

**Indoor Air Quality in Eating and Drinking Establishments in
the City of Fond du Lac**

September 2008

Submitted by: Fond du Lac Tobacco Control Program

Data analysis:

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The report was written by the University of Wisconsin Population Health Institute in cooperation with the University of Wisconsin Comprehensive Cancer Center Training and Technical Assistance Program and the Fond du Lac County Health Department. The study was conducted by the University of Wisconsin – Comprehensive Cancer Center Training and Technical Assistance Program along with volunteers. The study was funded by the Wisconsin Tobacco Prevention and Control Program, Division of Public Health, Wisconsin Department of Health and Family Services.

Executive Summary

Indoor air quality was tested in six eating and drinking establishments in Fond du Lac on July 18, 2008 and one on July 22, 2008. The city of Fond du Lac has an ordinance that prohibits smoking in restaurants that have alcohol sales less than 33% of their sales receipts.

The concentration of fine particle air pollution, PM_{2.5}, was measured using a TSI Sidepak AM 510 Personal Aerosol Monitor. PM_{2.5} is particulate matter smaller than 2.5 microns in diameter. Tobacco smoke is the biggest contributing factor to the amount of small particulate matter indoors that is smaller than 2.5 microns in diameter. This small size allows particles to penetrate deep into lung tissue and the walls of arteries. The results in the study are compared to the WI Department of Natural Resources Ambient Air Quality Standards for outdoor air (see Figure 1).

Key findings of the study include:

- 100% of Fond du Lac establishments tested that allow smoking had air quality that was at a minimum **Unhealthy**.
- Of the Fond du Lac establishments tested that allow smoking, one had **Unhealthy Air Quality**, three had **Very Unhealthy Air Quality**, and two had **Hazardous Air Quality**.
- Of the above-mentioned sites, one (establishment) had **two times the Hazardous Air Quality** during part of the period tested
- One establishment, a bar, was smoke-free and had **Good Air Quality**.

The air quality in these eating and drinking places that allow smoking present a serious health risk for patrons and employees because:

- There is no safe level of exposure to environmental tobacco smoke.
- It is not possible for patrons and employees to determine the level of environmental tobacco smoke in any specific establishment.
- Eating and drinking establishments may contain very high levels of dangerous pollutants for long periods after the last cigarette has been extinguished.
- Some employees are likely to be engaged in on-going strenuous physical activity while working in highly hazardous air quality conditions. Also, patrons and employees who have undiagnosed heart disease may not be aware of the added risk of a heart attack when exposed to secondhand smoke.

- Patrons and employees may believe they are not exposed to unsafe levels of secondhand smoke because of ventilation and air conditioning systems. However, these systems do not reduce pollutants to safe levels and are used primarily to remove offensive odors and visible particles.
- Children, who are most susceptible to smoke-related illness, cannot choose to avoid smoke-filled environments.

Background and Introduction

Since the 1986 U.S. Surgeon General's Report, *The Health Consequences of Involuntary Smoking*,¹ first made Americans aware of the dangers of secondhand smoke, public understanding of its health consequences has grown. Despite this increase in knowledge, in Wisconsin, secondhand smoke is estimated to cause more than 800 lung cancer and heart disease deaths each year while thousands more are made seriously ill by asthma, allergic attacks and chronic disease.²

While smoke free workplaces are increasingly the norm, eating and drinking establishments are among the last public places where smoking is usually allowed. As a result, drinking establishments commonly have extremely high levels of secondhand smoke, typically at levels that are much higher than the Environmental Protection Agency (EPA) allowable daily exposure limit³. As a result of exposure to secondhand smoke, many bar workers and patrons suffer from respiratory symptoms and have impaired lung function.⁴

In 1992, the City of Madison enacted the first smoke-free restaurant ordinance in Wisconsin. The measure applied to establishments requiring a restaurant license and whose alcohol sales are less than 33% of their gross receipts. In 1999, a similar but more stringent ordinance was passed in Fond du Lac and numerous other communities across the state. In 2003, Madison passed the first ordinance that required all workplaces, including bars, to be smokefree. By 2008, Appleton, Eau Claire and Marshfield passed similar comprehensive ordinances. As a result of a growing body of evidence of the potential harm caused by relatively low levels of exposure to secondhand smoke, public health advocates throughout Wisconsin sought information on the level of exposure to pollutants from secondhand smoke in eating and drinking establishments.

