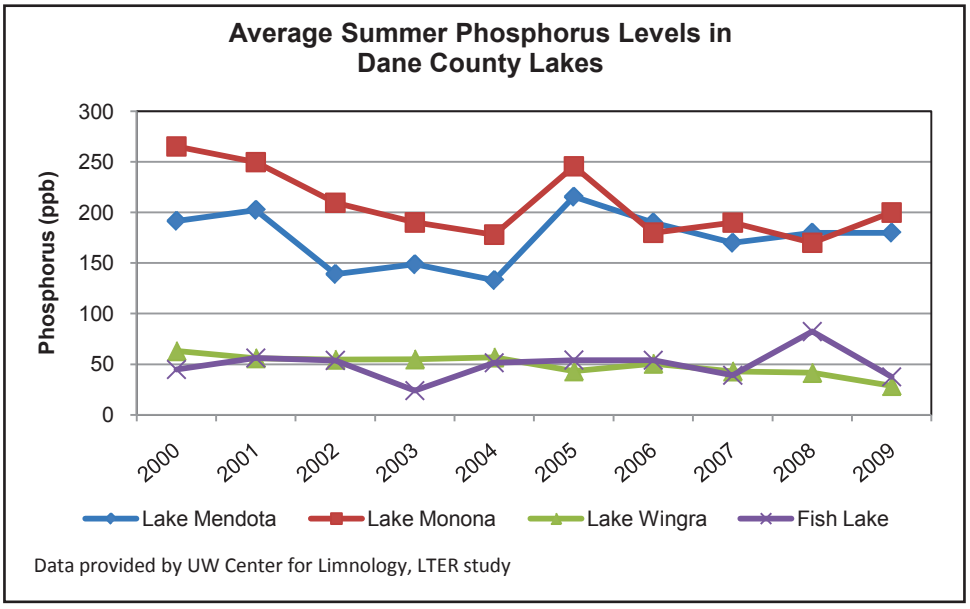
GRADE: NEEDS IMPROVEMENT

Steady increases in chloride levels in Dane County surface and drinking waters over the past several decades that continue during the current sampling period.

Phosphorus: Surface Waters

High levels of phosphorus in surface water leads to increased harmful algal blooms and excessive plant growth. Blue-green algae (cyanobacteria) blooms continue to be a nuisance throughout Dane County that typically results in beach closures, decreased surface water quality, and illness in humans and animals following exposure.[2,3] Algal blooms may occur at phosphorus levels above 30 ppb and are common at levels higher than 50 ppb; levels that are typically reported in Dane County lakes.[4]

As shown in the accompanying figure, the average phosphorus levels reported in the larger lakes forming the isthmus, Lake Monona and Lake Mendota are considerably higher in comparison to smaller lakes such as Lake Wingra and Fish Lake. Of these larger lakes, only Lake Monona has demonstrated a slight decrease in average phosphorus levels, approximately 25% since the year 2000. The levels recorded in the smaller lakes have remained relatively consistent throughout the past decade. Phosphorus levels displayed in the figure were sampled in 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.

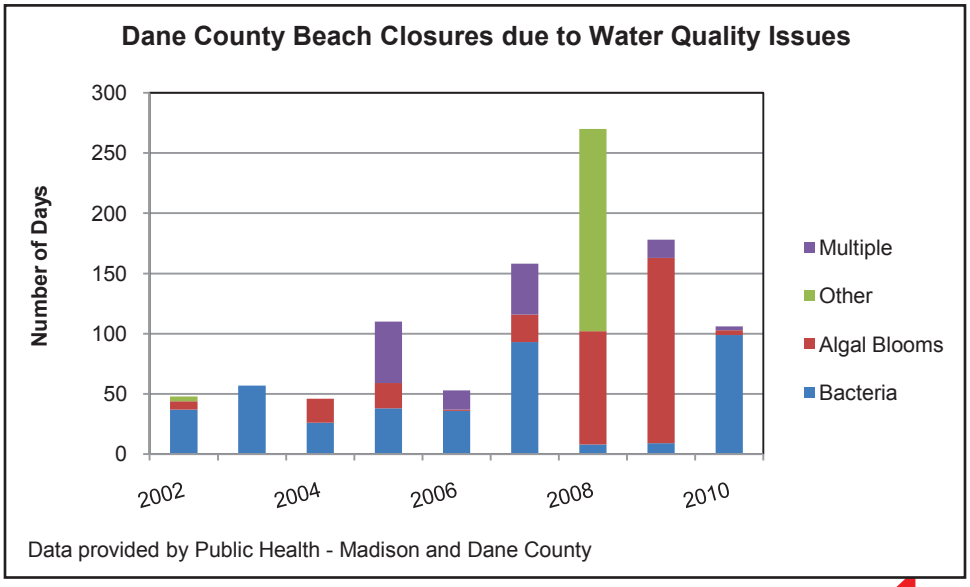


GRADE: NEEDS IMPROVEMENT

Little change in the average levels of phosphorus recorded in Dane County lakes during the past decade.

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 figure, the number of beach closures has declined since 2008 but still remains high. During 2008 a considerable number of closures were related to incidents of heavy rains and flooding that occurred in Southeastern Wisconsin. Continued flooding in 2009 contributed to the large number of reported beach closures; closures that were primarily due to harmful algal blooms (HABs) derived from storm water run-off contaminated with excess nutrients such as phosphorus and nitrogen. With the exception of these two years (2008 and 2009), the largest contributing factor to beach closures over the past decade has been high levels of bacteria such as *E. coli,* surface water contaminants derived from contaminated storm water run- and large populations of waterfowl. In fact, in 2010 a total of 84 beach closure days on two beaches were primarily due to urban geese waste; demonstrating the potential impact of uncontrolled populations of waterfowl.



GRADE: NO SIGNIFICANT CHANGE

Despite small reduction in beach closures compared to 2008, the number of closures reported during the current reporting period remains high.

In addition to nutrients, storm waters also wash 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.[5-9] The table below provides an example of the concentration of heavy metals found in Dane County surface waters for selected metals.

Median Pollutant Levels in Selected Dane County Surface Waters, 2010 (ppb)*						
Site	Arsenic	Cadmium	Chromium	Copper	Lead	Zinc
Dunn's Marsh	2.0	<2.0	<2.0	2.5	<2.0	14.4
Lake Kegonsa	<2.0	<2.0	<2.0	<2.0	<2.0	3.3
Lake Mendota	<2.0	<2.0	<2.0	<2.0	<2.0	2.3
Lake Monona	<2.0	<2.0	<2.0	<2.0	<2.0	10.0
Lake Waubesa	<2.0	<2.0	<2.0	<2.0	<2.0	3.42
Lake Wingra	<2.0	<2.0	<2.0	<2.0	<2.0	2.92
Yahara River	<2.0	<2.0	<2.0	<2.0	<2.0	10.25
Surface Water Quality Standard	148	9.65#	152.1	18.73	54.71	220.70

Data provided by the Public Health Madison & Dane County
*In 2010, the minimum detection level used for water sample analysis for heavy metals was 2 ppb unless otherwise specified.
#Surface water quality standard represents acute toxicity criteria, all other water quality standards listed in the table are chronic toxicity criteria at a water hardness level of 200 ppm.

Dane County surface water continues to demonstrate heavy metal levels that are significantly below surface water quality standards; changes in concentrations from 2009 (data not shown) to 2010 were negligible.

Recently, hexavalent chromium (Cr VI), found naturally in the environment and produced via industrial processes, sparked national and local attention due to its detection in drinking water supplies and its potential association with an increased risk of stomach cancer. However, research supporting an association between drinking water exposure to Cr VI and cancer risk is very limited, heavily disputed, and based upon high concentrations of the contaminant.[10,11] In fact, to date, the only study reporting 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).[11] 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 ranges from 0 to 2 ppb; thousands of times lower than levels proposed to increase the risk of stomach cancer.[10,11] 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

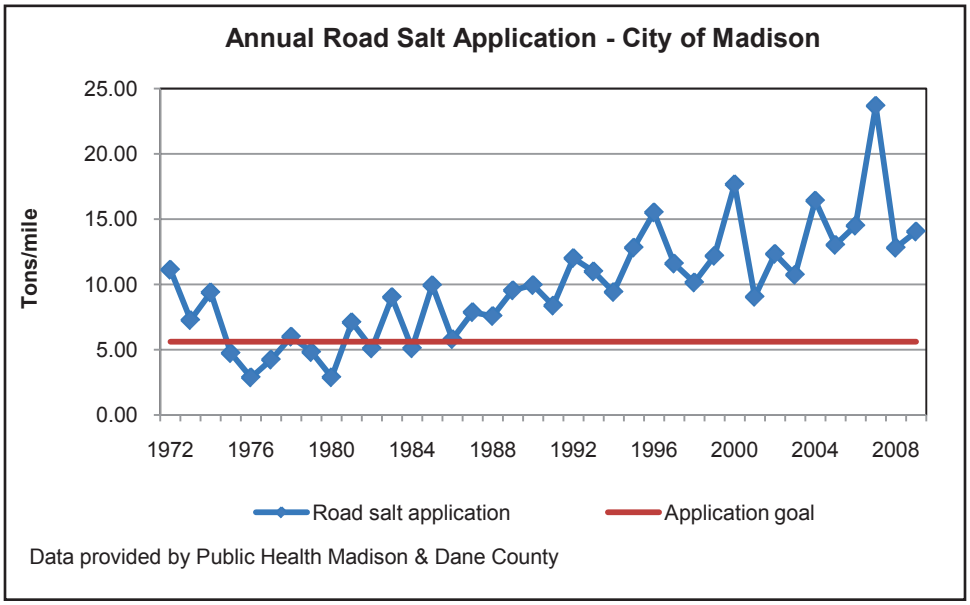
An estimated 200 million pounds of nitrate/nitrogen enter Wisconsin groundwater annually; approximately 90% from agricultural applications.[12] Additional sources of nitrogen contamination include septic and municipal sewage systems, lawn fertilizers, and decaying plant debris.[12,13] Nitrate reaches surface waters primarily through storm water runoffs derived from rains and snow melts; entering ground water either leaching into soils or in surface waters that infiltrate ground water resources. 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

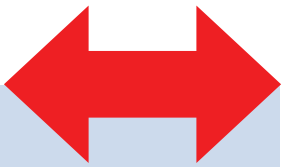
Manganese is a naturally occurring component of the deep-aquifer beneath Dane County. This metal can unevenly accumulate as sediment in water distribution pipes and fixtures, especially in large municipal systems. In municipal systems, the sediment may be resuspended with changes in the hydrostatic pressure and ultimately arrive in households in high concentrations. Additional sources of manganese include foods such as grains, beans, nuts, and tea and occupational exposures such as welding and steel manufacturing.[14]

Chloride

The routine application of road salt (sodium chloride) has been used for decades by Dane County and the City of Madison to improve winter road safety. Despite the noted effectiveness of this strategy in the maintenance of safe driving conditions, the application of road salt is also a primary cause of increased chloride concentrations in surface and ground waters supplies via runoff from snow melt.



During the winter of 2009-2010, Dane County received approximately 50 inches of snow; slightly above the seasonal average of approximately 45 inches annually.[15] In response, an estimated 36,000 tons of road salt was applied on roads, highways, and interstates throughout Dane County communities; an amount that has continued to increase. For example, the figure above demonstrates the trend from 1972 to 2009 (latest data available) in the City of Madison; the largest increase in this three decade sample period occurring in 2007 due to a record snow fall of over 100 inches. As further shown in the figure above, the road salt application goal established in 1973 has been routinely exceeded annually since 1984. In 2009, over 14 tons of road salt/mile was applied; approximately 158% more than the application goal. The largest increase recorded in this sampling period was over 300% of the application goal; this large increase was due to the record snow fall of over 100 inches that occurred in 2007.[16] Additional salt is applied to parking lots, sidewalks, and private property; uses that can 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 leading to increases in surface and ground water chloride levels.

Phosphorus

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

In an effort to reduce the level of phosphorus reaching Wisconsin surface waters, a statewide ban on phosphorus containing fertilizers was passed in 2009 and went into effect in the spring of 2010; Dane County has had a similar ordinance in effect since 2005.[17,18]

Heavy Metals and PCBs

The presence of heavy metals in surface and ground water is 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 these metals.[5-9] Material releases into the air may deposit over time into surface waters and soils; materials that will enter surface water resources via erosion and storm water run-off. Many chemicals, including mercury and polychlorinated biphenyls (PCBs), may persist in the environment long after their release providing a potential for bioaccumulation and magnification.

HUMAN HEALTH IMPACTS

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 derived 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.
  - In 2009, four cases of illness related to harmful algal blooms were reported in Dane County due to exposures derived from recreational water use; four cases were also reported in 2010. The small number of cases demonstrates the success of prevention efforts to reduce contact with algal blooms and the contribution of the community and employees of recreational sites in the reporting of blooms.

