

## **FACT SHEET: Outdoor Air Pollution From Secondhand Smoke**

James L. Repace  
Visiting Assistant Professor, Tufts University School of Medicine  
and Repace Associates, Inc.  
101 Felicia Lane, Bowie, MD 20720 U.S.A.  
<[www.repace.com](http://www.repace.com)>

1. Tobacco smoke contains at least 172 toxic substances, including 3 regulated outdoor air pollutants, 33 Hazardous Air Pollutants, 47 Chemicals restricted as Hazardous Waste and 67 Known Human or Animal Carcinogens (Repace, 2006). This is true whether tobacco smoke is inhaled in the act of smoking, or inhaled by nonsmokers out of the air indoors or outdoors.
2. The concentration of tobacco smoke pollution of buildings [secondhand smoke (SHS)] is governed by the density of smokers and by the ventilation rate. Tobacco smoke pollution outdoors or outdoor tobacco smoke (OTS) is determined by the density of smokers, the wind velocity (direction and speed), and the stability of the atmosphere.
3. SHS concentrations persist for hours after smoking ceases indoors, while OTS concentrations dissipate rapidly after smoking stops outdoors. However, during smoking, OTS levels outdoors may be as high as SHS indoors.
4. A limited number of controlled experiments and field studies of OTS have been conducted in California, Europe, in the Caribbean, and in Maryland:
  - California (1). The California Air Resources Board study (CARB, 2006), measured OTS nicotine concentrations outside an airport, college, government center, office complex, and amusement park. CARB found that at these typical outdoor locations, Californians may be exposed to OTS levels as high as indoor SHS concentrations. CARB found that OTS was strongly affected by counts of the number of smokers and moderately affected by the size of the smoking area and the measured wind speed. The CARB study indicated that OTS concentrations are detectable and sometimes comparable to indoor concentrations, and demonstrates that the number of cigarettes being smoked (i.e., total source strength), the position of smokers relative to the receptor, and atmospheric conditions can lead to substantial variation in average exposures. CARB declared that OTS is a “toxic air contaminant.”
  - California (2). Klepeis, et al. (2007) measured OTS respirable particle concentrations in outdoor patios, on airport and city sidewalks, and in parks. They also conducted controlled experiments of SHS indoors and OTS outdoors. Klepeis et al. (2007) found that mean SHS particle concentrations outdoors can be comparable to SHS indoors. Within about 2 feet of a smoker OTS was quite high and comparable to SHS concentrations measured indoors. They found that levels measured in 2 sidewalk cafés were detectable at distances beyond 13 feet. They found that in contrast to SHS, OTS does not accumulate and that OTS peaks are more sensitive to source-receptor proximity and wind velocity. Thus, long-term averages for OTS concentrations are averaged over a large number of transient

peaks, which only occur when smokers are active, whereas indoor concentrations remain high long after cigarettes have ended, and the total dose to a person indoors from each cigarette will be greater than for a cigarette smoked outdoors. Klepeis et al. (2007) found upwind OTS concentrations very low and downwind OTS much higher.

