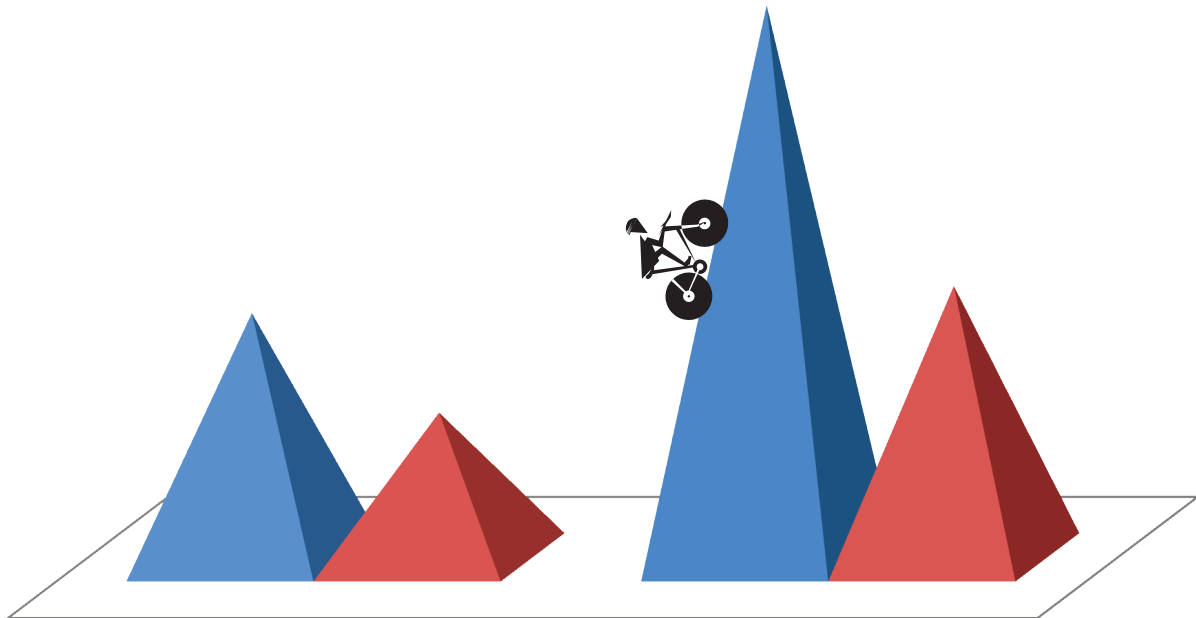


# Madison and Dane County Environmental Health Report Card 2008



 **Public Health**  
MADISON & DANE COUNTY

*Healthy people and places*

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# INTRODUCTION

Public Health – Madison and Dane County is pleased to present the 2008 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 include manganese in drinking water, fine particulates and carbon dioxide in 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 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 targets used to help assess this data have come from the Healthy People 2010 Objectives and Healthiest Wisconsin 2010 Objectives. 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 grow and change with each edition. Notable changes in this edition include utilization of an arrow grading system to indicate progress or identify areas of improvement and the inclusion of new datasets and potential issues and concerns that have been identified since the last edition of this report was published. An example is the inclusion of a new section of the report card dedicated to the evaluation of the sustainability of the City of Madison and Dane County 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.



*Healthy people and places*

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Cover Art: Chart prepared by Courtney Ziemer showing increases in miles of bike trails in Madison and Dane County

# AIR QUALITY

## Environmental Measures

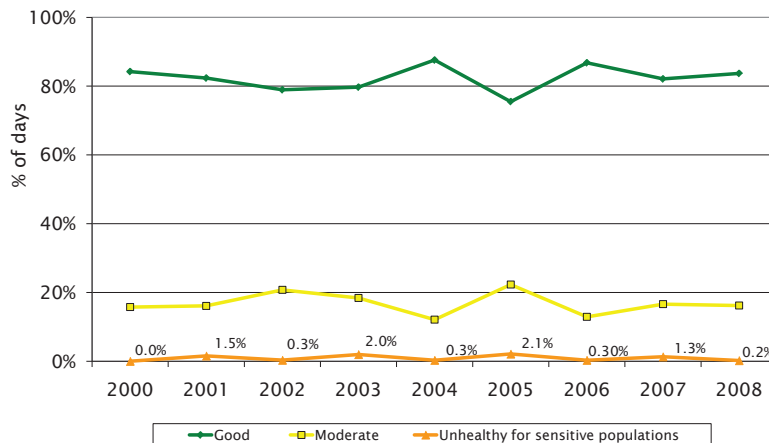
### AQI Data

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). The measurement values calculated by the AQI correspond to six health risk categories; “good” air quality representing the best scores and “hazardous” representing the worst. The specific categories are outlined below.<sup>1</sup>

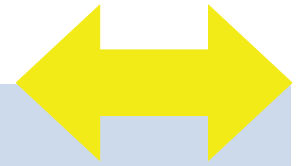
AQI Value	Level of Health Concern	Description
0 to 50	Good	Air quality considered satisfactory and poses little or no risk.
51 to 100	Moderate	Air quality acceptable but may be of moderate health concern to individuals unusually sensitive to specific pollutants.
101 to 150	Unhealthy for Sensitive Groups	General public not at risk but air quality may affect specific populations such as elderly, children, and persons with chronic respiratory and/or cardiovascular diseases.
151 to 200	Unhealthy	Unhealthy to general population but sensitive groups may experience more serious effects.
201 to 300	Very Unhealthy	Health alert would be issued; everyone may experience more serious health effects.
301 to 500	Hazardous	Health warnings of emergency conditions would be issued; entire population impacted.

The Air Quality Index (AQI) from 2000 to 2008 for Dane County is shown in the figure below. As indicated in the figure, AQI measurements for 2007 – 2008 displayed continued consistency with the air quality demonstrated throughout the current decade. In 2007 approximately 82.1% of recorded days were categorized as “Good” and 83.7% in 2008; approximately 16.6% and 16.2% were “Moderate” days, respectively. The greatest improvement was noted in the number of days unhealthy for sensitive populations, 1.3% in 2007 and 0.2% in 2008.

Air Quality in Madison and Dane Co according to the Air Quality Index (AQI)



Data provided by WI Department of Natural Resources

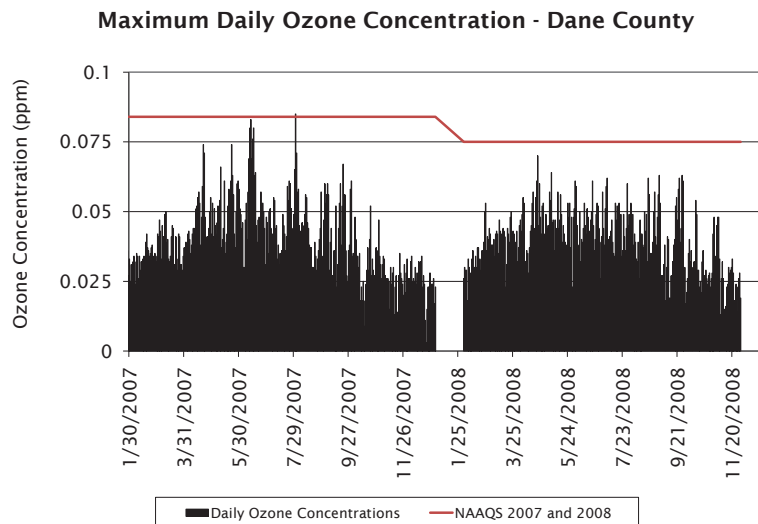


**GRADE: NO CHANGE**

**Air quality has been generally consistent over the past 8 years; the vast majority of recorded days demonstrating “Good” AQI scores.**

**Ozone Concentrations**

In Dane County, high levels of ozone lead to days with unhealthy air quality. Short-term exposures to ozone have been linked to respiratory symptoms, decreases in lung function, and irritation of the eyes, nose, and throat.<sup>2,3</sup> Due to the potential dangers of prolonged exposure to ozone a National Ambient Air Quality Standard (NAAQS) has been established to monitor this pollutant. The NAAQS for ozone were changed in 2008 from 0.084 ppm to 0.075 ppm averaged over eight hours. The following chart displays the maximum daily ozone concentrations in Dane County for the 2007 and 2008 seasons.



Data provided by WI Department of Natural Resources

During the summer months warmer temperatures and prolonged sunlight lead to generally higher levels of ozone compared to levels reported in other seasons. Limited data were available for January 2007 and December 2008. Ozone levels recorded during 2008 did not reach the new stricter 2008 NAAQS ozone exposure levels but 10 days were reported in ranges that were unhealthy for sensitive populations under this new regulation. In contrast, no ozone concentrations recorded in 2007 exceeded the old NAAQS standards threshold of 0.084 ppm used for air quality measurement during that reporting year.

The data displayed in the above figure earned Dane County a grade of “A” in 2008 and “F” in 2009 from the American Lung Association State of the Air report for high ozone days; the data utilized for these reports were from the 2007 and 2008 reporting periods, respectively.<sup>4,5</sup> This change in distinction does not necessarily indicate a decrease in the air quality in Dane County during this time period but reflects the fact that the US EPA has adopted more stringent environmental standards to protect the health of the public. Regardless, the results of these two reports demonstrate the need for continuing improvement to reduce days of high ozone and more effectively meet US EPA standards. Unfortunately, the levels of surface ozone are projected to gradually increase in the coming decades due to increasing temperatures attributed to climate change. These projected higher temperatures favor the atmospheric chemical reactions that produce ozone; however the specific impact on Wisconsin is uncertain and requires a significant amount of additional research.<sup>6</sup> However, it should be noted that the US EPA has indicated that further revisions to the current NAAQS for ozone is expected and the standards are likely to be more stringent.

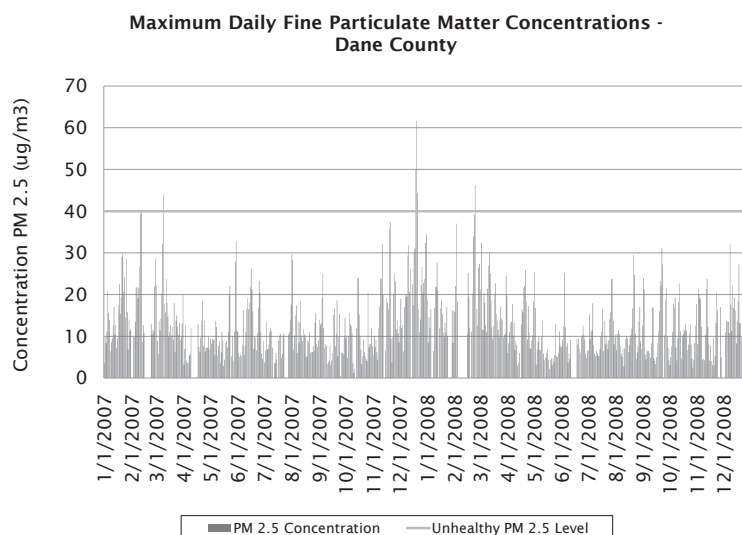
**GRADE: NEEDS IMPROVEMENT**

**A reduction in the air quality grade awarded by the American Lung Association’s State of the Air report for ozone and need to better meet updated US EPA NAAQS.**



**Fine Particulate Matter (PM 2.5)**

PM 2.5 is less dependent on outdoor temperature than is ozone. Unhealthy levels of fine particulate matter may occur at any time of the year, however during the 2007 – 2008 reporting periods the highest reported concentrations occurred in the winter months.



Data provided by WI Department of Natural Resources

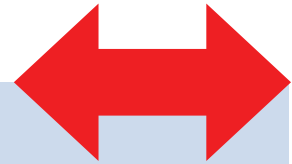
Overall, a similar pattern was reported in 2007 and 2008 compared to the previous year. However, due to a change in the NAAQS from 65  $\mu\text{g}/\text{m}^3$  to a stricter threshold of 35  $\mu\text{g}/\text{m}^3$  for allowable levels of PM 2.5 Dane County was nearly designated as a “non-attainment area” by the United States Environmental Protection Agency (US EPA).<sup>7,8</sup> Since this change, Dane County has taken significant strides to lower the level of PM 2.5 in the air to meet the new federal standard. The data reviewed by the US EPA from the 2008 reporting period allowed Dane County to officially meet the new regulatory requirement and avoid the poor designation entirely.<sup>8</sup>

Dane County continues to make significant efforts to further reduce the release of fine particulate matter including initiatives to reduce burning coal, improve ridesharing participation, 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.

During the 2007-2008 monitoring periods only a few days reached levels that were unhealthy for sensitive populations and/or exceeded the new US EPA standards. In 2007, six days were reported with levels of PM 2.5 that exceeded these new standards; in 2008 only two days reached levels that surpassed 35  $\mu\text{g}/\text{m}^3$ . The data collected during 2007 was sufficient to earn Dane County a grade of “D” from the American Lung Association State of the Air report for 2008 for fine particle pollution. The grade in this report was derived from a weighted average of the Air Quality Index. The grading scale assigned greater value to increasing levels of severity multiplied by the number of days the range was recorded; the total of each range (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous) was subsequently added to achieve county totals from which the final county grade was derived.<sup>4</sup> Dane County received an “F” in the 2009 version of this report (data from 2008) demonstrating the continued need to improve the air quality.<sup>5</sup>

#### **GRADE: NO SIGNIFICANT CHANGE**

**Dane County met new regulatory requirements but continues to receive poor grades from the American Lung Association State of the Air report.**



### **Other Pollutants**

Measurements of carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>) indicate that the level of these air pollutants is much lower than NAAQS and do not pose a health risk during the observed data collection period.

Carbon dioxide (CO<sub>2</sub>), is derived from industrial and vehicular emissions, has developed into a community and global health concern due to its role in climate change. Due to the focus on this pollutant in efforts to improve Dane County sustainability efforts, CO<sub>2</sub> is described in greater detail in the Sustainability section of this report.

Regional monitors for these contaminants are located in Dodge County, WI.



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 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. Data on emissions of hazardous air pollutants can be found later in this section.

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

### School Air Quality

Industrial emissions were the subject of an article published in USA Today that focused on the potential dangers of air toxics and the safety of the air quality near schools across the country. The study ranked 128,000 schools nationwide in order of potential risk (1st percentile being the worst and 100th percentile the best air quality) utilizing the Risk Screening Environmental Indicator (RSEI) model and data derived from the Toxic Release Inventory (TRI).<sup>9,10</sup> While several schools in Dane County were identified within this ranking system as potential health concerns, the Wisconsin Department of Natural Resources (WI DNR) is confident that these schools have safe air quality and do not pose a health risk to the students of these institutions.<sup>10,11</sup> In fact, additional refined modeling of these industrial emissions by the US EPA and WI DNR does not show potential risks at Dane County schools identified by the USA Today article.

The following are examples of safe guards to protect the air quality of Dane County students.

- Wisconsin's list of almost 600 regulated air toxics is one of the most extensive in the nation.
- Area school districts, assisted by the Dane County Clean Air Coalition and WI DNR, installed clean diesel retrofits on 200 school buses operated in Dane County to reduce emissions of VOCs, CO, and PM.
- WDNR routinely monitors air quality and issues air pollution permits to:
  - » Allow evaluation and regulation of air toxics.
  - » Require analysis and assessment of industrial emissions to predict downwind impacts of air pollution on facilities such as schools.

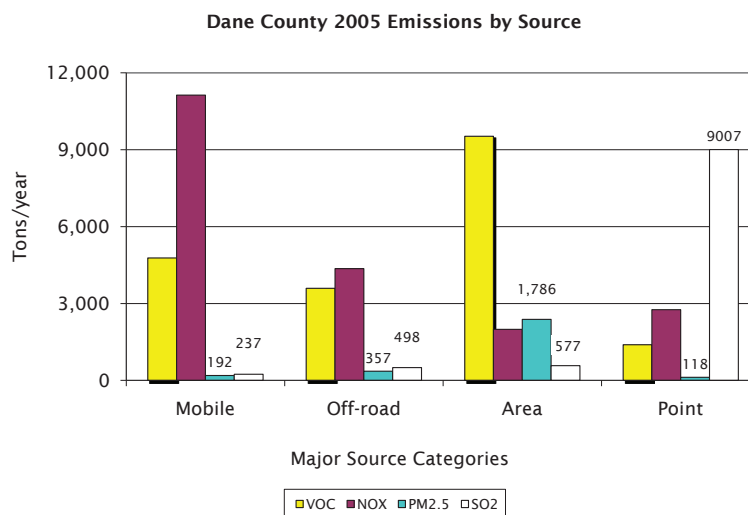
Monitoring provides a more realistic evaluation of Dane County air quality than the methods used in the USA Today ranking due to limitations derived from potential data errors (i.e., stack heights and emission rates) in the TRI database, model and risk assumptions.<sup>11</sup>

## Sources

### VOC, NOX, PM 2.5, and SO<sub>2</sub> Emissions

Ozone is the principal component formed in ambient air when nitrogen oxides (NOX) and volatile organic chemicals (VOC) react in hot, sunny weather conditions. Atmospheric PM 2.5 and SO<sub>2</sub> 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 and natural emissions.

The following chart shows the estimated amount of volatile organic compounds (VOCs), nitrogen oxides (NOX), PM 2.5, and sulfur dioxide by source category in Dane County.



Data provided by WI Department of Natural Resources

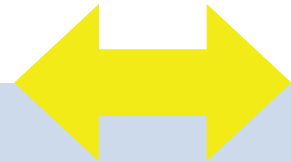
The data reported in 2005 closely mirror the previous emissions data collected in 2002 (data not shown) and published in the 2006 Environmental Health Report Card.