Drinking Water

- 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. Nitrate levels of 2 ppm or greater exceed the Wisconsin Preventative Action Limit (<2 ppm) and suggest that action is needed to prevent continued exposure to high levels of the contaminant.[19]
- Lead is rarely found in drinking water resources in concerning concentrations; however, the metal can enter the tap through the 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. 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.[20,21]
- 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 Drinking Advisory of 20 ppm for individuals on restricted sodium diets; all but three of municipal wells in the City of Madison meet this criteria.[22,23] The remaining three wells fall slightly below (2 wells) or slightly above (1 well) the lowest value for the aesthetic threshold value range of 30–60 ppm for taste. All wells are considered “very-low sodium” by US EPA sodium classifications.[23]

Contaminants in Fish

- The persistence and potential biomagnifications 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 impairment of vision, motor in-coordination, and loss of feeling; at very high doses seizures, severe neurological impairment, and death has been recorded. Methylmercury can also cause birth defects that range from mild neurological effects if consumed in significant portions during pregnancy.[24]
- Research of the potential impact of PCB-contaminated foods includes toxic effects to the liver, gastrointestinal tract, nervous 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.[25]
- Fish consumption advisories available from the Wisconsin Department of Natural Resources (**http://dnr.wi.gov/fish/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 (**www.dnr.state.wi.us/org/water/dwg/ccr/ccr_instructions.htm**).
- Individuals and households that are supplied by private wells should test their water annually for nitrate and bacteria.
  - » 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.
  - » Salt for melting ice, lawn fertilizers, and pesticides should only be used when necessary
  - » Oils, fuels, solvents, and cleaning chemicals should be disposed of 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 working properly.
- Keep yard waste and leaves out of the street gutters.
- Review and follow the guidance for fish consumption to reduce individual exposure potentially harmful contaminants such as mercury and PCBs.

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.
  - For example, in December 2000, there were approximately 6,000 water utility-side lead service lines and approximately 5000 customer-side lead service lines remaining for replacement in the City of Madison. Currently, only 3% of each type of lead service lines remain; the majority of the remaining water utility lead service lines will be replaced as part of reconstruction projects in 2011.
  - Outside of the City of Madison, lead service lines exist in many communities across Dane County. The local utilities that manage these systems should 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 waters.

ENVIRONMENTAL MEASURES

Foodborne illness is caused by the consumption of food and beverages that are contaminated with bacteria, viruses, parasites, and/or harmful chemicals resulting from improper harvest, processing, transportation, storage, and/or preparation. Although all food products have the potential to be contaminated, raw and under-cooked foods of animal origin including meat and poultry, eggs, unpasteurized milk, and shellfish are the most common sources of foodborne illness. Another significant source is the consumption of raw fruits and vegetables and products that contain them. To avoid contamination of food products and beverages and reduce the risk of foodborne illness among consumers, food temperature control, proper sanitation, good employee hygiene practices, and proper use and storage of chemicals are essential.[1]

The Centers of Disease Control and Prevention (CDC) have identified the most important risk factors that require control to prevent foodborne illness. Public Health Madison & Dane County (PHMDC) inspections focus efforts to ensure that the risk factors identified by the CDC are appropriately controlled in order to reduce public exposure to contaminated food and beverages.[2] The following tables list the CDC risk factor violations by category and the number of violations observed Dane County food establishments during 2009 and 2010.

CDC Risk Factor Violations Recorded During Inspections of Dane County Restaurants, 2009*

Restaurant Type	Unsafe Sources of Food	Inadequate Cooking	Improper Food Holding Temp	Cross Contamination	Lack of Handwashing	Other CDC Factors	Total CDC Risk Factor Violations	Number of Inspections	Number of Risk Factor Violations/Inspection
Simple	2	0	63	59	139	128	391	300	1.3
Moderate	17	5	557	504	603	540	2226	1006	2.2
Complex	1	1	190	143	185	137	657	214	3.1
Total	20	6	810	706	927	805	3274	1520	

*This table does not include retail food establishments.

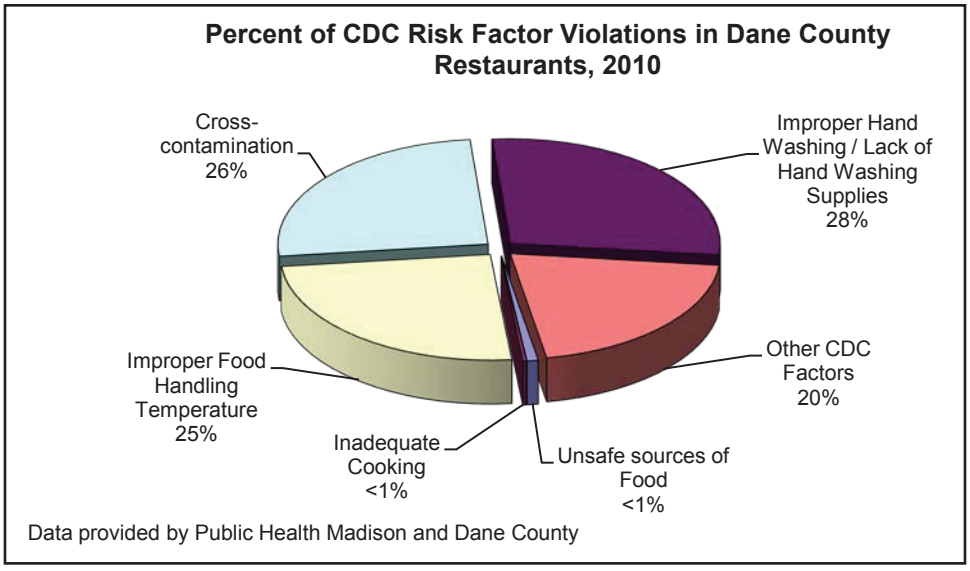
CDC Risk Factor Violations Recorded During Inspections of Dane County Restaurants, 2010*									
Restaurant Type	Unsafe Sources of Food	Inadequate Cooking	Improper Food Holding Temp	Cross Contamination	Lack of Handwashing	Other CDC Factors	Total CDC Risk Factor Violations	Number of Inspections	Number of Risk Factor Violations/Inspection
Simple	3	0	36	54	111	77	281	241	1.2
Moderate	14	8	436	472	485	396	1811	952	1.9
Complex	6	0	195	159	161	77	598	192	3.1
Total	23	8	667	685	757	550	2690	1385	

*This table does not include retail food establishments.

In the above tables, restaurants are grouped into categories representing the complexity of food handling activity reported by individual establishments.

- Simple: Minimal preparation and processing of food products. In other words, the food is prepared when ordered by the customer. An example would be a concession stand.
- Moderate: This category has an increased amount of food preparation and processing. A typical fast food restaurant is an example of moderate handling activity.
- Complex: This category has the most extensive amount of food preparation and processing. These types of establishments may cool, reheat, and/or cater food. An example of a complex establishment is a large hotel kitchen.

As indicated in the table and pie chart, improper hand washing, cross-contamination, and improper food handling were the most frequent violations reported in 2010; similar results were also reported in 2009 (pie chart not shown).

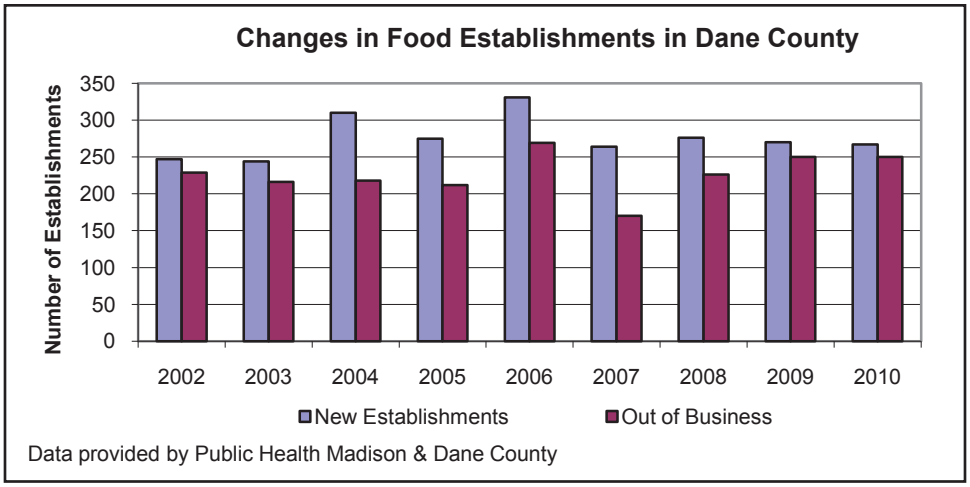


SOURCES

The contamination of foods and beverages has led to outbreaks of foodborne illness at the local, county, and national levels. Both small scale and large outbreaks are possible due to the modern food supply system that allows the transportation of food products to consumer markets across town, across the country, and across the globe. The most common foodborne infections reported in these outbreaks are those caused by *Camplyobacter, Salmonella,* and *E. coli* O157:H7 bacteria and a group of viruses called caliciviruses (Noroviruses).[1]

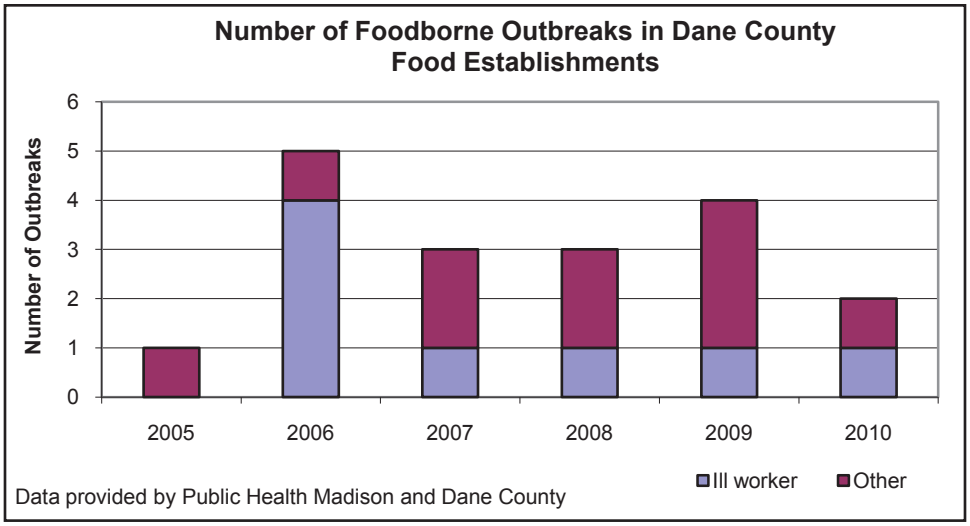
Unsafe food can be found both in the home and commercial food establishments but the commercial food industry has a much greater potential impact on individual and community health. Unsafe food served in a home can result in a small number of people becoming ill, while contaminated food served in a commercial food establishment or temporary event vendor has the potential to cause illness in many people.

- 1553 permanent restaurants and 733 retail food establishments were licensed in Dane County in 2010.
- 2207 temporary food vendor permits were issued in 2010.



Unsafe food handling practices such as lack of hand washing or hand washing supplies and improper food holding temperature are the prevailing causes of foodborne illness. These practices may be the result of inexperience or a lack of knowledge from inadequate employee training practices. As demonstrated in the figure above, the continuous turnover of food establishments over the last decade has created an on-going demand for food operator training to ensure appropriate food handling practices and consumer safety.

Another source of food contamination is individuals that work in food establishments while ill. Ill worker contact with food products and beverages provide an opportunity for bacteria, viruses, and parasites to be passed to others by eating contaminated foods. The figure below shows the number of foodborne outbreaks in Dane County over the past several years. An outbreak is defined as the report of two or more individuals that have consumed the same contaminated food and developed the same illness; at least 2 of the 6 reported outbreaks in 2009 and 2010 involved ill food workers.



These small number of outbreaks resulted in multiple cases of reported human illness; two notable examples are shown below and demonstrate the necessity of safe food handling and preparation practices.

- 8 confirmed cases and 3 probable cases of *Salmonella* enteric subspecies Heidelberg were reported in 2009 resulting from an ill food handler.
- 25 cases of norovirus were derived from two separate outbreaks reported in the county during 2009 – 2010.

GRADE: NO SIGNIFICANT CHANGE

The number of reported foodborne illnesses in Dane County similar to the previous reporting years of 2007-2008.

