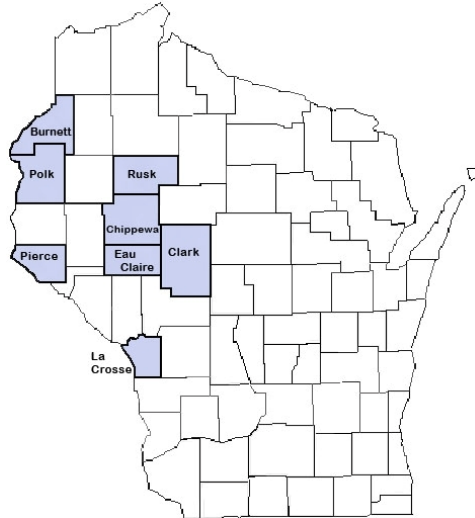


Indoor Air Quality in Eating and Drinking Establishments in Western Wisconsin



October 2008

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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. The study was conducted by the University of Wisconsin-Comprehensive Cancer Center, the Wisconsin Tobacco Prevention and Control Training and Technical Assistance Program along with local tobacco control coalitions, volunteers and staff members of Burnett, Eau Claire, La Crosse, Pierce, Polk and Rusk County Public Health Departments in Western Wisconsin. The study was funded by the Wisconsin Tobacco Prevention and Control Program, Division of Public Health, Wisconsin Department of Health Services.

Executive Summary

Air quality was tested in 58 eating and drinking establishments in the western Wisconsin counties of Clark, Eau Claire, La Crosse, Polk, Rusk, Pierce, Burnett and Chippewa in the period February 15 - March 14, 2008. The air quality **in close to three-fourths** of these establishments was, by the Wisconsin Department of Natural Resources (DNR) standards, at or above the hazardous-level (more than 210 micrograms of fine particulate/ cubic meter). **(See Figure 1)** At the hazardous-level, children, elderly and individuals who are unhealthy are strongly advised to avoid breathing air with this level of particulate pollutants. Everyone is warned to avoid physical activity while exposed to this level of hazardous air. In most establishments the air quality was, at a minimum, two to three times more dangerous than the hazardous-level. With three exceptions, the air quality in all restaurants that permitted smoking was “unhealthy” (more than 55 micrograms/ cubic meter).

The common standard of measurement of air quality is the amount of fine particulate in the air. Tobacco smoke is the biggest contributing factor to the amount of fine particulate matter indoors. Large particles from cooking or grilling were excluded for the test. The measurement of these fine particles is less than 2.5 microns/micrograms or about one tenth the width of a human hair. This is important as fine particles are able to penetrate deep into lung tissue and the walls of arteries causing damage.

The Department of Natural Resources (DNR) reports that in calendar years 2005 and 2006, there was one single day in which the outdoor air quality level was over **34 micrograms** per cubic meter and may be harmful to individuals with “sensitive conditions.” At **210 micrograms** per cubic meter, the air is considered hazardous to all persons. The data indicate that the air quality in some of the establishments in this study was **more than six times** higher than the hazardous level. It was also many times worse than the air quality when the public received an alert about outdoor air pollution. In one establishment, air pollution was measured at over 1400 micrograms.

The air quality in these eating and drinking places presents 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.
- Patrons and employees may believe they are not exposed to unsafe levels of secondhand smoke because of the presence 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.
- 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, many patrons and employees are not aware of their risk due to disease.
- 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 multiples of the Environmental Protection Agency (EPA) allowable daily exposure limit³. As a result of the exposure to secondhand smoke, many bar workers and patrons suffer from respiratory symptoms and have impaired lung functions.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 were less than 33% of their gross receipts. In subsequent years, similar ordinances were passed in much of La Crosse County, the City of Eau Claire 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 58 eating and drinking establishments in the eight-county area were selected. The restaurants and bars tested were not randomly selected but were specifically chosen because they were known to be representative of a class of establishment such as a restaurant-bar combination, restaurant only, bar only, smoke-free or those that are heavily patronized. These establishments were visited primarily during the evening hours between February 15 and March 14, 2008. Tests occurred on Friday and Saturday evenings to monitor air quality conditions when the largest number of patrons and employees were present and exposed to air contaminants.

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 respiratory particles that are smaller than 2.5 micrograms per cubic meter (PM_{2.5}). 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 may contribute to air pollution, smoking is the source of most indoor air pollution. 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.

The importance of the small measure (2.5 micrograms) is that the SidePak monitor only collects particles that are as small as tobacco smoke in indoors facilities or diesel pollution in the outdoor air. These particles are about one-seventh of the diameter of a human hair. The monitor does not collect larger particles such as most cooking related particles.

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 because the study organizers do not want to give the impression that the monitored eating and drinking establishments have more or less polluted air than any other establishment in the eight-county area. We also sought to maintain the confidentiality of the business. Any establishment that permits smoking has residue of secondhand smoke which presents a health risk to people.)

Results

The Ambient Air Quality Index of the Department of Natural Resources (DNR) is the appropriate standard for analysis. **(See Figure 2)** 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 asthmatics, 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.

The data from the on-site tests indicates that in 40 of the 58 establishments that allowed smoking, air quality was at or above the level considered hazardous to health. In many cases, the air pollution levels in these places were many times the hazard level. With a single exception, the air in all sites that allowed smoking had air quality that was “unhealthy.”

Five restaurants were monitored in rural Eau Claire County on February 15, 2008. The first establishment visited in rural Eau Claire at 5:30 PM was a restaurant without an alcohol license. The air quality in the restaurant was at a hazardous level. Monitors noted that restaurant patrons included children as well.

The second establishment monitored at 6:30 PM had no smokers though it allowed smoking and at the time of the visit had an acceptable level of air quality. The third establishment, a restaurant-bar had “unhealthy” air quality levels monitored at 7:30 PM. The fourth and fifth restaurant-bars in an Eau Claire County community had air pollution levels from 125 to 275 micrograms/ cubic meter and were monitored between 8- 9:30 PM. Children under the age of 10 were present in both of these establishments. **(See Figure 3)**

Six restaurants and bars were monitored on February 16 in or near the City of Eau Claire. The air quality of the first restaurant-bar (monitored at 5:30 PM) was almost twice the level considered to be at hazardous-level under federal standards. Monitors noted that only one in eleven customers smoked cigarettes but nonetheless created a serious health effect. A second restaurant had air pollution levels that peaked above the hazardous level and also had very few smokers. Over the half-hour test, 6:30- 7 PM, very few of the forty customers smoked. The third site visited between 7- 7:30 PM had air quality levels that were on average more than two times the hazardous air quality level. The next three sites air quality also exceeded the hazardous air quality level. **(See Figure 4)** (Two additional sites were monitored in Eau Claire on March 6; see pages 7 and 19 for additional information.)

Seven eating and drinking establishments’ air quality was surveyed from 5-10 PM on February 22, 2008 in La Crosse. The first three establishments visited were restaurants that served alcohol. Two of the three had many children patrons. The air quality in one restaurant was, on average, below the hazardous-level, though at peak periods it did reach 120 micrograms/cubic yard, which is “very unhealthy”. Other restaurants had air pollutants that at

times exceeded the hazardous-level. The four bars surveyed all had highly hazardous levels of fine particulate matter. The establishment that recorded the worst air quality (monitored at 8-8:30 PM), at 870 micrograms/ cubic meter, also had many individuals dancing. In light of the federal and state requirements to alert the public to refrain from physical activity when air pollutant levels are at or above 34 micrograms/ cubic meter, dancing in this environment can have serious adverse health effects. **(See Figure 5)**

The first establishment monitored at 8 AM on February 23 in La Crosse County was a restaurant exempt from the local ordinance because seating is below 50. The air quality levels on average exceeded the level considered to be at hazardous-level under state standards. **(See Figure 6)**

Two establishments monitored between 9- 10 AM, had wide variations in air quality. The first had air that was above hazardous, briefly declined and then increased as the air monitor circulated through the restaurant. The third establishment was a bar that served breakfast and had high pollution levels. Each of these establishments had about 15 patrons. During the time of their monitoring a relatively small number of cigarettes (1-3) were smoked but resulted in very high levels of pollutants. **(Also Figure 6)**

