BIG SMOKE
AIR QUALITY STUDY
2007
Marriott Marquis Hotel
New York City

A Scientific Air Quality Study to Measure Particulate Matter In the Marriott Marquis Hotel during *Cigar Aficionado* Magazine's "Big Smoke" Event

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BACKGROUND

Researchers from the University of Waterloo (Waterloo, Ontario, Canada) and Roswell Park Cancer Institute (Buffalo, NY) collaborated on a study to measure the impact of the "Big Smoke" event on air quality in the Marriott Marquis Hotel, in New York City. The Big Smoke event was sponsored by *Cigar Aficionado*, a popular lifestyle magazine created for cigar smokers or those interested in cigars/cigar culture.

Researchers attended Session 2 of the Big Smoke, which took place 7:30 pm to 10:00 pm on Tuesday November 20th, 2007. Session 1 took place 4:30 pm to 7:00 pm in the same room—the Manhattan Ballroom on the 6th floor of the Marriott Marquis Hotel in Times Square, New York City. The research team purchased a ticket for the event and were paid guests in the hotel.

Details of the Event from the *Cigar Aficionado*'s Website:

The Big Apple *welcomed more than 3,000 cigar devotees … for the sold-out Cigar Aficionado Big Smoke New York City held in the heart of Times Square at the Marriott Marquis hotel. The now not-so-smoke-friendly City that Never Sleeps returned to its plentiful puffing days of yore for one night before the long Thanksgiving weekend.*

A crowd of aficionados from around the country descended on Manhattan as they have since 1993, and took over the hotel ballroom for a pair of two and a half hour sessions, filling the cavernous place to the ceiling with smoke. Music boomed and dancers gyrated to the beat, silhouetted behind neon screens, as guests treated themselves to some of the best in cigars, booze, cuisine, accessories, transportation and entertainment.

TOBACCO SMOKE POLLUTION

Tobacco smoke pollution (TSP; also known as secondhand smoke and environmental tobacco smoke) constitutes a major global public health concern.[1] TSP is a known human carcinogen containing at least 250 chemicals that are known to be toxic or carcinogenic[2], and is responsible for an estimated 3,000 lung cancer deaths annually in never smokers in the U.S., as well as over 35,000 deaths annually from coronary heart disease in never smokers, plus respiratory infections, asthma, Sudden Infant Death Syndrome (SIDS), and other illnesses in children.[3] TSP is a major source of respirable suspended particles (RSPs). A specific category of RSPs, known as $PM_{2.5}$ (i.e. particulate matter less than 2.5 microns in diameter), are very small particles suspended in the air that are easily inhaled deep into the lungs, with potential to cause adverse health effects. In order to protect the public health, the US Environmental Protection Agency (EPA) has set limits of 15 $\mu g/m^3$ as the average annual level of $PM_{2.5}$ exposure and 35 $\mu g/m^3$ 24-hour exposure.[4, 5]

METHODS

An air quality researcher used a TSI SidePak AM510 Personal Aerosol Monitor (TSI, Inc., St. Paul, MN) to sample and record the levels of respirable suspended particles, or $PM_{2.5}$, in the air in various areas of the hotel before, during and after the event. These areas are described in Table 1. The hotel areas included: (a) outside the ballroom doors of the 6th floor, (b) further from the ballroom doors (near the elevators) of the 6th floor, (c) the hotel check-in area on the 8th floor, (d) the guest room hallway areas on the 10th, 11th, and 15th floors, (e) the 1st floor lobby area, (f) a non-smoking dining area on the 6th floor, and (g) outside the hotel, as well as (h) the 6th floor ballroom where the Big Smoke was being held.

Table 1. Sampling Areas

SAMPLING AREA	DESCRIPTION
6th Floor Near the Ballroom Doors	Sampling was conducted about 15 feet from the doors into the ballroom area, where the Big Smoke was being held.
6th Floor Near Elevators	On the same floor as the ballroom – sampling was conducted near the elevators—about 50 feet from the ballroom doors.
Guest Room Hallway Areas	Guest Rooms were on floors 10 and up – Sampling was conducted in the hallways close to the open well in the center of the hotel where it was possible to see down to the 6th floor where the Big Smoke was being held. Sampling was conducted in the hallways of guest room areas on the10th, 11th, and 15th floors.
8th Floor Check-in Area (Hotel Registration)	Guests checked in on the 8th floor – also near the open area mezzanine.
1st floor	Sampling was conducted inside the hotel at street level where there are several entrances, a coffee shop, and express check-in counters. Smokers went outside so sometimes there was the smell of smoke on the 1st floor. The area outside also had numerous idling vehicles (taxis would regularly line up to transport guests).
Outside the Hotel	Readings taken outside on the sidewalk area off the grounds of the Marriott.
Ballroom	The 6th floor ballroom was the location of the Big Smoke. This was a very large ballroom with two sets of doors (north and south). Sampling during the event was randomized inside. Researchers walked around inside the areas in order to obtain measurements that were generally representative of the experiences of an attendee across the breadth of the event. This included visiting booths and walking around to collect cigars.