HUMAN HEALTH IMPACTS

According to the CDC, an estimated 48 million foodborne related illnesses occur annually in the United States. Although the majority of these cases are mild, some reported cases can be much more severe; an estimated 128,000 hospitalizations and 3,000 deaths are derived from foodborne causes each year. Typically, foodborne illnesses are cause by a variety of bacteria, viruses, and/or parasites that may be present in contaminated food products resulting in reported symptoms that include nausea, fever, vomiting, abdominal cramps, and/or diarrhea. However, other food product contamination such as poisonous concentrations of chemicals and/or harmful toxins may also result in symptoms in exposed persons.[3]

LOCAL RESPONSE

Individual Actions

- Wash your hands thoroughly prior to handling food products, following handling of raw meats, and before eating. Alcohol-based gels or sanitizers are not adequate substitutes to hand washing when preparing food by food workers.[4] However, alcohol-based gels is considered an acceptable alternative for members of the general public.
- Cook meat, poultry, and eggs thoroughly. Using a thermometer to measure the internal temperature of these items is an excellent method to ensure proper cooking of the foods.
- Keep your refrigerator at or below 40°F and refrigerate leftovers promptly.
- Do not cross-contaminate one food with another. This can be avoided by washing hands, utensils, and cutting boards after contact with raw meat or poultry before they touch another food item.
- Rinse fruits and vegetables thoroughly.
- Report illnesses that are suspected to have come from eating food as soon as possible to Public Health Madison & Dane County (608) 266-4821.

Community Actions

- Ensure safe handling and proper storage of food by conducting inspections of food establishments.
  - In 2009, a total of 2015 regular and 398 follow-up re-inspections were performed in Dane County food establishments; a total of 1995 regular and 318 re-inspections were performed in 2010.
- Investigate all potential occurrences of foodborne illness to prevent and/or reduce the occurrence of disease outbreaks.
  - Public Health Madison & Dane County staff investigated 6 foodborne illness outbreaks in 2009 and 2010.
- Educate food service operators.
  - Staff educated 337 food service operators and workers about safe food handling in 2009 and an additional 242 in 2010.
- Correct repeated food safety problems through the use of referrals for legal action, temporary license suspensions, and permanent license revocations.
  - In 2009, a total of 52 enforcement actions were taken against problem food establishments; in 2010 an additional 77 enforcement actions were taken.
- Test soft-serve and ready-to-eat foods to identify problems that may lead to human illnesses.
  - In 2009 and 2010, Public Health staff tested over 900 food samples for bacteria and inspectors worked with establishment owners to correct problems.
  - Results have shown that routine, thorough cleaning of soft-serve ice cream equipment is essential for limiting the presence of bacteria in these products.

Food Testing Activity for 2009 and 2010, Dane County

Sample	Total Samples	Unsatisfactory Samples	% Unsatisfactory Samples
Deli Foods	239	23	9.6%
Soft-Serve Ice Cream	645	123	20.5%
Frozen Yogurt	26	5	19.2%

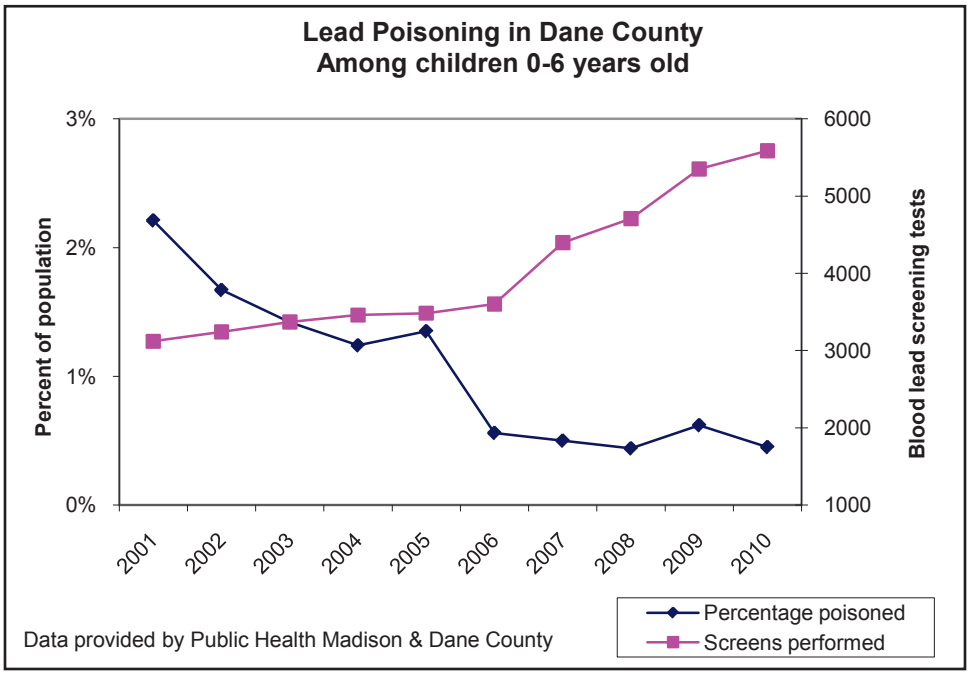
CHILDHOOD LEAD POISONING

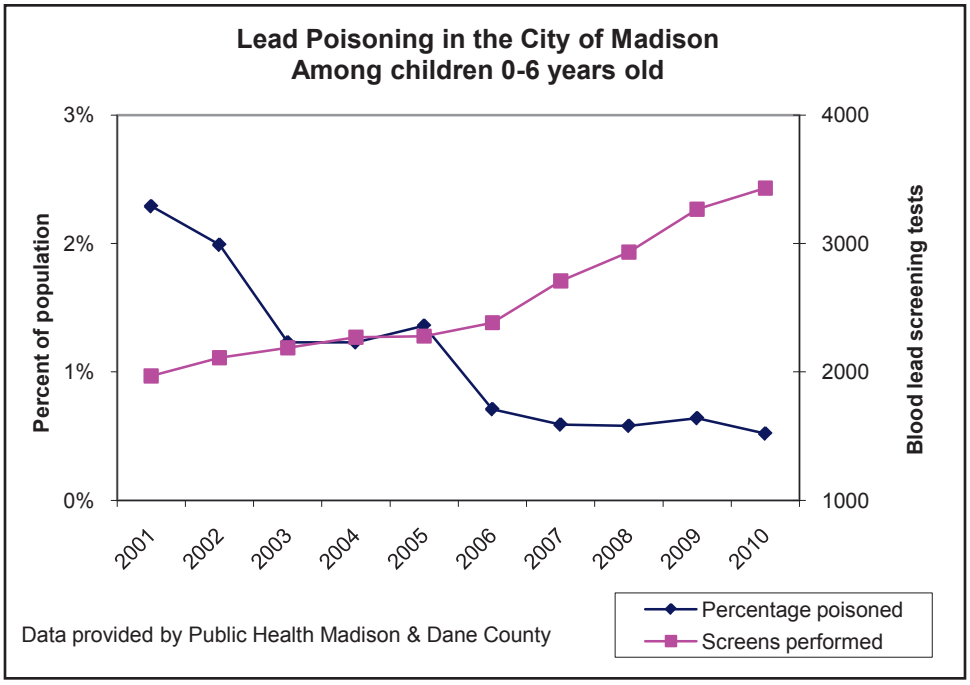
Environmental Measures

In the City of Madison and Dane County, the number of reported cases of childhood lead poisoning has continued to decline over the past decade; despite this success, childhood exposure to lead remains a persistent and preventable public health challenge. The risk of childhood lead poisoning is primarily due to presence of lead-based paints in Dane County homes built before 1950. The highest concentration of these older homes in Dane County is located in the City of Madison; however, many older homes are also located in rural areas and other cities and villages throughout the county.[1]

The performance of blood lead level (BLL) screening tests is accurate method to assess potential lead exposure and identify high-risk children. The tests are recommended for children at 12 months and again at 24 months of age; children not previously screened at these ages should be screened anytime between the ages of 36 to 72 months.[1] The identification of children exposed to lead is essential to reduce the risk of lead-related health impacts by eliminating or reducing the source of exposure and provide necessary treatment as needed.

Over the past decade the number of lead poisoned children has steadily decreased while the number of lead screening tests continues to increase. At the beginning of the decade the percentage of the population screened for childhood lead exposure that were reported as lead poisoned was approximately 2.2%; by 2010, the percentage had declined to 0.45%. During this same time period, the number of lead screening tests rose from 3120 in 2001 to over 5500 in 2010. A similar trend is also evident in the City of Madison. As shown in the figure below, the percentage of the tested population reported as lead poisoned was 2.3% in 2001 and 0.5% in 2010; the number of blood screening tests also increased from 1968 to 3431 tests during this same time period.





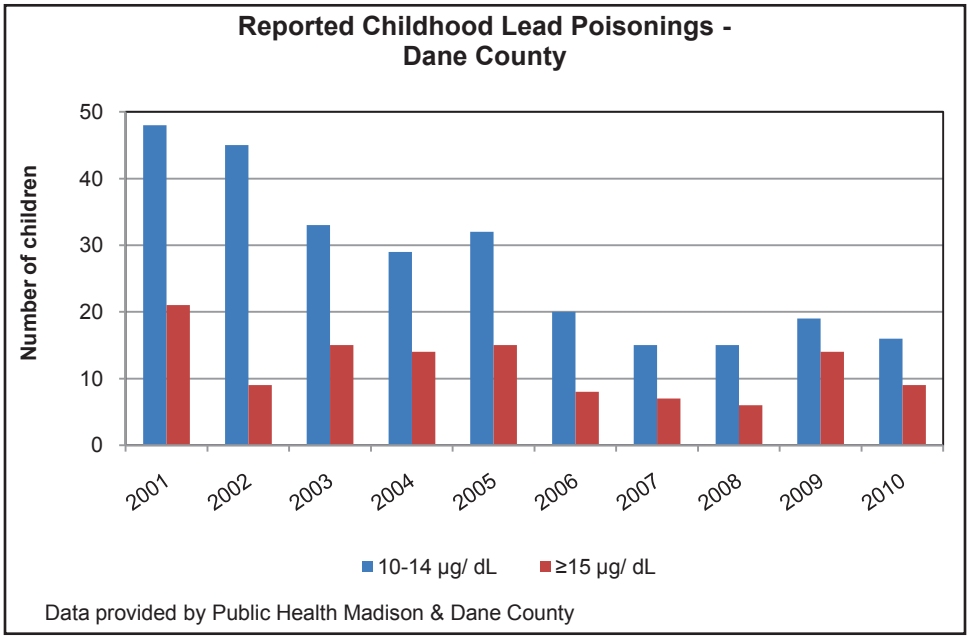
Sources

Lead-based paint has been identified as the primary source of childhood lead poisoning in Dane County communities. Although lead-based paints were banned for use on residential property in 1978, homes built before this legislation may contain this potential source of lead hazards.[1] Lead poisoning resulting from lead paints often occurs when painting and remodeling older homes create lead containing dusts during the sanding of older painted and varnished surfaces. In addition to this source, lead exposure from toys and furniture with lead-based paints is also a potential source of childhood exposure.[1,2] Other potential sources of lead exposure include the direct exposure to the material and/or fumes derived from parental hobbies such as stained glass and building lead-based models, exposure to lead dusts brought into the home due to occupational exposure of the parent(s), and the consumption of drinking water from older lead pipes or pipes containing lead solder found in older homes.[2-4] Lead pipes were commonly used prior to 1930 and lead solder was not banned for use in drinking water supply systems until 1986; more recently, faucets, valves, and fittings made of brass (a metal alloy containing lead) have also been recognized as a potential source of elevated blood lead levels.[1,2,4]

Human Health Impacts

Exposure to lead can lead to neurological and behavioral disorders in children and adolescents that include learning disabilities, behavioral problems, impaired hearing, and sleeping disorders.[1,2] High levels of exposure increase the risk of the development of anemia and kidney damage; extremely high levels may lead to seizure, coma, and death.[1,2,4]

In Dane County, a reported blood lead level of ≥10 micrograms of lead per deciliter of blood (µg/dL) in children screened for lead are considered lead poisoned. During the last decade only minor fluctuations have been reported in the number of children reporting blood lead levels of 15 µg/dL and above; also during this time a notable reduction in the number of children reporting levels of 10 to 14 µg/dL has been reported.



GRADE: NO SIGNIFICANT CHANGE

A notable and continuing reduction of reported lead poisoning among children aged 0 – 6 years in Dane County.

Local Response

Individual Actions

- Have your children tested for lead exposure.
- Test your home for lead hazards if it was built before 1978; drinking water should also be tested.
- More information on home and water testing for lead is available at:
  www.publichealthmdc.com/environmental/healthyHomes/lead
  www.publichealthmdc.com/environmental/laboratory/water.cfm

Community Actions

- Provide lead screening services at little to no cost for at-risk low-income residents via public programs.
- Remove any existing lead water pipes or other potential sources of lead including lead containing solder and/or brass valves and fittings from municipal water supplies.

