Reviewed By:	
DH	_X_
CM	_X_
CA	_X_

CITY OF DANA POINT

AGENDA REPORT

DATE: DECEMBER 5, 2017

TO: CITY COUNCIL

FROM: MAYOR DEBRA LEWIS

SUBJECT: NO SMOKING IN PUBLIC PLACES ORDINANCE

RECOMMENDED ACTION:

That the City Council introduce and hold a first reading on an Ordinance entitled:

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF DANA POINT, CALIFORNIA AMENDING CHAPTER 6.40 OF THE DANA POINT MUNICIPAL CODE RELATING TO THE REGULATION AND PROHIBITION OF SMOKING IN THE CITY.

BACKGROUND:

On May 2, 2017 the City Council discussed the potential of a prohibition of smoking in all public places within the City of Dana Point. At that meeting the Council directed that staff include a question on the 2017 Dana Point Community Survey asking residents whether or not they support a smoking ban in public places in the City.

DISCUSSION:

On September 19, 2017 the City Council received a report of results from the 2017 Dana Point Community Survey from its contracted public opinion research firm FM3. The survey included a question that matched the same question asked in the Laguna Beach Community Survey on whether or not residents supported banning smoking in public places in Dana Point. An overwhelming majority of residents surveyed (73%) indicated their support (61% of which “strongly support”) of a ban on smoking in public places. Survey results from the subject question are included as Supporting Document B.

As a result of the strong showing of support for such a ban, I researched the Laguna Beach City Ordinance and found it to be a comprehensive approach at accomplishing such a ban. Attached as Action Document A is a draft amendment to the Dana Point Municipal Code which mirrors the Laguna Beach Ordinance.

The Brown Act requires that the City Council conduct its legislative deliberations in public at a noticed public meeting. The recommended actions for this item include Council's consideration of the draft, proposed amendment to the City of Dana Point's existing smoking regulations (attached as Supporting Document C) and deliberations on what, if any, suggested changes should be made to the draft ordinance amendment. Should the Council reach consensus, it is further recommended that we direct staff to make any Council-directed changes to the draft and agendize a first reading of the ordinance at the next regular meeting.

At the October 3, 2017 City Council meeting, the Council directed staff and City Attorney to review the Ordinance and prepare a final version for first reading at the first Council meeting in December. Action Document A reflects the City Attorney's revisions to align the proposed amendment to the structure and format of the Dana Point Municipal Code.

Councilmember Viczorek requested further information from staff regarding "the effect of breathing second hand smoke outside." Attached as Supporting Document E are materials from the Centers for Disease Control on second hand smoke, including scientific references. Attached as Supporting Document F is a study found by staff titled "Real Time Measurement of Outdoor Tobacco Smoke Particles."

NOTIFICATION AND FOLLOW-UP:

California State Parks, County of Orange, Dana Point Chamber of Commerce, South Coast Water District and South Orange County Wastewater Authority

FISCAL IMPACT:

There is no fiscal impact to the Council's deliberation of this legislative item. Should the Council direct staff to return with an ordinance for first reading, staff will need to estimate signage and any other costs of a proposed ordinance.

ALTERNATIVE ACTIONS:

Other Council-directed action.

ACTION DOCUMENTS: **PAGE #**

SUPPORTING DOCUMENTS:

ACTION DOCUMENT A

ORDINANCE NO. 17-XX

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF DANA POINT, CALIFORNIA AMENDING CHAPTER 6.40 AND DELETING PORTIONS OF CHAPTER 13.04 OF THE DANA POINT MUNICIPAL CODE RELATING TO THE REGULATION AND PROHIBITION OF SMOKING IN THE CITY

The City Council of the City of Dana Point does ordain as follows:

SECTION 1: Chapter 6.40 Prohibition Against Smoking in Certain Places Open to the Public is hereby amended to read in its entirety as follows:

Chapter 6.40 Smoking Regulated or Prohibited

6.40.010 Purpose

6.40.020 Definitions

6.40.030 Smoking prohibited in public places

6.40.040 Smoking and open fires prohibited in hazardous fire areas

6.40.050 Smoking prohibited in City facilities and on City property

6.40.060 Smoking prohibited on property of other government bodies

6.40.070 Posting of sign required

6.40.080 Enforcement

6.40.090 Other applicable laws

6.40.010 Purpose

This chapter recognizes the right of residents and visitors to the city to be free from unwelcome secondhand smoke, which is deemed to be a public nuisance. The purpose of this chapter is to promote and protect the public health, safety, and general welfare by prohibiting smoking in public places, in hazardous fire areas, and in City facilities and on City property where persons will be exposed to unwelcome secondhand smoke and also the risks and dangers associated with fires. This chapter is further intended to ensure a cleaner and more hygienic environment for the city, its residents and visitors, and its natural resources.

6.40.020 Definitions

The following words and phrases, whenever used in this chapter, shall be construed as defined in this section:

(a) "Electronic smoking device" means an electronic device that can be used to deliver an inhaled dose of nicotine, or other substances, including any component, part, or accessory of such device, whether or not sold separately. This definition includes any such device, whether manufactured, distributed, marketed, or sold as an electronic cigarette, an electronic cigar, an electronic cigarillo, an electronic pipe, an electronic hookah, or any other product name or descriptor, including any component, part or accessory of such device, whether or not sold separately.

(b) "Employer" means any person who employs the services of an individual person.

(c) "Employee" means any person who is employed by an employer for direct or indirect monetary wages or profit.

(d) "Enclosed" means closed in by a roof and four walls with appropriate openings for ingress and egress.

(e) "Place of employment" means any area under the legal or de facto control of an employer that an employee or the general public may enter in the normal course of operations, but regardless of the hours of operation, including, for example, indoor and outdoor work areas, construction sites, taxis, employee lounges, conference and banquet rooms, bingo and gaming facilities, long-term health facilities, warehouses, and any private residences subject to state licensing requirements that are used as child-care or health-care facilities.

(f) "Public place" means any indoor or outdoor public place publicly or privately owned, including but not limited to any public buildings, restaurants, dining areas, bars, entryways, elevators, hospitals and health care facilities, public meeting rooms, theaters and auditoriums, public restrooms, service lines, streets, alleys, rights-of-way, sidewalks, plazas, beaches and beach access ways, public transportation and bus shelters, parking lots, parking structures, parks, picnic areas, playgrounds, sports fields, walking paths, hiking trails, bike paths, and hazardous fire areas. "Public place" includes any place being used for a public event, including but not limited to a farmers' market, parade, craft fair, festival, or any other event open to the general public.

(g) "Smoke" means the gases, particles, or vapors released into the air as a result of combustion, electrical ignition or vaporization, when the apparent or usual purpose of the combustion, electrical ignition or vaporization is human inhalation of the byproducts, except when the combusting material contains no tobacco or nicotine and the purpose of inhalation is solely olfactory, such as, for example, smoke from incense. "Smoke" includes but is not limited to tobacco smoke, electronic cigarette vapors, and marijuana smoke.

(h) "Smoking" means the release of gases, particles, or vapors into the air as the result of combustion, electrical ignition, or vaporization and/or inhaling, exhaling, burning or carrying any lighted, heated or ignited cigar, cigarette, cigarillo, pipe, hookah, electronic smoking device, or any plant product, including but not limited to tobacco and marijuana, intended for human inhalation.

6.40.30 Smoking prohibited in public places.

(a) In addition to all places where smoking is prohibited under state or federal law, in which case those laws apply, no person shall smoke in, and smoking areas shall not be established or designated in, all of the following areas:

(1) Places of employment; and
(2) Public places.

(b) Smoking is permitted in the following locations within the city, unless otherwise provided by state or federal law or this code:

(1) Private residential properties, other than those used as a child-care or health-care facility subject to State licensing requirements; and
(2) Within a moving or stationary vehicle, including a vehicle on a public street or right-of- way or parked in a public place.

(c) No employer, owner, operator, manager, employee or other person having control of a place of employment or a public place shall knowingly permit smoking in an area in which smoking is prohibited by law. This subsection does not require the physical ejection of any person from the business or the taking of steps to prevent smoking under circumstances that would involve a significant risk of physical harm.

(d) The owner, operator or manager of a hotel, motel or bed and breakfast establishment may establish rules permitting or prohibiting smoking on the portions of the property not open to the public, including guest rooms, pools, and similar facilities and areas, provided that such rules comply with applicable laws.

(e) No employer, owner, operator, manager, employee or other person having control of an outdoor dining area, restaurant, snack shop or alcohol beverage establishment shall place ashtrays on tables or otherwise make ashtrays or receptacles for smoking waste available to patrons.

(f) Nothing in this chapter prohibits any person or employer with legal control over any property from prohibiting smoking on any part of such property, even if smoking is not otherwise prohibited in that area.

6.40.040 Smoking and open fires prohibited in hazardous fire areas.

Smoking and open fires are prohibited in any hazardous fire area as identified by the chief.