On February 23rd, two restaurants were visited from 5:30- 7:30 PM that had relatively good air quality levels. One of the restaurants was smoke-free by ordinance. The other restaurant was visited early in the evening and no one had yet smoked. A restaurant and bar monitored around 8 PM had 400 micrograms per cubic meter, a level almost twice the hazardous standard. Monitors noted that a number of children were in the bar throughout their visit. A bar visited next had lower, but still very unhealthy levels of air quality. At 9:30 P.M. one bar was monitored that had particulate levels four times the standard for hazardous pollution. Patrons at the bar included one individual on oxygen. It also had a dance floor. The air quality in all of the bars was hazardous and far exceeded the EPA and the DNR standards. **(See Figure 7)**

Two establishments were monitored on February 29 in Clark County. The first location, monitored between 8:30- 9 PM, had air pollution levels at approximately 100 micrograms/cubic meter, rated as “unhealthy” and substantially higher than the standard for good air quality. The second bar, monitored between 9-9:30 PM had average air quality of 562 micrograms/cubic meter, more than twice the hazardous level. **(See Figure 8)**

Three drinking establishments were monitored on February 29 in Chippewa County. The pollution level in the first tavern, monitored between 10-10:30 PM, was at peak, over 400 micrograms and twice the hazardous-level. The second establishment, monitored at 11 PM, had a pollution level of over 580 micrograms and almost three times the hazardous-level. Monitors noted that only two persons in the bar smoked cigarettes during their half-hour visit. The third establishment's air quality level exceeded 1440 micrograms/cubic meter, more than six times greater than the hazardous-level. Air monitoring occurred between 11:30-12 AM. Monitors noted that many people were dancing. While this is otherwise unremarkable, health officials warn individuals to refrain from physical activity when air pollution levels exceed 34 micrograms. **(See Figure 9)**

Seven establishments were monitored on March 1 in Polk County between 6 PM and 11:30 PM. These establishments included a smoke-free bar/restaurant over the state border in Minnesota and a smoke-free bar/restaurant in Polk Co. In both cases, the air quality was good. All other establishments, which included two bar/restaurants and three bars, had air pollution that at peak was at hazardous-level. One test site had an estimated 200 people exposed to high levels of secondhand smoke. The air pollution level in one bar level was on average, over 1000 micrograms during the test period, or five times the hazardous level. **(See Figure 10)**

On March 6, two bars were monitored in the City of Eau Claire between 9 – 10 PM. The first bar's average air pollution level was above the hazardous level. The second establishment had air pollution levels at three times the hazardous level. **(See Figure 11)**

Five establishments were monitored on March 7 in Pierce County. The first establishment monitored between 6:45- 7:15 PM was a restaurant. Though the restaurant had pollution levels below the hazardous-level, the particulate matter peaked at 80 micrograms, which is a level that is characterized as unhealthy. The next establishment, visited between 7:30- 8 PM had air pollution levels ranging from 500 to over 800 micrograms, far exceeding hazardous-level. The other three bars in Pierce County, monitored between 8:30- 11 PM, all had very high levels of pollutants averaging around 275 micrograms. **(See Figure 12)**

Four establishments were monitored on March 8 in Burnett County from 7:30- 10 PM. Three of the four sites had air pollution at or near the hazardous-level; all were well over "unhealthy". Air monitors noted that the initial site visited at 7:30 PM had many children in the

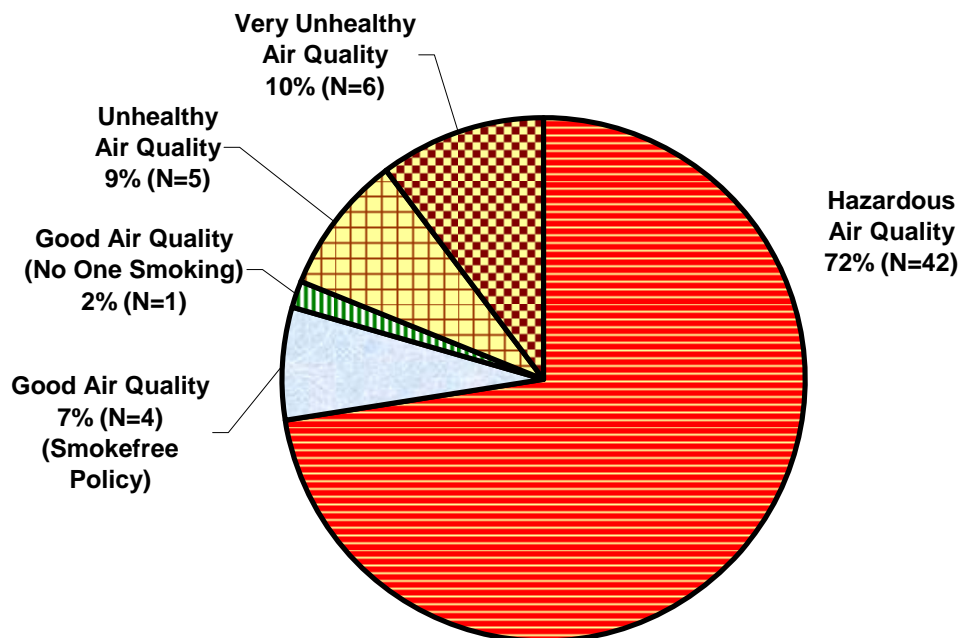
restaurant-bar. Peak air pollution levels at the last site visited between 9:30-10 PM exceeded 400 micrograms per cubic meter, a level twice the hazardous standard. (See **Figure 13**)

Seven establishments, including a smokefree restaurant, were monitored on March 14 in Rusk County. During the time of the monitors' visit between 5- 5:30 PM, no cigarettes were smoked in the first establishment; nonetheless, the air quality in the restaurant was "unhealthy" by DNR standards. The second site was a smoke-free establishment and had a very low level of pollutants, only 3-5 micrograms. The fourth establishment had many children at the bar during the period monitored, 7- 7:30 PM. The air pollution level exceeded the standard for hazardous-air quality. All of the remaining bars monitored between 7:30- 9:30 PM had air pollution levels that far exceeded the hazardous-level, ranging from 320 to 580 micrograms/cubic meter. (See **Figure 14**)

(Note: Data for Eau Claire County that was released in a report on March 20, 2008, conformed to the EPA standard effective at that time. Eau Claire County data presented in this regional report was changed to reflect revisions to the EPA standards effective April 1, 2008.)

Overall, air monitoring results indicated that the air quality in the great majority of the 58 establishments was hazardous. As indicated in Figure 1 below, approximately three-fourths of the restaurants or bars had air quality at hazardous levels.