RADON

Environmental Measures

An estimated 5 to 10% of Wisconsin homes, including Dane County communities, have radon levels above the current US EPA guideline of 4 picocuries of radon per liter of air (pCi/L).[5] Radon is an odorless radioactive gas derived from the natural breakdown of uranium in soil, rock, and water that enters the ambient air. The gas can enter any type of building from cracks in floors and walls, construction joints, gaps in suspended floors, and around pipes. The primary exposure to high indoor radon levels generally occurs in the home where the individual spends the majority of his/her time.[5,6] People living in homes with levels of radon ≥4 pCi/L have a greater risk of lung cancer development.[6]

The results of a total of 6005 radon tests were reported to the Wisconsin Department of Health Services in 2009 (latest data available) from Dane County residents and local businesses; the measurements were conducted in basements, up to a week in duration, while windows were kept closed. Of these results, approximately 60% were less than or equal to the US EPA guideline of 4pCi/L; the remainder of the measurements exceeded this guideline. In measurements that were higher than 4 pCi/L approximately 29% ranged from 4 to 10 pCi/L and 11% reported levels higher than 10 pCi/L.

However, since not all radon tests are reported this information represents only a fraction of the total number of radon tests completed.

Sources

Radon gas results from the radioactive decay of naturally occurring uranium in the soil, rock, and water.[5] This gas can enter households and other types of buildings from cracks, constructions joints, and gaps in the structure(s).[6] Exposure to radon is preventable but requires the accurate testing of current levels in the building and the identification of potential sources of entry that require repair, modification, and/or replacement.

Human Health Impacts

The United States Surgeon General and the US EPA consider indoor exposure to radon one of the leading causes of lung cancer in this country; second only to cigarette smoking.[5] In fact, as reported by the National Cancer Institute, approximately 15,000 to 22,000 lung cancer deaths are related to radon exposure every year in the United States.[7]

Local Response

Individual Actions

- Test your home for radon. The lack of action may lead to the continued exposure of your family to radon levels that increase the risk for lung cancer development.
- More information on home radon testing is available at:
  www.dhs.wisconsin.gov/radiation/radon/Lists/MeasProf.htm
  www.dhs.wisconsin.gov/radiation/radon/IntRdnMsurs.htm
  www.publichealthmdc.com/environmental/air/problems.cfm

Community Actions

- Provide outreach services to improve the community awareness of radon.
- Encourage home testing via education campaigns and legislation.

ENVIRONMENTAL TOBACCO SMOKE (ETS)

Environmental Measures and Sources

ETS, also known as "second-hand smoke" is a complex mixture of over 7,000 chemicals in vapor or particulate form that include known toxicants, heavy metals, irritants, and carcinogens.[8-10] Exposure to ETS typically occurs in the home and/or workplace due to the considerable time (approximately 90%) that is spent between these two environments by the average person.[11] Employees of certain occupations such as casinos and service industry positions (i.e. waitresses and bartenders) have reported exposures much greater than other types of employment.[11-13] Non-smoking adults and childhood exposures are primarily due to actively smoking family members and/or exposures to ETS in public establishments.[9]

Human Health Impacts

Exposure to ETS has been associated with an increased risk of tobacco-related disease development including respiratory disease, cardiovascular disease, and cancer among non-smoking adults.[9] The deaths of an estimated 53,000 non-smokers annually have been associated with ETS exposure nationwide; approximately 3400 of these deaths are attributed to ETS-related lung cancers.[9,10] Among children and adolescents, ETS has been associated with increased respiratory infections, asthma induction and exacerbation, low birth weight, and sudden infant death syndrome (SIDS).[8,9]

Local Response

Individual Actions

- Quit smoking and/or establish restrictive smoking policies in your home and automobile(s) to decrease ETS exposure to children and non-smoking adults in your family. These self-imposed household restrictions will not only decrease ETS exposure to non-smoking family members but may also reduce future tobacco use by children and adolescents.[14]

Community Actions

Community actions to reduce ETS exposure are centered on but not limited to legislative policy and enforcement. Research has repeatedly demonstrated that the establishment of smoking bans in workplaces and public areas such as restaurants and bars has resulted in increased rates of smoking cessation, decreased smoking prevalence, reduced exposure to ETS, and lower rates of tobacco-related disease.[15-17]

- In 2004, the City of Madison passed an ordinance that prohibited smoking in all workplaces, including bars and restaurants; in July 2005, this ordinance went into effect.[18]
- In Dane County, a similar ordinance took effect in August of 2009; the statewide smoking ban took effect in July the following year.[19-21]
- Prevent tobacco sales to minors. By decreasing the number of vendors that sell tobacco products to minors, an important source of supply of these products to Dane County youth is greatly restricted and may lead to a decline in use among this population.

MOLD

Environmental Measures

Molds are fungi that grow best in warm, damp, and humid conditions both indoors and outdoors where they play a key role in the breakdown of leaves, wood, and other plant and animal debris. Despite this positive role, the growth of molds in Dane County homes and businesses continue to be a significant public health concern due to the potential adverse human health effects of continued exposure to mold spores.[22-23] In fact, in 2009, approximately 20% of all environmental health complaints received by PHMDC involved mold. In 2010, mold complaints composed approximately 18% of reported environmental health complaints.

Sources

Sources of moisture leading to mold growth include roof leaks, flooding due to plumbing failures and/or heavy rains, uncontrolled humidity, and areas of high condensation. Common sites of mold growth include bathroom tiles and/or walls, showers, basements, and areas in close proximity to windows and leaky plumbing.[22-23]

Human Health Impacts

Mold problems in homes, offices, and other buildings can result in allergic and/or asthmatic reactions in sensitive individuals.[22] Additional human health impacts from mold exposure include irritation of the eyes, skin, nose, throat, and lungs.[22-23] More serious illness including opportunistic infection, immune suppression, liver damage, endocrine and central nervous system effects, and cancer may occur from exposure to mycotoxins (mold toxins) from specific strains of mold such as Aflatoxin and Aspergillus.[22]

Local Response

Individual Actions

To prevent exposure to mold excess moisture must be removed. This can be accomplished by:

- Remove and replace carpets and upholstery previously soaked with water. If needed accelerate the drying process with fans, dehumidifiers, and/or heaters. If possible, vacuum and remove water from surfaces.
- Keep the humidity level in the home, office, or other building structure between 40 - 60%.
- Do not carpet bathrooms and basements.
- Use an air conditioner or a humidifier during humid months.
- Ensure the building structure has adequate ventilation.
- Add mold inhibitors to paints prior to application; however, moisture must be removed to improve effectiveness of these products in the prevention of mold.[22-23]

Community Actions

- Provide access to low cost consultation, inspections, and additional resources relating to mold issues to businesses and the general public to help reduce exposure to mold toxins and encourage appropriate removal and future prevention.

SUSTAINABILITY

Sustainability creates and maintains conditions that allow the needs of the present to be met without compromising the environment and the ability of future generations to meet their own needs.[1] However, to meet this challenge, appropriate changes must occur at all levels of behavior (e.g. individual, community, state, national, and global levels) to counter the impact of human activities that have led to deforestation, degraded air and water quality, climate and atmospheric changes, damaged food quality, and modification of natural ecosystems.[2-6] The previous sections of this report have discussed several of these issues individually; in this section, information will be presented that outlines the impact of several non-sustainable activities on individual and community health. This section also highlights efforts that are currently taking place in Dane County and the City of Madison that are designed to move our community towards environmental sustainability.

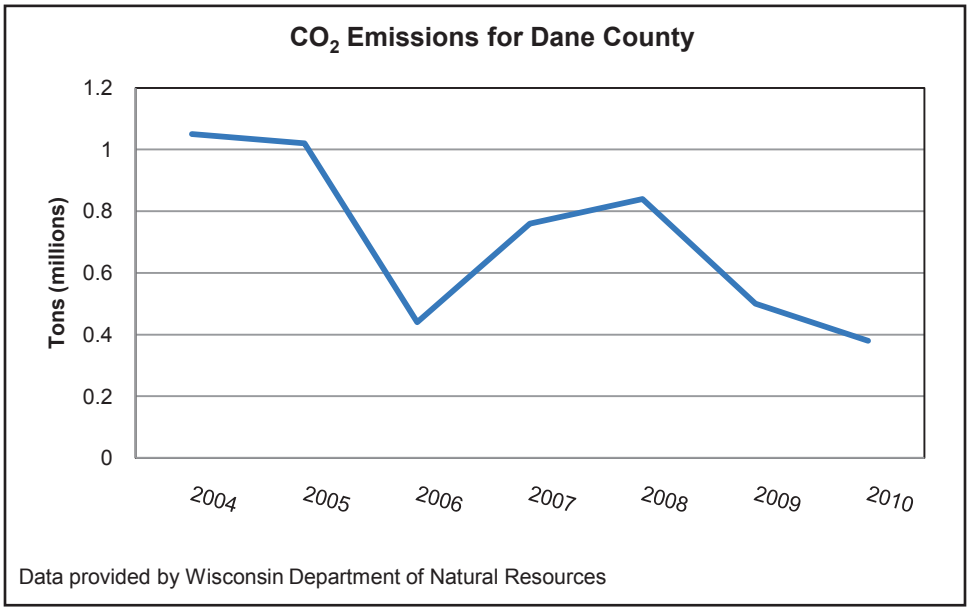
GREENHOUSE GASES

Since the Industrial Revolution, the levels of several greenhouse gases have increased approximately 25% across the globe. Human activities over this 200 year time period, including the burning of fossil fuels, industrial processes, and deforestation, have been and continue to be major contributors to the increased levels of greenhouse gases including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases including chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs).[7-8] Although some greenhouse gases such as carbon dioxide and methane also occur naturally, other greenhouse gases (e.g., fluorinated gases) are created and emitted into the atmosphere solely through human activity; the combined impact of natural and human activities has led to less heat escaping into space that has resulted in a gradual warming of global temperatures.[2,3,9] In addition to the recorded impacts to global temperature, greenhouse gas emissions also affect other aspects of the climate including rainfall patterns, snow and ice cover, sea level, and natural ecosystems.[2,4]

Environmental Measures

CO_2 is one of the most common greenhouse gases released into the atmosphere by human activity. In fact, atmospheric CO_2 concentrations have increased an estimated 35% since pre-Industrial Revolution levels and are currently higher than any time in at least the last 650,000 years.[10,11] Therefore, efforts to reduce the emission of CO_2 have been one of the cornerstones in strategies to decrease greenhouse gas production and move toward sustainability.
The reduction of greenhouse gas production is also an essential component of the ongoing sustainability efforts in Dane County and the City of Madison. Although variable by year, the reported levels of CO_2 have decreased since 2004. As shown in the following figure, the estimated levels of CO_2 from point source emissions reported in 2009 decreased approximately 53% compared to 2004; a larger reduction of 64% was reported in 2010. However, only facilities emitting over 100,000 tons of CO_2 are required to report emissions to the Wisconsin Department of Natural Resources; some voluntarily report their emissions of CO_2 even though they produce less than 100,000 tons.[12] Therefore, the available data may over or under estimate the reported reduction in emissions.

Data for mobile and area sources of CO_2 emissions (e.g. automobiles) were not available. Despite the progress in the reduction of point source emissions over the past decade the current amount of greenhouse gas emissions remains substantial. In addition, without accurate measurements of mobile and area source emissions and a more complete reporting of point source emissions, the full extent of the problem is not known and an appropriate evaluation of interventions designed to reduce CO_2 is not possible at this time. However, at both the state and county levels, the need for an accurate monitoring system to guide intervention efforts has been recognized. Unfortunately, the development of this system is in its infancy.



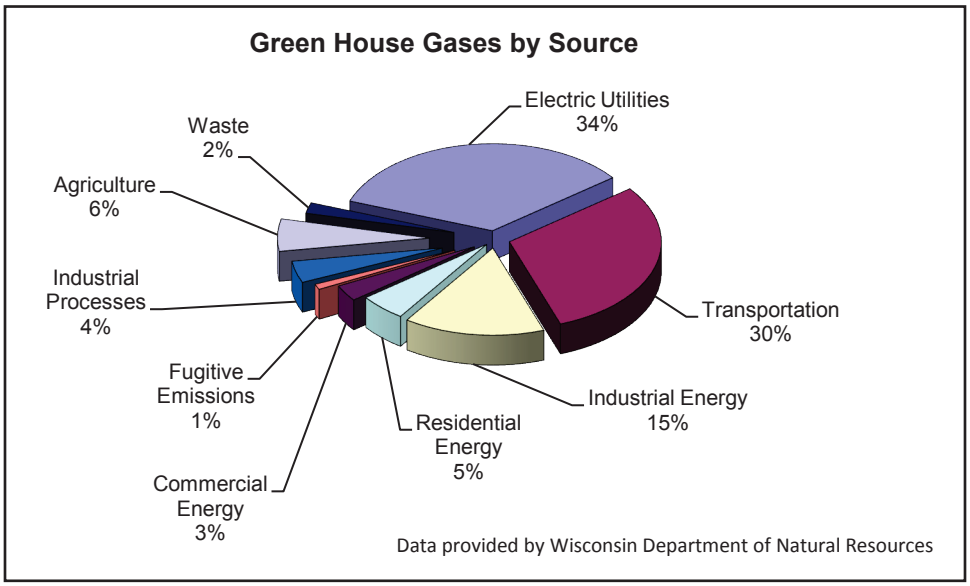
Data provided by Wisconsin Department of Natural Resources

GRADE: IMPROVED

Although there has been an improvement over the past decade to reduce CO_2 emissions there are still significant contributions of this and other green house gases into the atmosphere.

