
Tobacco Smoke Pollution in Oklahoma Workplaces

Preliminary Report

February 2010

The study

Smoking has been allowed inside a number of public places and indoor workplaces in Oklahoma since 2003 under the Smoking in Public Places and Indoor Workplaces Act adopted that year. This study, funded by the Oklahoma Tobacco Research Center at the University of Oklahoma, looks at the levels of smoke inside some of the types of spaces where tobacco smoke pollution is most likely to be encountered by the public and by workers, comparing those levels to an established health standard.

Smoke levels are measured by monitoring the concentrations of very fine suspended particulate matter, smaller than 2.5 microns (PM_{2.5}), measured in micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$).

The predominant source of this particulate matter in the settings studied is tobacco smoke.¹

The data

PM_{2.5} was measured using TSI Sidepak equipment at indoor workplaces in central Oklahoma, including 16 restaurants with smoking rooms, 43 bars that allowed smoking, and 8 entirely smokefree restaurants. Each location was monitored for a minimum of 30 minutes. Monitors recorded the time-weighted average (TWA) of PM_{2.5} in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for each location, summarized in Table 1.

Table 1.

Time-weighted average levels of very fine suspended particulate matter in micrograms per cubic meter

Type of Workplace	Average PM _{2.5}
Restaurants – all smokefree	25.56
Restaurants with smoking rooms – nonsmoking areas	72.7
Restaurants with smoking rooms – smoking rooms	379.8
Smoking bars	654.9

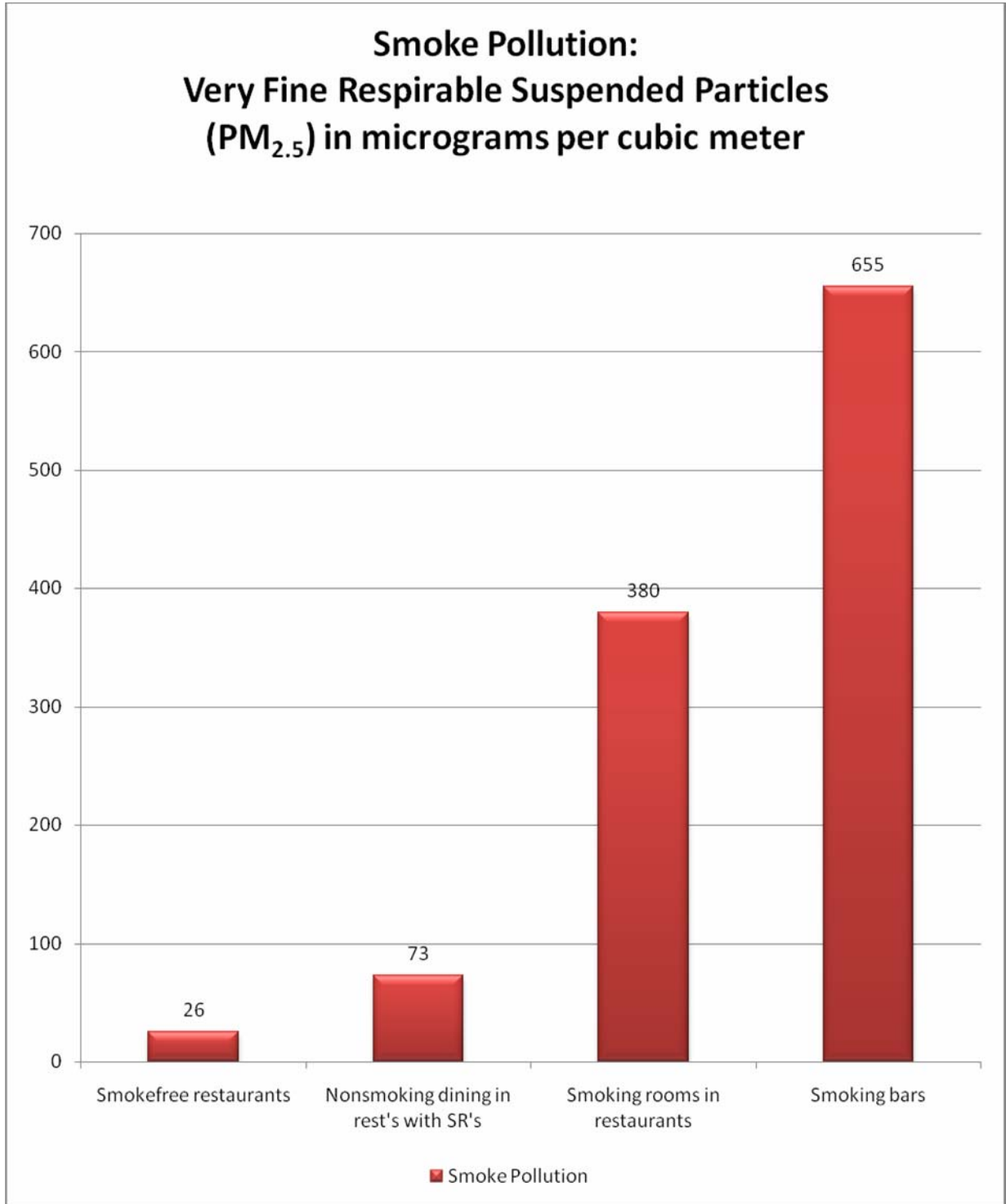
Variations in different types of workplaces

Highest average concentrations were found in smoking bars, with smoking rooms in restaurants at about two-thirds those levels on average. The exhaust required by statute for smoking rooms is intended to help speed clearance of smoke as well as to provide negative air pressure to help prevent smoke from escaping to nonsmoking spaces, but concentrations of smokers in the confines of these smoking rooms produced very unhealthy levels of toxic smoke (see discussion on page 5).