(a) The fire chief has identified the following locations as hazardous fire areas and has provided signage identifying such:

(1) All open space and wildland interface areas in and surrounding the city.

6.40.050 Smoking prohibited in City facilities and on City property.

Smoking is prohibited in all enclosed areas, including buildings and vehicles owned, leased, or operated by the City of Dana Point, as well as on all outdoor property owned, leased, or operated by the City of Dana Point.

6.40.060 Smoking prohibited on property of other governmental bodies.

Smoking is prohibited in all enclosed areas, including buildings, as well as on all outdoor property within the city owned, leased, or operated by other governmental bodies, including the State of California, the County of Orange, and special districts, when such other governmental body has consented in writing to the City enforcing the provisions of this section on such property.

6.40.070 Posting of sign required.

Except where other signs are required, whenever in this code smoking is prohibited, "No Smoking" or "Smoke Free" signs shall be conspicuously posted by the owner, operator, manager, or other persons having control of such room, building, or other place where smoking is prohibited. The City Manager shall post signs at or near the primary entrance(s) to a public place in which smoking is prohibited and which is owned or controlled by the City. Signage required by this section shall not be subject to Chapter 9.37. Notwithstanding this provision, the presence or absence of signs shall not be a defense to the violation of any other provisions of this chapter.

6.40.080 Enforcement.

(a) The provisions of this chapter may be enforced by the Orange County Sheriff’s Department, any peace officer or fire or code enforcement officer, or other employees designated by the City Manager.

(b) While an establishment is undergoing otherwise mandatory inspections, fire and code enforcement officers may inspect the establishment for compliance with this chapter.

(c) Notice of the provisions of this chapter shall be provided to all applicants for a business license or renewal thereof; provided, however, any failure to provide such notice shall be no defense to a violation of this chapter.

(d) Employers, owners, operators, managers or employees of same shall be required to orally inform persons violating this chapter of the provisions hereof. The duty to inform such violator shall arise when such employer, owner, operator, manager or employee of the same becomes aware of such violation.

(e) Causing, permitting, aiding, abetting, or concealing a violation of any provision of this chapter shall also constitute a violation of this chapter.

(f) Except as provided in subsection (g), any person who is found to violate any provision of this chapter shall be deemed guilty of an infraction and shall be punishable by:

(1) A fine not exceeding one hundred ($100.00) dollars for the first violation;
(2) A fine not exceeding two hundred ($200.00) dollars for a second violation within one (1) year; and
(3) A fine not exceeding five hundred ($500.00) dollars for a third violation within one (1) year.

(g) Any person who is found to violate the prohibition of smoking in a hazardous fire area pursuant to section 6.40.040 shall be guilty of a misdemeanor and shall be punishable as provided by state law.

(h) Any aggrieved person may enforce the provisions of this chapter by means of a civil action on his or her own behalf pursuant to California Civil Code section 3501 et seq.

6.40.090 Other applicable laws.

This chapter shall not be interpreted or construed to permit smoking where it is otherwise restricted or prohibited by other applicable laws.

SECTION 2: Section 13.04.105 Prohibition of Smoking of Tobacco Products in Public Parks is deleted in its entirety.

SECTION 3: Section 13.04.020 Definitions is hereby amended to delete the definitions of "Smoking" and "Tobacco Product" in subsections (e) and (f).

SECTION 4: CEQA Determination. In adopting this Ordinance, the City Council finds that the project is categorically exempt from the California Environmental Quality Act (CEQA) pursuant to Title 14 California Code of Regulations Sections 15061(b)(3) and 15378, in that it can be seen with certainty that the adoption of the Municipal Code amendments propose no activity that may have a significant effect on the environment and will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment.

SECTION 5: Severability. If any section, subsection, subdivision, sentence, clause, phrase, or portion of this Ordinance is, for any reason, held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this Ordinance. The City Council hereby declares that it would have adopted this Ordinance and each and every section, subsection, subdivision, sentence, clause, phrase, or portion thereof, irrespective of the fact that any one or more section, subsections, subdivisions, sentences, clauses, phrases, or portions thereof be declared unconstitutional.

SECTION 6: **Effective Date**. This Ordinance shall become effective thirty (30) days after its passage and adoption. Within fifteen (15) days of the date of adoption of this Ordinance, the City Clerk shall post a copy of said Ordinance in places designated for such posting and shall certify to the same. The City Clerk shall certify the passage of this Ordinance and shall cause the same to be published as required by law.

PASSED, APPROVED and ADOPTED this day of __________, 2017.

____
DEBRA LEWIS, MAYOR

ATTEST:

____
KATHY M. WARD, CITY CLERK

STATE OF CALIFORNIA)
COUNTY OF ORANGE) ss.
CITY OF DANA POINT)

I, Kathy M. Ward, City Clerk of the City of Dana Point, do hereby certify that the foregoing Ordinance No. 17-XX was duly introduced at a regular meeting of the City Council on the __th day of December, 2017, and was duly adopted and passed at a regular meeting of the City Council on the day of ___________, 2017, by the following vote, to wit:

AYES:

NOES:

ABSENT:

ABSTAIN:

____
KATHY M. WARD, CITY CLERK

STATE OF CALIFORNIA)
COUNTY OF ORANGE) ss
CITY OF DANA POINT)

AFFIDAVIT OF POSTING AND PUBLISHING

KATHY WARD, being first duly sworn, deposes, and says:

That she is the duly appointed and qualified City Clerk of the City of Dana Point;

That in compliance with State Laws of the State of California, ORDINANCE NO. 17-XX, being:

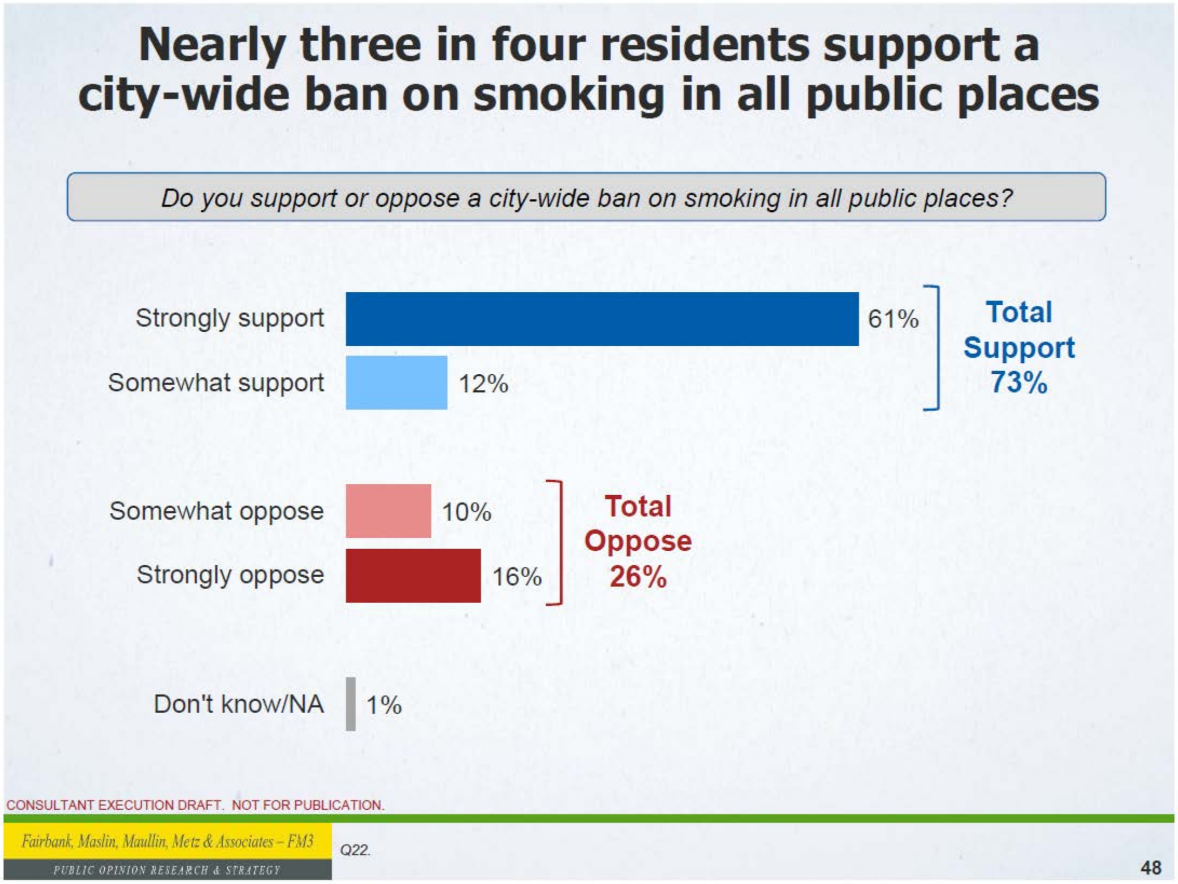
AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF DANA POINT, CALIFORNIA AMENDING CHAPTER 6.40 AND DELETING PORTIONS OF CHAPTER 13.04 OF THE DANA POINT MUNICIPAL CODE RELATING TO THE REGULATION AND PROHIBITION OF SMOKING IN THE CITY