Sources

In 2005, the state of Wisconsin produced an estimated 130 million metric tons of CO_2 equivalents (Mt CO_2 e) of greenhouse gases; approximately 1.8% of the total estimated amount produced in the entire United States.[12-13] Over 80% of the man-made greenhouse gas emissions in the United States was CO_2; the majority of this total was derived from the combustion of fossil fuels during electricity production, transportation, and manufacturing and industrial processes. Methane accounted for an additional 10% of total greenhouse gas emissions in this country.[13] A more specific description of the contribution by source-type is demonstrated in the accompanying figure.



Human Health Impacts

The release of greenhouse gases into the atmosphere may have direct and indirect adverse impacts to individual, community, and global health. Greenhouse gases directly impact air quality by increasing the frequency of high levels of ozone events resulting from warmer temperatures; increases in particulate matter may be impacted by increases in dusts from drier soils. Both of these air quality events increase the risk of asthma development and exacerbation and other chronic respiratory diseases among exposed populations.[14,15] Significant risk to individual and community health may also result from greenhouse gas emissions related to reported changes in climate; these risks include but are not limited to direct temperature effects, changes in rainfall, reduced water availability, and an increase in the frequency of extreme weather events. In addition to these direct threats to human health, climate change also poses several indirect health threats from the expansion of climate-sensitive diseases such as malaria, encephalitis, West Nile virus, and Lyme-disease derived from changes in seasonal temperature. On a global scale, increasing temperature and other climate change impacts are expected to lead to rising sea levels and decreases in agricultural yields that would ultimately lead to the displacement of human populations and further increases in the number of undernourished people in specific regions across the planet due to decreased crop yields, reduced availability of food, malnutrition, and/or increases in food prices.[6,14]

Local Response

Individual Actions

- Greenhouse gas emissions can be reduced by adjustments to individual lifestyle and behavior.
  - Purchase Energy Star® qualified products including appliances, light bulbs, home electronics, and heating and cooling equipment. In 2010 alone, Energy Star® products prevented the emission of an estimated 170 million of greenhouse gas.[16]
    - Energy Star® qualified products are available in over 60 product categories; more information is available at: **www.energystar.gov**.
  - Replace conventional light bulbs in your home with light bulbs that have earned the Energy Star® rating. If every household in the United States replaced just one conventional light bulb enough energy would be conserved to light approximately 3 million homes for a year, save about $600 million in annual energy costs, and prevent the annual release of an estimated 9 billion pounds of greenhouse gas emissions.[17] Replacing the five most frequently used light fixtures with Energy Star rated light bulbs would prevent the release of greenhouse gases equivalent to the emissions of an estimated 10 million cars.[18]
  - Seal and insulate your home.
  - Regularly clean air filters and have heating and cooling equipment serviced annually to improve efficiency.[18]
  - Purchase electricity that is generated from renewable sources such as solar and wind in your home; more information is available at: **www.epa.gov/climatechange/wycd/home.html**.
  - Buy fuel efficient vehicles and maintain vehicles regularly. A well-maintained vehicle is more reliable, efficient, and produces less greenhouse gases. Additional information is available at: **www.epa.gov/climatechange/wycd/road.html**.
  - Review and practices methods to reduce your consumption of energy and decrease your individual "carbon footprint." More information can be found at: **https://www.co2gether.org/my_co2/reduce**.
  - Use public transportation.

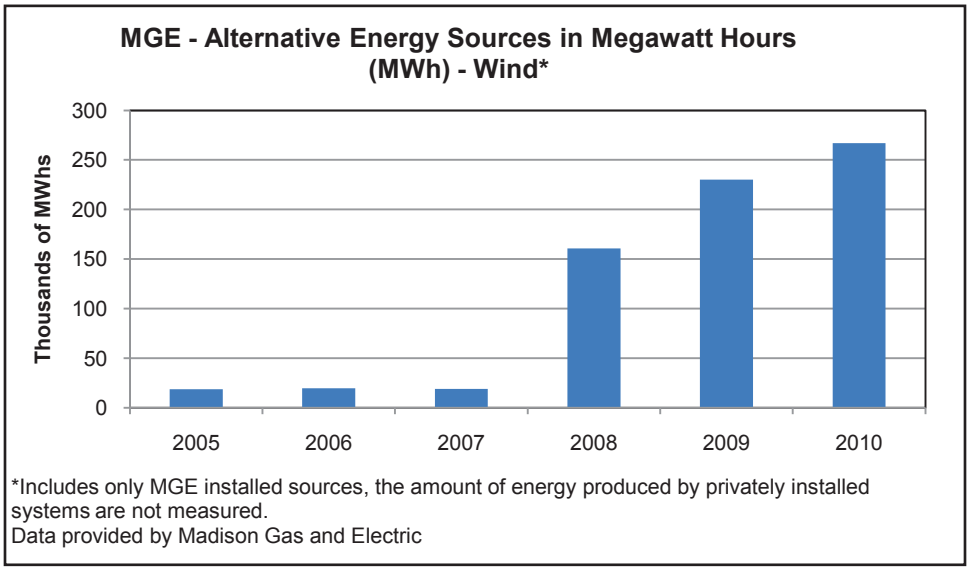
Community Actions

- Municipal and County governments should increase energy efficiency and the use of renewable fuels/energy in vehicles and buildings and promote these same principles to area businesses. The City of Madison and Dane County continues to advance these and similar policies to improve sustainability efforts; several examples are provided below:
  - The "Natural Step" program initiated by the City of Madison in 2005 continues to provide a framework to guide decision-making, operations, and management to improve energy efficiency and sustainability. More information is available at: **www.cityofmadison.com/sustainability/naturalStep**.
  - Providing public recycling and solid waste compost sites; these sites provide an alternative that allows residents to dispose of non-woody yard waste free of charge and purchase finished compost material at a limited cost. More information is available at: **www.countyofdane.com/pwht/recycle/compost_sites.aspx**.
  - The Mpower campaign (**www.mpoweringmadison.com**) was launched in 2007 by the City of Madison as a cooperative initiative between local government, public organizations, and industries to lower citywide emissions of CO_2.

- » For the past decade, Dane County has required that all new and renovated buildings must incorporate green building technology. Examples include the Dane County Airport, the Alliant Energy Center, and the Dane County Courthouse.
- » Develop affordable/accessible public transportation coverage and create, maintain, and/or expand rideshare programs.

➢ Increase the availability and promote the use of energy from renewable sources.

- » The use of manure digesters in Dane County increases the availability of renewable sources of electricity to homes in the community and reduces the use of fossil fuels.
- » The two main power companies in Dane County, Madison Gas and Electric (MGE) (**www.mge.com**) and Alliant Energy (**www.alliantenergy.com**) continue to develop, expand, and promote the use of cleaner sources of energy including wind, solar, landfill gases, and anaerobic digesters and decrease the use of coal for electricity production.



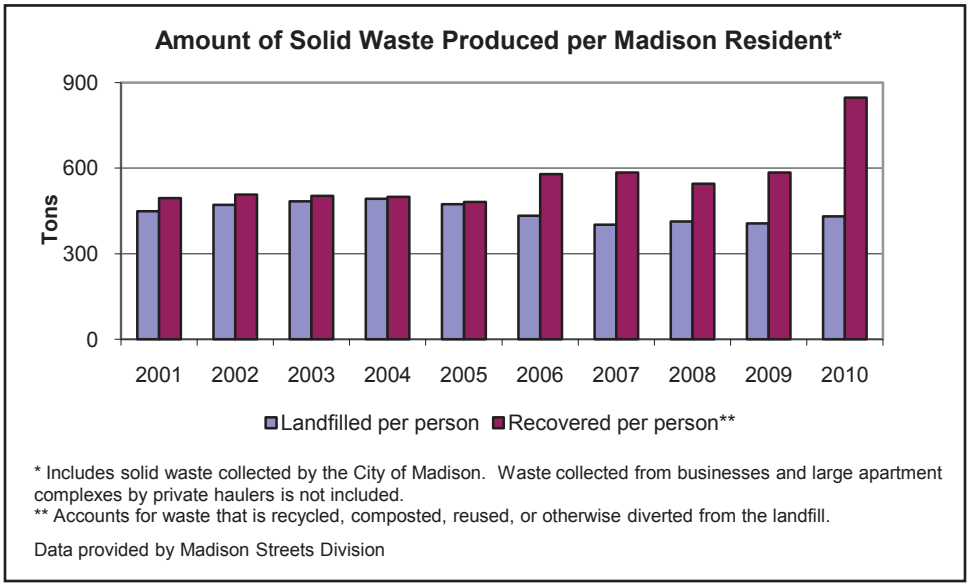
- Despite the increasing usage by both companies, these renewable sources still only compose a small fraction of the total energy generated. Each company continues to rely heavily on the use of coal.
- However, each of these companies continues to invest in renewable energy and continue to reduce this reliance on coal.[19,20] In fact, as shown in the figure above, MGE has significantly increased the percentage of energy produced by wind. Although wind and solar production of energy accounted for only 8% of the total energy produced by the company in 2010, MGE projects a 21% reduction in use of CO_2 from 2005 to 2015 due to its continuing commitment to increase the use of cleaner sources of energy.[20]

WASTE PRODUCTION AND RECYCLING

Environmental Measures

Solid Waste

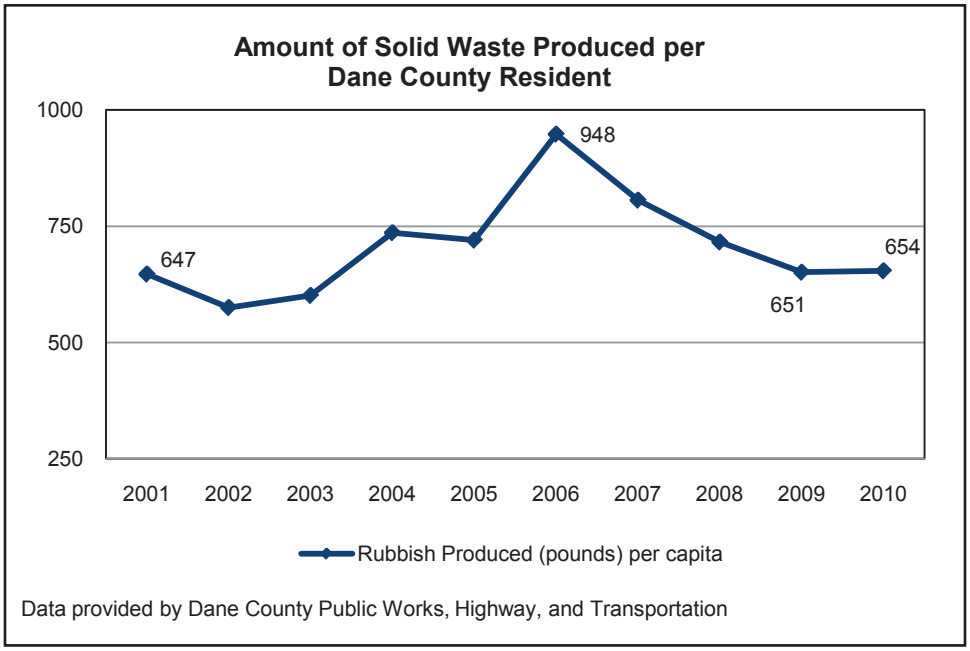
The production of solid waste in Dane County impacts the health of the environment and sustainability efforts in our community. In the City of Madison, the total solid waste production per person has increased approximately 30% since 2001. However, this increase is offset by notable increases in the amount of material that is either recycled or composted per capita; approximately 71% since 2001. In fact, 2010 was the largest increase in recovered materials on record. The result is less material deposited in the local landfill; thereby prolonging the life of the landfill and reducing the overall impact to the environment during production and disposal of these materials. In fact, the amount of waste deposited in the Dane County landfill from material collected in the City of Madison varies year to year but has decreased approximately 13% since 2004 and 4% over the past decade. Unfortunately, a precise total of the amount of solid waste produced and recovered at the county level cannot be determined since a portion of the material is collected by private waste haulers that do not make this data available for surveillance purposes. However, from the available data from the City of Madison, approximately 59% of waste material was diverted from the landfill by recycling and/or reuse in 2009; in 2010, the amount of material diverted from the Dane County landfill increased to 66%.