- Cars and trucks (mobile sources) are the primary sources of air pollutants in Dane County. Specifically, these vehicles are the largest contributor of NOX and the second largest contributor of VOCs to Dane County air; both of these constituents contribute to ozone and PM 2.5 pollution formation.
- Off-road sources including farm tractors, construction vehicles, and other non-road vehicles and equipment are also a significant source of NOX and VOCs but much less than on-road vehicles.
- Area sources of these pollutants include many general activities such as painting, fueling machines and vehicles, and lawn mowing. While individually these activities do not create a significant amount of air pollution; when these combined activities are evaluated at the county level they are the major source of VOCs and fine particulate matter in Dane County.
- Point sources (industries and other distinct sources of emissions) are the primary source of SO<sub>2</sub> and important sources of VOCs, NOX, and PM 2.5.

Despite these similarities, there are important differences that both demonstrate the continued progress in air quality improvement and the continued challenges faced by Dane County. The emissions reported for VOC and NOX have been reduced by approximately 35.1% and 19.1%, respectively, in comparison with 2002 data. However, increases in PM 2.5 (8.7%) and SO<sub>2</sub> (1.2%) have also been observed and will require increased attention and action in order to reduce these levels.

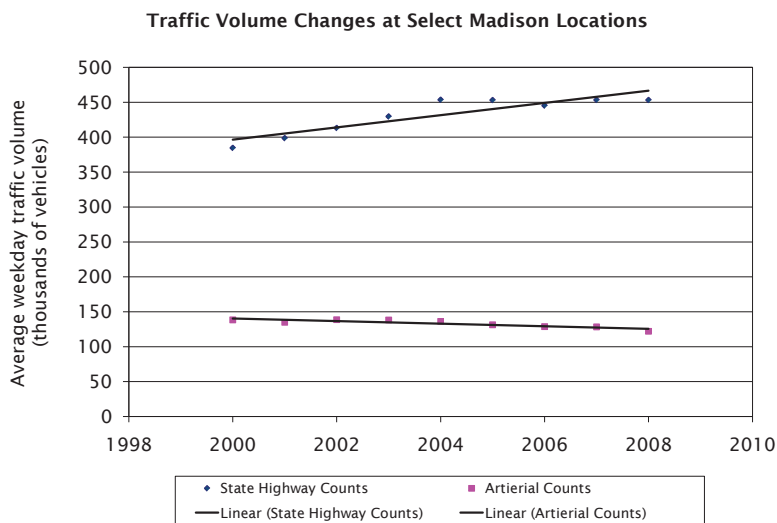
**GRADE: NO CHANGE**

**Decreases in VOC and NOX emissions but reported increases in PM 2.5 and SO<sub>2</sub> when compared to previous data.**



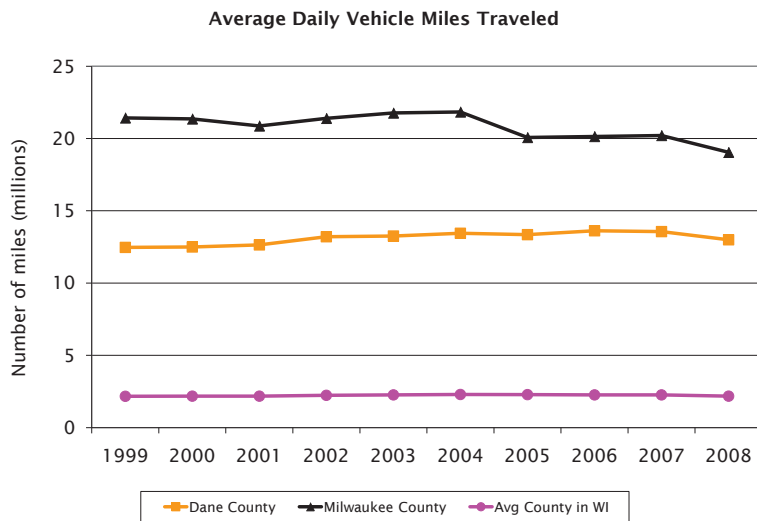
**Vehicular Traffic**

As demonstrated above, cars and trucks have a significant impact on the air quality of Dane County. However, the numbers of vehicles on state highways continue to increase while the number on arterial roadways remains steady.



Data provided by Madison Traffic Engineering

Overall (highway and arterial), the average weekday traffic volume has increased approximately 10% since 2000. The amount of increase is consistent with the rate of population growth in Dane County; an estimated 11%. However, since 2004 traffic volume has declined slightly. This decrease also affected the average daily vehicle miles traveled (VMT) resulting in the relative consistency since 2004 after annual increases from 2000 (shown below). Both trends are likely a result of increasing fuel prices during these time periods and the economic decline noted during recent years.

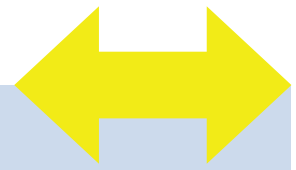


Data provided by WI Dept of Transportation

As shown in the figure above, the average daily vehicle miles traveled in Dane County has risen slightly during the current decade; approximately 4% since 2000. In addition, similar to previous years the average daily vehicle miles traveled for Dane County were considerably lower than Milwaukee County. However, this difference is related with the larger population of Milwaukee County and not the average driving habits of the cities' respective populations. This is demonstrated by the average VMT per person. In 2007, Dane County had more average vehicle miles traveled per person (28.44) compared to that of Milwaukee County (21.25). A similar pattern was observed in 2008; in Dane County had an average 26.92 average vehicle miles traveled compared to 19.98 VMT in Milwaukee County. Both counties did show decreases in VMT in 2008, but despite the larger population of Milwaukee County the residents of Dane County drove more miles per person on average.

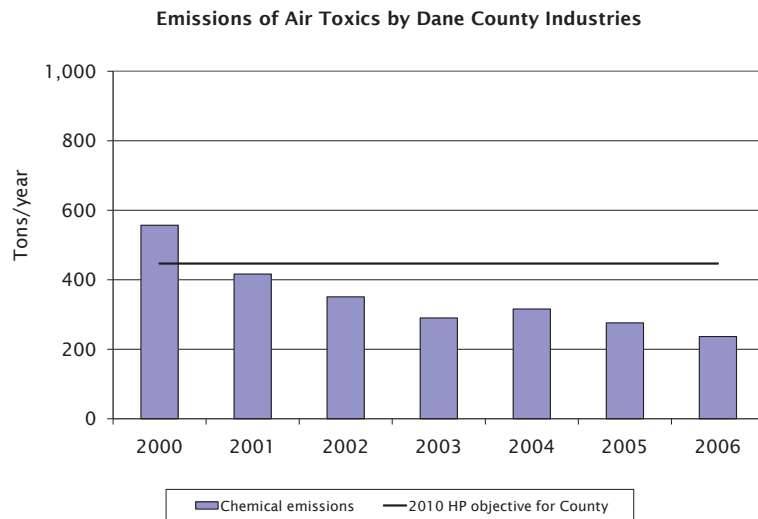
**GRADE: NO SIGNIFICANT CHANGE**

Although a notable decrease in VMT was reported in 2008 there has been little change in the last decade.



**Industry**

Industry is another significant contributor of air pollutants. However, in the last decade the amount of industrial toxic air pollutant emissions (HAPs) has decreased dramatically and has allowed Dane County to achieve the Healthy People 2010 objective to decrease emissions to 25% of 1993 levels (447 tons annually).



Data provided by US Environmental Protection Agency

The figure presents data from the years 2000 to 2006 (most recent data available). This time frame was chosen due to the changes made by the US EPA to the list of chemicals and acceptable chemical thresholds required for reporting purposes.<sup>12</sup> During this time frame, emission levels have steadily decreased; the only exception was 2004 which reported 9% increase from the previous year. Despite this increase, the emissions reported in 2006 compared to those of 2000 demonstrated an approximate 57.4% decrease in air toxics emissions.

- A total of 36 facilities report emissions in Dane County from 2000 through 2006. Of these facilities, only 29 reported emissions in 2006. A facility will stop reporting if it ceases to operate or release emissions totaling less than the US EPA reporting limits for a given year. During this time frame 13 facilities stopped reporting emissions for at least one year.

In Dane County and other communities across the country, industrial release of mercury emissions is a public health challenge due to its adverse effect on the environment and the potential impact to human health via biomagnification in the food chain. According to the US EPA, coal-fired power plants are the largest source of mercury air emissions from human activity in the United States (approximately 40%). An estimated one-quarter of these emissions from coal-burning power plants are deposited in the United States and the remainder is deposited across the globe.<sup>13</sup> Other large sources include industrial boilers, burning hazardous waste, and chlorine production. However, due to federal and state regulatory efforts, mercury emissions from these sources have declined approximately 85 to 90%.<sup>14</sup>

**GRADE: IMPROVED**

**Consistent decreases in industrial emissions during the reporting period.**

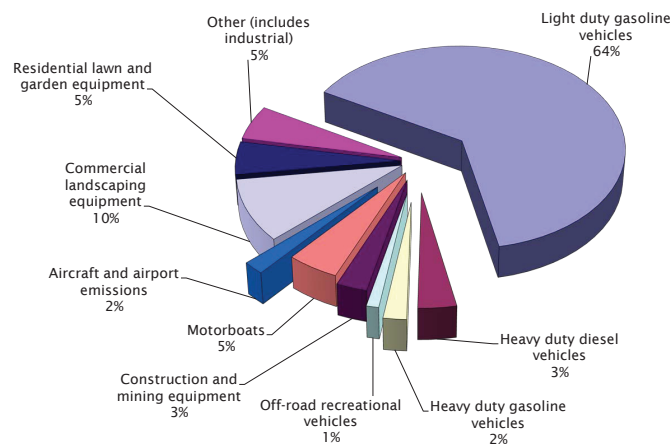


### Other Sources

In addition to gasoline and diesel vehicles and industrial contributions to air pollution in Dane County other significant sources of air toxics include construction and mining equipment, commercial landscaping equipment, residential lawn and garden equipment and motorboats. However, light duty gasoline vehicles continue to be the largest source.

Benzene, formaldehyde, acetaldehyde, and 1, 3-butadiene are compounds also listed by the US EPA as presenting potential high risks to public health and welfare.<sup>9</sup> The source distribution reported for benzene (most recent data available) is shown below to serve as an example of the role many of the sources listed above play in the release of this compound and other air toxics present in Dane County ambient air.

**Largest Sources of 1,3-Butadiene in Dane County, 2005**



Data provided by WI Department of Natural Resources

In addition to the sources outlined above, air pollutants emitted from outside Dane County 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.

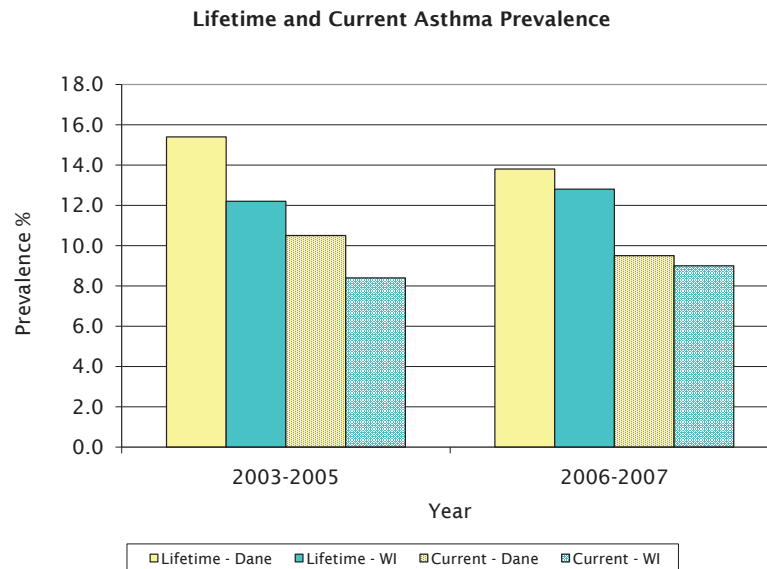
## Human Health Impacts

### Asthma

Asthma continues to be a problem for Dane County residents.

- School districts in Dane County have reported that during the 2006-2007 school year an estimated 7 to 15% of enrolled students had asthma.<sup>11</sup>
- Approximately 15% of Dane County adults were reported in 2003 to 2005 to have “ever been diagnosed” with asthma (lifetime prevalence).

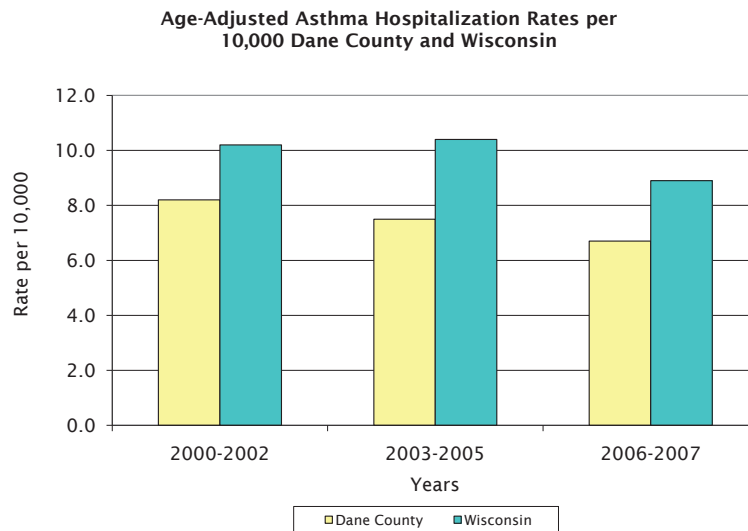
If fact, both the lifetime prevalence (ever diagnosed with asthma) and current prevalence (currently diagnosed) of asthma is consistently higher in Dane County compared to average rates for the state of Wisconsin as shown in the figures below.



Data provided by WI Department of Health and Family Services

Although Dane County has shown a slight decrease in both lifetime and current asthma prevalence while the state has witnessed a slight increase, the county is still consistently higher in both categories.

Despite the higher rates of prevalence, Dane County consistently reports a lower rate of asthma hospitalizations than the state average and achieves the Healthiest Wisconsin 2010 objective of 8.5 hospitalizations per 10,000 population during each of the displayed reporting periods.



**GRADE: IMPROVED**

**Dane County has consistent decreasing rates of asthma prevalence and hospitalizations during observed reporting periods.**

**Heart Disease, Stroke, and Lung Cancer Risk**

Research on potential impacts on human health posed by prolonged exposure to poor air quality, chiefly the result of incomplete combustion of fossil fuels producing constituents that include sulfur dioxide and particulate matter, has also demonstrated an association with increased risk of heart disease, stroke and lung cancer.<sup>15,16</sup> Elderly patients, individuals with underlying heart or lung disease, patients with lower socioeconomic status, and patients suffering from diabetes are particularly at risk.<sup>16</sup>

Exposure to particulate matter has been repeatedly cited as a significant contributing factor to the development of these health conditions. For example, the short-term exposure to elevated levels of particulate matter is associated with higher risk of death due to a cardiovascular event. In addition, hospital admissions for cardiovascular disease increase with increasing levels of particulate pollution.<sup>16</sup> Particulate matter has also been implicated as a contributing factor in lung cancer risk; however other pollutants found in ambient outdoor air including benzo[a] pyrene, benzene, chromium, and radionuclides also contribute to an increased risk. The US EPA has estimated that 0.2% of all cancers and approximately 1% of lung cancer diagnoses can be attributed to air pollution.<sup>15</sup> At the state level, this would translate to an estimated annual contribution of 53.4 additional cancer diagnoses (all sites) and 36.6 lung cancer diagnoses. In Dane County, poor air quality would contribute to an additional 17.1 (all sites) and 10.2 (lung) cancer diagnoses each year.

In addition to poor outdoor air quality, other factors make a larger contribution to the rates of heart disease, stroke, and lung cancer including obesity, poor diet, and cigarette smoking. Cigarette smoking is the main cause of lung cancer incidence in the United States; however the contribution of poor air quality to the development of these diseases is significant and worthy of discussion.



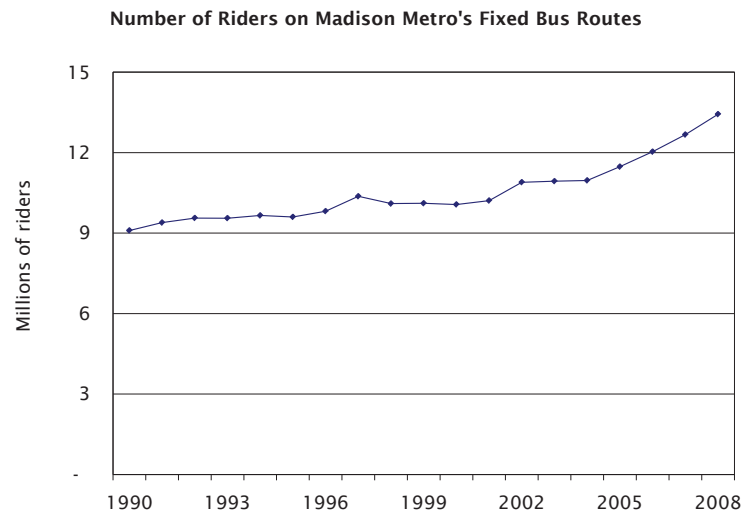
## Local Response

### Individual Actions

- Whenever possible walk, bike, carpool, or use available mass transit systems instead of driving your personal vehicle. Fewer vehicles on Dane County roads and highways translate into a reduction of air toxics, fine particulate matter, ozone, and CO<sub>2</sub> in the ambient air. Additional information about the City of Madison rideshare program is available at: [www.cityofmadison.com/rideshare](http://www.cityofmadison.com/rideshare).
- Volunteer for and/or initiate a neighborhood EnAct team ([www.enactwi.org](http://www.enactwi.org)) in your community. EnAct is an organization that strives to reduce the environmental impact of households, neighborhoods, and communities by reducing waste, improving energy conservation, and expanding awareness of environmental issues and community resources.<sup>17</sup> For example, Dane County communities were able to reduce the number of single occupancy vehicle miles driven by 1,194 miles per household; amounting to a total of 352,312 fewer vehicle miles.<sup>18</sup>
- Consider a more fuel-efficient and/or hybrid vehicle during the next purchase of a new or used vehicle.
- Practice energy conservation at your home and work and shop at businesses that promote and utilize green power. A partial list is available from Madison Gas and Electric (MGE) at: [www.mge.com/environment/green/bizprofiles](http://www.mge.com/environment/green/bizprofiles).
- Purchase renewable energy from your utility and use other cleaner and/or more efficient energy alternatives when available.
- Use Green Building techniques when building or remodeling your home or business in order to reduce air toxics emissions, conserve energy, and improve individual indoor air quality.<sup>19</sup>
- Stay informed concerning the air quality in your community. Changes in air quality can be viewed from the Wisconsin Partners for Clean Air ([www.healthyardane.org](http://www.healthyardane.org)) and the US EPA air quality forecast ([www.airnow.gov](http://www.airnow.gov)).