SAMPLING AREA	DESCRIPTION
Non-Smoking Dining Area	A separate ballroom area beside the large ballroom where the Big Smoke was being held. Patrons had to leave the Big Smoke event, and walk approximately 20 feet to this area where food was served. No smoking was allowed in this area.

Air quality data collected by the SidePak Monitor were downloaded using Trakpro Software Version 3.6.2 (TSI Inc., St. Paul, MN). A calibration factor of 0.32, suitable for tobacco smoke [6-8], was applied to the data during analysis. The data were plotted over time, and are presented in figures below. Mean values were calculated to determine air quality levels monitored in each of the different sampling areas of the hotel.

RESULTS

The results from the air quality monitoring are reported in Table 2. Baseline readings, taken November 19th, 2007, were consistently at low levels of $PM_{2.5}$ and were similar in all areas of the hotel. During the event, however, the $PM_{2.5}$ levels inside the ballroom rose to an extremely high level. The mean $PM_{2.5}$ level was 2,043 $\mu g/m^3$ (micrograms per cubic meter) while levels immediately outside the ballroom were 42 $\mu g/m^3$. The area near the elevators on the 6th floor (a further distance from the event) had average readings of 25 $\mu g/m^3$. After the event, the $PM_{2.5}$ levels decreased to closer to observed baseline levels.

Table 2.
Mean $PM_{2.5}$ levels ($\mu g/m^3$) Measured in Different Areas of the Hotel Before, During, and After the 'Big Smoke' Event – November 19th and November 20th 2007.

	Inside Ballroom	Right Outside Ballroom	6th Floor Near elevators	Guest Room Hallways	Check-in Area (8th Floor)	1st floor Lobby Area	Outside
BEFORE EVENT	n/a	8	6	6	6	10	7
DURING EVENT	2043	42	25	17	18	n/a	n/a
AFTER EVENT	n/a	18	13	n/a	7	15	23

Figure 1 shows in a bar graph how $PM_{2.5}$ levels inside the event rose and then fell throughout the evening. Session 1 (Big Smoke event from 4:30pm-7:00pm) had just taken place when the research team entered the ballroom.

Figure 1. Average $PM_{2.5}$ Levels in Smoking Areas During Event

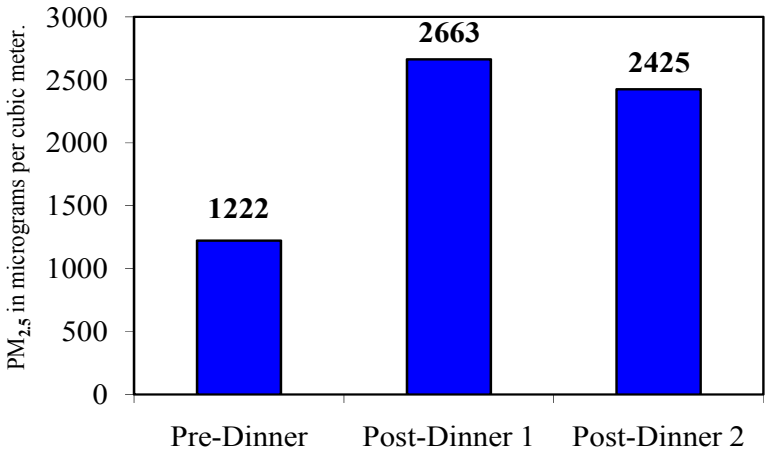
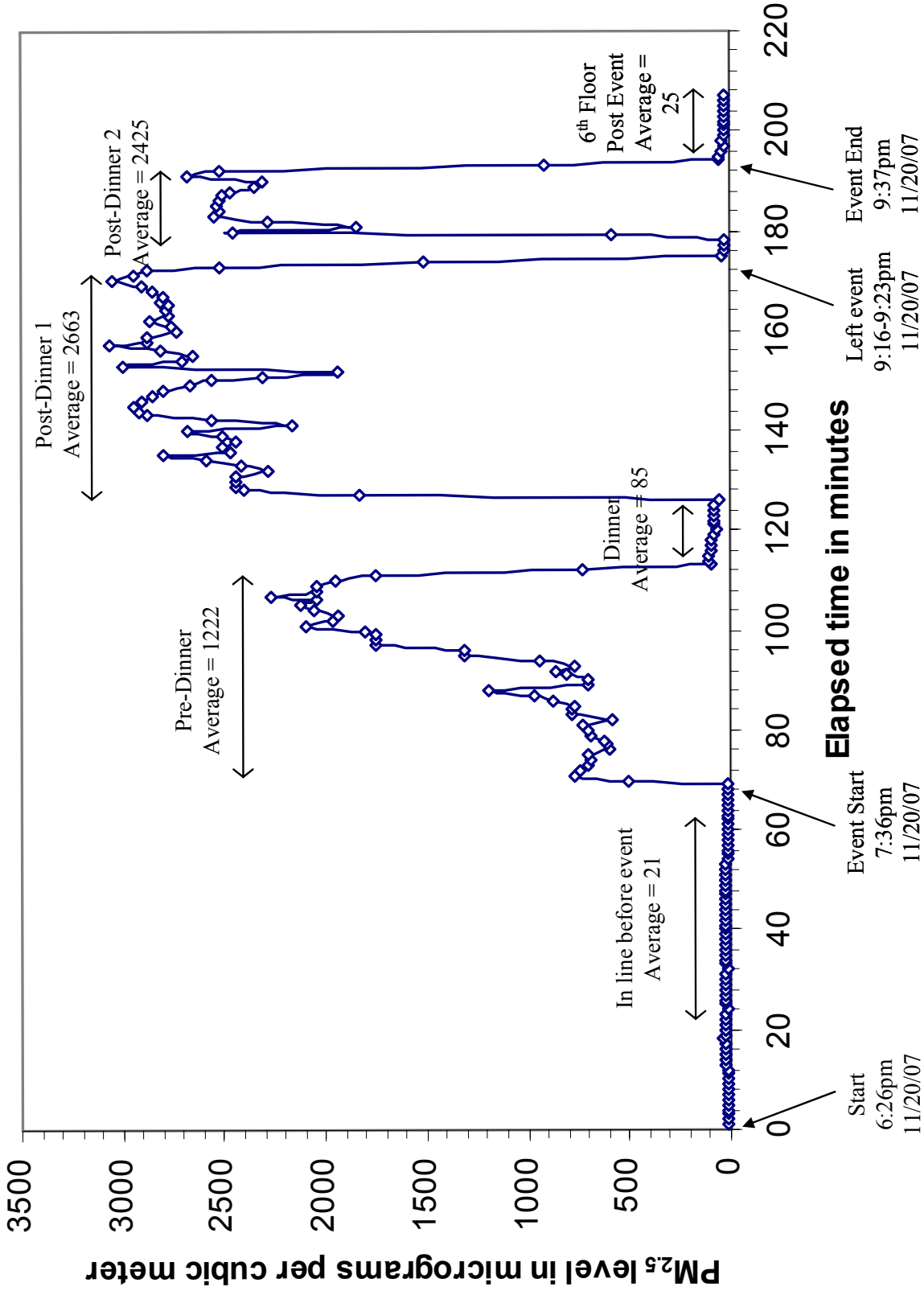