* Includes solid waste collected by the City of Madison. Waste collected from businesses and large apartment complexes by private haulers is not included.
** Accounts for waste that is recycled, composted, reused, or otherwise diverted from the landfill.

Data provided by Madison Streets Division

At the county level, there has also been reported increases in the amount of waste delivered to the Dane County landfill; approximately 13% over the past decade based on the available data monitoring total rubbish received at the landfill. A portion of this increase may be explained by the population growth in Dane County; approximately 14% since 2000 and an average increase of 1.3% each year.



However, similar to the trend reported for the City of Madison, a significant amount of this waste is recycled and/or reused to offset the amount of material deposited in the Dane County landfill. In 2007 (last data available), the amount of material recycled per resident had increased 10.5% since the year 2000 but still only composed of approximately 23% of the waste produced during that year. The recycling of waste material at the county level has been privatized and the data is no longer available for analysis.

GRADE: IMPROVED

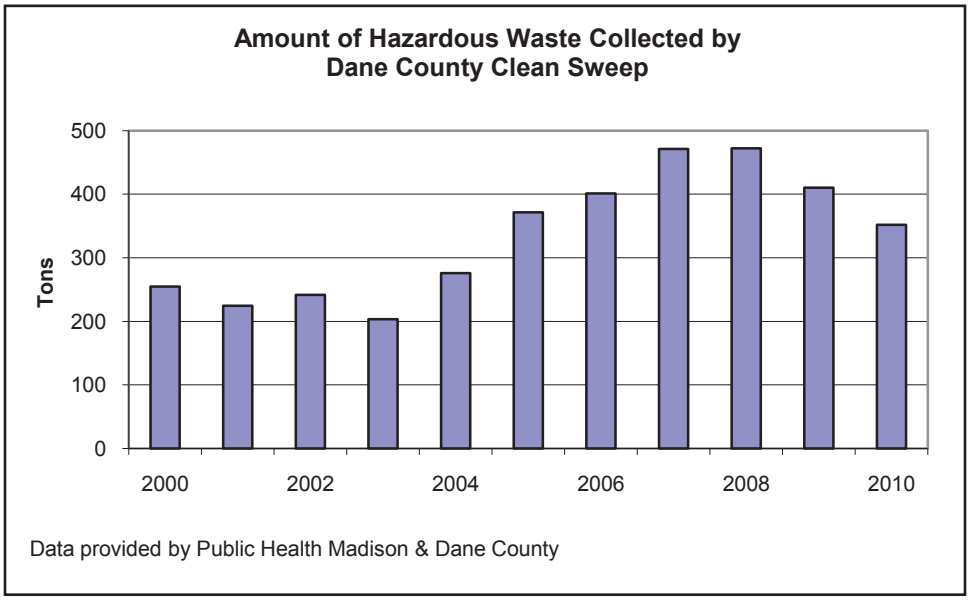
Notable increases in the amount of material recycled and/or reused in the City of Madison.

Hazardous Waste

Hazardous materials including oil-based paints and paint-related products, pesticides, organic solvents, flammable liquids, and rechargeable batteries are also a public health concern facing Dane County communities. Therefore, the collection and proper disposal of these and other hazardous material is essential to efforts to improve and/or sustain the quality of our local environment.

The City of Madison/Dane County Clean Sweep Program provides the community with a resource for appropriate disposal of hazardous materials at little or no cost.[21] Over the past decade, the amount of material collected by this program has steadily increased, albeit, varying year to year, by approximately 61% and 38% since the year 2000 in 2009 and 2010, respectively. The slight decrease in material collected since 2008 can be attributed to the reported reduction in the collection of latex paint products. Received volumes of latex paint have decreased over the past 2 years by approximately 43%; this decrease is possibly due to the enhanced educational and waste minimization efforts targeting this material.[21]

In addition to these efforts, Madison/Dane County Clean Sweep offers a Product Exchange program that allows collected materials such as paints, chemicals, thinners, and pesticides that are still useable to be available free to the public. In 2009, this program facilitated the reuse of over 31,000 donated products that would have otherwise required disposal; in 2010, over 25,000 products were returned to the public via the Product Exchange program.[21]



GRADE: IMPROVED

Notable increases in the amount of hazardous waste collected and properly disposed over the past decade.

Sources

Solid and hazardous waste materials are routinely produced during average daily activities of Dane County residents and local businesses. Sources of the material include product packaging, non-functional electronics and appliances, batteries, yard debris, solvents and cleaners, and household garbage. A comprehensive list of potential sources is beyond the scope of this document. The improper disposal and/or failure to recycle these items jeopardizes water sources, wildlife, ecosystems, and human health due to the contamination of the environment with hazardous chemicals and heavy metals and the provision of potential havens for insects and rodents. In addition, the failure to recycle also leads to the loss of cost savings and degrades sustainability efforts that aim to improve Dane County communities.

Human Health Impacts

Solid and hazardous waste affects individual and community health by degrading land and water quality that could otherwise be used for other purposes such as agriculture, drinking water resources, recreation, and/or other developmental needs. The improper disposal of these wastes and/or unintentional escape from landfills pollutes soil and water resources that may result in adverse impacts to the environment, ecosystems, wildlife, and humans. A couple of examples to demonstrate the variety of pathways that solid and/or hazardous materials may led to adverse health impacts at the individual and community level.

- The incorrect disposal of antibiotics by humans and the overuse of the pharmaceuticals in livestock have led to an increased risk of antibiotic resistant bacteria and endocrine-disrupting chemicals in the environment; a development that may increase the risk of endocrine-related disease and create new challenges in the treatment of bacterial diseases.[22]
- Solid materials such as vehicle tires, aluminum cans, and paint containers that are improperly disposed can provide havens for rodents and insects; including the *Culex* mosquito that is the major type of mosquito group involved in the transmission of West Nile Virus.[23]

Local Response

Individual Actions

- Decrease the amount of solid waste produced by households and businesses.
  - Participate in EnAct teams; voluntary action-oriented teams that aim to help people live a greener life and to build a better community. Since the EnAct program in 2003, the average annual savings per EnAct household is:
    - 1.5 fewer tons of CO_2
    - 12,500 less gallons of water used
    - 196 fewer pounds of garbage created
    - 1,400 less miles driven[24]
  - Increase the percentage of waste your household recycles.
  - Drink tap water instead of purchasing bottled water to reduce the number of plastic bottles that end up in local landfills and the greenhouse gases generated during the production, packaging, and shipment of the bottles.
  - Reuse, sell, or donate usable items instead of throwing them away. The following resources may be used to fully pursue this option:
    - Freecycle (**http://www.freecycle.org/group/US/Wisconsin**)
    - Goodwill (**www.goodwillscwi.org**)
    - Craig's List (**http://madison.craigslist.org**)

Community Actions

- The Dane County Solid Waste Division has banned roof shingles at the Dane County landfill to encourage their delivery to shingle recyclers. Recyclers process this material so that it can be reused in applications such as asphalt for roads and highways.
- Provide, support, and expand alternatives to landfilling waste such as recycling, composting, and product exchange opportunities. Excellent example include:
  - Madison/Dane County Clean Sweep and Product Exchange (**www.danecountycleansweep.com**)
  - City of Madison Stuff Exchange (**www.madisonstuffexchange.com**)
  - Dane County yard and solid waste composting sites. These sites accept only non-woody yard waste for composting; the completed compost (screened and unscreened) is available for purchase. More information is available at **http://www.countyofdane.com/pwht/recycle/compost_sites.aspx**.

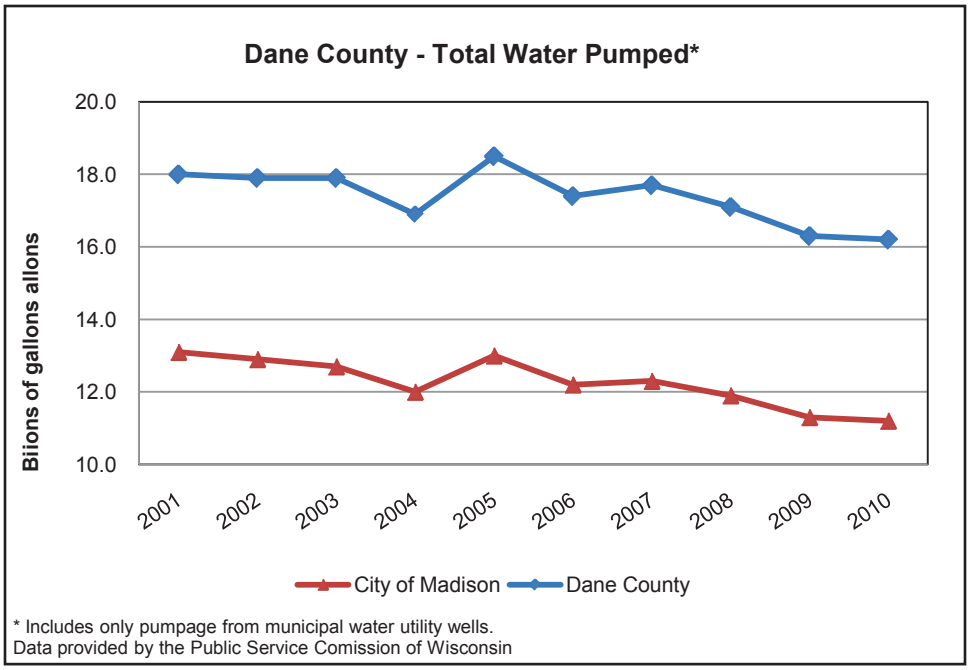
WATER USE AND CONSERVATION

Environmental Measures

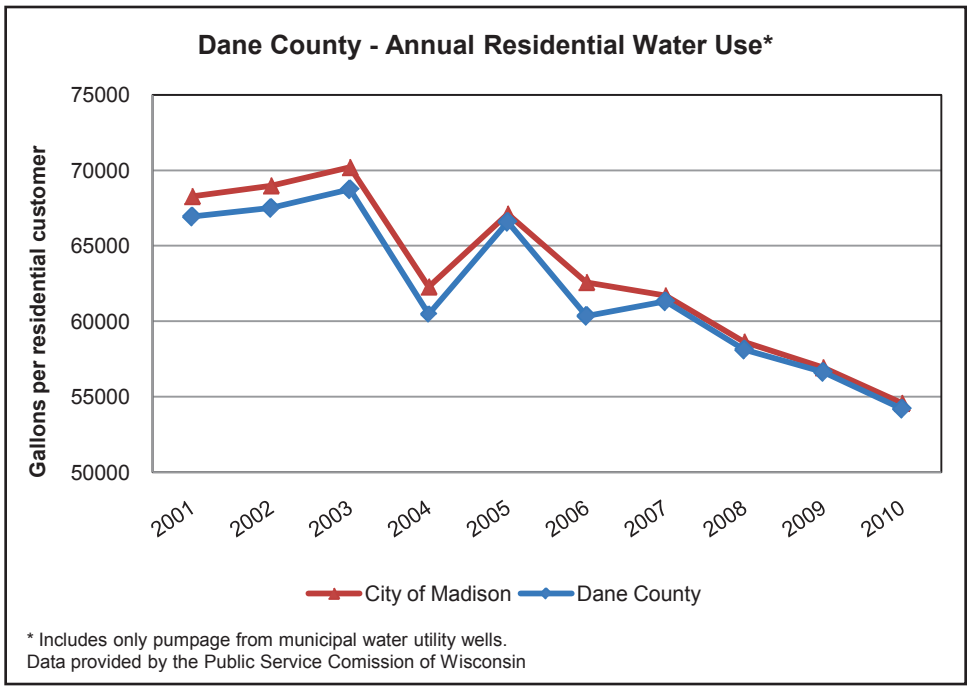
The appropriate use of water supplies is critical to the establishment of a sustainable and healthy community. Currently, an average of 47 million gallons of water is pumped each day in Dane County (over 17 billion gallons annually) to supply residential, agricultural, industrial, and commercial water demands. These totals include the over 30 million gallons per day (12 billion gallons annually) pumped by the City of Madison Water Utility for the City of Madison and neighboring cities and villages. As shown in the figures on page 49, the per capita use of water resources in Dane County and the City of Madison has steadily decreased over the past decade despite the steady increase in the number of municipal water customers. However, this data depicts only municipal water usage and not private well or industrial water use; complete data of water use trends in these areas is not currently available.

This reduction in per capita residential use has contributed to relatively consistent amount of municipal water pumped annually over the past decade despite the annual increase in population and municipal water consumers. As shown in the accompanying figure, this consistency is demonstrated at both the city and county level.