Figure 1: Summary of Air Quality Findings



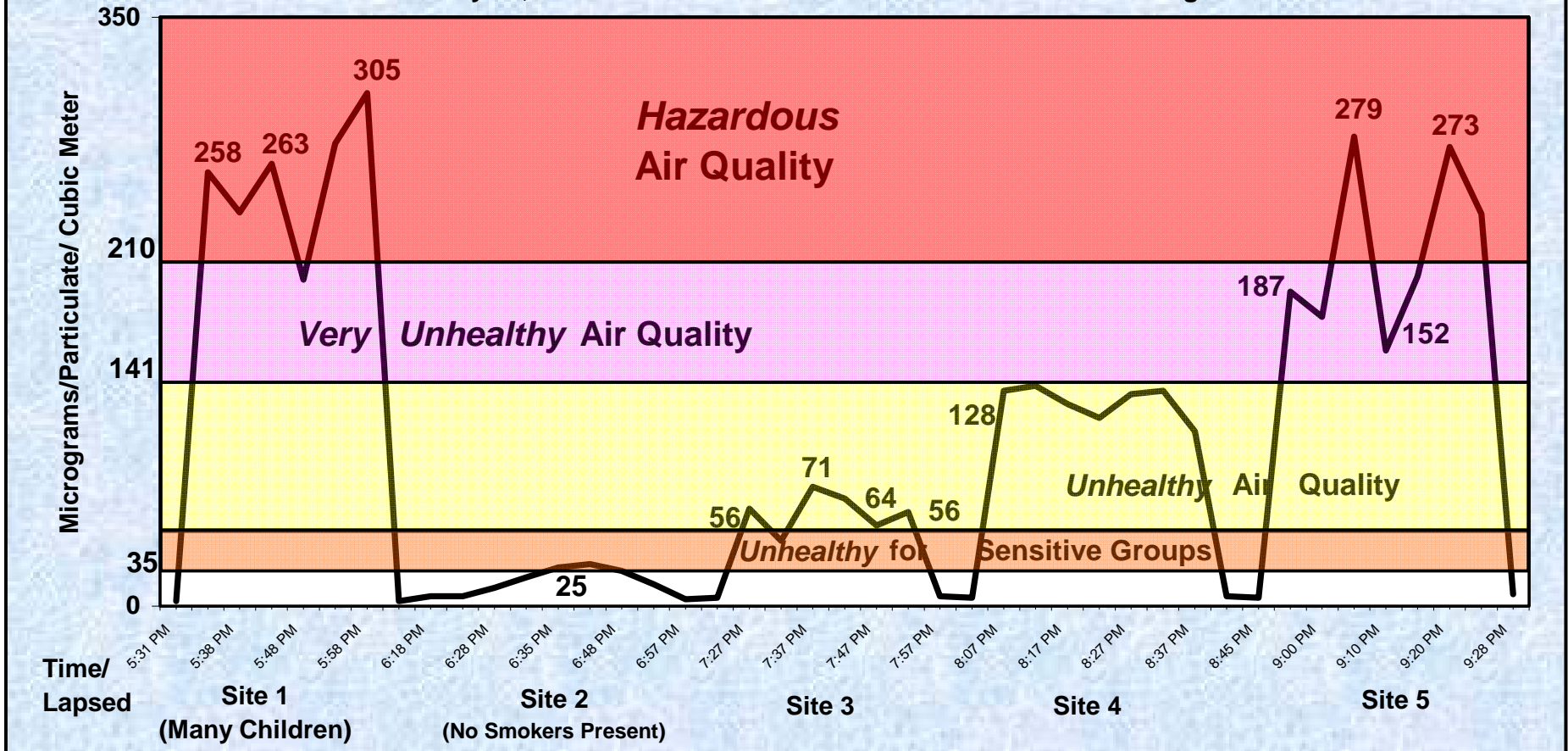
**2008 Western Wisconsin Indoor Air Quality Study:
Results of 58 (N=58) Restaurants/Taverns Sampled**

Figure 2: Ambient Air Quality Standard (DNR)

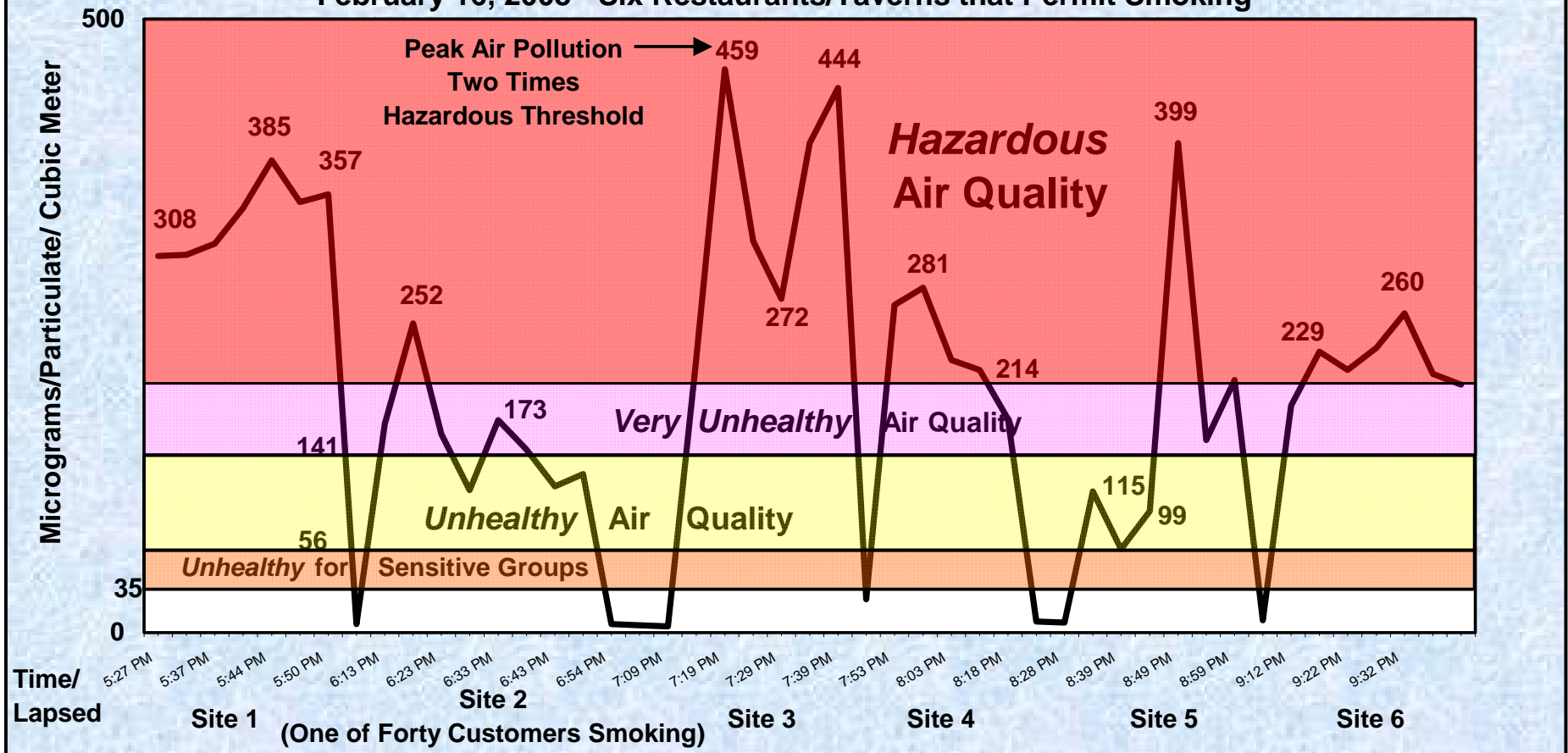
Index Values	Levels of Health Concern	Cautionary Statements
0-50 (15 micrograms or below)	Good	None
51-100* (16- 34 micrograms or less)	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101-150 (35-55 micrograms)	Unhealthy for Sensitive Groups	People with heart 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 40 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).

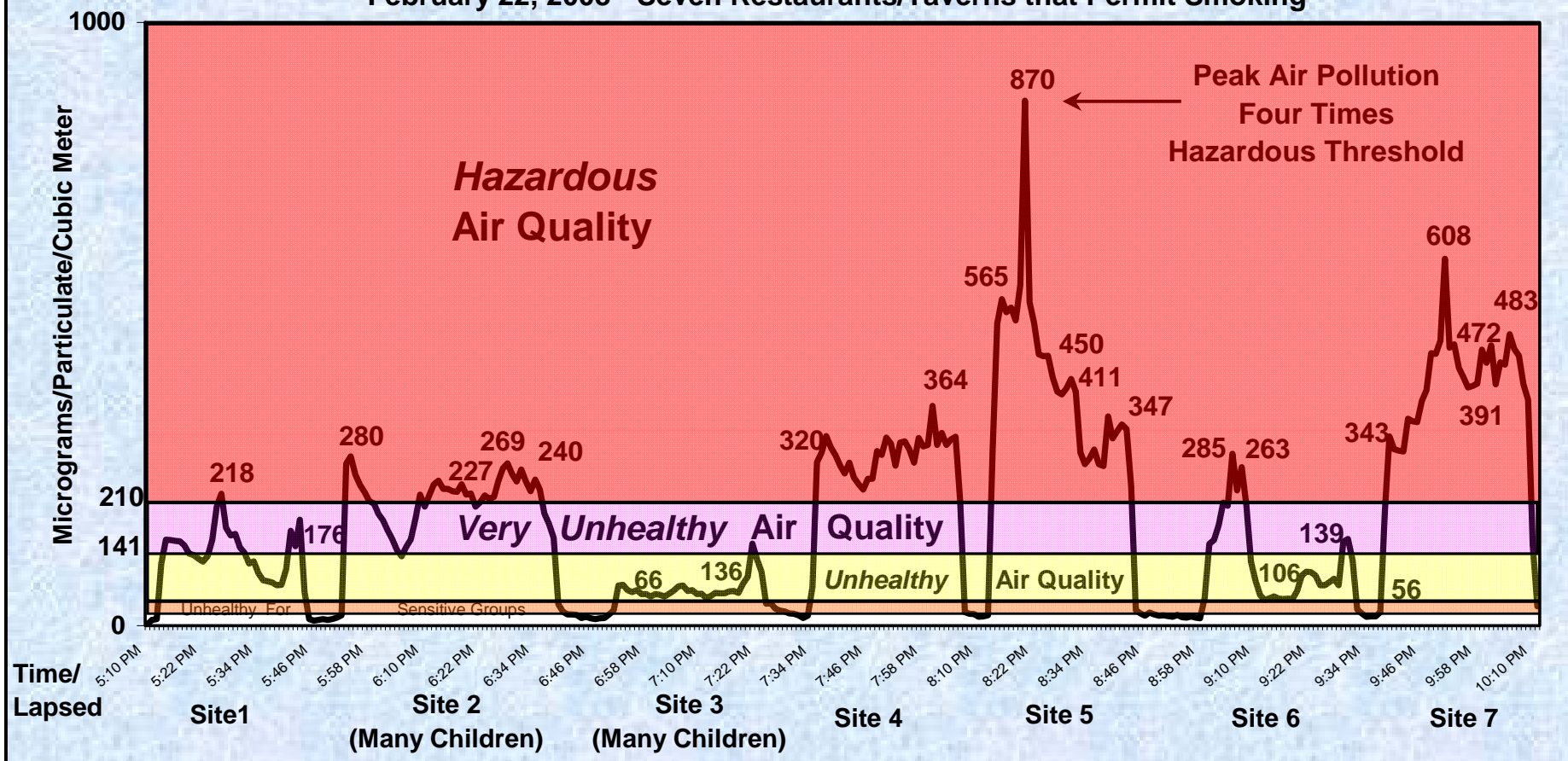
**Figure 3. Rural Eau Claire Indoor Air Quality Sampling:
February 15, 2008 - Five Restaurants/Taverns that Permit Smoking**