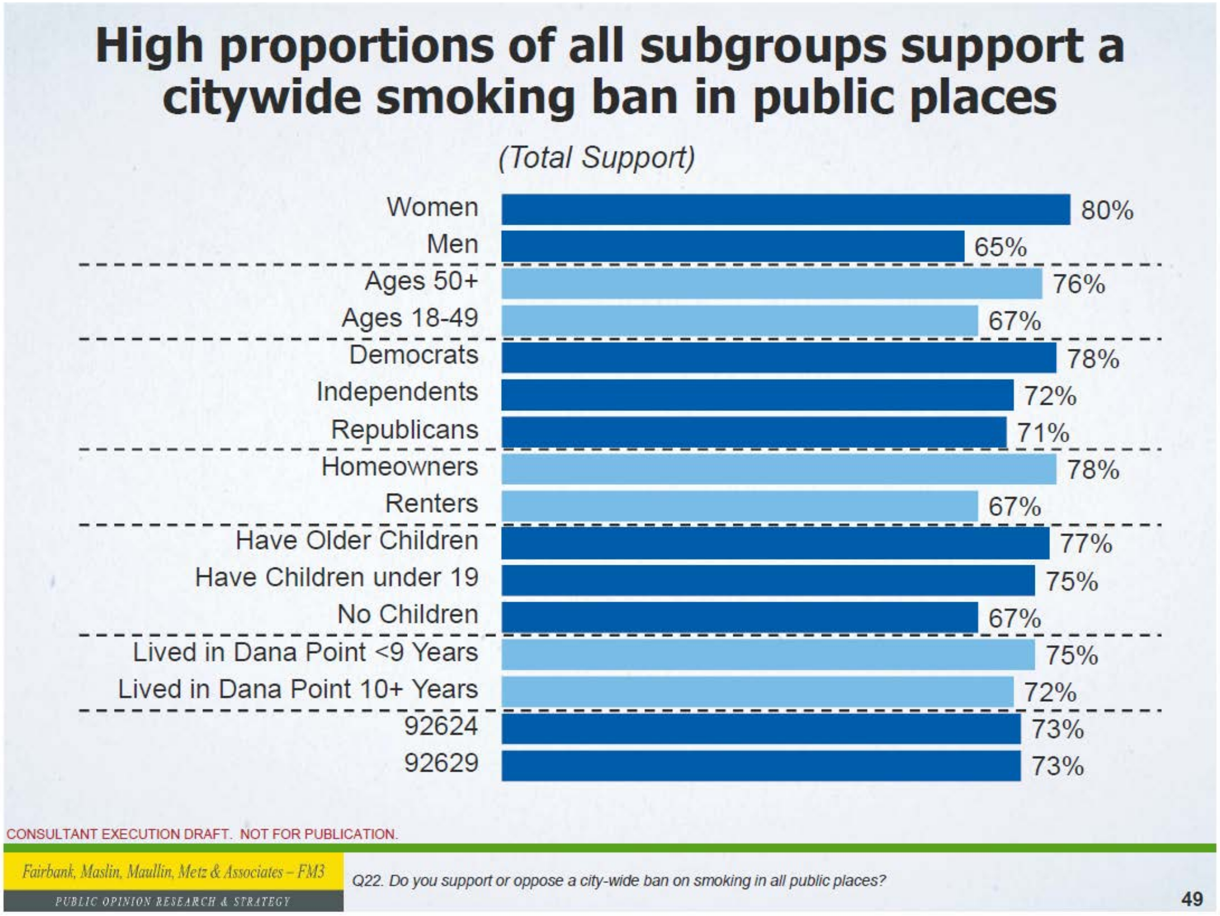
was published in summary in the Dana Point News on the ___ day of ________, 2017, and, in further compliance with City Resolution No. 91-10-08-01, on the ___ day of ________, 2017, and the ___ day of ________, 2017, was caused to be posted in four (4) public places in the City of Dana Point, to wit:

Dana Point City Hall
Capistrano Beach Post Office
Dana Point Post Office
Dana Point Library

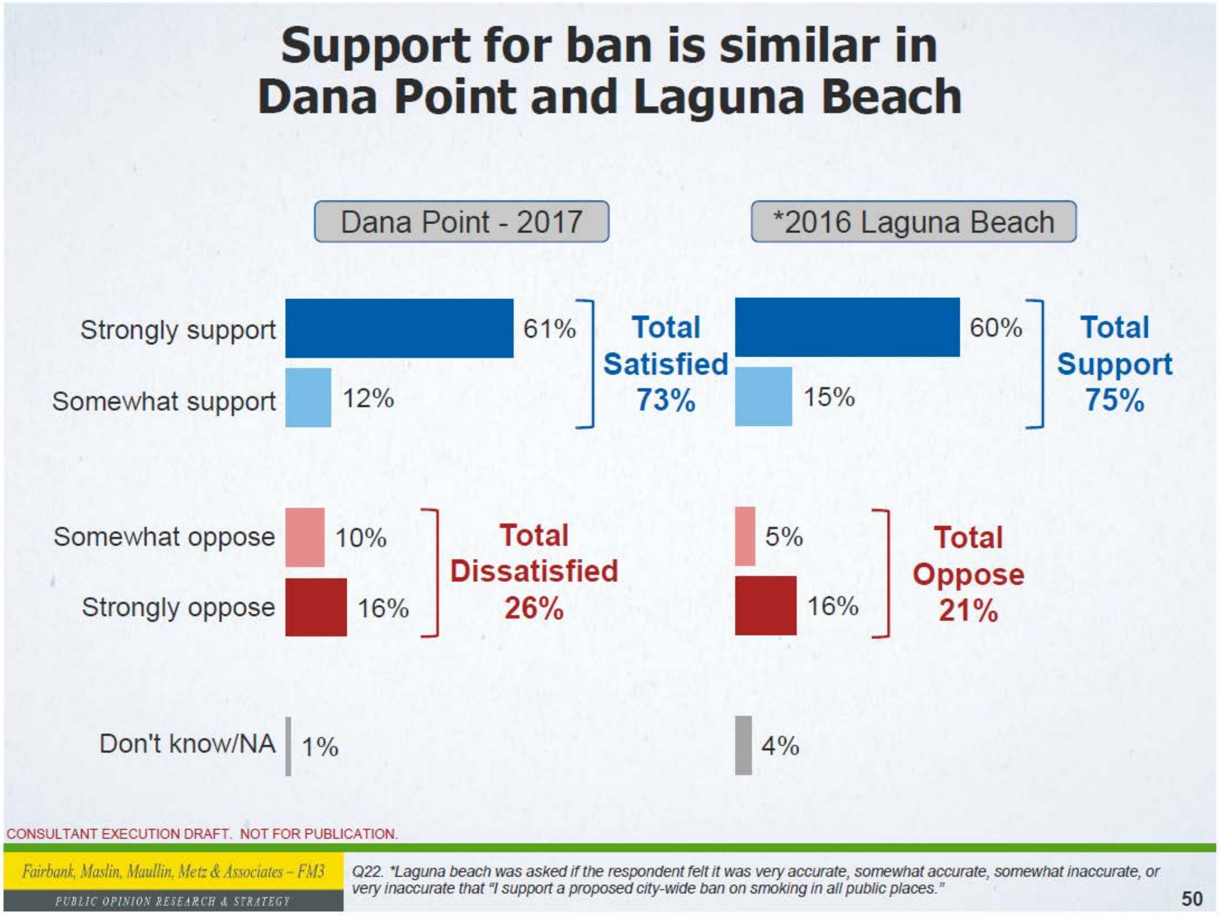
____
KATHY WARD, CITY CLERK
Dana Point, California

SUPPORTING DOCUMENT B





High proportions of all subgroups support a citywide smoking ban in public places
(Total Support)
Women 80%
Men 65%
Ages 50+ 76%
Ages 18-49 67%
Democrats 78%
Independents 72%
Republicans 71%
Homeowners 78%
Renters 67%
Have Older Children 77%
Have Children under 19 75%
No Children 67%
Lived in Dana Point <9 Years 75%
Lived in Dana Point 10+ Years 72%
92624 73%
92629 73%
CONSULTANT EXECUTION DRAFT. NOT FOR PUBLICATION.
Fairbank, Maslin, Maullin, Metz & Associates – FM3
PUBLIC OPINION RESEARCH & STRATEGY
Q22. Do you support or oppose a city-wide ban on smoking in all public places?
49