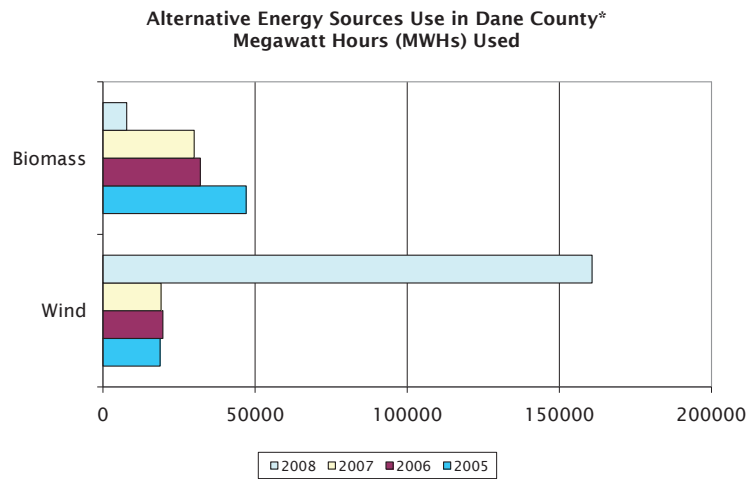
### Community Actions

- Dane County Clean Air Action Days are used to warn the public of the immediate need to reduce VOCs, nitrogen-oxide, and other polluted emissions to decrease ozone and fine particulate matter pollution. When ground-level air pollution is forecast to reach an unhealthy level for sensitive groups this program alerts area residents, employers, and the media and urges everyone to drive less, conserve energy, and alter use of solvent-based products or refueling of gasoline powered equipment and vehicles on these days in order to reduce emissions.<sup>20</sup>
- The support, promotion, and improvement of mass transit and other alternative modes of transportation is also an effective method to reduce potentially harmful emissions. For example, Madison Metro is continuing to improve its services to residents in order to increase ridership and reduce the number of vehicles on Dane County roads and highways. As a result, the number of users increased by 5.3% in 2007 and increased another 6.0% in 2008. This trend is demonstrated in the figure below.



Data provided by City of Madison Metro Transit

- Increase the availability of energy from renewable sources
  - » The use of manure digester in Dane County improve air quality by reducing methane emissions from manure and providing an opportunity for energy production.
  - » Reducing the reliance on coal and developing these alternative energy sources will help reduce emissions of CO<sub>2</sub>, SO<sub>2</sub>, and mercury into our ambient air.
  - » The two main power companies in Dane County, Madison Gas and Electric (MGE) ([www.mge.com](http://www.mge.com)) and Alliant Energy ([www.alliantenergy.com](http://www.alliantenergy.com)) continue to develop, expand, and promote the use of cleaner sources of energy including wind, hydro, solar, landfill gases, switchgrass, and anaerobic digesters. In fact, Alliant Energy is one of only two utility companies in the United States utilizing switchgrass as an energy source.<sup>21</sup> The use of alternative fuels over the last four years has demonstrated efforts to curb harmful emissions with notable increases in wind and solar coupled with decreases in burning of biomass-derived fuel sources. As shown in the figure below, the use of wind to generate energy, measured as megawatt hours (MWHs), was improved substantially while modest increases occurred in solar sources (data not shown). The use of solar increased over 200% from 49 MWHs in 2007 to approximately 156 MWHs in 2008.
  - » Biomass is composed of landfill gases and preconsumer waste including paper and plastic wrap materials. Burning this fuel instead of coal reduces the emissions of CO<sub>2</sub> and SO<sub>2</sub>.



\*Includes only Madison Gas and Electric installed sources, the amount of energy produced by privately installed systems are not measured.

Data provided by Madison Gas and Electric

- » Despite the significant increases in the use of wind power alternative fuels these fuels only compose a small fraction of the total energy supplied to Dane County residents. For example, the large increase of wind power in 2008 by MGE in 2008 only represented 4.8% of the total energy purchased by consumers. However, even this small amount is a significant positive change considering that wind power only represented 0.6% of the total energy purchased in 2007.

# WATER QUALITY

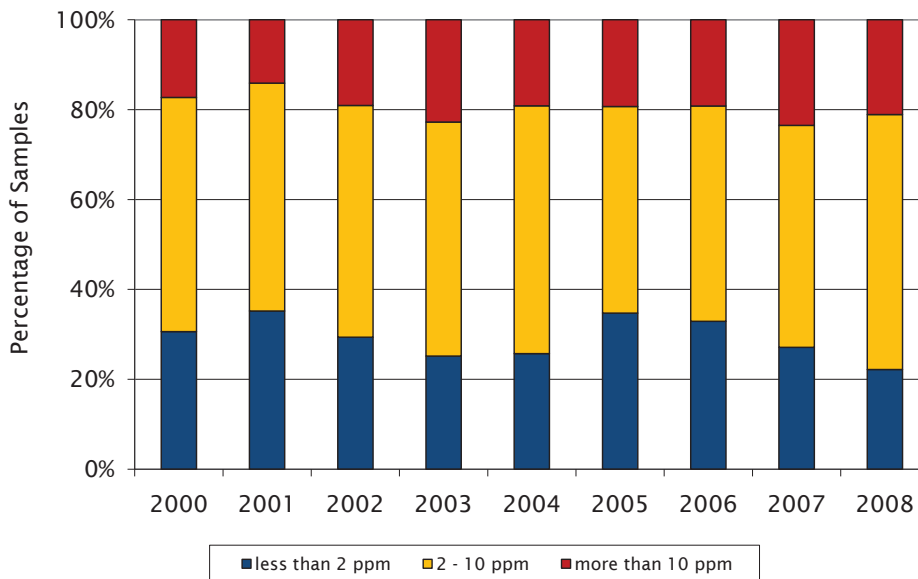
## Environmental Measures

### Nitrate Levels

Nitrate contamination is a significant problem in private wells in Dane County. An estimated 100,000 of the county's residents are served by approximately 22,000 private drinking water wells. Over the last decade over 3,000 private well samples have been tested for nitrate levels to ensure water quality and safety; however, the number of wells that are tested varies from year to year. In addition, testing conducted via private laboratories is not available for surveillance purposes.

The results reported from available data show that approximately 19% of the samples exceeded the water quality standards for nitrate; an estimated 53% had nitrate levels between 2 and 10 ppm. All other samples were below 2 ppm.

Results of Nitrate Testing in Private Wells, Dane County



Data provided by WI Department of Natural Resources

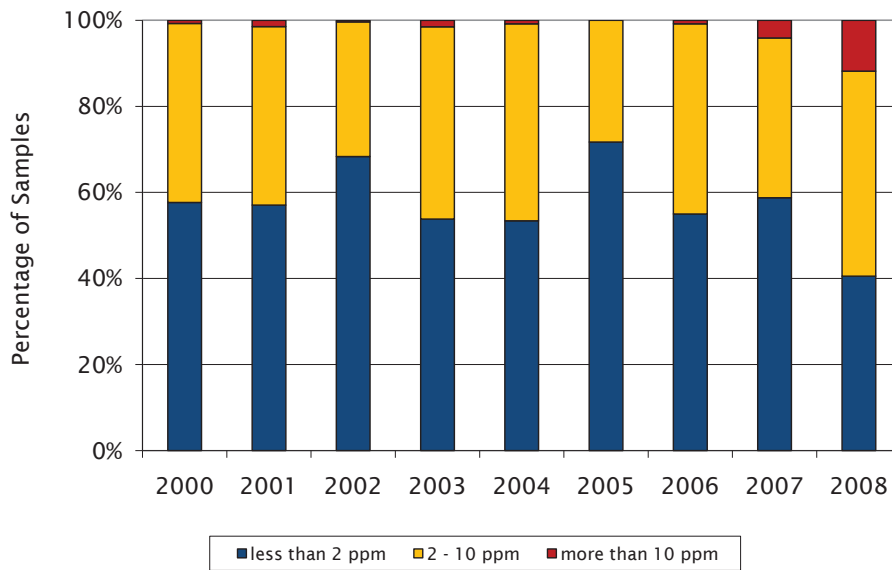
**GRADE: NO SIGNIFICANT CHANGE**

The percentage of private wells with high nitrate has remained relatively consistent during the reported time period.



High nitrate concentrations are less prevalent in municipal well tests. During the last decade over 2000 samples have been tested for nitrate; approximately 4% of these samples were found to exceed the nitrate standard of 10 ppm. The remaining samples were within acceptable levels; approximately 38% had concentrations between 2 and 10 ppm while all others were below 2 ppm.

**Results of Nitrate Testing in Municipal Wells, Dane County**



Data provided by WI Department of Natural Resources

As demonstrated in the figure above, nitrate levels were higher in 2008 than previous years; approximately 11% of wells tested had rates higher than 10 ppm.

**GRADE: NEEDS IMPROVEMENT**

**Increased number of nitrate samples in municipal well water that exceeds 10 ppm.**

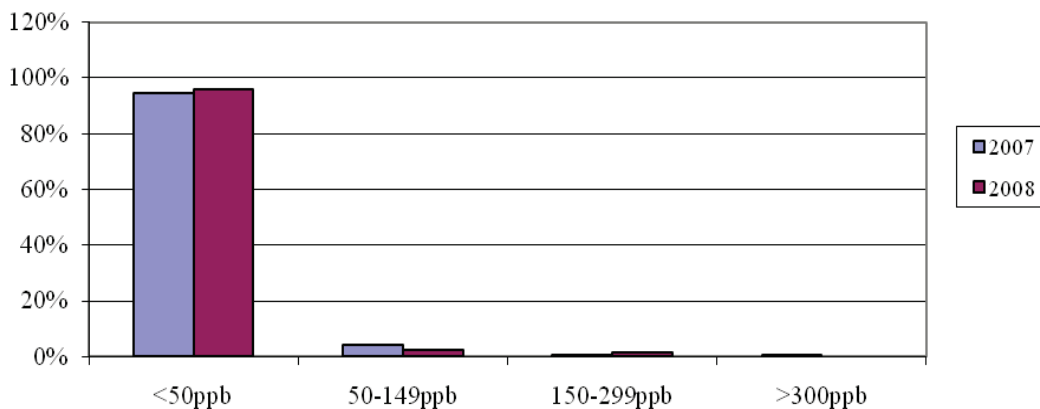


## Manganese

Manganese became a significant concern among City of Madison residents in 2005 and 2006 after several homes reported black-colored water that contained high levels of the element.<sup>1,2</sup> A collaborative effort between Public Health – Madison and Dane County (PHMDC) and Madison Water Utility (MWU) identified the impacted geographical areas. Successful remedial efforts included water main flushing, replacement of water mains with high level of sediment, and expanded manganese monitoring and sampling.<sup>2,3</sup>

Mandatory water quality standards at the state or federal level have not been established for manganese. However, non-enforceable secondary maximum contaminant levels (SMCLs) have been developed by the US EPA guidelines to assist public water systems manage drinking water quality.<sup>4</sup> The SMCL for manganese is 50 ppb to protect against discolored water and the health advisory guideline is 300 ppb.<sup>1,3</sup>

Frequency of Mn Concentration in Municipal Drinking Water



Data provided by Public Health Madison and Dane County

The preventative strategy employed following the high manganese findings in 2005 and 2006 has resulted in significant improvements. These improvements are demonstrated in recorded water quality samples in Dane County municipal wells.

- In 2006, approximately 92% of samples were within the SMCL standard of 50 ppb.
- In 2007, approximately 94.5% of samples met this standard. In addition, only 2 samples were found to exceed 50 ppb. Of these drinking water samples, only 1 exceeded the health advisory level of 300 ppb.
- In 2008, approximately 96.2% met the SMCL; only two samples exceeded this standard with none greater than 300 ppb.

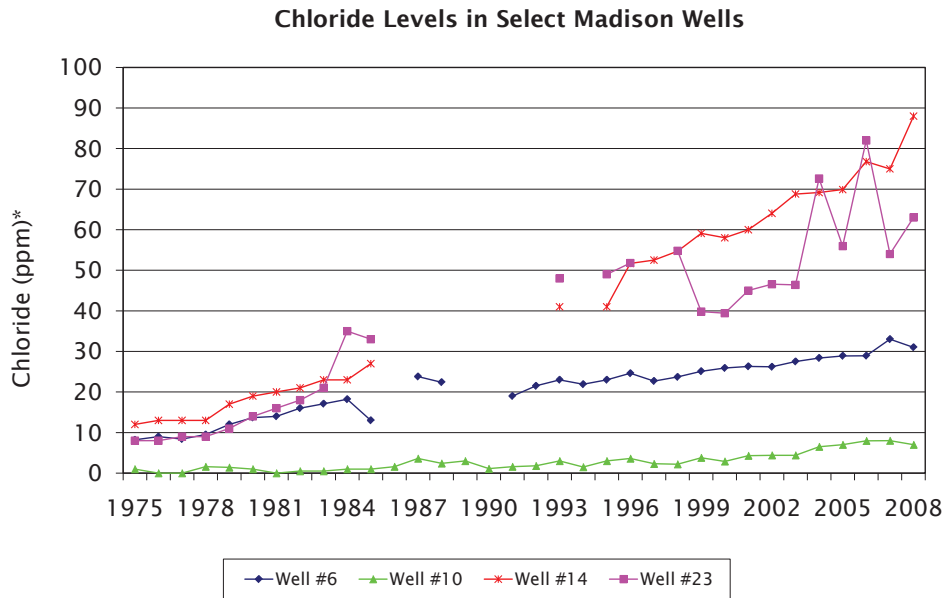
### GRADE: IMPROVED

Continued increase in the percentage of homes with water below 50 ppb and no homes found with water Mn concentrations above 300 ppb since 2008.



### Chloride: Drinking Water

Similar to manganese, chloride does not have enforceable federal or state drinking water quality standards. However, a secondary standard of 250 ppm and has been established by the US EPA for chloride and the state of Wisconsin has established a Preventative Action Limit (PAL) of 125 ppm.



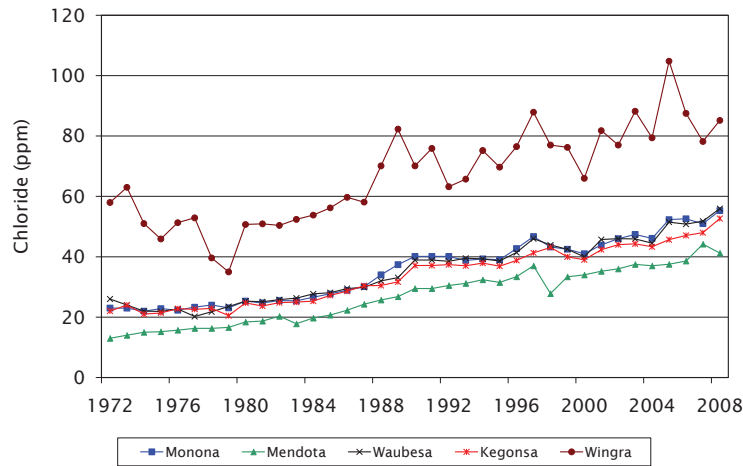
Data provided by Public Health – Madison and Dane County  
 \*Breaks in the trend lines indicate missing data

As shown in the figure above, chloride levels in Dane County have been increasing in some wells over the past 30 years. Well no. 14, has demonstrated the largest increases among wells that are routinely monitored. In fact, in 2008 this well had a recorded chloride level of 88 mg/L (88 ppm); an estimated 633% increase compared to levels recorded in 1975.

### Chloride: Surface Waters

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

Dane County Lake Chloride Levels



Data provided by Public Health - Madison and Dane County

**GRADE: NEEDS IMPROVEMENT**

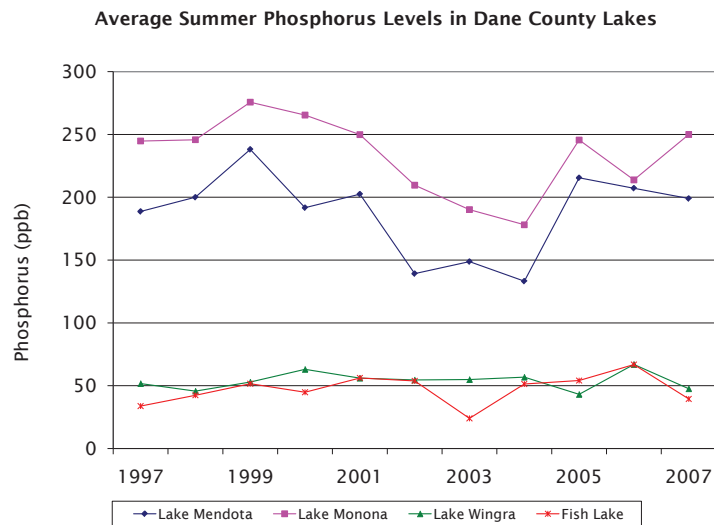
Consistent increases in chloride levels in Dane County surface and ground waters during reporting period.