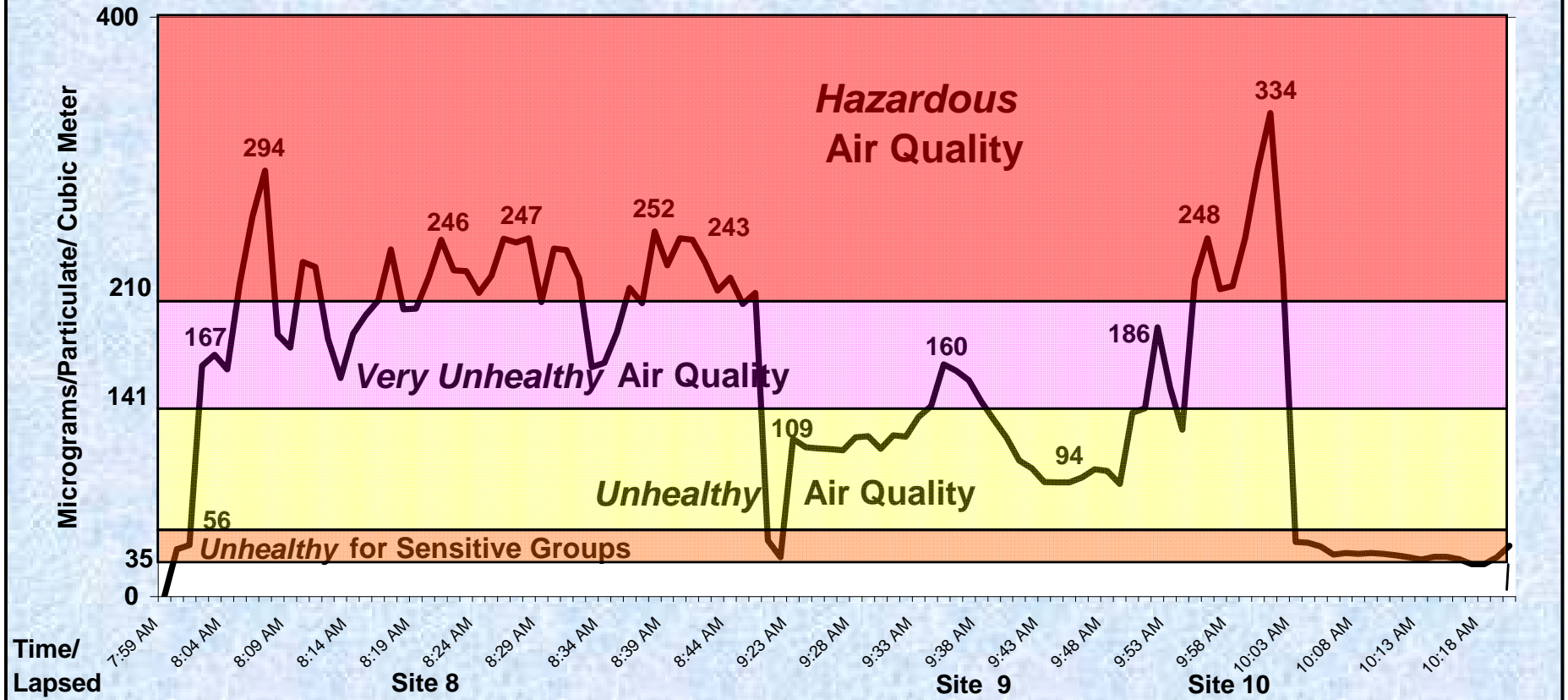
**Figure 4. Vicinity of City of Eau Claire, Indoor Air Quality Sampling:
February 16, 2008 - Six Restaurants/Taverns that Permit Smoking**



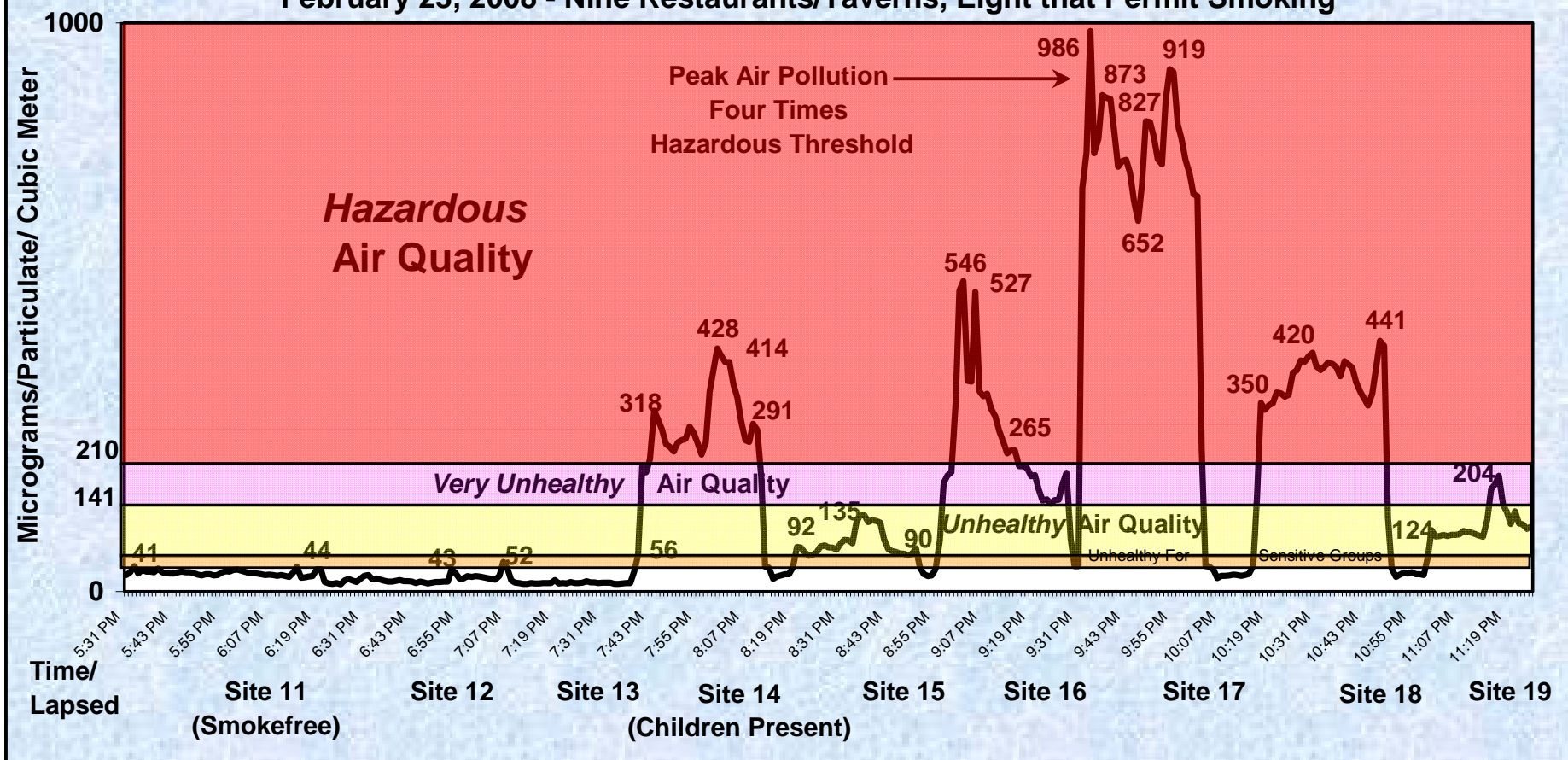
**Figure 5. La Crosse Indoor Air Quality Sampling:
February 22, 2008 - Seven Restaurants/Taverns that Permit Smoking**