Support for ban is similar in Dana Point and Laguna Beach
Dana Point - 2017
*2016 Laguna Beach
Strongly support
61%
Somewhat support
12%
Total Satisfied 73%
60%
15%
Total Support 75%
Somewhat oppose
10%
Strongly oppose
16%
Total Dissatisfied 26%
5%
16%
Total Oppose 21%
Don't know/NA
1%
4%
CONSULTANT EXECUTION DRAFT. NOT FOR PUBLICATION.
Fairbank, Maslin, Maullin, Metz & Associates – FM3
PUBLIC OPINION RESEARCH & STRATEGY
Q22. *Laguna beach was asked if the respondent felt it was very accurate, somewhat accurate, somewhat inaccurate, or very inaccurate that "I support a proposed city-wide ban on smoking in all public places."
50

SUPPORTING DOCUMENT C

Chapter 6.40 PROHIBITION AGAINST SMOKING IN CERTAIN PLACES OPEN TO THE PUBLIC

6.40.010 Prohibition.

Smoking shall be prohibited in the following public places within the City:

(a) Elevators open to and in use by the public;

(b) Waiting rooms, public hallways and patients' rooms of every private or public health care facility, including, but not limited to, hospitals except rooms limited to a single patient and not open to the general public;

(c) Within every room, chamber, place of meeting or public assembly, during such time as a meeting required by law to be open to the general public is in progress;

(d) Within any building or room not open to the sky, except the lobby, when that building or room is open to the public for the purpose of exhibiting any motion picture, stage drama, lecture, musical recital or other similar performance except when smoking is part of the stage production;

(e) In any establishment where food is being served to the general public; provided, however that:

(1) Until June 30, 1995, this prohibition against smoking shall not apply within a building wherein a "no smoking" area of not less than seventy-five (75%) of the floor space and of the seating capacity in which customers are served is maintained;

(2) Commencing on July 1, 1995, smoking shall be prohibited in one hundred percent (100%) of any building where food is being served to the general public;

(3) This prohibition against smoking shall not apply to any area of a building establishment which is:

(i) Open to the sky or open on at least two full sides, and wherein not less than fifty percent (50%) of such area is a "no smoking" area;

(ii) Any private party or banquet room or rooms during its use by a private party group or groups;

(iii) Any bar, cocktail lounge, or other similar area where alcoholic beverages are the primary sales items.

(f) In the halls, reading and viewing rooms of museums and libraries when open to the public;

(g) Within retail stores doing business with the general public in areas posted by the management to that effect, except in areas not open to the public. (Added by Ord. 93-07, 4/13/93)

6.40.020 Places Open to the Public Within Buildings Owned or Leased by the City.

Those places open to the public under section 6.40.010 located within buildings owned or leased by the City shall be regulated under section 6.40.010; the prohibition of Section

4-7-11 of the Codified Ordinances of the County of Orange shall be inapplicable to such public places. (Added by Ord. 93-07, 4/13/93)

6.40.030 Enforcement of Labor Code Section 6404.5.

(a) The provisions of the Labor Code Section 6404.5, governing smoking in enclosed places of employment, shall be enforced by the officers of the Code Enforcement Unit of the Community Development Department and deputies of the Orange County Sheriff's Department.

(b) In the performance of their duties of monitoring and enforcing compliance with the provisions of Labor Code Section 6404.5, all persons authorized by the Director of the Community Development Department to engage in such enforcement activities shall have the power, authority and immunity of a public officer to issue infraction citations. (Added by Ord. 02-06, 6/11/02)

Chapter 13.04 PARKS AND RECREATIONAL FACILITIES REGULATIONS

13.04.010 Scope.

The provisions of this Chapter 13.04, unless otherwise expressly provided, shall apply in all parks, beaches, and recreational areas maintained by the City. (Ord. 94-12, 8/23/94)

13.04.020 Definitions.

The following words shall have the meaning indicated when used in these regulations:

(a) "Alcoholic beverage" means alcohol, spirits, liquor, wine, beer and every liquid or solid containing one-half of one (0.5) percent or more of alcohol by volume and which is fit for beverage purposes either alone or when diluted, mixed or combined with other substances.

(b) "Amplified sound" means music, sound wave, vibration, or speech projected or transmitted by electronic equipment, including amplifiers.

(c) "Natural open-space" consists of Hilltop Park, Harbor Point Park and the South Strand Open Space as defined in the conservation easement approved by the City on November 30, 2005 and other conservation areas as may be designated by the City Council, including the Center for Natural Lands Management (CNLM) Dana Point Preserve.

(d) "Park" means any community park, neighborhood park, trail, natural open-space, conservation or recreational area owned or maintained by the City.

(e) "Smoking" means inhaling, exhaling, burning, carrying or possessing any lighted cigarette, cigar, pipe, weed, plant, tobacco product or any other combustible substance in any manner or in any form.

(f) "Tobacco product" means any substance containing tobacco leaf, including, but not limited to, cigarettes, cigars, pipe tobacco, snuff, chewing tobacco, or any other preparation of tobacco. (Ord. 94-12, 8/23/94; amended by Ord. 09-05, 5/11/09; Ord. 10-03, 3/22/10; Ord. 10-04, 3/22/10)

13.04.105 Prohibition of Smoking of Tobacco Products in Public Parks.

Smoking is prohibited and unlawful in all City parks unless specifically permitted by the prior written approval of the City. Smoking is defined in Dana Point Municipal Code Section 13.04.020. (Added by Ord. 10-04, 3/22/10)

SUPPORTING DOCUMENT D

From: Robin Dier <robinandbobdier@yahoo.com>
Date: September 29, 2017 at 8:09:39 PM GMT+2
To: KATHY WARD <kward@danapoint.org>
Subject: to distribute to city councilmembers
Reply-To: Robin Dier <robinandbobdier@yahoo.com>

Hi Kathy:

I am unable to attend the city council meeting next week. Would you please distribute my statement to the council members on my behalf.

I ask that you pass an ordinance prohibiting smoking or vaping tobacco in the city of Dana Point, with the exception of private residences and in vehicles with the the windows up.

I get severe migraines being anywhere near cigarette smokers and sometimes it is impossible to avoid especially when they are standing just outside a business or in a large group setting. Besides health concerns, smokers often leave their butts behind leaving a mess for others to deal with.

Thank you for bringing this important issue to a vote. I was so excited when Laguna Beach made this decision and hope you follow suit.

Sincerely,

Robin Dier
Capistrano Beach

Agenda Item No. 18
October 3, 2017

BOBBI OGAN

From: KATHY WARD
Sent: Monday, October 02, 2017 9:26 AM
To: BOBBI OGAN
Subject: Fwd:

FYI....

Begin forwarded message:

From: Mary Therese Spivey <mtspiveypru@gmail.com>
Date: September 30, 2017 at 4:47:44 PM GMT+2
To: kward@danapoint.org

Hello Kathy,

I won't be able to make the next City meeting, however I'am very much in favor of the smoking ban. The City of Dana Point has organically become a place for healthy life style. The Turkey Trot is one of my favorite's. With surfing, biking and the city becoming so walkable. I think it will send a message to young people as well as keep our Clean a little bit cleaner.

Thank you!

MT Spivey

Agenda Item No. 18
October 3, 2017

BOBBI OGAN

From:	KATHY WARD
Sent:	Tuesday, October 03, 2017 11:04 PM
To:	BOBBI OGAN
Subject:	Fwd: City Council - Smoking Ban
Attachments:	city council - smoking ban.docx; ATT00001.htm

FYI...

Begin forwarded message:

From: Cindy Monroe <cindymonroe1@yahoo.com>
Date: October 4, 2017 at 1:40:06 AM GMT+1
To: KATHY WARD <kward@danapoint.org>
Subject: City Council - Smoking Ban

Hi Kathy,
I planned to attend the meeting tonight, but I came down with a fever, aches and bad cough.
I hope that I submitted this in time for tonight's meeting!
Warm Regards,
Cindy
949-573-5321

Cindy Monroe
Luxe Restaurant & Martini Bar
www.LuxeDanaPoint.com

October 3, 2017

Dear members of our City Council,

I had planned to attend the council meeting to speak this evening, but I fell ill. I am submitting this letter in lieu of my attendance.

As a 13-year Dana Point resident and business owner, I would like to insert my two cents regarding the proposed "smoking ban." First and foremost, I am not a smoker. If you were to verbally survey residents (as I did,) asking them what their most important issue and concern is as a Dana Point resident, nobody will tell you "public smoking." The number one response I received by far was the issue of homeless/transients that have no place to go who are begging in front of Circle K, gas stations and other storefronts. They are also smoking meth and defecating in our alleyways.

Public cigarette smoking is a non-issue. They only way someone has an opinion about it is if you ASK them if they like it. There are VERY FEW smokers that reside in our town. For those that do smoke, I have placed an ash tray in a dedicated smoking area in front of my restaurant which people use respectfully. Our city's hotels attract several European tourists – many of which smoke. Would these tourists no longer be welcome in Dana Point? Would they no longer be welcome to patronize mine and other businesses due to our "public smoking (non) issue?" Who would patrol these "illegal smokers?" Would it be our sheriffs who are already spread thin?