Methods

A convenience sample of six eating and drinking establishments in the City of Fond du Lac were selected. These establishments were visited primarily during the evening of July 18 and in the afternoon of July 22.

Each monitoring team spent approximately 30 minutes in each establishment. The number of people inside the venue, the number of patrons and the number of cigarettes burning were recorded every 15 minutes during sampling.

A TSI SidePak AM510 Personal Aerosol Monitor was used to sample and record the level of respirable particles that are smaller than 2.5 micrograms per cubic meter (PM2.5). The TSI SidePak is a professional air monitoring device used for the measurement of fine particulates. It is used to measure and record in real-time the level of tobacco pollutants in the air.

The SidePak was zero-calibrated prior to each use. While other air pollutants in the atmosphere as well as particles from cooking and indoor wood burning may contribute to air pollution, tobacco smoke is the major source of fine particle air pollution in establishments where smoking is present. The equipment recorded particulate levels every second and records the average particulate level at one-minute intervals. The monitor was located at different locations within the main areas of each establishment to get a sample of readings.

Air samples were taken outside of the establishments to obtain a “baseline” measure. This is to assure that the air quality measured inside is not polluted air that has infiltrated from the outside. The measures of the ambient or outside air indicated good quality. On average, the air quality level indicated less than 10 micrograms per cubic meter.

The data from the SidePak was downloaded to the University of Wisconsin Comprehensive Cancer Center Surveillance and Evaluation Program, which analyzed the data and prepared this report.

(Note on confidentiality of data: The establishments monitored for air quality are not identified by name, only by general area and type. We do not identify the establishments in part because the study organizers do not want to give the impression that these particular eating and drinking establishments have more or less polluted air than any other establishment. Any establishment that permits smoking has residue of secondhand smoke which presents a health risk to people.)

Results

The Ambient Air Quality Standard of the Department of Natural Resources (DNR) is the appropriate standard for analysis (**See Figure 1**). The national standard from which the DNR standard is based on was established in 2005 by the EPA following detailed analysis by leading scientists and Bush Administration officials. On April 1, 2008, the DNR slightly modified (lowered) the standard for ozone and fine particulates.

The pollutants measured under these standards are considered harmful to public health and the environment. The primary standard for fine particulate matter (less than 2.5 micrograms) is the limit set to protect public health, including the health of sensitive populations such as people with asthma, children and the elderly. The standard for annual exposure to fine particulate matter, that is the average of the different rates of exposure over one year, is 15 micrograms per cubic meter. The standard for daily exposure, that is the greatest exposure allowable in a single 24-hour period, is 40 micrograms per cubic meter.

Five eating and drinking establishments were monitored in Fond du Lac on July 18, 2008. The first establishment monitored was a bar and restaurant that had children customers. The air quality level was **Hazardous**. (**See Figure 2**) Air particulates at times exceeded 300 parts per cubic meter. At the Hazardous level, the state and federal environment agencies advise that “people with heart and lung disease are advised to stay indoors and to keep activities level low. Everyone should avoid all physical exertion.”

The second establishment was a bowling alley that also had children customers. Air pollution levels were **Unhealthy**, exceeding 55 micrograms per cubic yard. (**See Figure 3**) At this level of air quality, people with heart or lung disease, older adults, and children are advised to avoid any prolonged or heavy exertion and everyone is advised to reduce prolonged or heavy exertion.

The third establishment was a bar. Air quality was **Very Unhealthy** and often approached or exceeded the Hazardous level. (**See Figure 4**) Similar to the level of Hazardous level of pollutants, people with heart or lung disease, older adults, and children should avoid exposure and everyone else should avoid any physical activity.