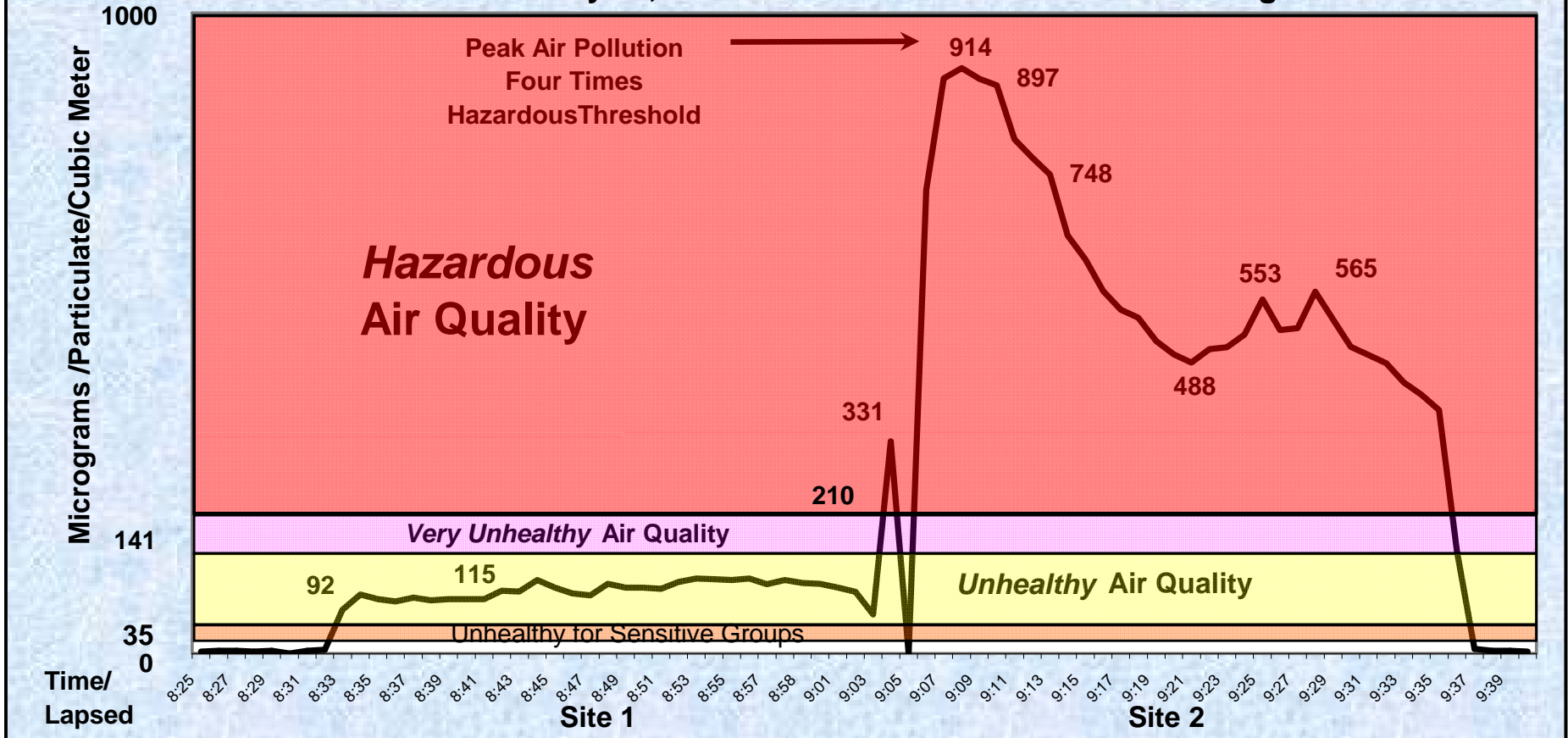
**Figure 6. La Crosse Indoor Air Quality Sampling:
February 23, 2008 - Three Restaurants/Taverns that Permit Smoking**



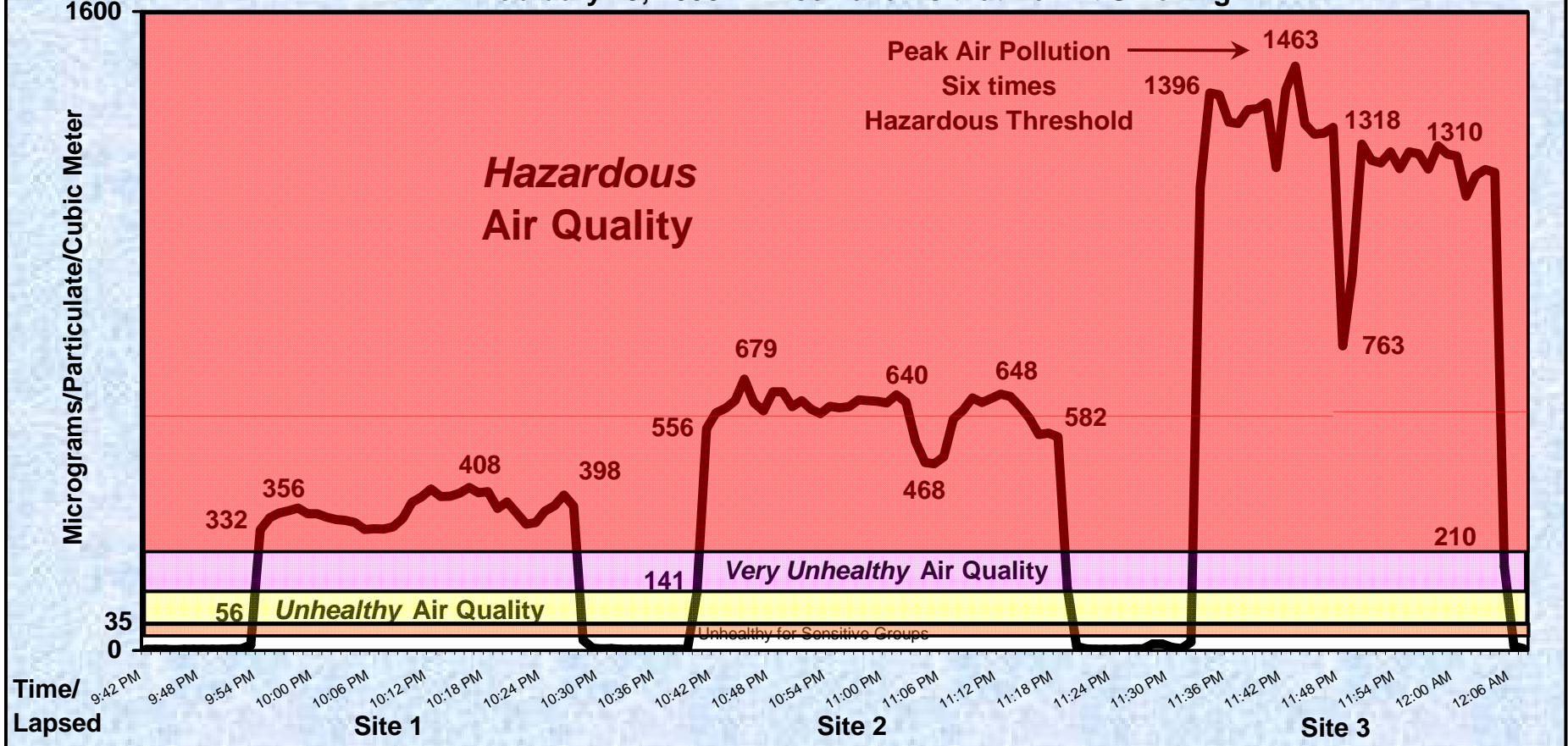
**Figure 7. La Crosse County Indoor Air Quality Sampling:
February 23, 2008 - Nine Restaurants/Taverns, Eight that Permit Smoking**