Chart 1 displays the average levels found in the indoor spaces measured in this research, which ranged from 26 μm^3 in entirely smokefree restaurants to 655 μm^3 in smoking bars.

Nonsmoking dining areas in restaurants with smoking rooms had three times as much PM_{2.5} as restaurants that were entirely smokefree. Smoking rooms in restaurants had much higher levels, in fact, averaging more than five times higher than nonsmoking dining areas.

Chart 1.



Significance of these levels of tobacco smoke pollution

Secondhand tobacco smoke contains more than 4,000 chemicals, including more than 50 carcinogens and approximately 200 other substances toxic to humans. In addition, since 2000, secondhand smoke itself has been officially classified by the National Toxicology Program as a known human carcinogen for which there is no safe level of exposure.²

In addition to the carcinogenic effects, secondhand smoke exposure causes cardiovascular and respiratory problems and can also have adverse effects on other aspects of human health. Of the 50,000 or more deaths in the United States each year attributed to secondhand smoke exposure, at least 46,000 are cardiovascular deaths.¹ Even brief exposures, such as patrons experience in restaurant smoking rooms or in bars in Oklahoma, produce measurable adverse cardiovascular effects^{3,4}, and workers in those environments may have much longer exposures.

In October 2009, the Institute of Medicine reported its objective review of the medical and scientific evidence on secondhand smoke, heart disease and heart deaths, confirming the previously reported adverse cardiovascular effects and pointing out that, based on experiences around the world, enacting entirely smokefree laws reduces the number of heart attacks.⁵ Studies in the United States have shown as much as a 40% reduction in heart attacks when smokefree laws have been implemented.⁶

Some harmful health effects of secondhand smoke exposure are caused by inhaling the very fine particulate matter. Other adverse effects result from the many toxic chemicals in the smoke, some in the form of particulates, some in gaseous form, some as semi-volatile organic compounds.⁷

The one scale in common use relating levels of exposure to very fine respirable suspended particles to health effects, is the Environmental Protection Agency's (EPA) air quality index, prepared in conjunction with the National Ambient Air Quality Standards (NAAQS, 40CFR part 50). It is sometimes included in weather reports, when particulates are anticipated as a pollutant. Though it does not consider the numerous carcinogens and other toxic substances that are found in tobacco smoke, it does provide an indication of adverse health effects just from breathing the very fine particulates. That scale is shown in Table 2 on page 6.

Table 2.

US EPA Air Quality Index		
Air Quality	PM_{2.5} (µg/m³)	Health Advisory
Good	≤15	None.
Moderate	16-40	Unusually sensitive people should consider reducing prolonged or heavy exertion.
Unhealthy for Sensitive Groups	41-65	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
Unhealthy	66-150	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
Very Unhealthy	151-250	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
Hazardous	≥251	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.

Conclusions

Smoking inside certain types of public places and workplaces, allowed under current state laws in Oklahoma, creates unhealthy to hazardous environments in those places.

- Restaurants that are entirely nonsmoking have moderate levels of PM_{2.5} material in the air.
- Nonsmoking dining areas of restaurants with smoking rooms have three times as much PM_{2.5} as entirely nonsmoking restaurants, averaging in the range considered “unhealthy” by the EPA based on particulate concentration.
- Smoking rooms in restaurants averaged 1.5 times the “hazardous” level established by the EPA for particulate concentrations.
- Bars averaged 2.6 times the “hazardous” level established by the EPA for particulate concentrations.

Based on the particulate levels alone (PM_{2.5}), the air inside smoking workplaces in Oklahoma is hazardous. Even air in neighboring spaces was found on average to be unhealthy, based on particulates. Adding in the class A human carcinogens---for which there is no safe level of exposure---and other toxic chemicals in tobacco smoke pollution harmful to the cardiovascular system and other aspects of health, these indoor public places and workplaces are very high risk environments.

Citations

1. U.S. Department of Health and Human Services. (2006). *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. USDHS. Atlanta, GA.
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4. Heiss C, Amabile N, Lee AC, Real WM, Schick SF, Lao D, Wong ML, Jahn S, Angeli FS, Minasi P, Springer ML, Hammond SK, Glantz SA, Grossman W, Balmes JR, Yeghiazarians Y. Brief secondhand smoke exposure depresses endothelial progenitor cells activity and endothelial function: sustained vascular injury and blunted nitric oxide production. *J Am Coll Cardiol*. 2008;51:1760 –1771.
5. IOM (Institute of Medicine). 2009. *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. Washington, DC: The National Academies Press
6. Lightwood JM, Glantz SA. Declines in acute myocardial infarction after smoke-free laws and individual risk attributable to secondhand smoke. *Circulation*. 2009;120(14):1373–9.
7. Air Resources Board, California Environmental Protection Agency. *Proposed identification of environmental tobacco smoke as a toxic air contaminant*. 2006.