The fourth establishment tested on July 18, 2008 was a bar that allowed smoking. Even with three exhaust fans operating, the air quality was **Very Unhealthy**. Survey results from July 18, 2008 can be reviewed in **Figure 5**.

At midnight of July 18th, a bar was monitored. The bar air quality was significantly higher than the level for **Hazardous** air quality despite having five exhaust fans in operation. At the time of the monitoring air particulate levels were in excess of 300 micrograms of particulate per cubic yard.

On July 22nd, a smoke-free restaurant and bar was monitored. The air quality was **Good** (below 15 micrograms per cubic meter). **(Figure 7)**

Figure 1: Ambient Air Quality Standard (DNR)

Air Quality Index Values (Particulate levels)	Levels of Health Concern	Cautionary Statements
0-50 (15 micrograms or below)	Good	None
51-100* (16- 34 micrograms or less)	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101-150 (35-55 micrograms)	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
151-200 (56-140 micrograms)	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
201-300 (141-210 Micrograms)	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
301-500 (Above 210 Micrograms)	Hazardous	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all

physical activity outdoors.

*An AQI of 100 for particles up to 2.5 micrometers in diameter corresponds to a level of 34 micrograms per cubic meter (averaged over 24 hours). An AQI of 100 for particles up to 10 micrometers in diameter corresponds to a level of 150 micrograms per cubic meter (averaged over 24 hours).