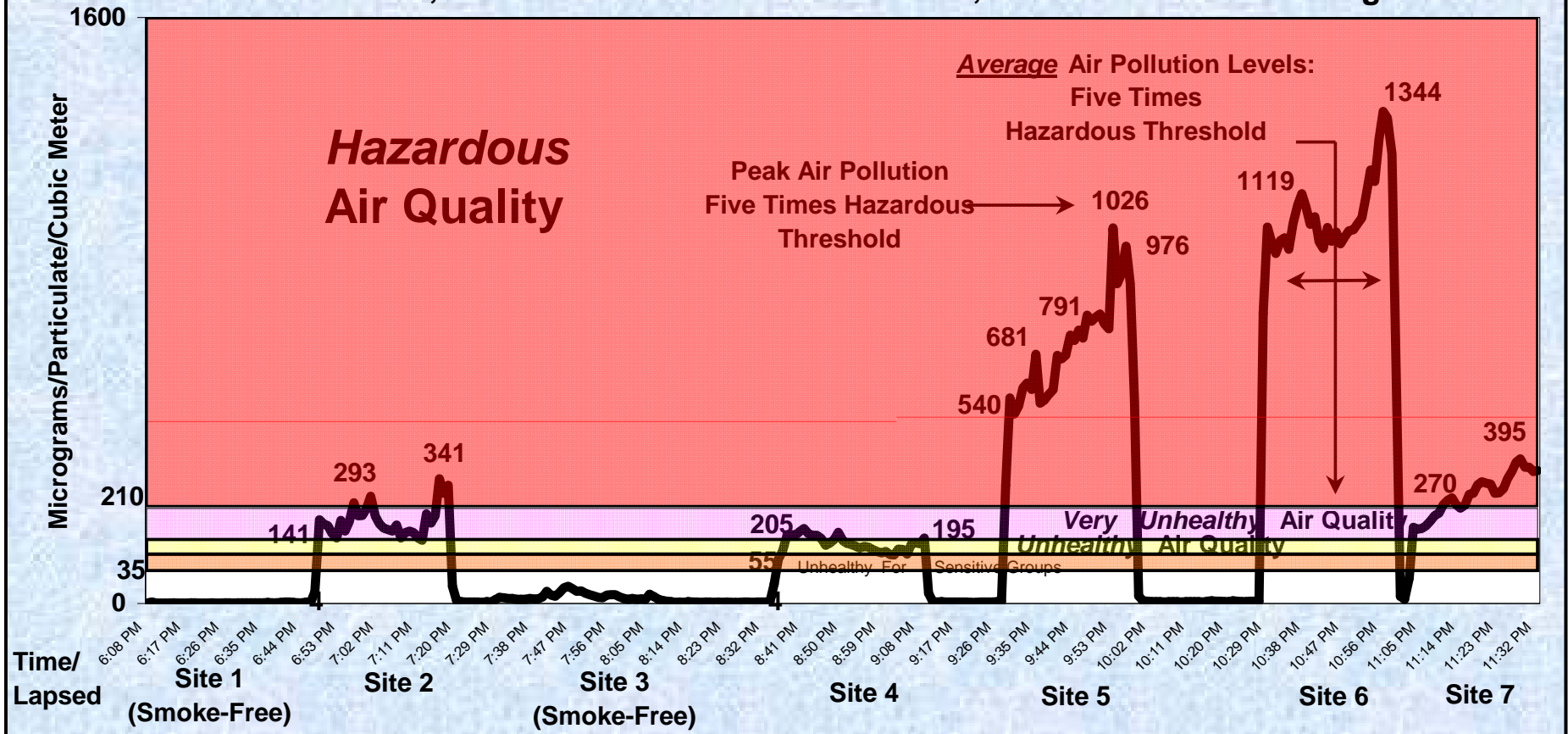
**Figure 8. Clark County Indoor Air Quality Sampling:
February 28, 2008 - Two Taverns that Permit Smoking**



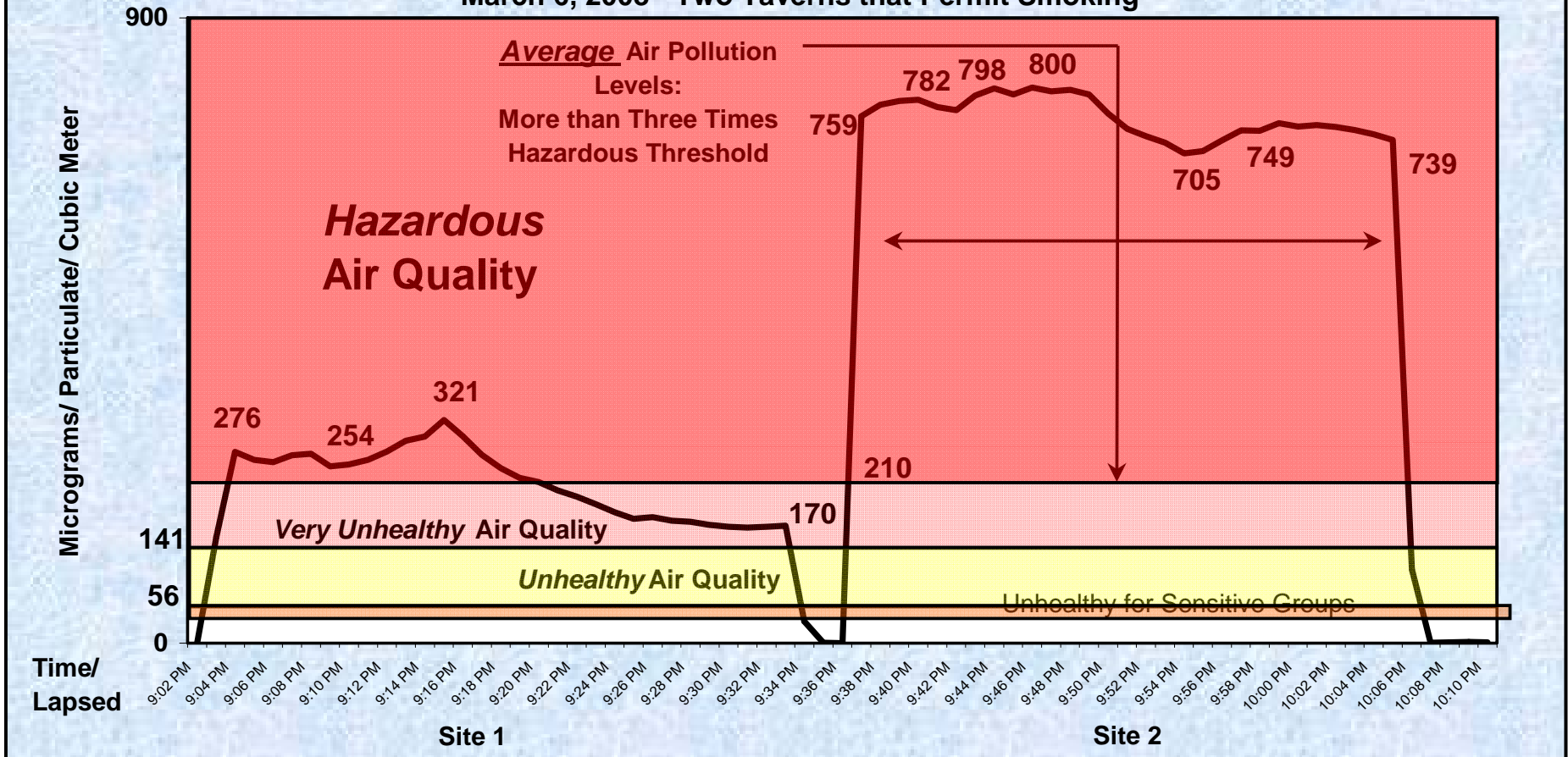
**Figure 9. Chippewa County Indoor Air Quality Sampling:
February 29, 2008 - Three Taverns that Permit Smoking**