I hope that you will all see the bigger picture and realize that a smoking ban is not a priority for our city. Additionally, I urge you to drive by the Sandpiper Bar in Launa Beach on a weekend night. Despite the smoking ban in Laguna, there are 10 people out front smoking cigarettes at any given time...even with Laguna's large/private police presence. This ban seems to be nothing more than part of a political agenda.

Thank you,

Cindy Monroe (33616 Circula Corona)
proprietor
Luxe Restaurant (24582 Del Prado Ave)

KATHY WARD

From: linda moore <casalindamg@yahoo.com>
Sent: Monday, October 23, 2017 3:10 PM
To: KATHY WARD
Cc: Debra Lewis; Paul Wyatt; JOE MULLER; JOHN TOMLINSON; RICHARD VICZOREK
Subject: No Smoking in Public Ordinance

I am imploring all members of the city council of Dana Point, Ca, to pass with all haste the above ordinance. Not only has the majority of citizens "polled" agreed with this, but we believe it is the first, best, most important action that should be taken to protect the physical health of our residents and to promote our town as a healthy, desirable beach community to visit.
It would prevent the problem of cigarette, cigar, and vape butts littering our beaches, streets and neighborhoods., and go a long way to improving the hazards of second-hand smoke.

Laguna Beach has already done so; and my friends, neighbors, and others have observed the pleasant, positive effect it is having on their beautiful village.

Urgently,
Linda D Moore, Dana Point (Historic Village) resident.

From: Eirlys Kunny <eirlysk@icloud.com>
Date: November 27, 2017 at 6:42:38 PM PST
To: kward@danapoint.org
Subject: Fwd: No smoking in Public (ordinance)

Street name is San Marino.

Sent from my iPad

Begin forwarded message:

From: Eirlys Kunny <eirlysk@icloud.com>
Date: November 27, 2017 at 6:41:06 PM PST
To: kward@danapoint.org
Subject: No smoking in Public (ordinance)

I live just up from the Craft House, unbelievable how much smoking going on on outside and the cigarette butts strewn in the street behind behind. Definitely something should be done. Eirlys Kunny
Sent from my iPad

Please sign, fill out and send to D.Pt City Council ASAP - by 11-28-17 - Agenda is set up 1 week prior to council meeting - Tues 12-5 @ 6pm City Council Chambers 2nd floor

Subject: No Smoking in Public Ordinance

From: linda moore (casalindamg@yahoo.com)

Email To: kward@danapoint.org; Kathy Ward, DP City Clerk - she can forward to each council member & jmuller@danapoint.org; jtomlinson@danapoint.org; dlewis@danapoint.org; pwyatt@danapoint.org;

cc: rviczorek@danapoint.org

Date: Monday, October 23, 2017 3:10 PM

& mail or drop off: City Hall - 33282 Golden Lantern Suite 203 2nd floor, Dana Point CA 92629

I am imploring all members of the city council of Dana Point, Ca. to pass with all haste the above ordinance. Not only has the majority of citizens "polled" agreed with this, but we believe it is the first, best, most important action that should be taken to protect the physical health of our residents and to promote our town as a healthy, desirable beach community to visit.

It would prevent the problem of cigarette, cigar, and vape butts littering our beaches, streets and neighborhoods, and go a long way to improving the hazards of second-hand smoke.

Laguna Beach has already done so; and my friends, neighbors, and others have observed the pleasant, positive effect it is having on their beautiful village.

Urgently,
Linda D Moore, Dana Point (Historic Village) resident

Name(s)	Email or Street Address	City of Residence	Opinion / Comments
Evelyn Kenny	34182 Blue Lantern	DP	Evelyn Kenny 11/28/17

From: Elke Lienhop [mailto:lienhop@cox.net]
Sent: Tuesday, November 28, 2017 7:11 AM
To: KATHY WARD; Debra Lewis; Paul Wyatt; JOE MULLER; JOHN TOMLINSON; RICHARD VICZOREK
Subject: No Smoking in Public Ordinance

to: kward@danapoint.org
cc: dlewis@danapoint.org; pwyatt@danapoint.org, jmuller@danapoint.org, jtomlinson@danapoint.org, rviczorek@danapoint.org

Dear Council Members,

I am imploring all members of the city council of Dana Point, CA, to pass the above ordinance.

Not only has the majority of citizens 'polled' agreed with this, but we believe it is the first, best, and most important action that should be taken.

tIt will protect the physical health of our residents and to wildlife.

It will promote our town as a healthy, desirable beach community to visit. .

It would prevent the problem of cigarette, cigar, and vape butts littering our beaches, streets and neighborhoods, and go a long way to eliminating the hazards of second-hand smoke.

Laguna Beach has already done so and we should follow their lead.

Sincerely,

Elke Lienhop,

Dana Point resident.

From: Roman Groedl [mailto:romangroedl@gmail.com]
Sent: Tuesday, November 28, 2017 7:04 AM
To: KATHY WARD
Cc: Debra Lewis; Paul Wyatt; JOE MULLER; JOHN TOMLINSON; RICHARD VICZOREK
Subject: No Smoking in Public Ordinance

Dear council members,
I am imploring all members of the city council of Dana Point, CA, to pass with all haste the above ordinance. Not only has the majority of citizens 'polled' agreed with this, but we believe it is the first, best, and most important action that should be taken to protect the physical health of our residents and to promote our town as a healthy, desirable beach community to visit.
It would prevent the problem of cigarette, cigar, and vape butts littering our beaches, streets and neighborhoods, and go a long way to eliminating the hazards of second-hand smoke.

Laguna Beach has already done so; and my friends, neighbors, and others have observed the pleasant and positive effect it is having on their beautiful village and their lives.

Sincerely,
Roman Groedl, Dana Point resident.

SUPPORTING DOCUMENT E

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Health Effects of Secondhand Smoke

On this Page

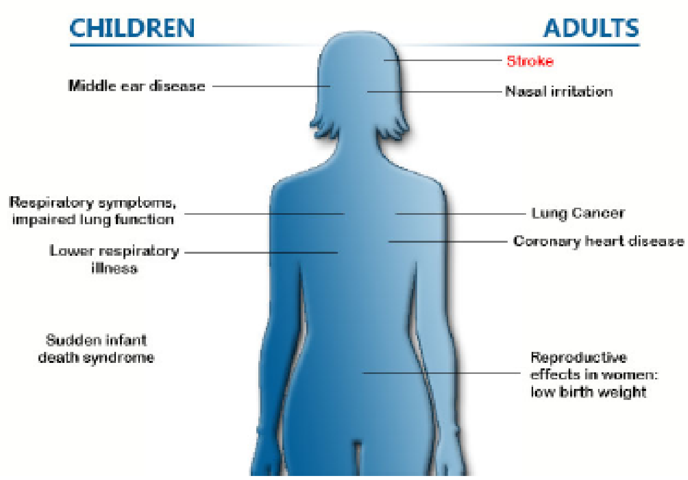
Secondhand smoke is the combination of smoke from the burning end of a cigarette and the smoke breathed out by smokers. Secondhand smoke contains more than 7,000 chemicals. Hundreds are toxic and about 70 can cause cancer.[1,2,3,4]

Since the 1964 Surgeon General's Report, 2.5 million adults who were nonsmokers died because they breathed secondhand smoke.[1]

There is no risk-free level of exposure to secondhand smoke.

- Secondhand smoke causes numerous health problems in infants and children, including more frequent and severe asthma attacks, respiratory infections, ear infections, and sudden infant death syndrome (SIDS).[1,4]
- Smoking during pregnancy results in more than 1,000 infant deaths annually.[4]
- Some of the health conditions caused by secondhand smoke in adults include coronary heart disease, stroke, and lung cancer.[1,4]

Health Consequences Causally Linked to Exposure to Secondhand Smoke



Note:
The condition in red is a new disease causally linked to secondhand smoke in the 2014 Surgeon General's Report[4]

Secondhand Smoke Causes Cardiovascular Disease

Exposure to secondhand smoke has immediate adverse effects on the cardiovascular system and can cause coronary heart disease and stroke.[2,4,5]

- Secondhand smoke causes nearly 34,000 premature deaths from heart disease each year in the United States among nonsmokers.[4]
- Nonsmokers who are exposed to secondhand smoke at home or at work increase their risk of developing heart disease by 25–30%.[1]
- Secondhand smoke increases the risk for stroke by 20−30%.[4]
- Secondhand smoke exposure causes more than 8,000 deaths from stroke annually.[4]

Breathing secondhand smoke can have immediate adverse effects on your blood and blood vessels, increasing the risk of having a heart attack.[2,3,4]

- Breathing secondhand smoke interferes with the normal functioning of the heart, blood, and vascular systems in ways that increase the risk of having a heart attack.
- Even brief exposure to secondhand smoke can damage the lining of blood vessels and cause your blood platelets to become stickier. These changes can cause a deadly heart attack.