Figure 2: Indoor Air Quality: Fond du Lac: 7/18/08

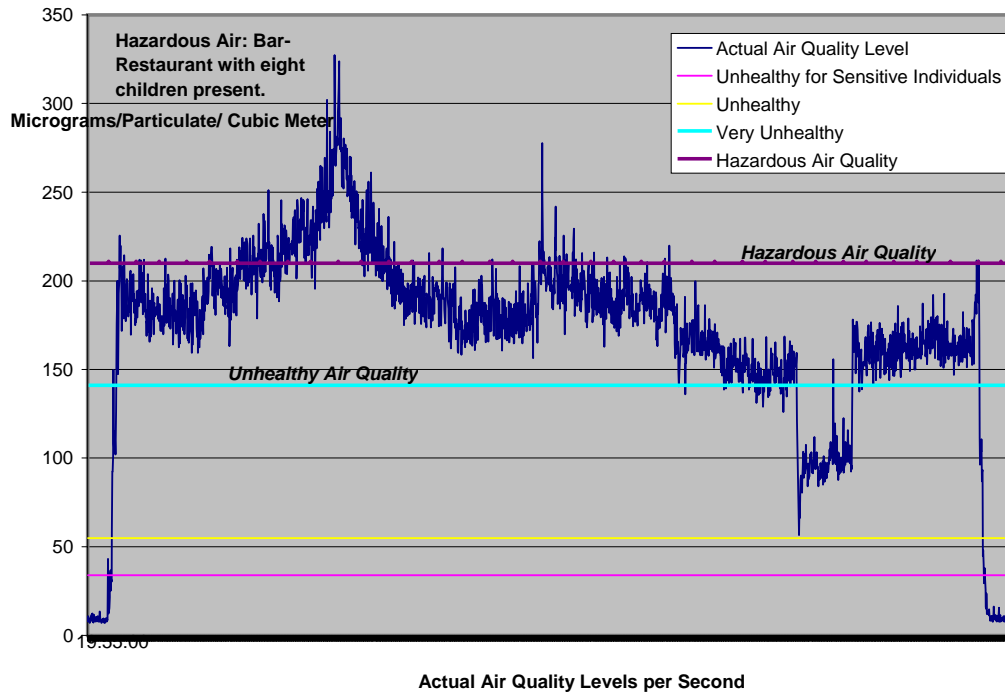


Figure 3: Indoor Air Quality:Fond du Lac: 7/18/08

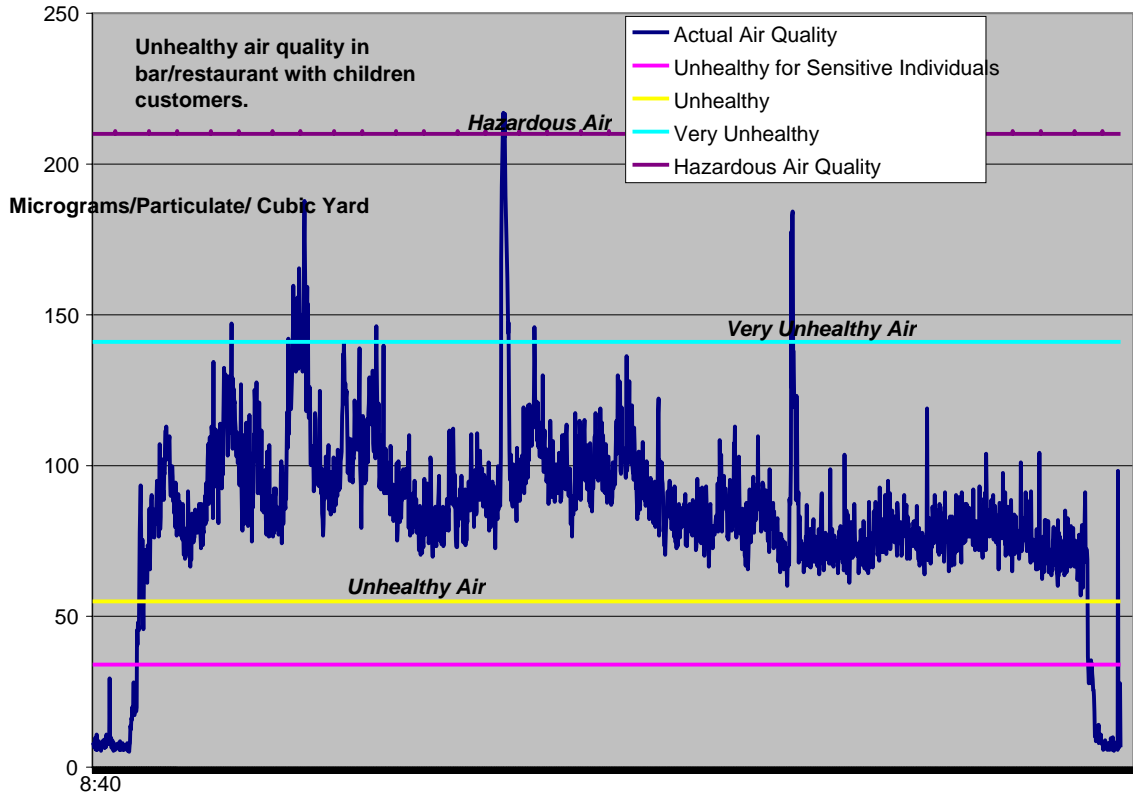