Figure 2 presents the minute-by-minute $PM_{2.5}$ levels for the entire evening. Upon entering the Ballroom, the initial $PM_{2.5}$ levels were in the 600 $\mu g/m^3$ range, but they quickly rose to greater than 1,000 $\mu g/m^3$. These very high initial readings, taken at the very beginning of the event, were likely the result of smoke remaining from Session 1. Levels rose quickly after the initial readings because the new Session 2 guests began collecting cigars and smoking them. The researcher left the ballroom area briefly at approximately 8:15pm to enter the dinner area – a non-smoking area in an adjacent room. Although smoking was not permitted in the eating area, the mean reading was 85 $\mu g/m^3$.

The researcher returned to the Big Smoke ballroom after dinner. This after-dinner time period yielded the highest average readings (2,663 $\mu g/m^3$). The average readings towards the end of the event stayed high but began to decrease as patrons slowed their smoking behaviour and started to leave.

FIGURE 2. Fine Particle Air Pollution: "Big Smoke", November 20, 2007



DISCUSSION

$PM_{2.5}$ levels recorded inside the Big Smoke Event were remarkably high, even relative to other indoor smoking studies. When readings from time spent in the event (so removing time out of the event for dinner and outside briefly), the average reading was 2,043 $\mu g/m^3$. The US EPA identifies $PM_{2.5}$ levels below 15 $\mu g/m^3$ as clean air. On the worst particle pollution day in Los Angeles California (the most polluted U.S. city[9]), between 2004-2006, the average $PM_{2.5}$ level was 74 $\mu g/m^3$ (maximum hourly reading was 250 $\mu g/m^3$).[10] $PM_{2.5}$ readings taken during forest fires average in the 200 $\mu g/m^3$ range. In the Global Study of Irish Pubs, the average $PM_{2.5}$ level in pubs with smoking from around the world was 340 $\mu g/m^3$ and the pub with the highest $PM_{2.5}$ level was 1,320 $\mu g/m^3$.[11]

A Marriott employee working at the Big Smoke event during the post-dinner period (average $PM_{2.5}$=2,663 $\mu g/m^3$) would be exposed to $PM_{2.5}$ in excess of the EPA 24-hour limit of 35 $\mu g/m^3$ in less than 19 minutes. It would take only 2 hours and 15 minutes for an employee to reach exposure levels that are "hazardous", the worst category of air pollution according to the EPA. This conservatively assumes no particle pollution exposure other than at this event. It should also be noted that tobacco smoke pollution contains substances that are considerably more toxic than substances within typical ambient air pollution. And thus our use of these EPA limits for air pollution to evaluate exposure to tobacco smoke pollution likely underestimates by a considerable margin the actual level of hazard.

Levels outside the ballroom area during the Big Smoke appear to be elevated from baseline; however, whatever drift occurred from the event was minimal in the other areas of the hotel. After the event, the levels in these locations away from the Big Smoke ballroom appear to have returned to the levels that had been recorded at baseline.

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