- Denmark. Boffi et al. (2006) measured OTS respirable particle pollution in a car park (open space), outdoors in front of a conference center with smokers under a roof (18 smokers during a measurement time of 35 min), indoors in the nonsmoking conference center, along the motorway to Copenhagen city centre, and inside a Copenhagen restaurant where smoking was allowed. Boffi et al. (2006) found that mean values observed with smokers in front of the conference center were significantly higher than the outdoor parking place, indoor conference center, motorway and Copenhagen outdoor official data.
  - Finland. Repace and Rupprecht (13 WCTOH, 2006 ) measured OTS respirable particle pollution in Five outdoor cafes and on city streets in downtown Helsinki. They found that air pollution levels in Helsinki outdoor cafes with many smokers during August 2003 were 5 to 20 times higher than on the sidewalks of busy streets polluted by bus, truck, and auto traffic.
  - Maryland. Repace (2005) measured outdoor fine particle and carcinogen concentrations from OTS on the campus of the University of Maryland at Baltimore. Using controlled experiments, Repace (2005) found that cigarette smoke RSP concentrations decline approximately inversely with distance downwind from the point source, whereas cigarette smoke carcinogen concentrations decline approximately inversely as the square of the distance from source to receptor. The experiments showed that OTS smoke levels did not approach background levels either for fine particles or carcinogens until about 23 feet from the source.
  - Caribbean: Experiments conducted on a cruise ship underway at 20 knots at sea in the Caribbean showed that OTS in various smoking-permitted outdoor areas of the ship tripled the level of carcinogens to which nonsmokers were exposed relative to indoor and outdoor areas in which smoking did not occur, despite the strong breezes and unlimited dispersion volume. Moreover, outdoor smoking areas were contaminated with carcinogens to nearly the same extent as a popular casino on board in which smoking was permitted (Repace, 2005).
- 5. Conclusions:** Field studies plus controlled experiments demonstrate that, regardless of which way the wind blows, an individual in an outdoor cafe, transiting through a building doorway, or otherwise surrounded by a group of smokers, is always downwind from the source. They also show that under some conditions, outdoor levels of tobacco smoke (OTS) can be as high as indoor levels of secondhand smoke (SHS). Outdoor smoking bans are already common in Canada (Figure below).



NEWS

BUSINESS

SPORTS

ARTS & ENTERTAINMENT

WEATHER

HEALTH & SCIENCE

CBC ARCHIVES

KIDS

TEENS

PROGRAM GUIDE

E-MAIL NEWSLETTERS

SERVICES

CONTACT US

ABOUT CBC

RADIO-CANADA

shop

## Second-hand smoke campaigns target great outdoors

Last Updated Tue, 15 Nov 2005 18:04:14 EST  
CBC News

Smoking has been banned in workplaces, restaurants and theatres, leaving the great outdoors as the next frontier for anti-smoking campaigns.

"People understand the concept of air pollution, that it may be everywhere," said Roberta Ferrence of the Ontario Tobacco Research Unit and the Centre for Addiction and Mental Health in Toronto. "Somehow [with] second-hand smoke outdoors they feel it's magically whisked away, and it isn't."

Newfoundland and Labrador, and Nova Scotia are working on provincewide bans on smoking on restaurant patios, which is already the law in 16 municipalities across Canada.

The governments have acted although there is little published research on levels of outdoor second-hand smoke or its health implications.



(CP file photo)

**References:**

CalEPA, 2006. California Environmental Protection Agency, Air Resources Board Office of Environmental Health Hazard Assessment, State of California Proposed Identification of, Environmental Tobacco Smoke as a Toxic Air Contaminant As Approved by the Scientific Review Panel, on June 24, 2005.

Klepeis, et al. (2007) Real-Time Measurement of Outdoor Tobacco Smoke Particles. *J. Air & Waste Manage. Assoc.* **57**:522–534

Repace (2005) Indoor and Outdoor Carcinogen Pollution on a Cruise Ship in the Presence and Absence of Tobacco Smoking Presented at the 14th Annual Conference of the International Society of Exposure Analysis, Oct. 17-21, Philadelphia, PA.

Repace JL and Rupperecht AA. Outdoor Air Pollution From Secondhand Smoke. Presented at the 13<sup>th</sup> World Conference on Tobacco Or Health, Washington, DC, July 12-15, 2006.

Repace JL. Exposure to Secondhand Smoke. Chapter 9, In: *Exposure Analysis*, W Ott, A Steinemann, and L Wallace, Eds. CRC Press (2006).

California: Officials in California Town Say Smoking Ban Is Working

Source: The Wall Street Journal Interactive Edition, 2006-05-30 Author: SHEARON ROBERTS; ORDINANCE NO. 2006-217 AN ORDINANCE OF THE CITY OF CALABASAS REGULATING SECOND-HAND SMOKE AND AMENDING THE CALABASAS MUNICIPAL CODE..