Figure 4: Indoor Air Quality: Fond du Lac 7/18/08

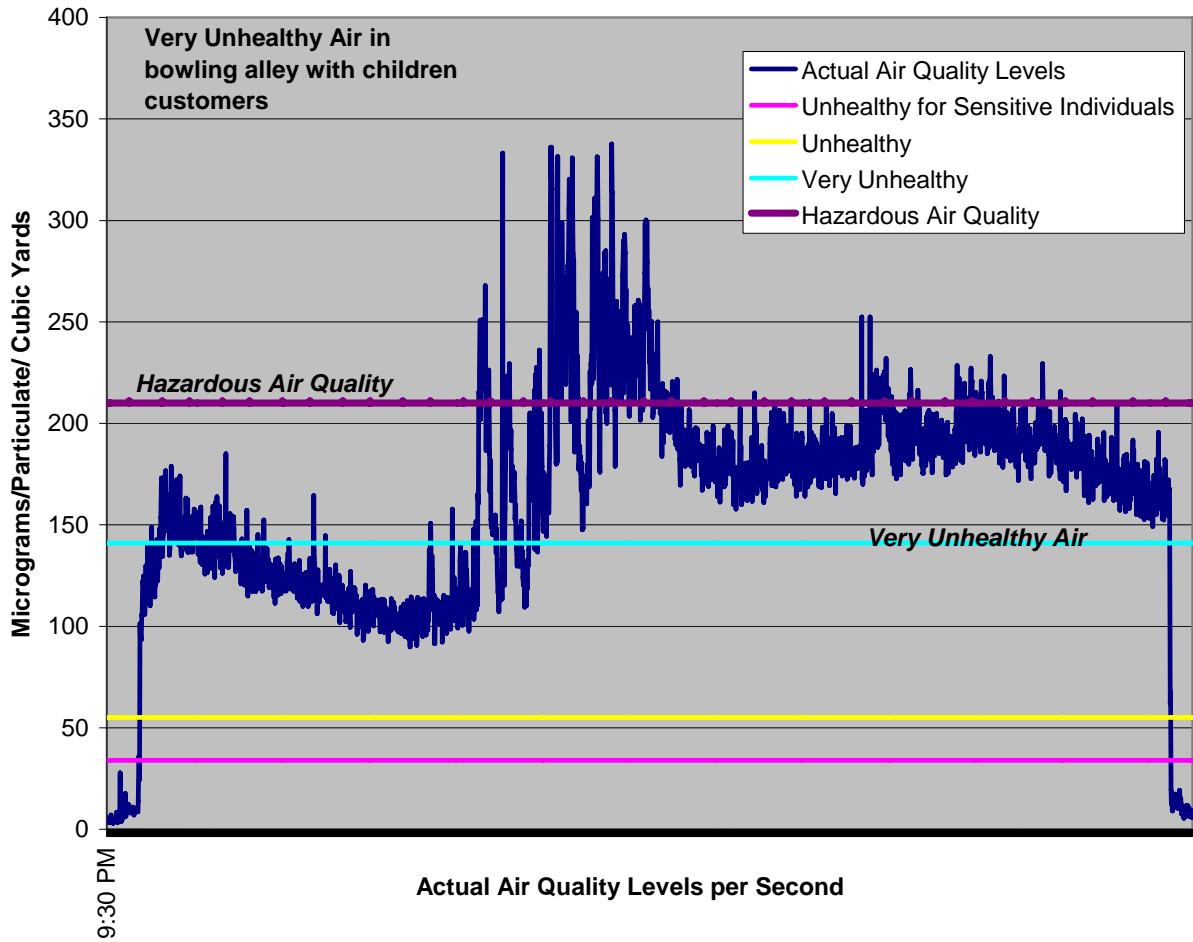


Figure 5: Indoor Air Quality: Fond du Lac, 7/18/08