**Phosphorus: Surface Waters**

High levels of phosphorus in surface water leads to increased harmful algal blooms and excessive plant growth. These blue-green algae (cyanobacteria) blooms continue to be a nuisance in Dane County that result in beach closures, decreased water quality, and illness in animals and humans following exposure.<sup>1,5-6</sup> These blooms may occur at phosphorus levels above 30 ppb and are common at levels higher than 50 ppb; levels that are typical in Dane County lakes.<sup>1</sup>





As shown in the figure above, phosphorus levels in the larger lakes forming the isthmus, Lakes Mendota and Monona, have increased since 2004 while the smaller lakes have remained relatively consistent during the reporting period. Phosphorus levels displayed in the figure above were sampled from the center of the lake. Conditions near the lake shoreline, where the majority of exposure to algae blooms would tend to occur, might be very different and may vary widely from day to day.

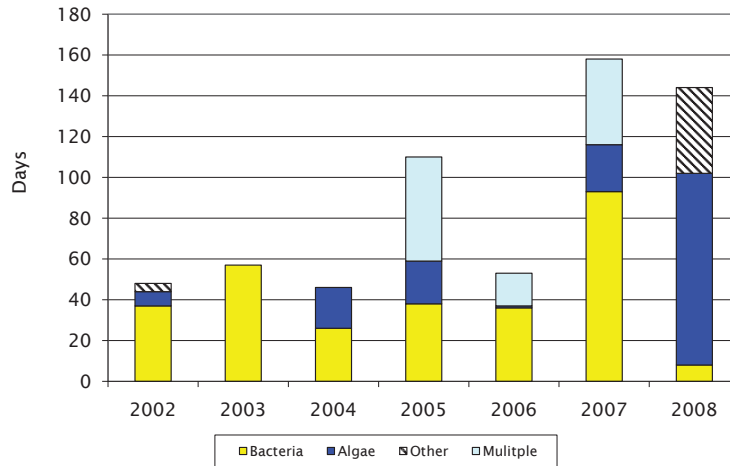
**GRADE: NEEDS IMPROVEMENT**

**Consistent increases in phosphorus levels in Lakes Monona and Mendota while smaller lakes remain consistent.**



As a precaution Dane County beaches are closed to the public when elevated levels of algae and/or bacteria are detected to protect the health of beach users. There are approximately 1,500 beach days in Dane County annually (15 beaches x 100 days between Memorial Day and Labor Day).

Dane County Beach Closures for Water Quality Problems



Data provided by Public Health - Madison and Dane County

As shown in the figure above, there were similar numbers of beach closures in 2007 and 2008; the majority of the lost days are primarily due to incidents of heavy rains and flooding that occurred in Southern Wisconsin during the reporting period. However, in 2008 over 29% of the beach closures were due to either precautionary closures caused by sewer pumping station repairs or accidental release of raw sewage into Dane County surface waters due to flooding; releases in 2007 contributed to the reported high levels of bacteria. In addition, beach closures due to high algae concentrations also increased in 2008 compared to reported closures in 2007 (34.8% versus 14.6%, respectively). This sharp increase was due to the flooding experienced by Dane County in 2008. Storm water run-off from heavy rains is normally contaminated with bacteria and excess nutrients such as phosphorus and nitrogen that may lead to beach closures due to high *E. coli* concentrations and/or harmful algal blooms.

**GRADE: NEEDS IMPROVEMENT**

**Increased numbers of beach closures due flooding and sewage releases.**



### Heavy Metals

In addition to nutrients, storm waters also wash other pollutants, such as heavy metals, into Dane County lakes, rivers, and streams. Several of these metals are public health concern if they reach high levels. High levels of these metals in surface waters may cause human health problems such as neurological, gastrointestinal, and cardiovascular effects; long term high level exposures may also include heart disease, kidney disease, and cancer.<sup>7-11</sup>

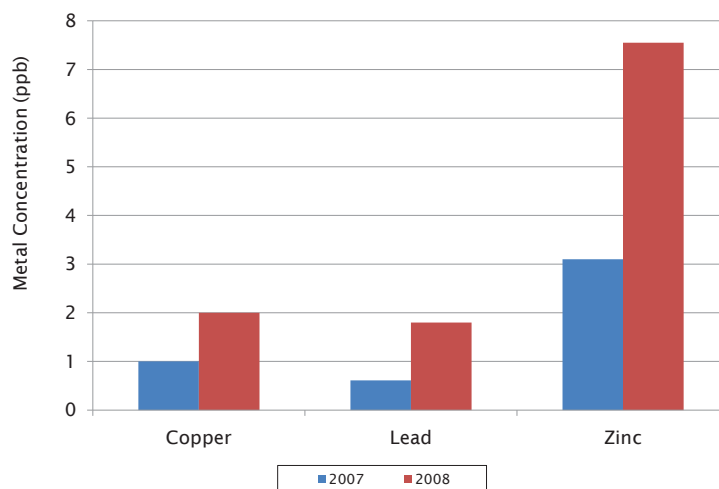
Median Pollutant Levels in Selected Dane County Surface Waters, 2008 (ppb)						
Site	Arsenic	Cadmium	Chromium	Copper	Lead	Zinc
Dunn's Marsh	1.43	<0.20	0.78	2.00	1.80	7.55
Lake Kegonsa	1.30	<0.20	<0.20	0.74	<0.20	1.10
Lake Mendota	1.10	<0.20	<0.20	0.51	<0.20	1.01
Lake Monona	1.30	<0.20	0.25	1.80	0.29	2.70
Lake Waubesa	1.20	<0.20	<0.22	0.90	<0.20	1.30
Lake Wingra	0.93	<0.20	<0.21	0.72	0.10	1.20
Yahara River	0.80	<0.20	0.78	1.40	0.43	3.05
Surface Water Quality Standard	148	1.97*	48.86	5.72	14.33	65.66

Data provided by the Public Health - Madison and Dane County

\*Surface water quality standard was derived from acute toxicity criteria, all other water quality standards listed in the table are derived from chronic toxicity criteria.

Dane County surface water continues to demonstrate levels of heavy metal that are significantly lower than surface water quality standards. Negligible changes in concentrations from 2007 (data not shown) to 2008 with the exception of Dunn's Marsh which showed notable increases copper, lead, and zinc. The most significant increase was reported for zinc; however the highest levels reported for this metal and the other heavy metals are well below water quality standards.

Median Metal Levels Reported in Dunn's Marsh, 2007 - 2008





**GRADE: NO SIGNIFICANT CHANGE**

**Heavy metal levels continue to be reported well below water quality standards.**

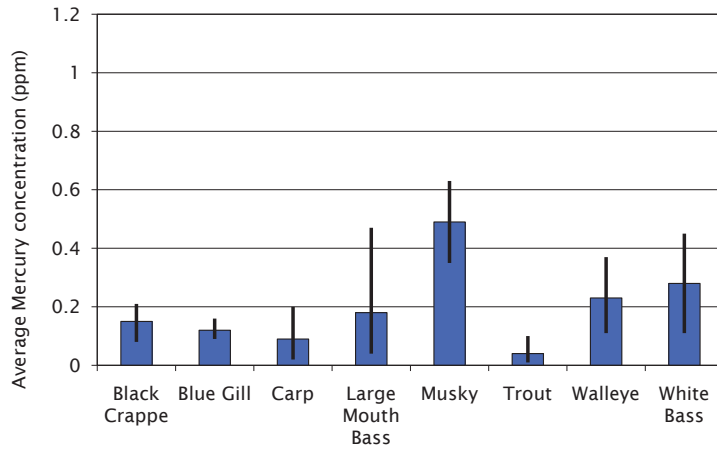
**Contaminants in Fish**

The levels of mercury and polychlorinated biphenyls (PCBs) in Dane County surface waters are a growing public health concern due to the potential contamination of fish living in these waters. This, in turn, impacts the individuals that consume the fish caught in these waters; this is especially true for subsistence fishing. Subsistence fishing is the use of local fish caught in Dane County surface waters as an extensive part of the diet. This practice may lead to increased exposure to mercury and PCBs if the fish are consumed above the recommended standards.<sup>12</sup> The recommendations from the Wisconsin Department of Natural Resources (WI DNR) are provided below. Public Health – Madison Dane County (PHMDC) has posted similar signs in multiple languages (English, Spanish, and Hmong) as part of a pilot project in the summer of 2009. The evaluation into the effectiveness of these signs to convey fish advisory information is ongoing.

 <b>Safe-eating guidelines – for most of Wisconsin’s inland (non-great lakes) waters</b>	
<p><b>Women of childbearing years, nursing mothers and all children under 15 may eat:</b></p> <p><b>1 meal per week</b> - Bluegill, crappies, yellow perch, sunfish, bullheads and inland trout;</p> <p><b>and</b></p> <p><b>1 meal per month</b> - Walleye, pike, bass, catfish and all other species.</p> <p><b>Do not eat</b> - Muskies.</p>	<p><b>Women beyond their childbearing years and men may eat:</b></p> <p><b>Unrestricted*</b> - Bluegill, crappies, yellow perch, sunfish, bullheads and inland trout;</p> <p><b>1 meal per week</b>- Walleye, pike, bass, catfish and all other species;</p> <p><b>and</b></p> <p><b>1 meal per month</b> - Muskies.</p>
 <p>Black Crappie</p>	 <p>Bluegill</p>
 <p>Muskellunge</p>	 <p>Channel Catfish</p>

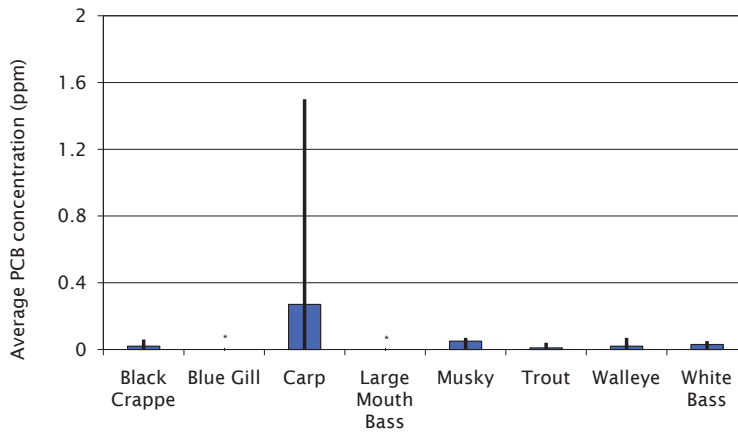
The WI DNR has routinely tested fish caught from various water bodies across the state of Wisconsin for mercury and PCB contamination.<sup>12</sup> The levels of reported contaminants in common fish from various Dane County surface waters are shown below.

**Mercury Levels in Fish from Dane County Surface Waters, 2001 - 2007**



Data provided by WI Department of Natural Resources

**PCB Levels in Fish from Dane County Surface Waters, 2001 - 2007**



Data provided by WI Department of Natural Resources  
 \*No PCB was detected in samples

## Viruses

The presence of enteric viruses is another emerging concern for the quality of Dane County ground and surface waters. Enteric viruses are spread by the fecal-oral route and are most commonly associated with gastrointestinal symptoms in humans such as diarrhea and vomiting; common enteric viruses include *Adenoviridae* (adenoviruses) and *Caliciviridae* (caliciviruses, including noroviruses).<sup>13,14</sup>

In Dane County, neither surface water nor ground water is routinely tested for contamination by viruses. In 2007 and 2008, the Wisconsin Geological and Natural History Survey in collaboration with the Marsfield Clinic collected and tested samples for viruses from Dane County lakes (Mendota, Monona, and Wingra), 11 municipal wells, and sewage influent from the municipal sewer system. Of the initial 11 wells tested in 2007, six were tested monthly in 2008.<sup>14</sup> The results are shown below; please note that total well samples from both sampling years are combined.

Water Source	Percent Positive	Average (gc/L)*
Wells#	43.4 %	0.47
Lakes	77.8 %	5.80
Sewage	100 %	581,000

\*Averages are expressed in genomic copies per liter (gc/L).

#All samples were collected prior to disinfection

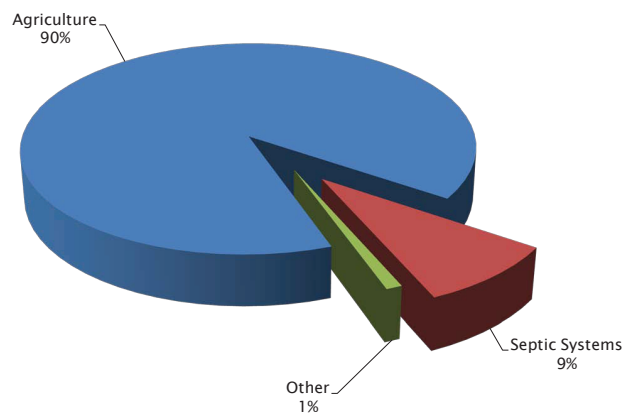
The sampling results demonstrated a correlation between the levels of virus occurrence in sewage and the levels reported in lakes and groundwater. Higher levels were also detected in lake waters during the periods of heavy rains and flooding in both 2007 and 2008; resulting in the contamination of surface waters by run-off. However, as noted in the table, the municipal well samples were collected prior to treatment with chlorine, a disinfectant utilized to kill viruses.<sup>14,15</sup> The findings for the municipal well water are not indicative of drinking water quality and safety due to lack samples evaluated post-disinfection; however the results do demonstrate the susceptibility of Dane County aquifers to viral contamination.

## Sources

### Nitrate

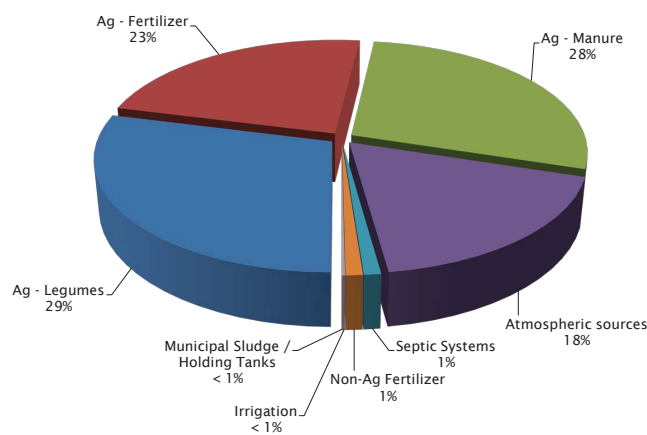
An estimated 2040 million pounds of nitrogen is deposited on the lawns and fields of Wisconsin annually from agriculture, atmosphere, septic systems, and other sources. An estimated 10% of the total nitrogen added to the soil annually leaches into the groundwater as nitrate. As shown in the figures below, the most significant source of nitrate in groundwater is derived from agricultural sources; composing an estimated 90% of reported nitrate in groundwater.<sup>16</sup> This is due to the availability of nitrogen to be carried by water sources infiltrating groundwater sources from the surface. A portion of the nitrate from the soil surface is absorbed by plant roots; however once nitrogen passes the root zone the soil does not bind a significant portion of the compound.

Sources of Nitrogen in Groundwater



Data provided by the report "Nitrate in Groundwater," 1999

Sources of Nitrogen to Soil



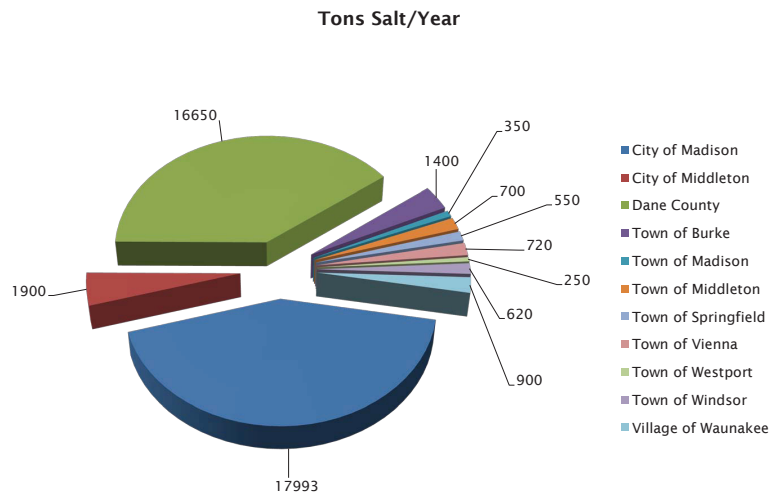
Data provided by the report "Nitrate in Groundwater," 1999

## Manganese

Manganese is a naturally occurring component of the deep-aquifer beneath Dane County and has previously been identified as a water quality problem. Manganese can unevenly accumulate as sediment in water distribution pipes and fixtures, especially in large municipal systems. In municipal distribution systems, this sediment may be resuspended with changes in hydrostatic pressure, and ultimately arrive in households at high concentrations.<sup>2</sup> Additional sources of manganese include foods such as grains, beans, nuts, and tea and occupational exposures such as welding and steel manufacturing.<sup>17</sup>

## Chloride

In the winter of 2007-2008, Wisconsin faced record snowfalls totaling over 100 inches; a total that is nearly 50 inches above average reported snowfalls. The result was the increased application of salt to Dane County roads to maintain safe driving conditions. The application of road salt is the primary cause of increased chloride concentrations in surface and ground water supplies via runoff from snow melt.