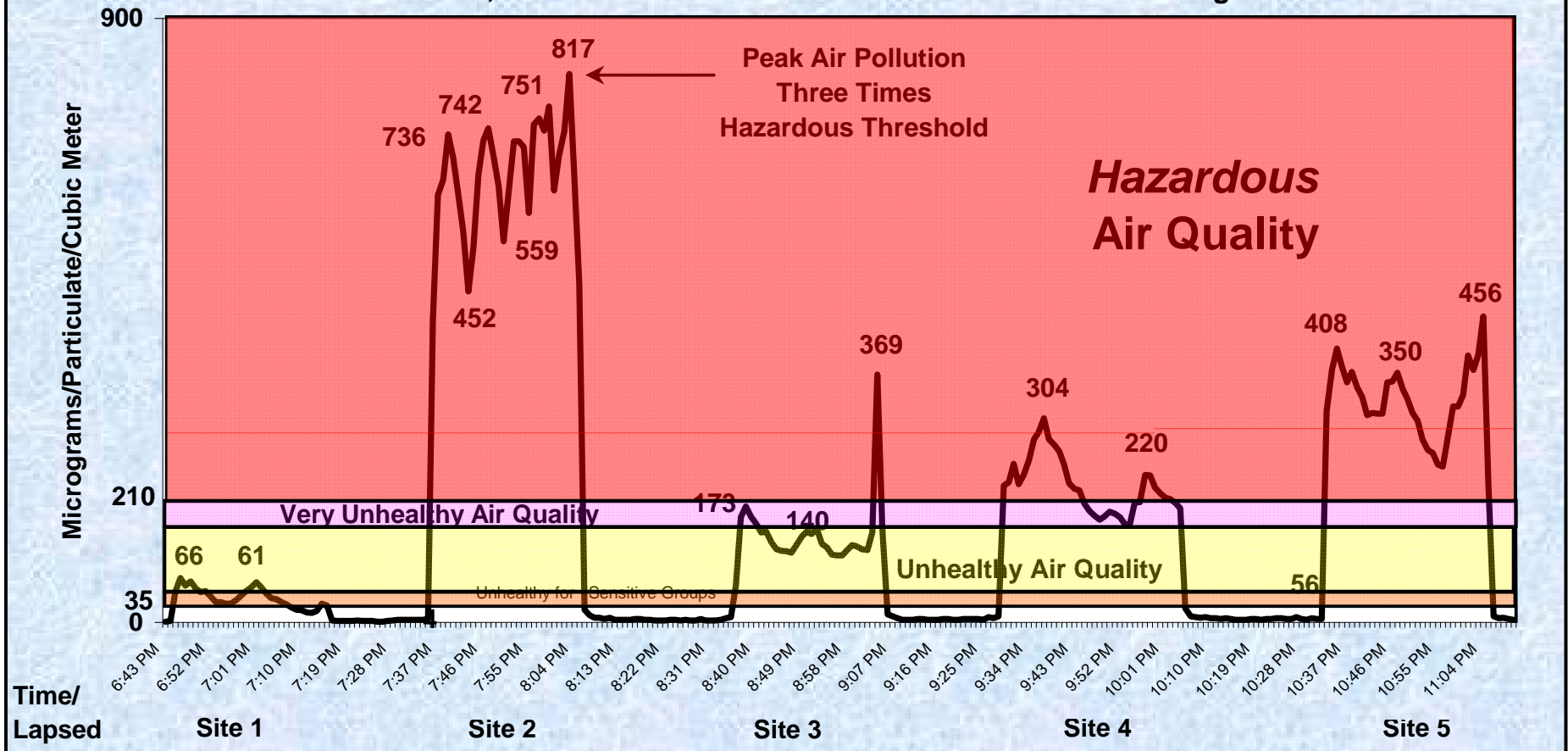
**Figure 10. Polk County Indoor Air Quality Sampling:
March 1, 2008 - Seven Restaurants/Taverns, Five that Permit Smoking**



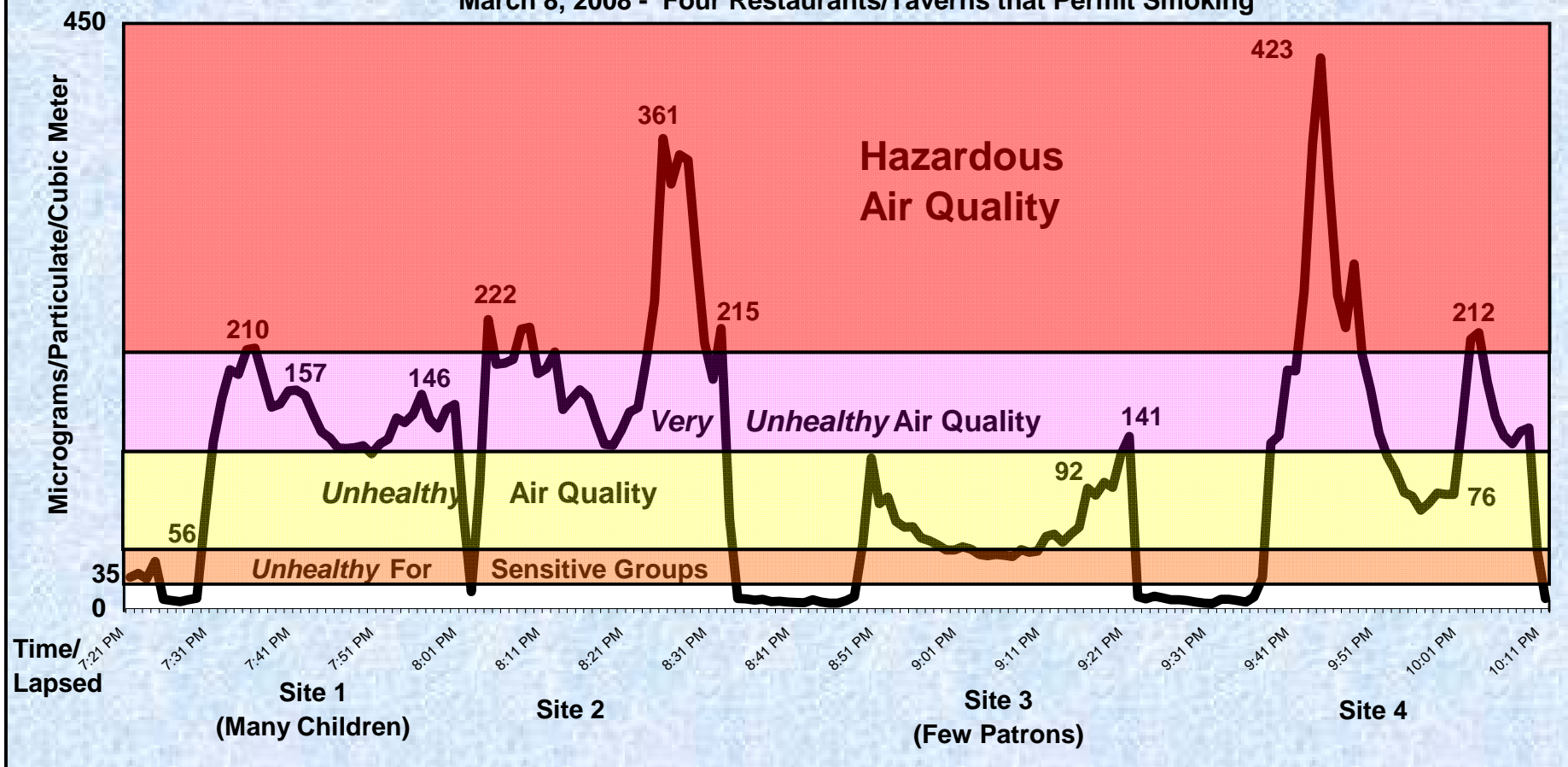
**Figure 11. City of Eau Claire Air Quality Sampling:
March 6, 2008 - Two Taverns that Permit Smoking**