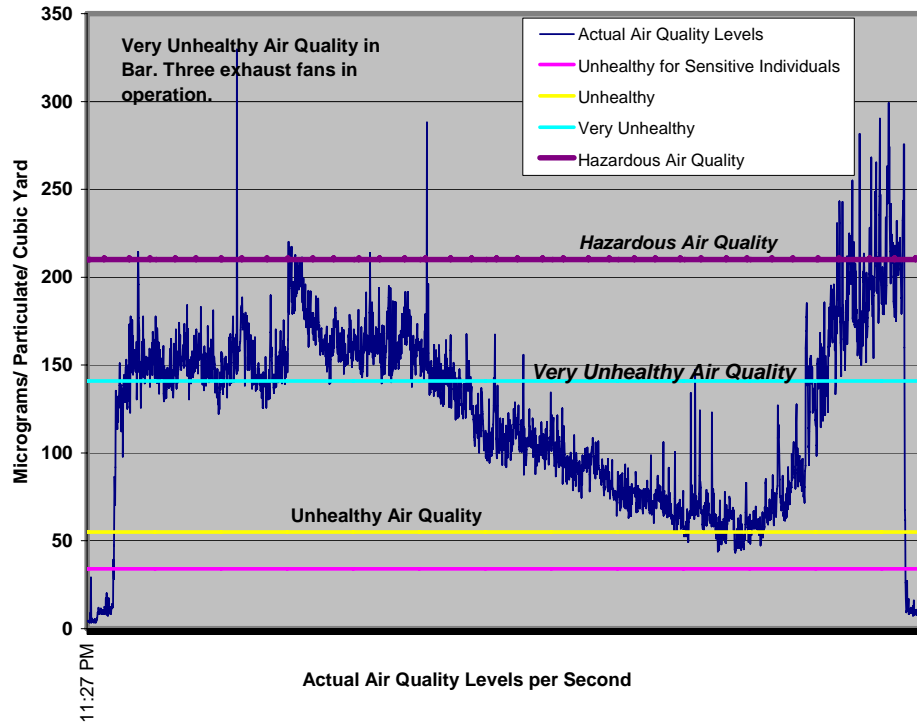


Figure 6: Indoor Air Quality: Fond du Lac: 7/19/08

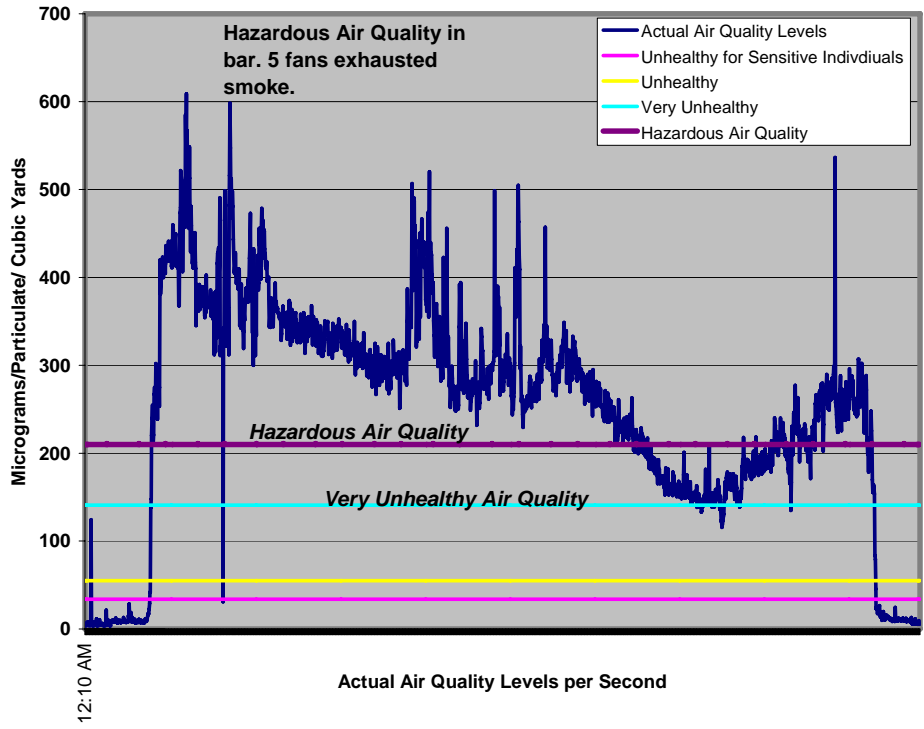
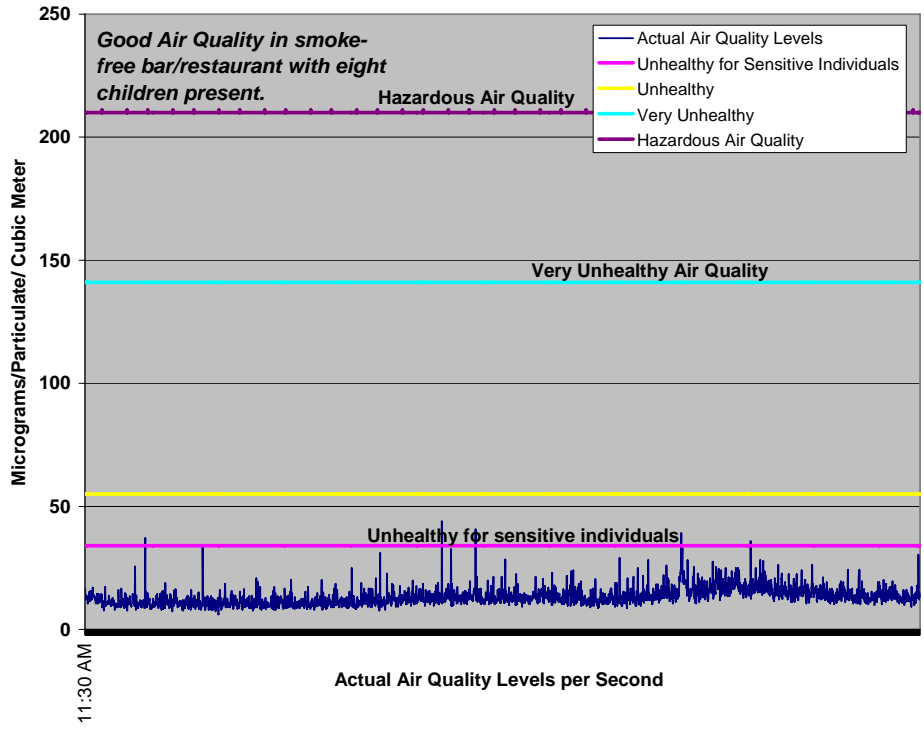