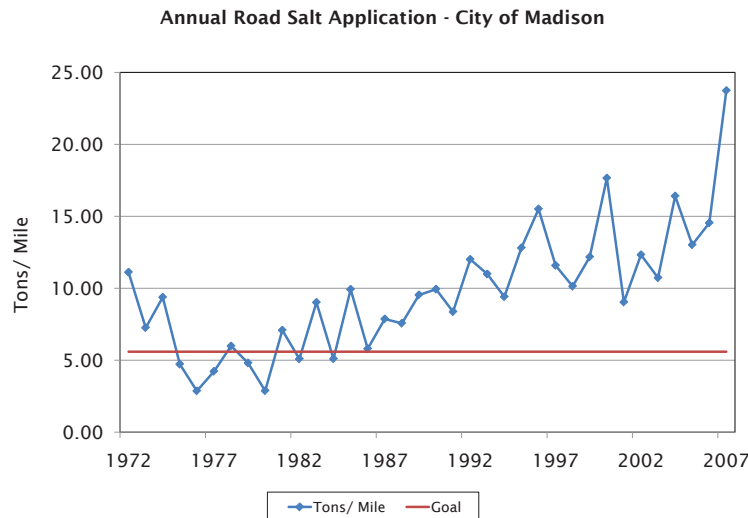


Data provided by Public Health - Madison and Dane County

In total these handful of communities utilized approximately 42,000 tons of salt on roads, highways, and interstates; an estimated 63% increase from the previous winter. The City of Madison was the largest consumer with nearly 18,000 tons of salt; however Dane County purchased approximately 16,650 tons for use on interstates.



Despite efforts to reduce road salt application, the use of salt by the City of Madison has steadily grown as shown below.



Data provided by Public Health – Madison and Dane County

Additional salt is applied to parking lots, sidewalks, and private property. This can also be a significant source of chloride to our surface and ground water but currently no data is available quantifying the amount of salt used in these situations.

**GRADE: NEEDS IMPROVEMENT**

**Consistent increases in levels of salt application leading to increases in surface and ground waters chloride levels.**

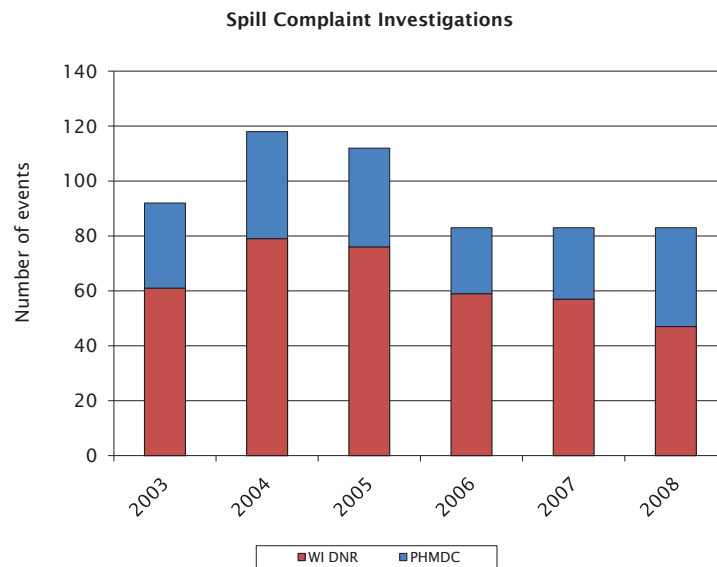


**Phosphorus**

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

### Heavy Metals and PCBs

The presence of heavy metal in surface and ground waters is derived from a variety of potential sources. The most common is their release in emissions from industrial sites that utilize materials containing metals; either intentional or unintentional release into air, soil, and/or water. Additional sources include household waste, landfills, chemical and material spills, and illegal and/or inappropriate dumping of materials containing these metals.<sup>7-11</sup> Material releases into the air may deposit over time into surface waters and soils; deposits into the soil will enter surface waters via erosion and storm water run-off. Many chemicals, including PCBs and mercury, may be present as a contaminant long after their release due to the persistence of the compound. Spill complaint data for Dane County is shown in the figure below. Although a notable spike in reported spill complaints to the WI DNR was recorded in 2004 and 2005 the numbers of investigations have been relatively stable during the reported timeframe; reported complaints to PHMDC have also remained consistent during this period.



**GRADE: NO SIGNIFICANT CHANGE**

**With the exception of 2004 and 2005, the number of spill complaints have remained relatively consistent.**



### Viruses

Although the evaluation of viral contamination of Dane County ground and surface water is in its preliminary stages, early evidence suggests untreated sewage as the key source. Given the high concentration of viruses in sewage it would take only minor leakage to produce the virus concentration reported in municipal wells and the Yahara lakes in 2007 and 2008.<sup>14</sup> However, the heavy rains, flooding, and record snow fall and subsequent snowmelt lead to increased risk of contamination due to floodwaters and storm and snow melt run-off.

## Human Health Impacts

Dane County has not had a significant disease outbreak from drinking or recreation water in recent history; however individual reports have occurred.

### Surface and Recreational Waters

- Illness outbreaks from recreational water use happen occasionally; no cases were reported in 2007 but seven individual cases were reported in 2008. Since 1989, only thirteen potential waterborne illness events have been reported to PHMDC; nine of these cases occurred at Madison area beaches and four additional cases occurred in swimming pools or whirlpools.
- Six of the seven individual cases of illness in humans reported in 2008 were related to swimming during an algae bloom; no cases associated with algae blooms were reported in 2007.

### Drinking Water

- The high levels of manganese observed in Madison-area drinking water in 2005 and 2006 raised a considerable amount of concern about the potential risk to human health posed by the contaminant.
  - » Precautionary health advisories were issued during the flushing of municipal water pipes to reduce the manganese containing sediment. During this process elevated levels of manganese were expected to be at their highest reported levels due to the dislodging of the materials into the water flow.<sup>1</sup>
  - » These water main flushing procedures coupled with repair efforts and expanded monitoring of manganese concentrations has improved Dane County drinking water supplies. In 2007, only 3 samples exceeded SMCL standards; 2 samples exceeded standards in 2008.
- 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 Wisconsin's Preventative Action Limit and suggest that action is needed to prevent continued exposure to high levels of the water contaminant.

### Contaminants in Fish

- The persistence and potential biomagnification of mercury and PCBs in fish has resulted in human exposure to high levels of these contaminants. The consumption of methylmercury-contaminated food may result in multiple reported symptoms including impairment of vision, motor in-coordination, and loss of feeling; at very high doses seizures, severe neurological impairment, and deaths have been reported. Methylmercury may also cause birth defects that range from mild to severe neurological effects if consumed in significant portions during pregnancy.<sup>18</sup>
- Research on the potential health impacts of the persistence and consumption of PCB-contaminated foods to include 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.<sup>19</sup>

## Local Response

### Individual Actions

- Individuals and households that receive water from a public water system should receive and review an annual Consumer Confidence Report that describes the results of local water quality monitoring. The most recent report is available from their local water utility or the WI DNR ([www.dnr.state.wi.us/org/water/dwg/ccr/ccr\\_instructions.htm](http://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) by diverting storm water into rain gardens, installing rain barrels, and/or infiltration devices.
  - » The storm water that runs off your property to ditches, streams, and lakes carry nutrients and other pollutants into surface and ground waters.
  - » Participate in community organizations dedicated to resource conservation and pollution prevention. For example, Sustain Dane ([www.sustaindane.org](http://www.sustaindane.org)) has provided over 3000 rain barrels since 2006 to catch rainwater and utilize this resource for other purposes. Additional recommendations may be found at [www.myfairlakes.com](http://www.myfairlakes.com).
  - » However, conservation efforts must not create additional problems. Therefore, ensure that rain barrels are closed and rain gardens are 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 and in moderation.
  - » As per the City of Madison and Dane County ordinances, do not use phosphorus fertilizers on your lawn unless you are establishing a new lawn or a soil tests show that your lawn needs phosphorus.
  - » Oils, fuels, solvents, and cleaning chemicals should be disposed of properly at Madison/ Dane County Clean Sweep locations. More information is available at the following website: [www.danecountycleansweep.com](http://www.danecountycleansweep.com).
- If your residence has a septic system make sure the system is operating properly.
- Keep yard waste and leaves out of the street gutters.
- Review and follow the guidance for fish consumption to reduce individual exposure to potentially harmful contaminants. This guidance is presented in an earlier section and on the WI DNR website (<http://dnr.wi.gov/fish/consumption>). In addition, these guidelines will also be posted on multilingual signs around Dane County lakes and rivers in the summer of 2009.

## Community Actions

- Monitor public water supplies to ensure the continued availability of safe drinking water.
  - » Drinking water chemistry from public drinking water systems is tested at least annually and bacterial testing done frequently to assure safety.
  - » Public health and landfill staff monitor groundwater near closed landfills to evaluate the movement and leaching of contaminants in groundwater.
- Take action to address water quality problems that are identified.
  - » Madison water utility remains on track to achieving its goal to remove all lead service pipes by the end of 2010. At the end of 2008, the Utility had replaced and/or eliminated a total of 5,681 (92%) city-owned and 4,410 (84%) privately owned lead water service lines. An additional 67 city-owned and 290 privately owned service lines are projected for remediation in 2009 and the remaining lines the following year.<sup>20</sup>
  - » Lead water pipes exist in water service systems throughout Dane County. The local utilities that manage these systems should take actions to ensure that water pipes are not releasing lead into the drinking water.
  - » Public water utilities that consistently find nitrate levels above 2 ppm should identify the potential sources and look for ways to maintain or reduce nitrate levels.
- Prevent pollution in our lakes, rivers, and streams implementing comprehensive watershed management plans.
  - » The Dane County Lakes and Watershed Commission ([www.danewaters.com](http://www.danewaters.com)) and the Dane County Land and Water Resources Department have worked for many years on developing and implementing watershed management plans throughout Dane County. Utilizing a variety of county, state, and federal programs these organizations continue to pursue nutrient management plans with farmers, monitor water quality, and permit manure storage facilities to prevent the pollution of ground and surface waters. Important accomplishments of these efforts include the countywide ordinance banning unnecessary phosphate in lawn fertilizers and coal tar sealants, strengthening storm water infiltration requirements, and controlling the application of liquid manure.
  - » Local establishment of regular leaf and yard debris pickup if currently not available.
- Monitor surface water to provide safe recreational water.
  - » Chemical and bacteriological tests on water from lakes, beaches, and storm sewers continue to be a priority for local and state Public Health Departments.
  - » Madison-area swimming areas are also sampled frequently during the 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.
  - » PHMDC, Dane County UW Extension, UW Madison, Edgewood College, US Geological Survey, WI DNR, and volunteer citizen monitoring efforts perform water testing in Dane County.
- Update fish consumption advisory 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.

# FOOD PROTECTION

## 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.<sup>1</sup>

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 and 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.<sup>2</sup> The following table lists the CDC risk factor violations by category and the number of violations observed Dane County food establishments.

CDC Risk Factor Violations Recorded During Inspections of Dane County Restaurants, 2008*									
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	0	2	66	45	84	106	303	370	0.8
Moderate	19	11	625	500	630	505	2290	827	2.8
Complex	3	1	218	162	173	110	667	408	1.6
Total	22	14	909	707	887	721	3260	1605	

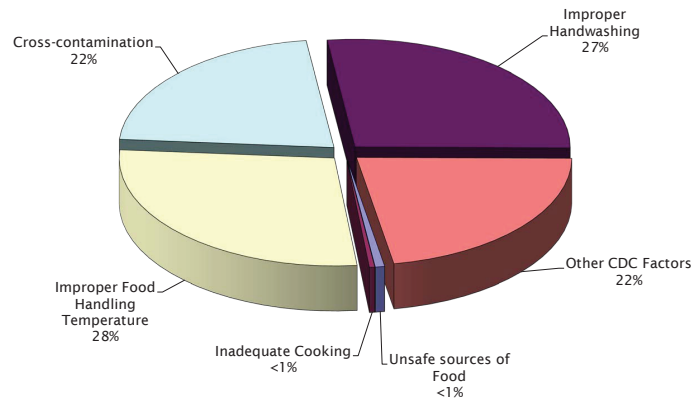
\*This table does not include retail food establishments

In the above table, restaurants are grouped into categories representing the complexity of food handling activity reported by the 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 prepare foods in one location then transport to another to sale and/or distribution. An example of a complex establishment is a large hotel kitchen.

As indicated in the table and subsequent pie chart, improper food holding temperature and handwashing are the most frequent violations reported.

Percent of CDC Risk Factor Violations in Dane County Restaurants, 2008



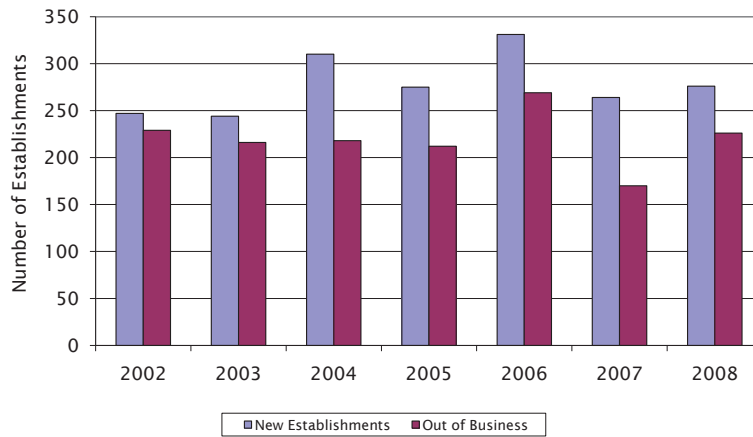
## Sources

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 *Campylobacter*, *Salmonella*, and *E. coli* O157:H7 bacteria and a group of viruses called caliciviruses (Noroviruses).<sup>1</sup>

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.

- 2114 permanent restaurants and retail food establishments were licensed in Dane County in 2008.
- 1765 temporary food vendors were licensed in Dane County in 2008.

Changes in Restaurants and Retail Food Establishments in Dane County

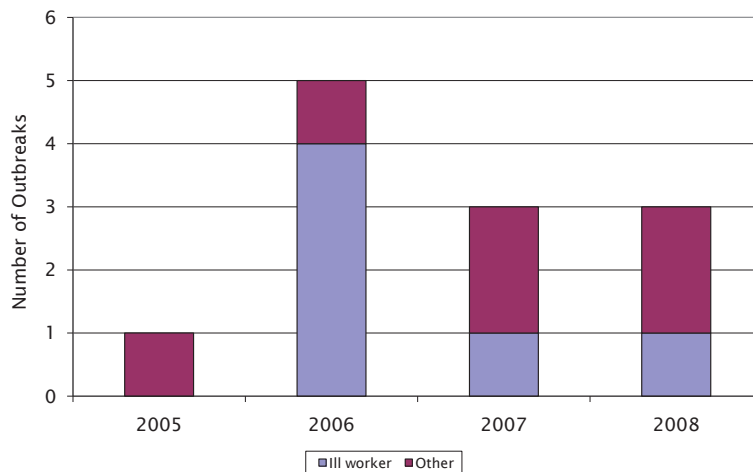


Data provided by Public Health – Madison and Dane County

As stated in the previous section, unsafe food handling practices such as lack of handwashing 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 contamination are 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 is shown below. An outbreak is defined as the report of two or more individuals that have consumed the same contaminated food and develop the same illness. At least 2 of the 6 reported outbreaks in 2007 and 2008 involved ill food workers.

Number of Foodborne Outbreaks in Dane County Establishments



Data provided by Public Health – Madison and Dane County



These relatively small number of outbreaks resulted in multiples cases of reported illness. Two notable examples are shown below that underscore the need for safe handling practices:

- 255 cases of norovirus were linked to the five outbreaks that occurred in the county during 2007 – 2008.
- 10 people were ill from a *Clostridium perfringens* outbreak in 2007.

### **Poor Handwashing + Sick Employees = Disease Outbreaks!**

#### **GRADE: IMPROVED**

**Reduction in foodborne illness reported in Dane County since 2006; specifically diseases resulting from ill workers.**



### **Human Health Impacts**

Foodborne illness can have a dramatic impact upon individual and community health. The CDC estimates that foodborne illness results in approximately 76 million illnesses, over 300,000 hospitalizations, and 5,000 deaths annually from contaminated foods and beverages.<sup>3,4</sup> The vast majority of these illnesses are caused by a variety of bacteria, viruses, and parasites that may be present in contaminated food products resulting in symptoms of illness that include nausea, fever, vomiting, abdominal cramps, and diarrhea. However, other food product contamination such as poisonous chemicals and harmful toxins may result in a variety of symptoms to exposed persons.<sup>4</sup>

In Dane County there also were several individual reported cases of illnesses that may have been associated with food. For example, in 2007, over 15 cases of *Campylobacter* infection and 11 cases of *Salmonella* infection per 10,000 people were reported. In 2008, a minor increase in each of these infections was reported; over 24 cases of *Campylobacter* and 13 cases of *Salmonella* infections per 10,000 people.