However, continuous water use at this level (billions of gallons annually) has led to reported draw-downs in county aquifer water levels ranging from 30 feet in the deep aquifer and at least 40 feet in localized areas of the shallow aquifer. In 2006, the Wisconsin Groundwater Advisory Board recommended that Dane County be listed as a Groundwater Attainment Area. This designation is considered a warning of potential increases in the ground water draw-down and a recommendation for initiating and developing a coordinated management plan to prevent further impact.[25] Without proper water management, planning, and conservation efforts the future availability of sufficient water supplies to adequately meet the needs of the county may be jeopardized. As indicated by the City of Madison water conservation plan, in order to maintain the current rate of ground water pumping and to decrease and/or prevent the lowering of aquifer levels, significant effort to reduce consumption must be made at the individual, industrial, municipal, and residential levels.[25]



* Includes only pumpage from municipal water utility wells.
Data provided by the Public Service Comission of Wisconsin



* Includes only pumpage from municipal water utility wells.
Data provided by the Public Service Comission of Wisconsin

GRADE: IMPROVED

Decreases in per resident use of municipal water sources over the past decade that continue to lower the burden on local ground water resources.

Sources

Groundwater is a renewable resource when the rate of water discharge does not outweigh the rate of recharge. Dane County draws its drinking water from two substantial aquifers that are continually resupplied by the water cycle; a process that takes much longer in ground water than surface water and is greatly impacted by human activities such as pumping of water for municipal use at a greater rate than recharge and land development that causes an increase of impervious area (e.g. payment and roof tops) that diminishes ground water recharge.[25] Although the pumping of ground water resources is fueled by legitimate water demands of the various Dane County communities, the demand and use of the resource could be reduced by improved efficiency of municipal water delivery systems and water use by consumers that will prolong the lifespan of the aquifer and may led to sustainable use of the water.[25,26]

Human Health Impacts

The overuse or inefficient use of ground water resources can have direct and indirect effects on human health outcomes. Ground water draw downs and overuse of ground water resources may impact Dane County lakes, streams, and wetlands by reducing water supplies to these sources that will ultimately lead to adverse effects on wildlife, aquatic ecosystems, and habitats. In addition, the continuation of ground water draw down will reduce the availability of viable drinking water sources, decrease livestock and agricultural production, and increase the cost of water for residents and local business. These impacts are compounded when coupled with water pollution by nutrients, chloride, and industrial chemical releases and/or spills (discussed in the Water Quality section of this report).

Local Response

Individual Actions

- Decrease individual water consumption and improve efficiency of water usage.
  - Purchase WaterSense approved products including toilets, faucets, and shower heads to reduce individual water use. More information is available at **www.epa.gov/watersense**.
  - Change water use behaviors to conserve water resources. Over 100 examples of ways to save water are listed by Water-Use It Wisely (**www.wateruseitwisely.com/100-ways-to-conserve**). A few examples from this list are shown below:
    - Run your clothes washer and dishwasher only when they are full. This can save up to 1,000 gallons each month.
    - Shorten your shower by 1 to 2 minutes; this will save up to 150 gallons of water each month.
    - Don't use running water to thaw food. Defrost food in the refrigerator for both increased water efficiency and food safety.

- » Participate in community programs (if available) that participate in water conservation efforts. As previously reported in the waste reduction section of this report, EnAct community teams continue to be involved in efforts to reduce water use; in fact, the average EnAct household conserves over 12,000 gallons annually.[24] In addition to EnAct (**http://enactwi.org**), other examples of community programs committed to water conservation include the Natural Step (**www.cityofmadison.com/sustainability/naturalStep**) and Sustain Dane (**www.sustaindane.org**). Contact these organizations for more information and participation opportunities.

Community Actions

- ➢ Initiate and/or expand community programs and legislation to improve water conservation and use efficiency. Several examples are listed below:
  - » In 2008, Wisconsin entered into the legally binding Great Lakes Compact; a regional agreement with other Great Lakes States and Canadian Provinces to ban diversions of water out of the basin with a few limited and strictly regulated exceptions.[27] This legislation provides guidance for ground and surface water withdrawal, conservation, water return flow, and prevention of environmental factors.[27,28] This agreement will aid water conservation in all counties in Wisconsin, including Dane County.
  - » Implemented in 2009, a toilet rebate program provides incentive to consumers to replace high water using toilets with US EPA WaterSense-rated high efficiency toilet (HET) models. Additional information and application forms are available from the City of Madison Water Utility (**www.cityofmadison.com/water**). Improve policies that safeguard surface water quality and restore natural habitats by improving storm water management and other sources of contamination to water resources.
  - » Provide water audits to residents and local businesses to improve knowledge of water use and provide insight into methods to improve water use efficiency.

REFERENCES

AIR QUALITY

[1] AirNow. (2010). Air Quality Index (AQI) - a guide to air quality and your health. Retrieved from: **www.airnow.gov/index.cfm?action=aqibasics.aqi**.

[2] United States Environmental Protection Agency (n.d.). Air Explorer - plot AQI values. Retrieved from: **www.epa.gov/cgi-bin/htmSQL/mxplorer/trend_aqi.hsql**.

[3] Fierro, MA, O'Rourke, MK, and Burgess, JL. (n.d.). What is ozone? Retrieved from: **www.airinfonow.org/html/ed_ozone.html**.

[4] Ritchie, IM and Lehnen, RG. (2004). Health effects of ozone and other environmental measures on children's respiratory health in the Indianapolis metropolitan area, 1997-1999. *The Internet Journal of Pulmonary Medicine,* 4(1). Retrieved from: **www.ispub.com/ostia/index.php?xmlFilePath=journals/ijpm/vol4n1/ozone.xml**.

[5] United States Environmental Protection Agency. (2010). National Ambient Air Quality Standards (NAAQS). Retrieved from: **www.epa.gov/air/criteria.html**.

[6] Power, S. (2010, December 9). EPA again delays tighter ozone restrictions. Retrieved from: **http://online.wsj.com/article/SB10001424052748703493504576007622632878748.html**.

[7] American Lung Association. (2010). State of the Air Report - 2010. Retrieved from: **www.stateoftheair.org/2010/assets/SOTA2010.pdf**.

[8] American Lung Association. (2011). State of the Air Report - 2011. Retrieved from: **www.stateoftheair.org/2011/states/wisconsin**.

[9] Public Health Madison & Dane County. (2009). Madison and Dane County Environmental Health Report Card, 2008. Retrieved from: **www.publichealthmdc.com/publications/documents/2008RptCard.pdf**.

[10] United States Environmental Protection Agency. (2010). Fine particulate (PM 2.5) designations - basic information. Retrieved from: **www.epa.gov/pmdesignations/basicinfo.htm**.

[11] United States Environmental Protection Agency. (2010). Our nation's air - status and trends through 2008. Retrieved from: **www.epa.gov/airtrends/2010**.

[12] United States Census Bureau. (2010). Dane County, Wisconsin. Retrieved from: **http://quickfacts.census.gov/qfd/states/55/55025.html**.

[13] United States Environmental Protection Agency. (2010). Controlling power plant emissions: emissions progress. Retrieved from: **www.epa.gov/hg/control_emissions/emissions.htm**.

[14] US Department of Transportation. (2010). Transportation and toxic air pollutants. Retrieved from: **www.fhwa.dot.gov/environment/air_quality/air_toxics**.

[15] United States Environmental Protection Agency. (n.d.) Asthma and outdoor air pollution. Retrieved from: **www.epa.gov/airnow/asthma-flyer.pdf**.

[16] California Environmental Protection Agency. (2010). Asthma and air pollution. Retrieved from: www.arb.ca.gov/research/asthma/asthma.htm.

[17] Cohen, AJ and Pope, CA. (1995). Lung cancer and air pollution. Environmental Health Perspectives, 103(Suppl 8), 219-224.

[18] American Heart Association. (2011). Air pollution, heart disease, and stroke. Retrieved from: www.americanheart.org/presenter.jhtml?identifier=4419.

[19] Wisconsin Department of Health Services. (2009). Wisconsin cancer incidence and mortality, 2002-2006. Retrieved from: www.dhs.wisconsin.gov/wcrs/pdf/cancerwi0206.pdf.

[20] National Cancer Institute (NCI). (1997). Smoking and Tobacco Control Monographs. Monograph 10: Health Effects of Exposure to Environmental Tobacco Smoke. Retrieved from: http://cancercontrol.cancer.gov/tcrb/monographs/10.

[21] National Cancer Institute. (n.d.). Smoking. Retrieved from: www.cancer.gov/cancertopics/tobacco/smoking.

[22] EnAct. (2010). How EnAct works. Retrieved from: www.enactwi.org/index.php?page=how-enact-works.

[23] United States Environmental Protection Agency. (2011). Green building. Retrieved from: www.epa.gov/greenbuilding.

[24] Agri-view. (2010, December 23). Digester switch "flipped" in Dane County. Retrieved from: www.agriview.com/articles/2010/12/23/dairy_news/dairy04.txt.

WATER QUALITY

[1] United States Environmental Protection Agency. (2004). Drinking water health advisory for manganese. Retrieved from: www.epa.gov/ogwdw000/ccl/pdfs/reg_determine1/support_cc1_magnese_dwreport.pdf.

[2] Wisconsin Department of Natural Resources. (2011). Blue-green algae in Wisconsin waters frequently asked questions. Retrieved from: http://dnr.wi.gov/lakes/bluegreenalgae.

[3] Wisconsin Department of Health Services. (2011). Blue-green algae. Retrieved from: www.dhs.wisconsin.gov/eh/bluegreenalgae.

[4] Public Health Madison & Dane County. (2010). Madison and Dane County environmental health report card 2008. Retrieved from: www.publichealthmdc.com/publications/documents/2008RptCard.pdf.

[5] Agency for Toxic Substances and Disease Registry (ASTDR). (2011). Toxic substances portal - lead. Retrieved from: www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=22.

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

[7] Agency for Toxic Substances and Disease Registry (ASTDR). (2011). Toxic substances portal - cadmium. Retrieved from: www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=15.

[8] Agency for Toxic Substances and Disease Registry (ASTDR). (2011) Toxic substances portal - arsenic. Retrieved from: www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=3.

[9] Agency for Toxic Substances and Disease Registry (ASTDR). (2011). Toxic substances portal - chromium. Retrieved from: www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=17.

[10] City of Madison Water Utility. (2011). Frequently asked questions: chromium in the water. Retrieved from: www.cityofmadison.com/water/waterQuality/ChromiumWater.cfm.

[11] Public Health Madison & Dane County. (2011). Chrome6 (hexavalent chromium) in Madison drinking water supplies - summary report. Retrieved from: www.publichealthmdc.com/documents/ChromiumSummaryReport20110209.pdf.

[12] University of Wisconsin - Madison, Water Resources Institute. (2009). Retrieved from: aqua.wisc.edu/publications/pdfs/nitratefactsheet.pdf.

[13] Wisconsin Department of Natural Resources. (2010). Nitrate in groundwater. Retrieved from: http://dnr.wi.gov/org/water/dwg/forms/nitrate.pdf.

[14] Agency for Toxic Substances and Disease Registry (ASTDR). (2011). Toxic substances portal - manganese. Retrieved from: www.atsdr.cdc.gov/toxfaqs/tf.asp?id=101&tid=23.

[15] Wisconsin State Climatology Office. (2011). Normal seasonal snowfall. Retrieved from: www.crh.noaa.gov/mkx/climate/avg-wi-snow.gif.

[16] Wisconsin Department of Transportation. (2010). Annual winter maintenance report, 2009-2010: meeting challenges with innovations.

[17] Novak, B. (2010, March 25). Ban on phosphorus in lawn fertilizer to start April 1. Retrieved from: http://host.madison.com/mobile/article_1baf81e0-3837-11df-9290-001cc4c03286.html.

[18] Wisconsin Association of Lakes. (2009). Bill to restrict phosphorus in lawn fertilizer. Retrieved from: www.wisconsinlakes.org/press1-12-09.html.

[19] Landis, M, Kempf, A, Remington, PL, Peppard, PE, & McElroy, J. (2004). Using air, water, and lead exposure as measures of the physical environment: the Wisconsin county health ranking. Retrieved from:http://uwphi.pophealth.wisc.edu/publications/issueBriefs/issueBriefv05n06.pdf.

[20] United States Environmental Protection Agency. (2011). Lead in drinking water. Retrieved from: http://water.epa.gov/drink/info/lead/index.cfm.

[21] Public Health Madison & Dane County. (n.d.). Drinking water: common water quality concerns. Retrieved from: www.publichealthmdc.com/environmental/water/concerns.cfm.

[22] Lafferty, JS, Hausbeck, J, & Voegeli, D. (2011). Sodium in drinking water. Retrieved from: www.publichealthmdc.com/documents/SodiumDrinkingWater20110228.pdf.