Figure 7: Indoor Air Quality: Fond du Lac 7/22/08



Discussion:

On three days in the past two years, Fond du Lac County had outdoor air quality with particulate levels of more than 40 micrograms/cubic yard. The air quality was slightly above the warning of **Unhealthy for Sensitive Individuals** on November 28, 2006 (41 micrograms), March 3, 2007 (41 micrograms) and December 20, 2007 (42 micrograms). On each of these days, the Wisconsin Department of Natural Resources and local public health agencies warned individuals with a compromising illness to stay indoors and cautioned against strenuous physical activity.

The data collected in Fond du Lac of selected eating and drinking establishments indicates that with the single exception of a non-smoking restaurant-bar, all establishments had air quality that exceeded the highest levels ever recorded in the outside air in Fond du Lac County. In all cases observed, the air quality was many times that which triggers health alerts.

The data in this report indicate that patrons and employees of taverns and some combined bars and restaurants of Fond du Lac are typically exposed to levels of secondhand smoke that are at, or many times greater than, the DNR's recognized **Good** level of air quality and are often exposed to **Very Unhealthy** or **Hazardous** levels of particulate matter. This exposure presents immediate and long-term health risks for patrons and employees.

Many proponents of smoking in public places propose that businesses post notices warning patrons and employees of the possible presence of secondhand smoke. The DNR warning on hazardous air states that people with heart and lung problems, older people and children should avoid exposure to hazardous or unhealthy air. Further, it states that all persons should avoid physical activity when exposed. **(See Figure 1)**

This warning makes a few often unwarranted assumptions. First, the warning assumes that people with heart and lung problems are aware of their disease. In most cases, the first knowledge of heart disease is a heart attack or for arterial disease, a stroke. Only a minority of people with heart disease have been warned of the clinical implications of their condition. As a result, customers and employees with serious but undiagnosed heart and lung disease are regularly exposed to very high levels of smoke

particles that can trigger a heart attack or seriously worsen an on-going chronic lung condition such as emphysema.

Second, the warning assumes that people who are employed can choose to avoid physical activity. Bartenders, cooks and wait staff have busy and often aerobically taxing duties of heavy lifting, carrying and walking. Work-related tasks that require deep breathing can cause a range of pulmonary and cardiac problems. We know that many of these problems can become chronic and last long after employment (and exposure to smoke) has ended. While customers can avoid engaging in physical activities such as dancing, they are not likely to know that such activities can be dangerous in high levels of secondhand smoke.