## 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 handwashing when preparing food.<sup>5</sup>
- 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 to Public Health. (608) 266-4821

### Community Actions

- Ensure safe handling and proper storage of food by conducting inspections on food establishments.
  - » In 2008, 4,181 regular and follow-up inspections were performed in Dane County restaurants, retail food stores, and temporary events.
- 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 2007 and 2008.
- Educate food service operators.
  - » Staff educated 720 food service operators and workers about safe food handling in 2007 and 2008.
- Correct repeated food safety problems through the use of referrals for legal action, temporary license suspensions, and permanent license revocations.
  - » In 2007, 79 enforcement actions were taken against problem food establishments; in 2008 an additional 96 enforcement actions were taken.
- Test soft-serve and ready-to-eat foods to identify problems that may lead to human illnesses.
  - » In 2007 and 2008, Public Health staff tested over 1000 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 2007 and 2008, Dane County			
Sample	Total Samples	Unsatisfactory Samples	% Unsatisfactory Samples
Deli Foods	280	28	10.0%
Soft-Serve Ice Cream	775	134	17.3%
Frozen Yogurt	14	1	7.1%

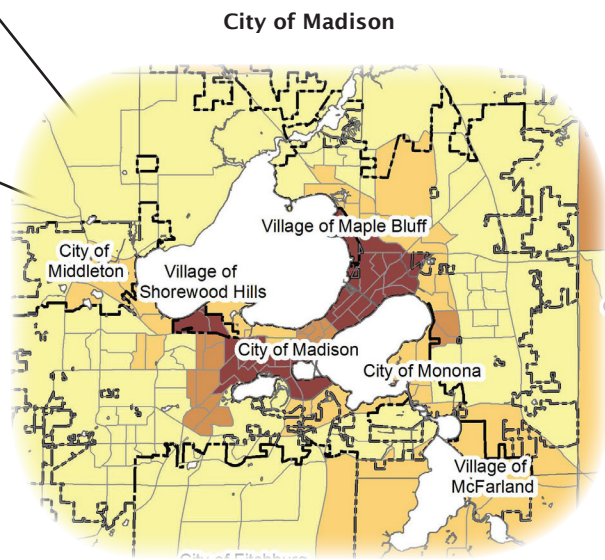
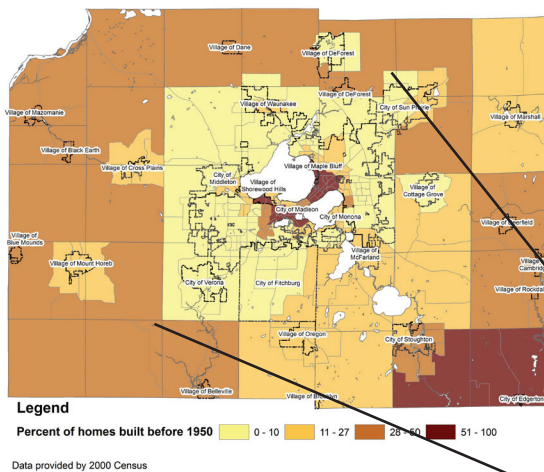
# HEALTHY HOMES AND COMMUNITIES

## Childhood Lead Poisoning

### ENVIRONMENTAL MEASURES

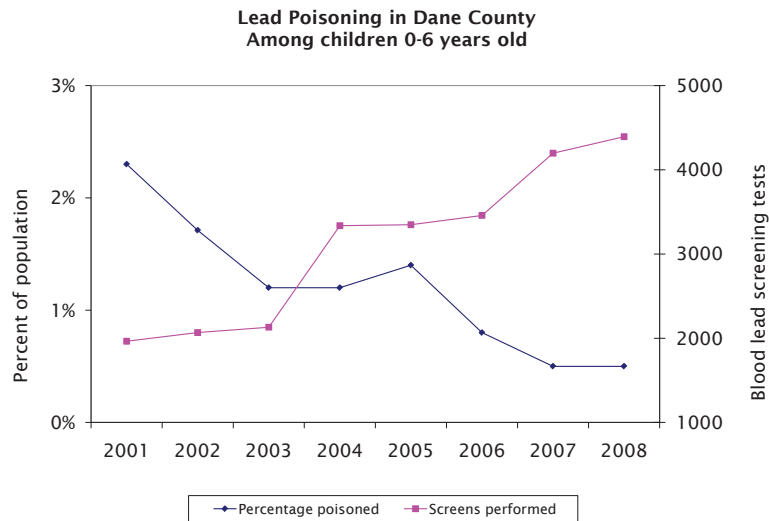
In the City of Madison and Dane County the number of reported cases of childhood lead poisoning has been steadily decreasing for several years; however efforts to reduce childhood exposure to lead remains a persistent and preventable public health challenge. The risk of lead poisoning is primarily due to the presence of lead-based paints in Dane County homes built before 1950. The highest concentrations of these homes are located in the central parts of the City of Madison; however, many old homes also persist in rural areas of the county and other cities and villages. In fact, the estimated 37,000 pre-1950 homes compose approximately 21% of the total housing stock in Dane County. An estimated 90% of all children first identified with lead poisoning live in pre-1950 homes.<sup>1,2</sup>

Percent of Dane Co. Homes Built Before 1950



The performance of blood lead level (BLL) screening tests is an 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 and 72 months of age.<sup>3,4</sup> In both 2007 and 2008, lead poisoning in Dane County children was reported as 0.5% of all children tested. This is a modest reduction from 0.8% reported in 2006. These rates are significantly lower than rates of lead poisoning reported in Milwaukee County and the State of Wisconsin. In 2007, Milwaukee County reported 4.4% while the state reported 2.2%; in 2008 these rates were 3.4% and 1.7%, respectively.

In addition, over the last decade the number of children screened in Dane County has increased from 1964 blood lead screening tests performed in 2001 to over 4300 in 2008. Despite this progress, the number of children tested continues to be far less than the number of children at risk. Approximately 22% of Dane County children less than 3 years of age were tested for lead poisoning in 2008; nearly half of the estimated 35 to 50% of Dane County children are considered at-risk for lead poisoning.



Data provided by Public Health - Madison and Dane County

**GRADE: NO SIGNIFICANT CHANGE**

**Increased number of screenings and decreased levels of blood poisoning noted but little progress reaching all Dane County children at risk.**



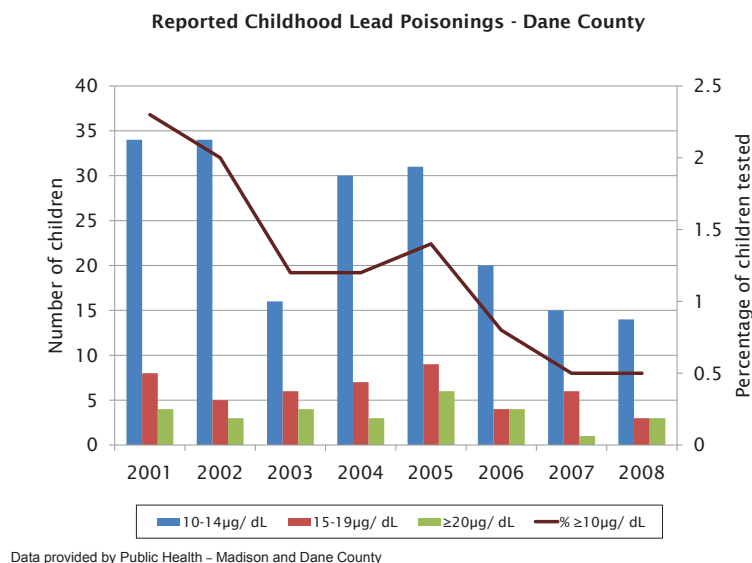
## SOURCES

Lead-based paint has been identified as the primary source of modern lead poisoning in Dane County children. Although lead-based paints were banned for use on residential property in 1978, homes built before this legislation may contain lead hazards.<sup>1</sup> Lead poisoning resulting from lead paints often occurs when painting and remodeling older homes creates lead containing dusts during the sanding of older paint and varnished surfaces. However, lead from toys and furniture with lead-based paints is another leading source of lead poisonings.<sup>1,5</sup> Additional sources of lead exposure include drinking water from older lead pipes or pipes containing lead solder found in older homes. 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 that contains lead) have also been recognized as a potential source of lead exposure.<sup>1,5,6</sup>

## HUMAN HEALTH IMPACTS

Long-term 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.<sup>1,3</sup> Extremely high levels of exposure may lead to anemia, kidney damage, seizure, coma, and death.<sup>1,6-8</sup>

In Dane County, a reported BLL of  $\geq 10$  microgram of lead per deciliter of blood ( $\mu\text{g}/\text{dL}$ ) in children screened for lead are considered lead poisoned. During the last decade, only minor fluctuations have been reported in reported levels 15  $\mu\text{g}/\text{dL}$  and above; however a notable reduction in the children BLLs of 10-14  $\mu\text{g}/\text{dL}$  has occurred since 2005. In addition, the percentage of children tested with reportable BLL levels has consistently declined since 2001.



## LOCAL RESPONSE

### Individual Actions

- Test your home for lead if it was built before 1978.
- Drinking water should also be tested for lead in homes built before 1930.
- More information on home and water testing for lead is available at:  
[www.publichealthmdc.com/environmental/healthyHomes/lead/index.cfm](http://www.publichealthmdc.com/environmental/healthyHomes/lead/index.cfm)  
[www.publichealthmdc.com/environmental/laboratory/water.cfm](http://www.publichealthmdc.com/environmental/laboratory/water.cfm)

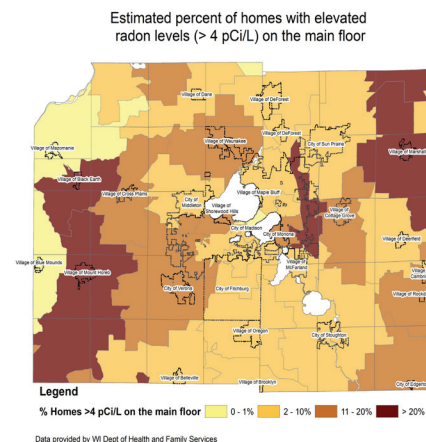
### Community Actions

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

## Radon

### ENVIRONMENTAL MEASURES

Radon has been found at elevated levels in over 2,000 homes and businesses throughout Dane County.<sup>2</sup> Radon is an odorless radioactive gas derived from the natural breakdown of uranium in soil, rock, and water that enters the ambient air.<sup>2,9</sup> 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.<sup>10</sup> People living in homes with 4 picocuries of radon per liter of radon per liter of air (pCi/L) or more have a greater risk of developing lung cancer.<sup>9,10</sup> However, despite these risks less than 25% of Dane County homes have been tested for radon.<sup>2</sup>



### GRADE: NEEDS IMPROVEMENT

Lung cancer risks are associated with high radon levels in homes but fewer than 25% of Dane County homes have been tested for radon.

## SOURCES

Radon gas results from the radioactive decay of naturally occurring uranium in the soil, rock, and water.<sup>9</sup> This gas can enter households and other buildings from cracks, construction joints, and gaps in the building structure.<sup>10</sup> Exposure to the gas is preventable but requires accurate testing of the levels in the building and the identification of potential sources of entry in the structure that need repair, modification, and/or replacement.<sup>2,9,10</sup>

## HUMAN HEALTH IMPACTS

The United States Surgeon General and the US EPA consider indoor radon one of the leading causes of lung cancer in this country; second only to cigarette smoking.<sup>2,10</sup> In fact, the US EPA estimates that radon leads to approximately 21,000 lung cancer deaths every year in the United States.<sup>11</sup>

## LOCAL RESPONSE

### Individual Actions

- Test your home for radon. The lack of action may expose your family members to radon levels that increase the risk of lung cancers.
- More information on home radon testing is available at:  
<http://dhs.wisconsin.gov/News/PressReleases/2009/010509Radon.htm>  
[http://dhs.wisconsin.gov/dph\\_beh/RadiatioP/index.htm](http://dhs.wisconsin.gov/dph_beh/RadiatioP/index.htm)

### 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

The vast majority of ETS exposures occur in the home and the workplace.<sup>12-14</sup> In fact, most individuals spend an estimated 90% of their time between these environments leading to an increased likelihood of exposure.<sup>14</sup> 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.<sup>12,14-15</sup> Non-smoking adults and childhood exposures are primarily due to actively smoking family members and/or exposures to ETS in public establishments.<sup>16</sup>

ETS, also referred to as “second-hand smoke,” is complex mixture containing over 4,000 chemicals in both vapor and particulate form that include known toxicants, heavy metals, irritants, and carcinogens.<sup>17-18</sup> The pollutant is released into the ambient air from both the burning of tobacco products and the exhalation from the active smoker. Exposure to ETS typically occurs in the home and/or workplace in which an active smoker or smokers either reside or are employed, respectively.<sup>12-14,18</sup>

## HUMAN HEALTH IMPACTS

Exposure to ETS has been associated with an increased risk of tobacco-related diseases to include respiratory disease, cardiovascular disease, and cancer among non-smoking adults.<sup>16</sup> The deaths of an estimated 53,000 non-smokers annually have been associated with ETS exposure nationwide; approximately 3000 of these deaths are attributed to lung cancer.<sup>16,19</sup> Among young children and adolescents, ETS has been associated with increased respiratory infections, asthma induction and exacerbation, low birth weight, and sudden infant death syndrome (SIDS).<sup>16,17</sup>

## LOCAL RESPONSE

### Individual Actions

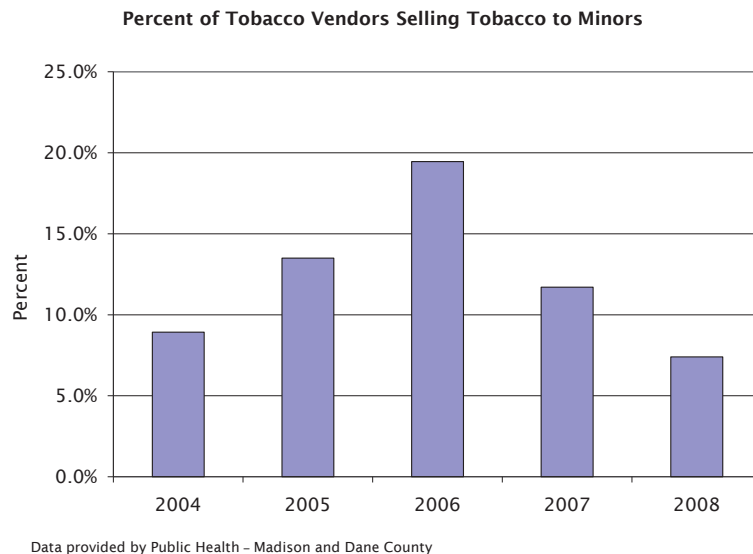
- Quit smoking or establish restrictive smoking policies in your home and automobile to decrease ETS exposure to children and non-smoking adults in your family. These self-imposed household restrictive policies will decrease ETS exposure to non-smoking family members and may reduce future tobacco use by children and adolescents.<sup>20</sup>

### Community Actions

Community actions to reduce ETS exposure are centered on but not limited to legislative policy and enforcement. For example, the establishment of smoking bans in workplaces and public areas such as restaurants and bars/taverns has resulted in increased rates of smoking cessation, decreased smoking prevalence, reduced ETS exposure, and lower rates of tobacco-related disease.<sup>21-23</sup>

- In 2004, the City of Madison passed an ordinance prohibiting smoking in all workplaces, including restaurants and bars/taverns. The ordinance went into effect in July 2005.<sup>24</sup>
- In Dane County a similar smoking ordinance took effect in August of 2009; the recently passed statewide smoking ban will take effect in 2010.<sup>25,26</sup>
- Prevent tobacco sales to minors. By decreasing the number of vendors that sell tobacco products to minors, we restrict an important source of tobacco products for Dane County youth. As shown in the figure below, the percentage of vendors selling to minors has continued to decrease since the sharp increase reported in 2006 of 19.5% to 11.7% in 2007 and 7.4% in 2008.



**GRADE: IMPROVED**

**The successful passage of smoking bans at the county and state levels and the reduction of tobacco sales to minors in Dane County.**

**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.<sup>27-28</sup> Flooding experienced in Dane County during 2007 and 2008 has increased the risk of likelihood of mold growth in homes and businesses throughout the impacted areas.

**SOURCES**

Sources of moisture leading to mold growth include roof leaks, flooding due to plumbing failure and/or heavy rains, uncontrolled humidity, and areas of high condensation.<sup>4,24,25</sup> Common sites of growth include bathroom tiles, basement walls, and areas in close proximity to windows and leaky plumbing.<sup>27,28</sup>

## HUMAN HEALTH IMPACTS

Mold problems in homes, offices, and other building can result in allergic and/or asthmatic reactions in sensitive individuals.<sup>2,28</sup> Additional human health impacts from mold exposure include irritation of the eyes, skin, nose, throat, and lungs.<sup>27,28</sup> 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 stains of molds such as Aflatoxin and Aspergillus.<sup>28</sup>

## LOCAL RESPONSE

### Individual Actions

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

- Remove or replace carpets and upholstery previously soaked with water.
- Do not carpet bathrooms and basements since moisture and persistent damp conditions in these areas may lead to mold growth.
- Keep the humidity level in the home, office, or other building structure between 40 – 60%.
- Use an air conditioner or a dehumidifier 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.<sup>28</sup>

### Community Actions

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

# SUSTAINABILITY

Sustainability is commonly defined as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>1</sup> However, to meet this challenge and sustain its achievement, appropriate changes must occur at the community and individual levels to counter the impact of human activity on the global environment. Industrialization, population expansion, deforestation, and modernization are only a handful of issues associated with human activity that have led to degraded water and air quality, climate and atmospheric changes, damaged food quality, and modification of natural ecosystems.<sup>2-4</sup> The preceding sections discussed several of these issues individually. In this section, information is presented that outlines the impact of non-sustainable activities on individual and community health. However, this section also highlights efforts that are currently taking place in the City of Madison and Dane County that are designed to move towards environmental sustainability.