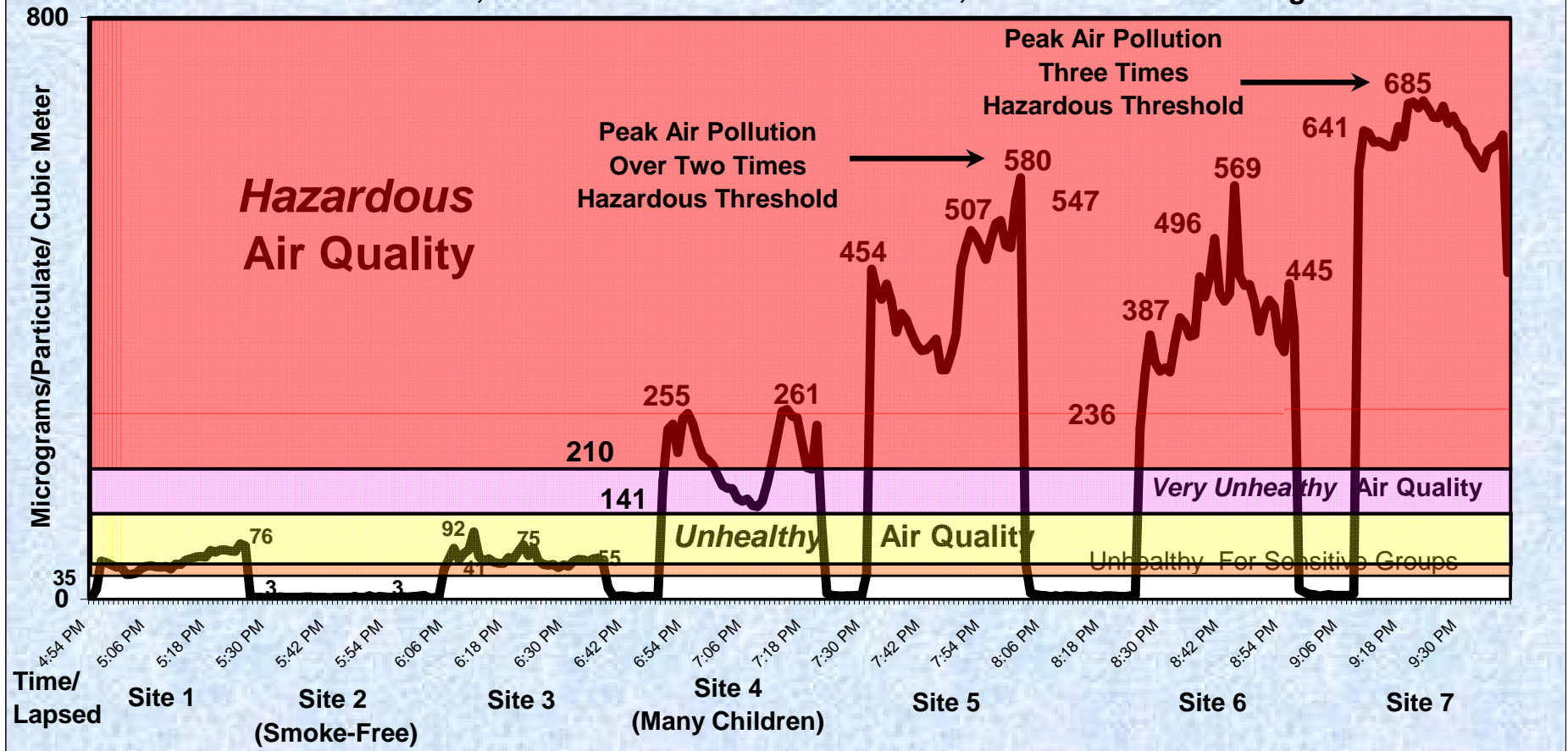
**Figure 12. Pierce County Indoor Air Quality Sampling
March 7, 2008 - Five Restaurants/Taverns that Permit Smoking**



**Figure 13 . Burnett County Indoor Air Quality Sampling:
March 8, 2008 - Four Restaurants/Taverns that Permit Smoking**



**Figure 14. Rusk County Indoor Air Quality Sampling:
March 14, 2008 - Seven Restaurants/Taverns, Six that Permit Smoking**



Discussion

On a number of occasions over the past year, residents of Eau Claire and La Crosse and to a lesser extent, residents of rural western Wisconsin, were alerted that the outdoor air was potentially unsafe to children, elderly and for individuals with chronic health conditions. During these periods, the DNR found that the air quality was at an “unhealthy-level” because there was, on average, 35 to 55 micrograms of fine particulate matter (of less than 2.5 micrograms) in each cubic meter of air. They warned individuals with a compromising illness to stay indoors and cautioned against strenuous physical activity.

The data collected in these western Wisconsin eating and drinking establishments indicates that with a few exceptions of the 58 sites, each had air quality that was many times healthier than the worst air quality outdoors that prompted a DNR alert and was indeed, hazardous to health.

The data in this report indicate that patrons and employees of taverns and restaurants of the largely rural counties of Wisconsin are typically exposed to levels of secondhand smoke that are at, or many times greater than, the EPA and the DNR’s recognized hazardous-level. This exposure presents immediate and long-term health risks for patrons and employees.

The DNR warning on hazardous air states that people with heart and lung problems, older people and children should avoid exposure to hazardous air. Further, it states that all persons should avoid physical activity when exposed. **(See Figure 2)**

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. 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 due to high levels of smoke.

Third, young children cannot control their exposure to secondhand smoke. The effects of the smoke on children are different than on adults and also more immediate and acute. Asthma and allergic attacks as well as ear and respiratory infections are common results of exposure, even for relatively brief periods of time.⁵ Those collecting data reported instances where children were present at the establishments with hazardous levels of fine particulate matter which comprises secondhand smoke.

Fourth, individuals have no ability to assess the level of fine particulate matter in any particular establishment. Except for the presence of odor and visible smoke a customer is unable to determine the risk to their health. Any establishment that permits smoking has secondhand smoke residuals that present a human health hazard.

There are more particles in the smoke coming off the end of a burning cigarette than inhaled smoke because there is incomplete combustion at this lower temperature. The public is unaware that secondhand smoke is much more toxic than smoke inhaled directly from a cigarette. They do not know that when smoke is aged (smoke more than 30 minutes old) it is 3-4 times more toxic than fresh smoke. The data from this study indicates that in a number of cases a small number of smokers create enough fine particulate matter to make air hazardous (210 ug/m³ or greater) in an entire establishment. Unfortunately, neither the EPA nor OSHA provides warnings against this significant hazard to the health of patrons and employees living and working in areas where smoking indoors in public establishments is allowed.

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 at 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.

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. For many establishments a longer study, especially over 24 hours would not be relevant to their health and safety concerns. 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 and the number of cigarettes smoked. While ventilation systems and seasonal changes may explain some differences between establishments, only smoke-free establishments had healthy air. 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.

As noted previously, subsequent to the testing in the western region, the DNR standard for ambient air levels was lowered at certain levels (Moderate, Unhealthy for Specified Groups, etc.) and increased for Healthy and Hazardous Levels. Similar revisions have been proposed for the EPA levels.

While these modifications are significant for outdoor air measurements where air pollution levels are rarely above 34 micrograms, the pollution levels measured in this survey were almost in all cases well above the highest levels ever measured outdoors.

Conclusion

It is well documented that secondhand smoke causes cancer, heart disease and a host of other illnesses. The data presented in this report found the majority of customers and hospitality workers in eating and drinking establishments in western Wisconsin were typically exposed to hazardous levels of fine particulate matter from secondhand smoke.

Ventilation and air circulation systems cannot make the air in 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 along 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.”⁶

Also, many individuals are unaware of their health status and how exposure to secondhand smoke can negatively influence their health. Previous studies have indicated even short-term exposure of 20 minutes can cause sudden life threatening cardiac events. This study confirms the presence of health hazards due to secondhand smoke in eating and drinking establishments in western Wisconsin communities. Legislation prohibiting smoking in these establishments would remove an unnecessary health risk to the public and employees of the hospitality industry.

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⁶ *The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General* : U.S. Dept of HHS, Centers of Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Washington DC, 2006