Third, relates to the problems faced by children. Children, particularly young children, cannot control their exposure to these hazardous conditions. Children are under the control of their parents and as such may be exposed to very high levels of these toxins without their knowledge or agreement. The effects of the smoke on children are different than on adults and are more immediate and acute. Asthma and allergic attacks as well as ear and respiratory infections are common outcomes of exposure -- even for relatively brief periods of time.⁵ Fourth, individuals have little or no ability to assess the level of smoke particulates in any particular establishment. Smoke filters may eliminate some of the larger particles and the smell of the smoke. However, it is the many invisible toxins and small particulate matter that enters the lungs and arteries. It is in part because they are so small that they commonly enter and “stick” in arterial walls.

Fifth, the warnings at all levels of poor air quality assume that the environment does not promote physical activity. For example, one of the Fond du Lac sites included a bowling alley and others may have had dancing. All of the patrons participating in these activities were at heightened risk.

Patrons and employees may be unaware that secondhand smoke is much more toxic than smoke inhaled directly from a cigarette because the smoke off the end of a cigarette is burned at a lower temperature than inhaled smoke. They may also not know that when this smoke is “aged” more than 30 minutes, it is 3-4 times more toxic than “fresh” smoke.⁶ Warnings by governmental organizations do not offer protections against this significant hazard to the health of patrons and employees living and working

in areas where smoking indoors in public establishments is allowed. Despite the health threat faced by thousands of local citizens each day, the data from this study indicates that in a number of cases a small number of smokers create enough smoke to make the entire establishment hazardous.

Study Limitations

Selection of the establishments for survey was based on the surveillance team's knowledge of the level of patronage. Higher levels of patronage would indicate the exposure to the highest percentage of the population. Random selection would not indicate the level of exposure to the most popular establishments. As such, the results of the study cannot be attributed to all eating and drinking establishments of the locality but instead to those who are most likely to be patronized.

A critical limitation of the study was the differences in the ventilation conditions in establishments. This study was conducted in mid-July in south-central Wisconsin. As such, in many of the establishments, windows and doors were open with additional exhaust provided by out-blowing fans. Other establishments had all doors and windows sealed and had air-conditioning on in addition to exhausts. These differences in conditions both from each other and most importantly, from the air quality most of the year when neither windows are open or air-conditioning is on is substantial. Nonetheless, despite these conditions which might appear to most patrons to be beneficial to health, a majority of the establishments had poor air quality and in some cases were highly hazardous.

Unlike the testing protocol conducted by the DNR and EPA which collects samples 24 hours per day over a number of days, the monitoring conducted for this study was taken over 30 minutes on a single occasion. As noted in the study, there is a very high level of variation within a single bar or restaurant depending on the number of smokers, the number of cigarettes smoked and to some extent, the level of ventilation, air flow patterns and climatic season. Thus, the levels indicated in this report, while extraordinarily high, may substantially underestimate the highest possible level of pollutants and the average exposure of patrons and employees.

Conclusion

It is well documented that secondhand smoke causes cancer, heart disease and a host of other illnesses. Even short-term exposure to secondhand smoke can trigger respiratory infections, asthma, and death from heart attack in people with existing heart disease.

Ventilation and air circulation systems cannot make establishments that allow smoking safe to breath. In their analysis of the use of ventilation to address smoking indoors, the U.S. Surgeon General concluded that “current heating, ventilating and air conditioning systems alone cannot control exposure to secondhand smoke” and that in fact may distribute smoke throughout a building. As such, “exposure to secondhand smoke can only be controlled with a complete smoking ban.”⁷

The data presented in this report indicate that patrons and employees of eating and drinking establishments in Fond du Lac that aren’t covered by the smoke-free restaurant ordinance are typically exposed to levels of pollutants that are **highly hazardous**. Many of these citizens may be unaware of their health status and how it can be seriously worsened by even short-term exposure. Further, they are unaware of the actual levels of the toxins at the time of their work or visit. These conditions are particularly dangerous to employees who are engaged in physical activities such as walking, lifting and carrying throughout their period of exposure.

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