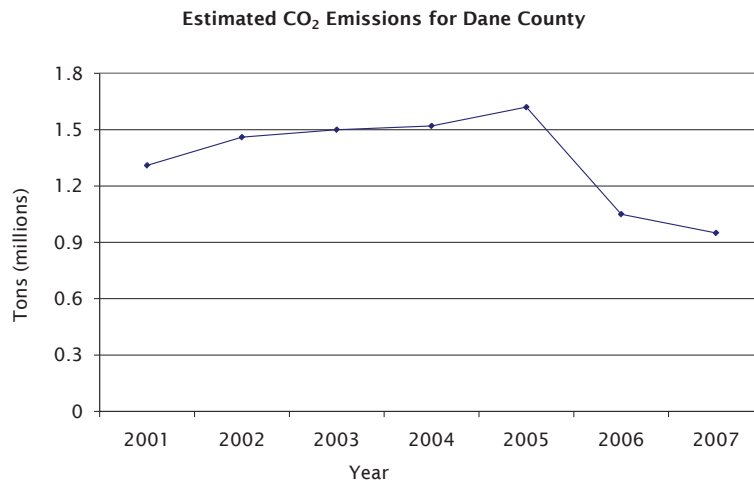
## Greenhouse Gases

### ENVIRONMENTAL MEASURES

Beginning with the Industrial Revolution in the late eighteenth century, human activities have led to increased green house gas concentrations in the atmosphere due to industrial activities and the burning of fossil fuels to power transportation and energy production.<sup>2,5</sup> These activities coupled with deforestation have led to increased levels of greenhouse gas pollutants including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) in the atmosphere; ultimately resulting in less heat escaping into space, degradation of the stratospheric ozone layer, and the gradual warming of the Earth’s surface temperature.<sup>2,5</sup> These impacts ultimately affect other aspects of the climate including rainfall patterns, snow and ice cover, and sea level.<sup>2</sup>

CO<sub>2</sub> is one of the most common greenhouse gases released into the atmosphere by human activity. In fact, atmospheric levels of CO<sub>2</sub> have reportedly increased an estimated 35% since pre-Industrial Revolution levels.<sup>6</sup> Therefore, efforts to reduce the emission of CO<sub>2</sub> have been one of the cornerstones in movements to decrease greenhouse gas production and move toward sustainability.

The reduction of greenhouse gas production is also an essential component of sustainability efforts in Dane County. As shown in the following figure, the estimated levels of CO<sub>2</sub> from point source emissions for Dane County have decreased an estimated 41% since 2005; however data for mobile and area source emissions were not available.

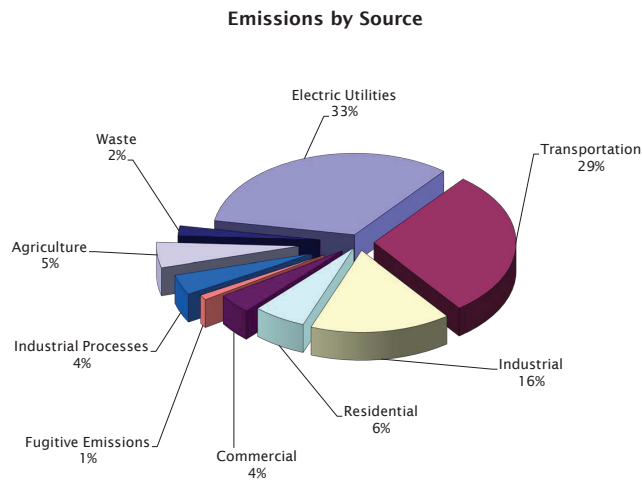


\* Emissions were calculated using emission factors from the Intergovernmental Panel on Climate Change (IPCC).  
 \*\*Only point source data is available. No data from mobile or area sources was available for inclusion.  
 Data provided by WI Department of Natural Resources

Despite this progress in the reduction of point source emissions the current amount of emissions remains substantial. In addition, without accurate measurements of mobile and area source emissions the full extent of the problem is unknown and an appropriate evaluation of interventions designed to reduce total CO<sub>2</sub> emissions is not possible. 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 early infancy.

## SOURCES

In 2003, the State of Wisconsin produced an estimated 123.1 million metric tons of CO<sub>2</sub> equivalents (Mt CO<sub>2</sub>e) of greenhouse gases; approximately 1.8% of the total estimated amount produced in the entire United States.<sup>7</sup> No accurate estimate of cumulative greenhouse gas emission was available for Dane County. The majority of these emissions including CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O are produced from both natural and human activities. Other examples of greenhouse gases such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>) are produced solely from industrial processes.<sup>4,6</sup> Over 90% of the man-made greenhouse gas emissions in the United States are a result of electricity production, transportation, manufacturing and industrial processes, agricultural practices, and heating of residential and commercial buildings.<sup>7</sup>



Data provided by WI Department of Natural Resources

## HUMAN HEALTH IMPACTS

The release of greenhouse gases into the atmosphere may have direct and indirect adverse impacts to both individual and community health. Greenhouse gases directly impact air quality by increasing the frequency of high levels of ozone events resulting from warming temperatures; increases in particulate matter may be impacted by increases in dust from drier soils. Both of these air quality events result in an increased risk of asthma development and exacerbation and other chronic lung disease among exposed populations.<sup>3,8</sup> Significant risk to human and community health is derived from greenhouse gas emissions related to climate change. Changes in the climate may lead to loss of human life by direct temperature effects and an increase in the frequency of extreme weather events. In addition, increased rates and expansion of climate sensitive disease such as malaria, encephalitis, and Lyme disease is expected to occur 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 result in the displacement of human populations and increases in the number of undernourished people in specific regions across the planet.<sup>8,9</sup>

## 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. Energy Star qualified products are available in over 50 product categories; more information is available at [www.energystar.gov](http://www.energystar.gov).
  - » Change at least five conventional light bulbs with energy star light bulbs in your home. The US EPA has estimated that if every household in the United States changed the light bulbs in the five most frequently used light fixtures it would prevent the greenhouse gas equivalent to the emission from approximately ten million automobiles.
  - » Seal and insulate your home.
  - » Regularly clean air filters and have heating and cooling equipment serviced annually to improve efficiency.
  - » Purchase electricity that is generated from renewable sources such as wind and solar at home and use renewable fuels in your vehicle; more information is available at [www.epa.gov/climatechange/wycd/home.html](http://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 the US EPA website ([www.epa.gov/climatechange/wycd/road.html](http://www.epa.gov/climatechange/wycd/road.html)).
  - » Purchase homes that have been built with green-building techniques certified by the US Green Building Council (USGBC) LEED ratings system ([www.greenhomeguide.org](http://www.greenhomeguide.org)).
  - » 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/index.htm](https://www.co2gether.org/my_co2/index.htm).

### Community Actions

- Municipal and County governments should increase energy efficiency and use of renewable fuels/energy in vehicles and building 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 shown 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 may be found at: [www.cityofmadison.com/mayor/tns/index.cfm](http://www.cityofmadison.com/mayor/tns/index.cfm).
  - » The Mpower campaign was launched in 2007 by the City of Madison as a cooperative initiative between local government, public organizations, and industries. The current program is designed to provide guidance to reduce CO<sub>2</sub> by 100,000 tons by 2011.<sup>10</sup>
  - » The installation of generators at the Dane County landfill to capture CH<sub>4</sub> and convert the gas to electricity. These generators are projected to produce enough electricity to power an estimated 4,000 homes and bring the county over \$3 million annually.<sup>11</sup>
  - » In 2000, Dane County became the first county in Wisconsin to adopt a Green Building Policy that required that all new and renovated buildings must incorporate green technology. Examples include the Dane County Airport, Alliant Energy Center, and the new Dane County Court House.

## Waste Production and Recycling

### ENVIRONMENTAL MEASURES

#### Solid Waste

The production of solid waste in Dane County impacts environmental health and sustainability efforts. In the City of Madison the total solid waste production per person has increased approximately 2% since 2000. However, this increase is offset by notable increases in the amount of material that is either recycled or composted; approximately 14.5% since 2000. The result is less material deposited in the local landfill. In fact, the amount of waste deposited in the Dane County landfill from material collected in the City of Madison has decreased 10.9% since 2005 and 3.4% since the year 2000. Unfortunately, an accurate total of the amount of solid waste produced in the county as a whole cannot be determined since a portion of the waste is collected by private waste haulers that do not make this data available for surveillance purposes.

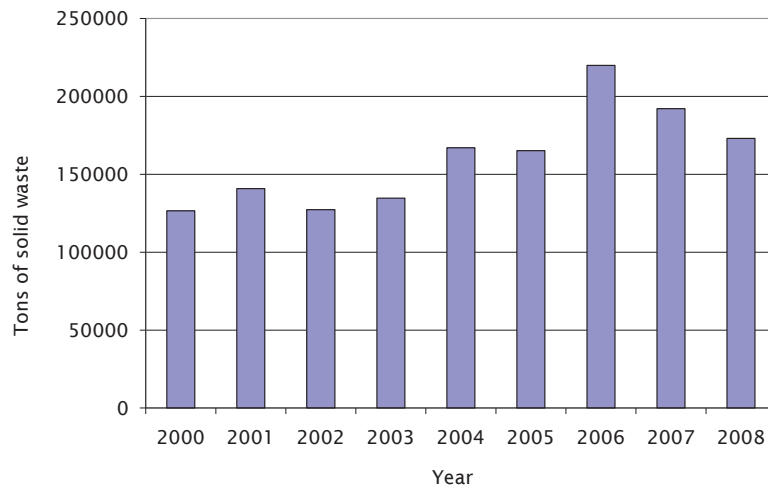
Amount of Solid Waste Produced per Madison Resident\*



\* 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 been reported increases in the amount of waste delivered to the Dane County landfill; approximately 36% since 2000 based on available data. A portion of this increase may be explained by the population growth in Dane County; approximately 13.2% since 2000 and an average increase of 1.6% each year.

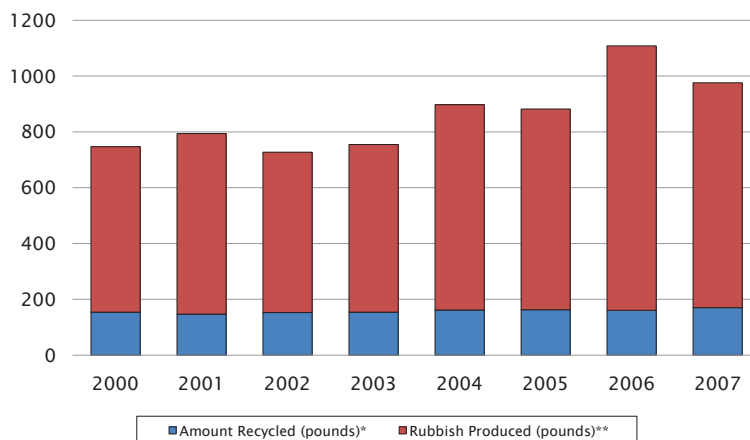
Waste Delivered to Dane County Landfills



Data provided by Dane County Public Works, Highway, and Transportation

However, similar to the City of Madison, the amount of solid waste recycled per Dane County resident has also increased allowing more material to be reused instead of its disposal in the Dane county landfill. For example, the amount of material recycled per resident has increased 10.5% since 2000. However, these modest increases are diminished in comparison to the amount of waste produced by Dane County residents. As shown in the figure below, the amount of material recycled annually only composes approximately 23% of the waste produced during that year.

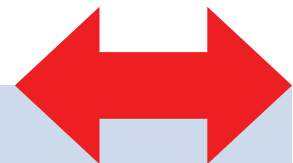
Amount of Solid Waste Produced per Dane County Resident



\* Data provided by WI Department of Natural Resources  
 \*\* Data provided by Dane County Public Works, Highway, and Transportation

**GRADE: NO SIGNIFICANT CHANGE**

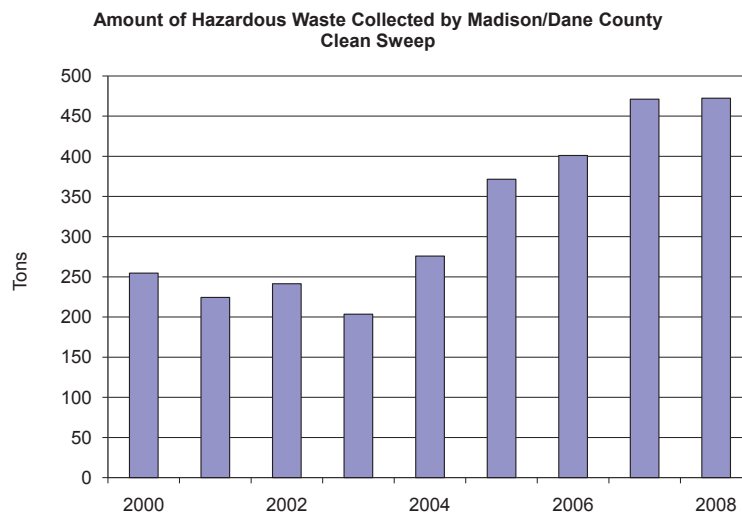
**A modest increase in the amount of recycled material but also increases in the total amount of waste produced and deposited to the Dane County landfill.**





## Hazardous Waste

Hazardous materials including oil-based paints and paint-related products, pesticides, organic solvents, flammable liquids, aerosols, and rechargeable batteries are also a public health concern facing Dane County. The collection and proper disposal of these materials by the Madison/Dane County Clean Sweep has steadily increased over the last decade reducing the potential threat posed by these materials to environmental quality and human health.<sup>12</sup> Included in these totals are several thousand pounds of pharmaceuticals collected at designated pharmaceutical collection program events. Established in 2007, this program collected over 1500 pounds of pharmaceuticals its initial year and an additional 3100 lbs in 2008.<sup>13</sup>



Data provided by Public Health - Madison and Dane County

In addition to these efforts, Madison/Dane County Clean Sweep also 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 from a product exchange facility. In 2008 alone, this program facilitated the re-use of over 23,000 donated products that would have otherwise required costly disposal.<sup>12,13</sup>

**GRADE: IMPROVED**

**Notable increases in the amount of hazardous waste collected and properly disposed.**



## SOURCES

Solid and hazardous waste materials are routinely produced during average daily activities of Dane County residents. 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 these sites 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 to the community and degrades sustainability efforts.

## HUMAN HEALTH IMPACTS

Solid and hazardous waste affects human health by degrading land and water quality that could otherwise be used for other purposes such as recreation, agriculture, or other developmental needs. The improper disposal of these waste and/or their unintentional escape from landfills pollute soil and water sources resulting in potential adverse impacts to the environment, ecosystems, wildlife, and humans. For example, 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.<sup>4</sup> This development has created new challenges in the successful treatment of bacterial diseases.

## LOCAL RESPONSE

### Individual Actions

- Decrease the amount of solid waste produced by households and businesses.
  - » Households participating in EnAct teams in Madison and Dane County reduced solid waste by an average of 143 lbs per household in 2008 for an overall reduction of 822,828 lbs.<sup>14</sup> More information is available about the Enact community organization at [www.enactwi.org/index.jsp](http://www.enactwi.org/index.jsp).
  - » Increase the percentage of waste your household recycles.
  - » Reuse, sell, or donate usable items instead of throwing them away. The following resources may be used to fully pursue this option:
    - Goodwill ([www.goodwill.org](http://www.goodwill.org))
    - Freecycle ([www.freecycle.org](http://www.freecycle.org))
    - Craig's List ([www.madison.craigslist.org](http://www.madison.craigslist.org))

### Community Actions

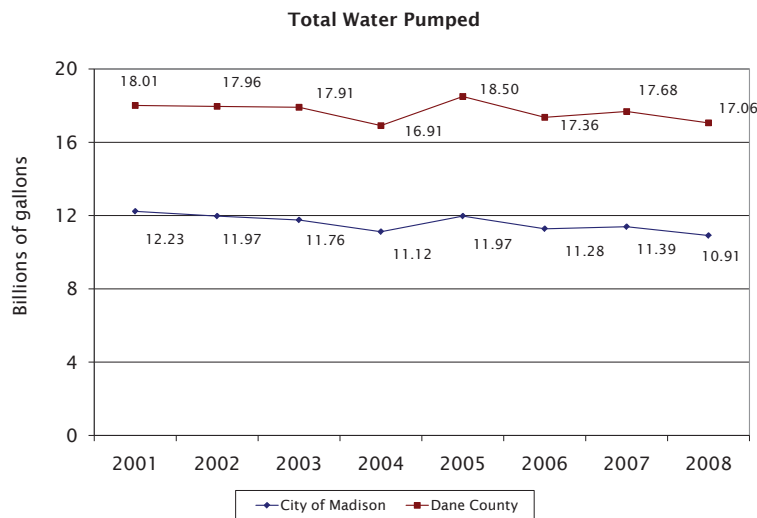
- The Dane County Solid Waste Division has banned shingles at the Dane County landfill to encourage their delivery to shingle recyclers. Recyclers process this material so that it can be reused in applications such as asphalt for roads and highways.

- Provide and expand alternatives to landfilling waste such as recycling, composting, and product exchange opportunities. Excellent examples include:
  - » Madison/Dane County Clean Sweep and Product Exchange ([www.danecountycleansweep.com](http://www.danecountycleansweep.com))
  - » City of Madison Stuff Exchange ([www.madisonstuffexchange.com](http://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 [www.co.dane.wi.us/pwht/recycle/compost\\_sites.aspx](http://www.co.dane.wi.us/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, approximately 50 million gallons is pumped each day in Dane County (17 billion gallons annually) to supply drinking, industrial, commercial, municipal, livestock, irrigation, and residential water demand. These totals include the over 30 million gallons per day (11 billion gallons annually) pumped by the City of Madison.<sup>16</sup> As shown in the figure below these totals have remained relatively stable over the past decade. However, an estimated 10% of pumped water is typically lost annually due to evaporation, flushing, leakage, and/or unreported use.