People who already have heart disease are at especially high risk of suffering adverse effects from breathing secondhand smoke and should take special precautions to avoid even brief exposures.[1]

Secondhand Smoke Causes Lung Cancer

Secondhand smoke causes lung cancer in adults who have never smoked.[4]

- Nonsmokers who are exposed to secondhand smoke at home or at work increase their risk of developing lung cancer by 20–30%.[2]
- Secondhand smoke causes more than 7,300 lung cancer deaths among U.S. nonsmokers each year.[4]
- Nonsmokers who are exposed to secondhand smoke are inhaling many of the same cancer-causing substances and poisons as smokers.[2,3,4]
- Even brief secondhand smoke exposure can damage cells in ways that set the cancer process in motion.[4]
- As with active smoking, the longer the duration and the higher the level of exposure to secondhand smoke, the greater the risk of developing lung cancer.[4]

Secondhand Smoke Causes SIDS

Sudden Infant Death Syndrome (SIDS) is the sudden, unexplained, unexpected death of an infant in the first year of life. SIDS is the leading cause of death in otherwise healthy infants.[6] Secondhand smoke increases the risk for SIDS.[2,4]

- Smoking by women during pregnancy increases the risk for SIDS.[2,4,7]
- Infants who are exposed to secondhand smoke after birth are also at greater risk for SIDS.[2,4]
- Chemicals in secondhand smoke appear to affect the brain in ways that interfere with its regulation of infants' breathing.[2,4]
- Infants who die from SIDS have higher concentrations of nicotine in their lungs and higher levels of cotinine (a biological marker for secondhand smoke exposure) than infants who die from other causes.[2,4]

Parents can help protect their babies from SIDS by taking the following three actions:[8]

- Do not smoke when pregnant.
- Do not smoke in the home or around the baby.
- Put the baby down to sleep on its back.

Secondhand Smoke Harms Children

Secondhand smoke can cause serious health problems in children.[2,4]

- Studies show that older children whose parents smoke get sick more often. Their lungs grow less than children who do not breathe secondhand smoke, and they get more bronchitis and pneumonia.
- Wheezing and coughing are more common in children who breathe secondhand smoke.
- Secondhand smoke can trigger an asthma attack in a child. Children with asthma who are around secondhand smoke have more severe and frequent asthma attacks. A severe asthma attack can put a child's life in danger.
- Children whose parents smoke around them get more ear infections. They also have fluid in their ears more often and have more operations to put in ear tubes for drainage.

Parents can help protect their children from secondhand smoke by taking the following actions:[9]

- Do not allow anyone to smoke anywhere in or near your home.
- Do not allow anyone to smoke in your car, even with the window down.
- Make sure your children's day care centers and schools are tobacco-free.
- If your state still allows smoking in public areas, look for restaurants and other places that do not allow smoking. "No-smoking sections" do not protect you and your family from secondhand smoke.

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For Further Information

Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion
Office on Smoking and Health
E-mail: tobaccoinfo@cdc.gov (mailto:tobaccoinfo@cdc.gov)
Phone: 1-800-CDC-INFO

Media Inquiries: Contact CDC's Office on Smoking and Health press line at 770-488-5493.

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(https://www.cdc.gov/Other/plugins/#pdf)

Page last reviewed: January 11, 2017
Page last updated: January 11, 2017
Content source: Office on Smoking and Health (/tobacco/about/), National Center for Chronic Disease Prevention and Health Promotion (http://www.cdc.gov/chronicdisease/)

Secondhand Smoke (SHS) Facts

On This Page

Secondhand smoke harms children and adults, and the only way to fully protect nonsmokers is to eliminate smoking in all homes, worksites, and public places.[1,2,3]

You can take steps to protect yourself and your family from secondhand smoke, such as making your home and vehicles smokefree.[2,3]

Separating smokers from nonsmokers, opening windows, or using air filters does not prevent people from breathing secondhand smoke.[1,2,3]

Most exposure to secondhand smoke occurs in homes and workplaces.[2,3]

People are also exposed to secondhand smoke in public places—such as in restaurants, bars, and casinos—as well as in cars and other vehicles.[2,3]

People with lower income and lower education are less likely to be covered by smokefree laws in worksites, restaurants, and bars.[4]

What Is Secondhand Smoke?

- Secondhand smoke is smoke from burning tobacco products, such as cigarettes, cigars, or pipes.[1,5,6]
- Secondhand smoke also is smoke that has been exhaled, or breathed out, by the person smoking.[5,6]
- Tobacco smoke contains more than 7,000 chemicals, including hundreds that are toxic and about 70 that can cause cancer.[1]

Secondhand Smoke Harms Children and Adults

- There is no risk-free level of secondhand smoke exposure; even brief exposure can be harmful to health.[1,2,6]
- Since 1964, approximately 2,500,000 nonsmokers have died from health problems caused by exposure to secondhand smoke.[1]

Health Effects in Children

In children, secondhand smoke causes the following:[1,2,3]

- Ear infections
- More frequent and severe asthma attacks
- Respiratory symptoms (for example, coughing, sneezing, and shortness of breath)
- Respiratory infections (bronchitis and pneumonia)
- A greater risk for sudden infant death syndrome (SIDS)

Health Effects in Adults

In adults who have never smoked, secondhand smoke can cause:

- Heart disease
  - For nonsmokers, breathing secondhand smoke has immediate harmful effects on the heart and blood vessels.[1,3]
  - It is estimated that secondhand smoke caused nearly 34,000 heart disease deaths each year during 2005–2009 among adult nonsmokers in the United States.[1]
- Lung cancer[1,7]
  - Secondhand smoke exposure caused more than 7,300 lung cancer deaths each year during 2005–2009 among adult nonsmokers in the United States.[1]
- Stroke[1]

Secondhand smoke can infiltrate into other units through hallways and stairwells.

Larger infographic

Smokefree laws can reduce the risk for heart disease and lung cancer among nonsmokers.[1]

Patterns of Secondhand Smoke Exposure

Exposure to secondhand smoke can be measured by testing saliva, urine, or blood to see if it contains cotinine.[3] Cotinine is created when the body breaks down the nicotine found in tobacco smoke.

Secondhand Smoke Exposure Has Decreased in Recent Years

- Measurements of cotinine show that exposure to secondhand smoke has steadily decreased in the United States over time.
  - During 1988–1991, almost 90 of every 100 (87.9%) nonsmokers had measurable levels of cotinine.[7]
  - During 2007–2008, about 40 of every 100 (40.1%) nonsmokers had measurable levels of cotinine.[7]
  - During 2011–2012, about 25 of every 100 (25.3%) nonsmokers had measurable levels of cotinine.[8]
- The decrease in exposure to secondhand smoke is likely due to:[8]
  - The growing number of states and communities with laws that do not allow smoking in indoor areas of workplaces and public places, including restaurants, bars, and casinos
  - The growing number of households with voluntary smokefree home rules
  - Significant declines in cigarette smoking rates
  - The fact that smoking around nonsmokers has become much less socially acceptable

Many People in the United States Are Still Exposed to Secondhand Smoke

- During 2011–2012, about 58 million nonsmokers in the United States were exposed to secondhand smoke.[8]
- Among children who live in homes in which no one smokes indoors, those who live in multi-unit housing (for example, apartments or condos) have 45% higher cotinine levels (or almost half the amount) than children who live in single-family homes.[9]
- During 2011–2012, 2 out of every 5 children ages 3 to 11—including 7 out of every 10 Black children—in the United States were exposed to secondhand smoke regularly.[8]
- During 2011–2012, more than 1 in 3 (36.8%) nonsmokers who lived in rental housing were exposed to secondhand smoke.[8]

Differences in Secondhand Smoke Exposure

Racial and Ethnic Groups[8]

- Cotinine levels have declined in all racial and ethnic groups, but cotinine levels continue to be higher among non-Hispanic Black Americans than non-Hispanic White Americans and Mexican Americans. During 2011–2012:
  - Nearly half (46.8%) of Black nonsmokers in the United States were exposed to secondhand smoke.
  - About 22 of every 100 (21.8%) non-Hispanic White nonsmokers were exposed to secondhand smoke.
  - Nearly a quarter (23.9%) of Mexican American nonsmokers were exposed to secondhand smoke.

Income[8]

- Secondhand smoke exposure is higher among people with low incomes.
- During 2011–2012, more than 2 out of every 5 (43.2%) nonsmokers who lived below the poverty level were exposed to secondhand smoke.