[23] United States Environmental Protection Agency. (2009). Sodium in drinking water. Retrieved from: http://water.epa.gov/scitech/drinkingwater/dws/ccl/sodium.cfm.

[24] United States Environmental Protection Agency. (2011). What you need to know about mercury in fish and shellfish. Retrieved from: http://water.epa.gov/scitech/swguidance/fishshellfish/outreach/advice_index.cfm.

[25] United States Environmental Protection Agency. (1999). Polychlorinated biphenyls (PCBs) update: impact on fish advisories. Retrieved from: http://fn.cfs.purdue.edu/fish4health/HealthRisks/PCB.pdf.

FOOD PROTECTION

[1] Centers for Disease Control and Prevention. (2010). Foodborne illness. Retrieved from: www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm.

[2] Public Health Madison & Dane County. (2009). Madison and Dane County environmental health report card, 2008. Retrieved from: www.publichealthmdc.com/publications/documents/2008RptCard.pdf.

[3] Centers for Disease Control and Prevention. (2010). CDC 2011 estimates: findings. Retrieved from: www.cdc.gov/foodborneburden/2011-foodborne-estimates.html.

[4] Food and Drug Administration (FDA). (2003). Handwashing versus alcohol-based gels - FDA information. Environmental Health, 66(2), 40.

HEALTHY HOMES AND COMMUNITIES

[1] Wisconsin Department of Health and Family Services. (2011). The legacy of lead. The report on childhood lead poisoning in Wisconsin, 2008. Retrieved from: www.dhs.wisconsin.gov/lead/LegacyofLead.

[2] UW Health. (2010). Lead poisoning. Retrieved from: www.uwhealth.org/health/topic/major/lead-poisoning/hw119898.html.

[3] National Institute of Environmental Health Sciences. (2005). Lead and your health. Retrieved from: www.niehs.nih.gov/health/assets/docs_f_o/lead-body-health.pdf.

[4] Agency for Toxic Substance and Disease Registry. (2007). Public health statement - lead CAS# 7439-92-1. Retrieved from: www.atsdr.cdc.gov/tfacts13.pdf.

[5] Wisconsin Department of Health Services. (2011). Radon information for Wisconsin. Retrieved from: www.dhs.wisconsin.gov/radiation/radon/index.htm.

[6] United States Environmental Protection Agency. (2009). A citizen's guide to radon. Retrieved from: www.epa.gov/radon/pdfs/citizensguide.pdf.

[7] National Cancer Institute. (2004). Radon and cancer: questions and answers. Retrieved from: www.cancer.gov/cancertopics/factsheet/Risk/radon.

[8] United States Environmental Protection Agency. (2009). Environmental tobacco smoke. Retrieved from: **http://epa.gov/ncer/childrenscenters/smoke.html**.

[9] National Cancer Institute. (1997). Smoking and tobacco control monographs. Monograph 10: health effects of exposure to environmental tobacco smoke. Retrieved from: **http://cancercontrol.cancer.gov/TCRB/monographs/10/index.html**.

[10] Centers for Disease Control and Prevention. (2011). Second hand smoking and tobacco use. Retrieved from: **www.cdc.gov/tobacco/data_statistics/fact_sheets/secondhand_smoke/general_facts**.

[11] Davis, RM. (1998). Exposure to environmental tobacco smoke: identifying and protecting those at risk. *Journal of the American Medical Association,* 280(22), 1947-1949.

[12] Brownson, RC, Figgs, LW, & Caisley, LE. (2002). Epidemiology of environmental tobacco smoke exposure. Oncogene, 21, 7341-7348.

[13] Stamatakis, KA, Brownson, RC, & Luke, DA. (2002). Risk factors for exposure to environmental tobacco smoke among ethnically diverse women in the United States. *Journal of Women's Health and Gender Based Medicine,* 11(1), 45-51.

[14] Elder, JP, Perry, CL, Stone, EJ, Johnson, CC, Yang, M, Edmundson, EW, Smyth, MH, Galati, T, Feldman, H, Cribb, P, Parcel, GS. (1996). Tobacco use measurement, prediction, and intervention in elementary schools in four states: the CATCH study. *Preventative Medicine,* 25(4), 486-494.

[15] Braverman, MT, Aaro, LE, Hetland, J. (2008). Changes in smoking among restaurant and bar employees following Norway's comprehensive smoking ban. *Health Promotion International,* 23(1), 5-15.

[16] Farkas, AJ, Gilpin, EA, Distefan, JM, Pierce, JP. (1999). The effects of household and workplace smoking restrictions on quitting behaviours. *Tobacco Control,* 8, 261-265.

[17] Longo, DR, Johnson, JC, Kruse, RL, Brownson, RC, Hewett, JE. (2001). A prospective investigation of the impact of smoking bans on tobacco cessation and relapse. *Tobacco Control,* 10, 267-272.

[18] Mosiman, D. (2009, April 19). Madison's smoking ban hits 5-year anniversary. Retrieved from: **www.smokefreewi.org/media/documents/madisonssmokingbanhits5-yearanniversary.pdf**.

[19] The Daily Cardinal. (2008, September 22). County ban a positive step. Retrieved on May 27, 2009 from: **www.dailycardinal.com/article/20511**.

[20] CNBC. (2009, May 18). Wisconsin governor signs smoking ban into law. Retrieved on May 27, 2009 from: **www.cnbc.com/id/30607799**.

[21] Wisconsin Legislative Reference Bureau. (2009). Indoor smoking ban in Wisconsin. Retrieved from: **http://legis.wisconsin.gov/lrb/pubs/Lb/09Lb1.pdf**.

[22] Centers for Disease Control and Prevention. (2010). Mold - basic facts. Retrieved from: **www.cdc.gov/mold/faqs.htm**.

[23] United States Environmental Protection Agency. (2011). Mold remediation in schools and commercial buildings. Appendix B- introduction to molds. Retrieved from: www.epa.gov/mold/append_b.html.

SUSTAINABILITY

[1] United States Environmental Protection Agency. (n.d.). Sustainability. Retrieved from: www.epa.gov/sustainability/basicinfo.htm#sustainability.

[2] United States Environmental Protection Agency. (2011). Climate change - basic information. Retrieved from: http://epa.gov/climatechange/basicinfo.html.

[3] United States Environmental Protection Agency. (2011). Frequently asked questions about global warming and climate change: back to basics. Retrieved from: www.epa.gov/climatechange/downloads/Climate_Basics.pdf.

[4] United States Environmental Protection Agency. (2011). Climate change and ecosystems. Retrieved from: http://epa.gov/climatechange/downloads/Climate_Change_Ecosystems.pdf.

[5] United States Environmental Protection Agency. (2011). Climate change science facts. Retrieved from: http://epa.gov/climatechange/downloads/Climate_Change_Science_Facts.pdf.

[6] United States Environmental Protection Agency. (2011). Climate change and society. Retrieved from: http://epa.gov/climatechange/downloads/Climate_Change_Society.pdf.

[7] National Energy Information Center. (2004). Greenhouse gases, climate change, and energy. Retrieved from: www.eia.gov/oiaf/1605/ggccebro/chapter1.html.

[8] United Nations (2001). Emissions of greenhouse gases. Retrieved from: www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/isd-ms2001environmentalA.htm.

[9] United States Environmental Protection Agency. (2011). Climate change - greenhouse gas emissions. Retrieved from: www.epa.gov/climatechange/emissions/index.html.

[10] United States Environmental Protection Agency. (2011). Carbon dioxide. Retrieved from: www.epa.gov/climatechange/emissions/co2.html.

[11] United States Environmental Protection Agency. (2011). Atmospheric changes. Retrieved from: www.epa.gov/climatechange/science/recentac.html.

[12] United States Environmental Protection Agency. (2011). U.S. greenhouse gas inventory. Retrieved from: www.epa.gov/climatechange/emissions/usgginventory.html.

[13] Wisconsin Department of Natural Resources. (2011). Wisconsin climate change - basics. Retrieved from: http://dnr.wi.gov/climatechange/weather.htm.

[14] United States Environmental Protection Agency. (2011). Climate change - health and environmental effects. Retrieved from: www.epa.gov/climatechange/effects/health.html.

[15] United States Environmental Protection Agency (US EPA). (2009). Assessment of the impacts of global change on regional US air quality: a synthesis of climate change impacts on ground-level ozone. An interim report of the US EPA Global Change Research Program. Retrieved from: **http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=491176**.

[16] United States Environmental Protection Agency. (2011). Energy Star® overview of 2010 achievements. Retrieved from: **www.energystar.gov/ia/partners/publications/pubdocs/2010%20CPPD%204pgr.pdf**.

[17] Energy Star. (n.d.). Light bulbs. Retrieved from: **http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=LB**.

[18] United States Environmental Protection Agency. (2011). Climate change - what you can do. At home. Retrieved from: **www.epa.gov/climatechange/wycd/home.html**.

[19] Alliant Energy. (2010, September). Alliant Energy environmental report. Retrieved from: **www.alliantenergy.com/Environmental/PolicyCompliance/ssLINK/025679**.

[20] Madison Gas and Electric (2010). Environmental responsibility report. Retrieved from: **www.mge.com/Images/PDF/ECA/EnvResRpt_2010.pdf**.

[21] City of Madison/Dane County Clean Sweep Program. (2011). Annual report 2010. Retrieved from: **http://danedocs.countyofdane.com/webdocs/pdf/Cleansweep/2010/FinalAnnualReport.pdf**.

[22] Rosenblatt-Farrell, N. (2009). The landscape of antibiotic resistance. *Environmental Health Perspectives,* 117(6), A245-A250.

[23] Public Health Madison & Dane County. (2011). West Nile Virus. Retrieved from: **www.publichealthmdc.com/disease/westNile**.

[24] EnAct. (2010). How EnAct works. Retrieved from: **http://www.enactwi.org**.

[25] City of Madison Water Utility. (2008). Water conservation and sustainability plan. Retrieved from: **www.cityofmadison.com/water/documents/ConservationPlan_71708.pdf**.

[26] Wisconsin Groundwater Coordinating Council. (2011). Fiscal year 2011 report to the legislature. Groundwater Wisconsin's buried treasure. Retrieved from: **http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/Report/gccReport2011.pdf**.

[27] Wisconsin Department of Natural Resources. (2011). Great Lakes Compact. Retrieved from: **http://dnr.wi.gov/org/water/greatlakes/annex2001**.

[28] Great Lakes Commission. (2003). The Great Lakes basin compact. Retrieved from: **www.glc.org/about/glbc.html**.

ACKNOWLEDGEMENTS

Many thanks to those individuals and organizations that provided data, reviewed draft report sections, and provided suggestions to improve the final report. This final report would not have been possible without their efforts. The following individuals, organizations, and databases provided the data presented in this report.

AIR QUALITY

American Lung Association
Jeanne Hoffman, City of Madison Engineering
Glen Hyland, Public Health Madison & Dane County
Carrie Tomasallo, Wisconsin Department of Health Services
United States Environmental Protection Agency, AirData (**www.epa.gov/airdata**) and TRI Explorer (**http://iaspub.epa.gov/triexplorer/tri_release.chemical**).
Laura Williamson, Madison Gas & Electric
Ralph Patterson, Grant Hetherington, and Chris Bovée, Wisconsin Department of Natural Resources
Lisa MacKinnon, Dane County Clean Air Coalition

WATER QUALITY

Emelia McAuliff, Wisconsin Department of Health Services
Carol McCurry, Candy Schrank, and Sue Josheff, Wisconsin Department of Natural Resources
Gail Gawenda & Joe Grande, City of Madison Water Utility
Kirsti Sorsa, Glenn Hyland, & Rick Wenta, Public Health Madison & Dane County
Chemical Limnology of North Temperature Lakes LTER Primary Study Lakes: Nutrients, North Temperate Lakes Long Term Ecological Research program (**http://lter.limnology.wisc.edu**)
Susan Jones, Dane County Land and Water Resources Department

FOOD PROTECTION

Beth Cleary & Amanda Kita-Yarbro, Public Health Madison & Dane County

HEALTHY HOMES AND COMMUNITIES

Clint Marshall, Public Health Madison & Dane County
Jeff Havlena, Wisconsin Department of Health and Family Services

SUSTAINABILITY

Laura Williamson, Madison Gas & Electric
Jeff Ripp & Bruce Schmidt, Public Service Commission of Wisconsin
Jeanne Hoffman, City of Madison Engineering
Ralph Patterson and Chris Bovée, Wisconsin Department of Natural Resources
Gail Gawenda, City of Madison Water Utility
Jeanne Hoffman, City of Madison Engineering
George Dreckmann, City of Madison Streets Division
Mike DiMaggio, Dane County Department of Public Works, Highway, and Transportation
Dave Radisewitz, Public Health Madison & Dane County