Data provided by the City of Madison Water Utility

Due to the continuous use of water at this level, a significant draw-down in the county ground water levels ranging from 10 to 30 feet has been reported by the City of Madison Water Utility. 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 groundwater draw-down and a recommendation for initiating and developing a coordinated management plan to prevent further impact.<sup>15</sup> Without proper water management, planning, and conservation efforts the future availability of sufficient water supplies to meet the growing water needs of the county may be jeopardized.<sup>15,16</sup> As indicated by the City of Madison water conservation plan, in order to maintain the current rate of groundwater pumping and to decrease and/or prevent the lowering of aquifer levels significant effort to reduce water consumption must be made at the community, industrial, municipal, and residential levels.<sup>15</sup>

#### **GRADE: NEEDS IMPROVEMENT**

**Significant draw-down of ground water levels have been reported and improved water conservation is necessary to reduce and/or prevent further impact.**



#### **SOURCES**

Groundwater is a renewable resource when the rate of water discharge does not outweigh the rate of recharge of water supplies. Dane County draws its drinking water from two substantial aquifers that are continually supplied by the water cycle. This process takes much longer in ground water than surface water and is greatly impacted by human activity. Human activity leading to aquifer draw downs is the pumping of ground water at a greater rate than resupplied in order to meet the water demands of the community.<sup>15</sup> Although this demand is fueled by legitimate water demands of the various Dane County communities the demand for this essential resource could be reduced by improved efficiency of municipal water delivery systems and water use by consumers.<sup>15,16</sup>

#### **HUMAN HEALTH IMPACTS**

The overuse or inefficient use of groundwater resources can have direct and indirect effects on human health. Groundwater draw down may impact Dane County lakes, streams, and wetlands by reducing water supplies to these sources leading to adverse effects on wildlife, aquatic ecosystems, and habitats.<sup>16</sup> In addition, the continuation of groundwater draw down will ultimately reduce the availability of adequate stores of drinking water, decrease livestock and agricultural production, and increase the cost of water for residents and local business.<sup>16,17</sup> These impacts are compounded when coupled with water pollution by nitrates, chloride, and industrial chemicals releases and 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 showerheads to reduce individual water use. More information is available at [www.epa.gov/watersense](http://www.epa.gov/watersense).
  - » In addition to the purchase of more efficient products change water use behaviors to conserve water resources. For example, the daily indoor per capita water use in a typical single family home is an estimated 69.3 gallons. By installing more efficient water fixtures and appliances, regularly checking for leaks and exercising improved water management, households can reduce daily per capita water use by approximately 35% to an estimated 45 gallons per day.<sup>18</sup>
  - » Participate in community programs (if available) that participate in water conservation efforts. As demonstrated above for waste reduction, EnAct community teams have also reduced water consumption. These households have reduced water consumption by an estimated 11,026 gallons per household; an estimated 3,252,665 gallons are conserved program-wide.<sup>19</sup> In addition to EnAct ([www.enactwi.org](http://www.enactwi.org)), other examples of community programs committed to water conservation include Sustain Dane ([www.sustaindane.org](http://www.sustaindane.org)) and Madison Natural Step ([www.cityofmadison.com/mayor/tns](http://www.cityofmadison.com/mayor/tns)). Contact these organizations for more information and participation opportunities.

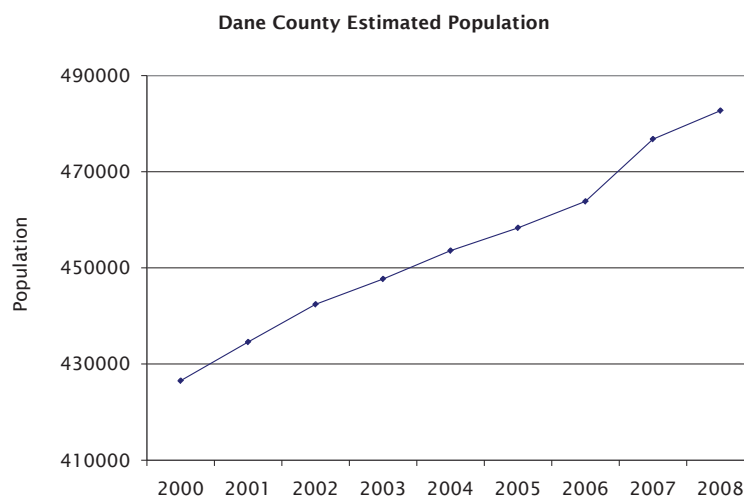
### Community Actions

- Initiate and/or expand community programs and legislation to improve water conservation efforts and improve use efficiency. Several examples are listed below:
  - » In 2008, Wisconsin entered into a legally binding regional agreement with other Great Lake states to prevent large diversions of Great Lakes water out of the region and require improved conservation and environmental protection standards. A non-binding agreement between the Great Lakes states and Canadian provinces was also established. The legislation provides guidance for ground and surface water withdrawal, conservation, water return flow, and prevention of environmental impacts.<sup>20,21</sup> This agreement will aid water conservation efforts in all counties in Wisconsin, including Dane County.
  - » A toilet rebate program implemented in 2009 to provides an incentive to consumers to install high-efficiency toilets via the establishment of a rebate program with local plumbers and retail outlets.<sup>14</sup>
- Provide water audits to residents and local businesses to improve knowledge of water use and provide insight of methods to improve water use efficiency.

## Land Use

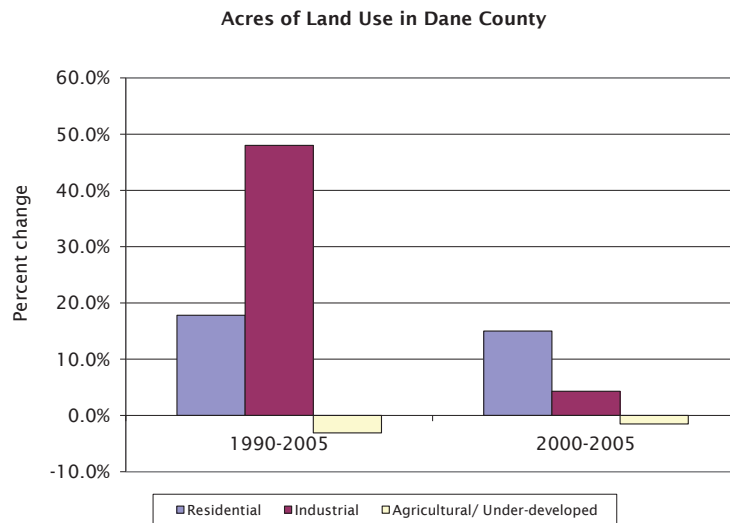
### ENVIRONMENTAL MEASURES

The appropriate use of land resources is an essential component to the development of sustainable and healthy communities. However, increases in population fuel the demand to utilize these land resources to meet the growing need of additional housing, transportation, and industry that is required to support these expanding communities. For example, over the last decade, the population of Dane County has increased by an estimated 13%; an average annual growth of an estimated 1.5%. Since 2000, approximately 30% of this growth can be traced to population increases reported in the City of Madison, the largest city in the county and the second largest city in the state.



Data provided by the United States Census Bureau

Population expansion in Dane County has led to a surge in land use for residential housing and industrial purposes; while this trend has slowed in the last decade the acres devoted to residential and industrial purposes has increased 17.8% and 48% since 1990, respectively. Consequentially, as shown in the figure below, a decrease in acres devoted to agricultural purposes including farmlands has decreased 1.5% since 2000 and approximately 3.1% since 1990.

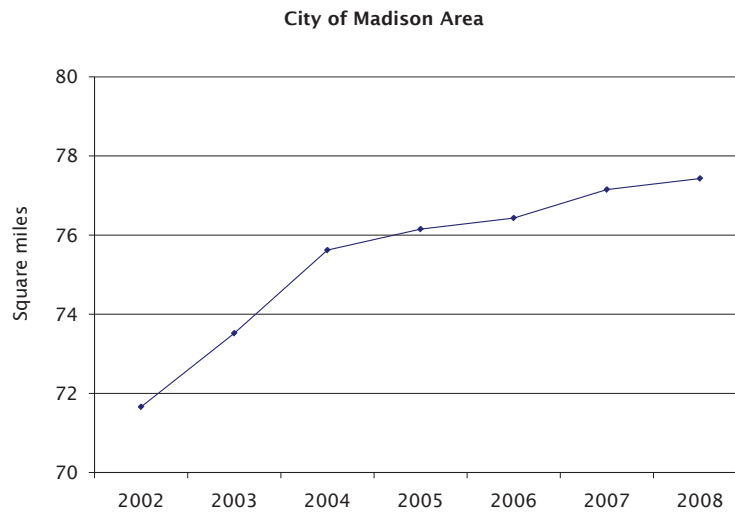


Data provided by Dane County Planning and Development

Although overshadowed by the total loss of agricultural acreage there was a documented increase in the amount of lands devoted to outdoor recreation, natural and cultural preservation, and county parks during this same time period; included are outdoor sporting facilities, walking and biking trails, historic and cultural sites, and preserved natural resource areas and forests. An example is the number of acreages devoted to woodland preservation in Dane County. Data reported by Dane County Planning and Development indicate that woodland acreage has increased in the last decade but this progress has slowed considerably in comparison with previous reporting periods; from 1990 to 2000 the acreage of woodlands had increased approximately 12% while a 6.5% increase was documented from 2000 - 2005. This pattern is also consistent with other natural areas including vacant unused land and open areas. However, one exception is acreage devoted to outdoor recreational activities where consistent gains were reported in both reporting periods; approximately 18% increase from 1990 - 2000 and over a 20% gain from 2000 - 2005.

## SOURCES

The increase in population and city expansion has driven increasing human demands upon natural resources; this demand has dramatically impacted land use trends in favor of continued and expanded urbanization in Dane County. For example, the City of Madison has increased its total square mile area by over 7% since 2001 to meet the strains of population growth.<sup>22</sup>

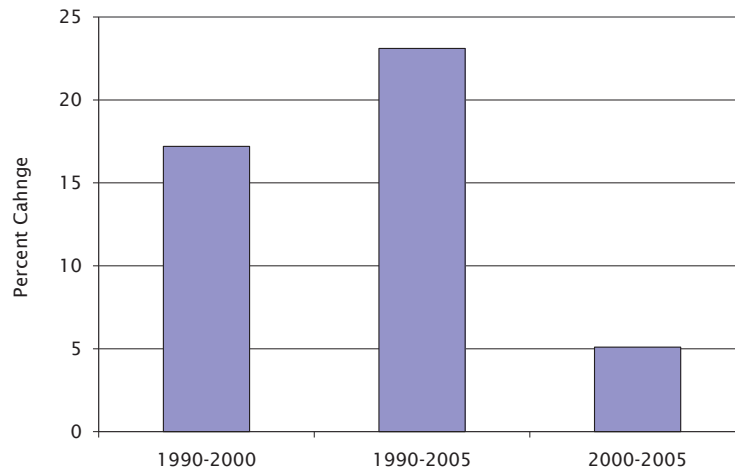


Data provided by City of Madison Planning Division

These expansions require the use of more lands for development and impact natural ecosystems not only from the acquisition of these resources but the interaction of the human population with this environment. Appropriate zoning of land resources can also contribute to these impacts. Zoning codes allow strict guidelines to be established for the acquisition and use of lands, building codes, and environmental protections.<sup>23</sup> Over the last several decades, the application of zoning codes in community development has isolated locations for employment, shopping and services, and housing from one another.<sup>24</sup> The result has been the continued need and expanded construction of infrastructure to connect these community resources and residences. In Dane County, the amount of acreage allocated for transportation use has grown over 23% since 1990 to an estimated 46,000 acres reported in 2005. However, this growth has slowed considerably since the year 2000 to approximately 5%.



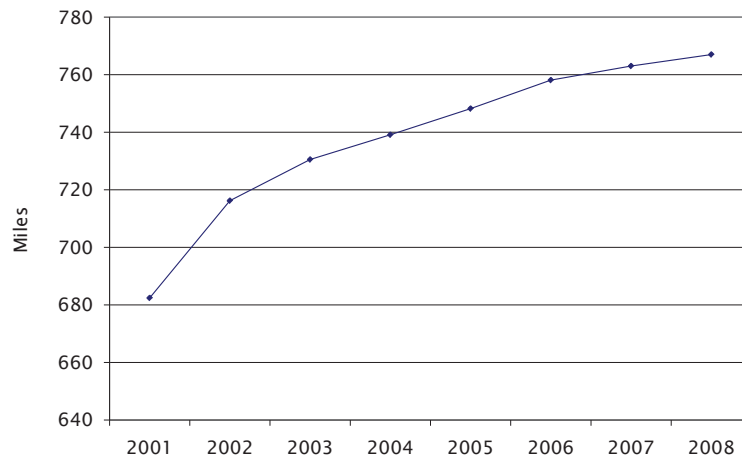
Transportation Acres - Dane County



Data provided by Dane County Planning and Development

This trend is also apparent in the City of Madison. The total miles of street in the city have increased approximately 12% since 2001 to an estimated 767 miles.

City of Madison - Miles of Street



Data provided by City of Madison Engineering Division

## HUMAN HEALTH IMPACTS

Land use has a multi-faceted impact to community health. For example, land allocated for safe recreational activities such as biking and walking trails promote exercise and healthier lifestyles among residents, as well as, presenting other options for commuting.<sup>25</sup> In addition, the conservation and/or expansion of natural habitats and agricultural acreage may improve domestic food production capabilities and reduce greenhouse gas concentrations in the atmosphere via carbon sequestration; a process that allows trees and plants to absorb carbon dioxide from the atmosphere and turn it into biomass (i.e. wood, leaves, etc).<sup>3,8,26,27</sup> However, the reduction of natural land acreage and increased urbanization decrease infiltration of water into the ground due to the replacement of natural ground covers with impervious surfaces such as concrete and asphalt. This reduction may exacerbate groundwater draw downs and impact surface water resources, wildlife, natural habitats.<sup>15,28</sup> In addition, the design of communities that encourage the development of urban sprawl and require longer commutes for employment, recreation, and commerce result in increased pollution from vehicle exhaust that may increase the incidence and prevalence of diseases such as asthma, heart disease, stroke and cancer from chronic exposure to these air contaminants.<sup>29-31</sup>

## LOCAL RESPONSE

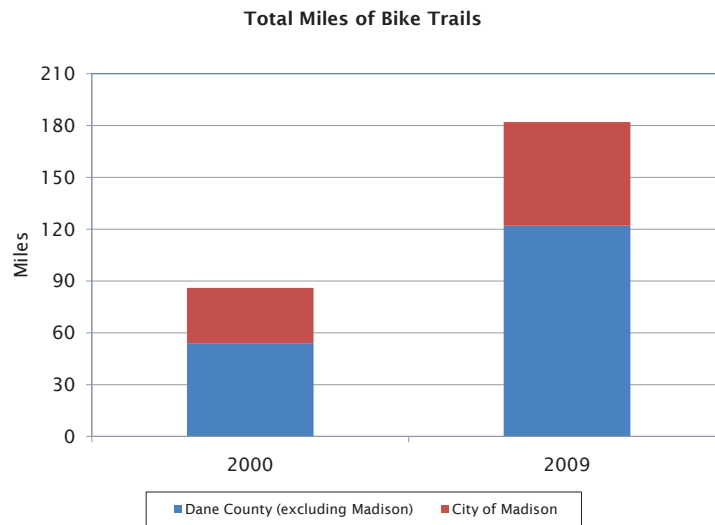
### Individual Actions

- Support local farmers and growers with your business. More information concerning farmers markets in Dane County can be found at: [www.dcfm.org](http://www.dcfm.org).
- Stay informed with local land use issues and get involved by working with conservation organizations and voting for officials that support land use sustainability.
  - » Volunteer and financial donation opportunities are available with several organizations that work to preserve Wisconsin, including Dane County. One example is the Dane County Parks – Adult Conservation Team ([www.co.dane.wi.us/lwrd/parks/volunteer](http://www.co.dane.wi.us/lwrd/parks/volunteer)). However, other private opportunities are also available.

### Community Actions

- Provide improved protections for natural and agricultural areas via improved zoning ordinances and improved community planning guidelines for future development.<sup>23-24</sup>
  - » Continue to expand compliance with Smart Growth standards. This legislation was passed in the state in 1999 and is aimed at developing “economically, environmentally, and socially sound” communities.<sup>32</sup> Additional information about Smart Growth communities and strategies may be found at: <http://dnr.wi.gov/org/es/science/landuse/smart>.
- The Wisconsin Brownfields initiative was initially established in 1994 with additional initiatives contained in the 1997-1999 biennial budget. The combination of these efforts allowed opportunities to clean and redevelop Brownfield properties via grant programs, tax incentives, and/or legislation and regulation. These properties are abandoned, idled, or under-developed acreage that may contain a real or perceived environmental threat.<sup>33,34</sup> The redevelopment of this property type may conserve undeveloped acreage that would have been utilized for development; examples of projects that occurred within Dane County may be found at: [www.dnr.state.wi.us/org/aw/rr/cleanup/sstories.htm](http://www.dnr.state.wi.us/org/aw/rr/cleanup/sstories.htm).

- Continue to develop and/or expand local and county programs to further protect and conserve natural lands including land erosion prevention, wetland and woodland restoration, and purchase and/or acquisition of acreage for protection.
- Continue to devote lands for walking and biking trails to promote safe environments for exercise and alternative opportunities for commuting. For example, during the last decade the total miles of bike paths/trails in Dane County has more than doubled from approximately 86 miles in 2000 to 182 miles in 2009. These totals also include City of Madison bike trails which totaled 32 miles in 2000 and 60 miles in 2009.
  - » These efforts have gained Dane County a reputation for being one of the top bicycling areas in the country and earned a Gold award from the League of American Bicyclists for the City of Madison.



Data provided by the Madison Area Transportation Planning Board

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