Occupation[10]

- Differences in secondhand smoke exposure related to people's jobs decreased over the past 20 years, but large differences still exist.
- Some groups continue to have high levels of secondhand smoke exposure. These include:
  - Blue-collar workers and service workers
  - Construction workers

What You Can Do

You can protect yourself and your family from secondhand smoke by:[2,3,4]

- Quitting smoking if you are not already a nonsmoker
- Not allowing anyone to smoke anywhere in or near your home
- Not allowing anyone to smoke in your car, even with the windows down
- Making sure your children's day care center and schools are tobacco-free
- Seeking out restaurants and other places that do not allow smoking (if your state still allows smoking in public areas)
- Teaching your children to stay away from secondhand smoke
- Being a good role model by not smoking or using any other type of tobacco

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For Further Information

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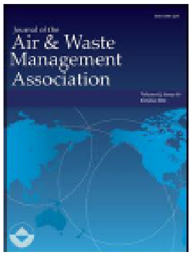

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Real–Time Measurement of Outdoor Tobacco Smoke Particles

Neil E. Klepeis , Wayne R. Ott & Paul Switzer

TECHNICAL PAPER

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DOI:10.3155/1047-3289.57.5.522

Real-Time Measurement of Outdoor Tobacco Smoke Particles

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Stanford University, Stanford, CA

ABSTRACT

The current lack of empirical data on outdoor tobacco smoke (OTS) levels impedes OTS exposure and risk assessments. We sought to measure peak and time-averaged OTS concentrations in common outdoor settings near smokers and to explore the determinants of time-varying OTS levels, including the effects of source proximity and wind. Using five types of real-time airborne particle monitoring devices, we obtained more than 8000 min worth of continuous monitoring data, during which there were measurable OTS levels. Measurement intervals ranged from 2 sec to 1 min for the different instruments. We monitored OTS levels during 15 on-site visits to 10 outdoor public places where active cigar and cigarette smokers were present, including parks, sidewalk cafés, and restaurant and pub patios. For three of the visits and during 4 additional days of monitoring outdoors and indoors at a private residence, we controlled smoking activity at precise distances from monitored positions. The overall average OTS respirable particle concentration for the surveys of public places during smoking was approximately 30 $\mu g\ m^{-3}$. OTS exhibited sharp spikes in particle mass concentration during smoking that sometimes exceeded 1000 $\mu g\ m^{-3}$ at distances within 0.5 m of the source. Some average concentrations over the duration of a cigarette and within 0.5 m exceeded 200 $\mu g\ m^{-3}$, with some average downwind levels exceeding 500 $\mu g\ m^{-3}$. OTS levels in a constant upwind direction from an active cigarette source were nearly zero. OTS levels also approached zero at distances greater than approximately 2 m from a single cigarette. During periods of active smoking, peak and average OTS levels near smokers rivaled indoor tobacco smoke concentrations. However, OTS levels dropped almost instantly after smoking activity ceased. Based on our results, it is possible for OTS to present a nuisance or hazard under certain conditions of wind and smoker proximity.

IMPLICATIONS

This article is the first peer-reviewed publication of systematic measurements of OTS concentrations. The main conclusion from these data, that OTS levels can be substantial under certain conditions, is vital to the development of outdoor tobacco control policy. Because adequate information on OTS levels and human exposures has previously been lacking, the estimation of health risks associated with OTS has been hindered, and public discourse concerning OTS has been impaired. The present study also has shown that continuous, portable airborne particle monitors are suitable in OTS investigations across a range of locations and environmental conditions.

INTRODUCTION

Secondhand tobacco smoke (SHS), also called environmental tobacco smoke (ETS) or passive smoke, is defined as diluted and dispersed air pollutant emissions generated from the consumption of tobacco products. Emissions may be exhaled by a smoker (mainstream) or by leaving the burning tip of a cigarette or cigar (sidestream). When occurring outdoors, SHS is called outdoor tobacco smoke (OTS).

Indoor SHS has an established connection to adverse health outcomes in adults and children, such as asthma, respiratory infection, and lung cancer.[1] More recent work has shown an association between SHS exposure and reduced cognitive ability in children,[2] increased respiratory disease in adults from work exposure and increased cancer for people exposed at home as children,[3] increased coronary heart disease in women exposed at home or work,[4] and a general increase in mortality for persons living with smokers.[5] The U.S. Surgeon General's Report titled "The Health Consequences of Involuntary Exposure to Tobacco Smoke" concludes that there is no level of exposure to SHS without some associated risk,[6] and the California Air Resources Board (CARB) recently designated SHS as a "toxic agent,"[7] a classification also given to pure compounds such as arsenic or benzene.[8]

The body of evidence demonstrates clear harm from SHS exposure and supports the pursuit of exposure reduction policies. In 1995, California Assembly Bill 13 was passed, which effectively banned smoking inside eating and drinking establishments throughout California. Other state- or country-wide initiatives that ban smoking inside bars and restaurants have also been enacted.[9]

Cities and counties have just started to institute bans on outdoor smoking, such as those for parks and beaches.[10] Bans may be supportable because of the drift of OTS inside buildings or from the littering of cigarette butts. Outdoor smoking bans may also serve to discourage smoking behavior in general, by making it more difficult for smokers to find a place to light up or by preventing children from associating smoking with enjoyable outdoor activities. However, the ongoing debate over the appropriateness of outdoor bans from an exposure standpoint suffers from a lack of air monitoring data. To date, no data have been published in the archival literature on the systematic measurement of human exposure to OTS.

Table 1. Characteristics of five real-time airborne particle monitors used in the present work.

Monitor Type	Abbreviation	Description	References
Piezobalance	PZB	The model 3511 (Kanomax, Inc.) and model 8510 (TSI, Inc.) PZBs measure RSP mass in units of μg m^{-3} by passing an air stream though a 3.5-μm size-selective particle impactor and onto a vibrating piezoelectric crystal. The frequency change in the crystal is converted to an average particle concentration with a resolution of ~10 μg m^{-3}, which we record automatically in 1-min intervals using a custom-built logging system.	Ott et al.[16] and Sem et al.[17]
Nephelometer	NEPH	The model M903 integrating nephelometer (Radiance, Inc.) uses a flash lamp and optical filter to measure a light scattering coefficient ("extinction coefficient") for particles drawn into the instrument at intervals as small as 2 seconds. The instrument does not include a size-selective inlet.	Brauer et al.[18] and Radiance Research[34]
Laser photometer	SIDEPAK	The model AM510 SIDEPAK (TSI) is a 90° light scattering system using a 670-nm laser diode that is precalibrated by the manufacturer using Arizona road dust to measure aerosol mass in units of mg m^{-3}. In the present work, we equipped the monitor with a 2.5-μm impactor and used the internal logger to record levels at intervals as small as 10 seconds. Before each monitoring visit, the SIDEPAK inlet flow rate was adjusted to 1.7 l min^{-1} using a Gilibrator primary flow calibrator	TSI[35]
Laser counter	GRIMM	The model 1.108 laser counter (GRIMM, Inc.) internally records counts of airborne particles every minute in 14 size ranges from 0.3 to 20+ μm with a resolution of 1 particle count per liter. It measures light photons from a semiconductor laser that have been scattered at an angle of ~90°	Grimm Technologies[36]
Photoelectric aerosol sensor	PAS	The model PAS 2000CE photoelectric aerosol sensor (EcoChem, Inc.) takes advantage of the physics of PAH photoemission on the surface of particles. It uses UV light to ionize PAH on particles <1 μm in diameter and measures the resulting electrical charges. The instrument is precalibrated to internally record the mass concentration of PAH in units of ng m^{-3} at intervals as small as 30 seconds. Because it measures particle-bound PAH, the PAS instrument may respond differently to aerosols that have comparable total mass concentrations but vary in their surface PAH content.	Ott and Siegmann[23] and EcoChem Analytics[37]

To meet this need, we performed OTS monitoring surveys and controlled OTS experiments in public outdoor locations and a private residential patio using state-of-the-art, real-time particle sensing instruments. These instruments were anticipated to be useful for pinpointing and understanding transient elevations in OTS pollution. We expect that the results of our study will be helpful to those involved in tobacco-related policy development, as well as to risk assessors and environmental epidemiologists.

EXPERIMENTAL WORK

Although there are many potentially toxic compounds in both the gaseous and particle phases of SHS,[8,11] for the present work we used airborne particle concentrations to characterize SHS levels. The use of particles to indicate the presence of SHS is common practice.[12] Airborne particles comprise a significant portion of the sidestream and mainstream mass emissions from burning cigarettes and other tobacco products, and indoor particle concentrations associated with SHS are substantial.[13] The size range of SHS particles is approximately 0.02–2 μm,[14] so that all of the SHS particles fall within the fine particulate matter ($PM_{2.5}$) and respirable suspended particle (RSP; also called particulate matter with diameters <3.5 μm) size ranges. When inhaled, these particles can deposit in the human lung. Other benefits of using particles to characterize SHS are that particle concentrations can be measured using standard techniques, particles have a direct association with adverse health effects, and there are existing health standards for time-averaged particle concentrations.[15]

Because many types of portable continuous monitors for airborne particles are currently available, we decided for the present study to use a range of different instruments to characterize dynamic OTS levels in the field and under controlled conditions. The simultaneous use of multiple monitors of the same type and of different types allowed us to achieve a high level of confidence in measured OTS levels and to perform intensive evaluations and comparisons of the instruments.

Real-Time Monitors

We used 5 types of portable real-time airborne particle monitoring instruments to measure OTS concentrations at intervals ranging from 2 sec to 1 min. The monitor types included a piezoelectric microbalance (piezobalance [PZB]), a photoelectric aerosol sensor (PAS), and three light-scattering photometers: an integrating nephelometer (NEPH), a laser particle counter (GRIMM), and a laser diode photometer (SIDEPAK). A brief summary of the characteristics of each real-time particle monitoring instrument, along with references to the scientific literature or manufacturers' guides, is given in Table 1. We selected each instrument because of its sensitivity to tobacco smoke particles, rapid response time, portability, and/or proven reliability in the field. In addition to these instruments, we used a real-time hot wire anemometer to record airflow (0.01 m sec^{-1} threshold), temperature, and relative humidity (RH) every minute (VelociCalc Model 8386, TSI).

Table 2. Native units and conversion factors for real-time particle monitoring instrument readings.

[a]Instrument	Native Units	[b]Conversion Factor from Native Units to RSP Mass Concentration ($\mu g\ m^{-3}$) $\bar{x}$	CI_{90}	s	$s/\bar{x}$
PZB	$\mu g\ m^{-3}$	—	—	—	
NEPH	$10^{-6}\ m^{-1}$	$4.6\ m^2\ g^{-1}$	±0.4	$0.78\ m^2\ g^{-1}$	0.17
SIDEPAK	$mg\ m^{-3}$	$3.3 \times 10^{-3}\ mg\ \mu g^{-1}$	±0.3	$0.53 \times 10^{-3}\ mg\ \mu g^{-1}$	0.16
GRIMM	counts L^{-1}	6300 counts $m^3\ (\mu g\ L)^{-1}$	±800	160 counts $m^3\ (\mu g\ L)^{-1}$	0.25
PAS	$ng\ m^{-3}$	$0.83\ ng\ \mu g^{-1}$	±0.1	$0.19\ ng\ \mu g^{-1}$	0.23

Notes: [a]Real-time airborne particle monitoring instrument abbreviations: PZB = Kanomax or TSI PZB; NEPH = Radiance integrating nephelometer; SIDEPAK = TSI Sidepak laser photometer; GRIMM = Grimm laser counter; PAS = Ecochem photoelectric aerosol sensor. [b]The sample mean ($n = 12$) of conversion factors from native units to estimated RSP mass concentration units are given for readings of each realtime airborne particle monitoring instrument. Also given are the 90% confidence intervals for the sample mean.[38] Dividing the native units by the conversion factor gives RSP units of $\mu g\ m^{-3}$. The conversion factors were determined by comparing average particle measurements for fresh cigarette smoke emissions of the NEPH, SIDEPAK, GRIMM, and PAS instruments against those for the PZB instrument taken during 12 monitor collocation experiments where valid PZB readings were available. Abbreviations: $\bar{x}$ = the sample mean; CI_{90} = the 90% confidence interval for the sample mean; s = the sample standard deviation; $s/\bar{x}$ = the relative standard deviation.

The PZB was designated as the reference particle mass monitor because it provides direct measurements of RSP mass concentrations and it has a long history of use with tobacco smoke. The PZB has been shown to agree well with reference pump- and filter-based RSP measurements. Ott et al.[16] provide a review of previous studies that evaluated the PZB, including one by Sem et al.,[17] who report PZB mass readings for tobacco smoke to be within 15% of filter-based samples. Based on 9 recent experiments that we performed in a 9-m^3 chamber using cigarettes and incense as sources, we found that average mass readings of an impactor-equipped PZB were within approximately 10% of average mass concentrations determined from cyclone mass filter samples ($R^2 = 96\%$).

Instrument Testing and Calibration

The NEPH, SIDEPAK, GRIMM, and PAS continuous monitors can be used to estimate RSP mass concentrations. However, it is essential to first calibrate them with respect to the specific aerosol under study. We tested, calibrated, and compared the monitoring instruments for a tobacco smoke source during a set of 14 side-by-side experiments in a 44-m^3 room of a residence. For each experiment, a single cigarette was lit and allowed to burn by itself (smolder smoked) for 4–10 min. Doors and windows were kept closed, except to clear smoke from the room in between experiments. The room SHS particle concentrations were measured during and after each cigarette burn period. We subtracted background particle levels, which were observed just before smoking began, from all of the readings. Over the range of relative humidities, which we measured during the experiments (40–70%), we found no influence of RH on measured particle levels.

We calculated one conversion factor for each of 12 experiments where valid PZB readings were available (see Table 2) by taking the ratio of the fresh 5-min average for the PAS, SIDEPAK, GRIMM, and NEPH readings to the fresh PZB 5-min average RSP mass levels measured during a period starting 5–10 min after smoking stopped (at which time concentrations were evenly mixed in the room). Background levels were subtracted before taking the ratio. Fresh levels were used to determine conversion factors, because OTS was expected to consist exclusively of fresh emissions. Except for the GRIMM monitor, we used the raw readings of each instrument to determine the conversion factors. In the case of the GRIMM, we used the sum of all of the particles from the lowest measured diameter of 0.3 μm up to 3 μm, because tobacco smoke particles are expected to be in the 0.02–2 μm range.[14] Although linear regressions between 1-min average PZB readings and the other instruments across all of the well-mixed concentrations (fresh and aged) showed generally good agreement on a per-experiment basis ($R^2 = 80$–99%), there was evidence of a nonlinear relationship in many cases. Our use of ratios of background-subtracted 5-min average particle concentrations to calculate conversion factors, rather than linear regressions, resulted in lower relative variation for conversion factors, likely because it minimized biases because of deposition, coagulation, or evaporation of tobacco smoke particles occurring over time.

The average conversion factors from NEPH and SIDEPAK native units to RSP units observed in the present study ($4.6\ m^2\ g^{-1}$ and $3.3 \times 10^{-3}\ mg\ \mu g^{-1}$, respectively) are similar to those determined by other investigators. For example, Brauer et al.[18] found a value of $4.7\ m^2\ g^{-1}$ for the NEPH conversion to mass for cigarettes, and both Travers[19] and Lee[20] found values of ~$3 \times 10^{-3}\ mg\ \mu g^{-1}$ for the SIDEPAK conversion. Lee performed 14 laboratory calibration tests of the SIDEPAK using gravimetric $PM_{2.5}$ filter samples and a smoking machine. Previous investigators have also found good agreement between personal nephelometers (e.g., the MIE personal DataRam) and reference gravimetric methods when calibrated for the target aerosols and adjusted properly for high RH.[21] Personal nephelometers, which have been used by U.S. Environmental Protection Agency (EPA) and others to characterize particle exposures,[22] operate on principles similar to the SIDEPAK and NEPH light-scattering photometers used in the current study. Our SIDEPAK conversion factor corresponds with an internal "custom calibration factor" of approximately 0.3 (dimensionless), which is calculated by multiplying our result by 1000 and taking the reciprocal.

Unlike the other particle instruments, the PAS is expected to exhibit variation in response to RSP based on the polycyclic aromatic hydrocarbon (PAH) content of particle emissions, and it only responds to particles <1 µm in diameter.[23] However, evidence suggests that the PAS-measured PAH in cigarette smoke consistently tracks RSP mass across a range of cigarette types and smoking styles. Ding et al.[24] report that mainstream smoke for U.S. cigarettes contains 1–1.6 µg of PAH per cigarette. The average PAS-to-RSP conversion factor of 0.83 ng μg^{-1}, which we observed in the present study for the PAS monitor's response to smolder-smoked Marlboro cigarette emissions, implies that 0.083% of the emitted particle mass consists of particulate PAH. Our value for the conversion factor is similar to a value of 0.8 ng μg^{-1} observed by Repace[25] in a casino and values of 1 and 0.8–1.3 ng μg^{-1} observed in two of our previous studies,[26,27] which used an older version of the PAS monitor (Model PAS 1000i, EcoChem, Inc.). We found that the older PAS 1000i monitor's response had to be reduced by a factor of 10 relative to the PAS 2000CE because of the fact that the 1000i uses a krypton bromine ultraviolet (UV) lamp, whereas the 2000CE uses a mercury vapor UV lamp.

Our use of particles measured by the GRIMM in the 0.3- to 3-µm range avoided interference from nontobacco sources of ultrafine particles (<0.1 µm) and large dust particles (>3 µm). The empirical GRIMM conversion factor of 6300 counts m^3 $(\mu g\ L)^{-1}$ agrees well with a theoretical mean value of ~6500 counts m^3 $(\mu g\ L)^{-1}$ (relative standard deviation [RSD] of 0.15), which we calculated from the particle count data by assuming spherical particles, a uniform distribution of particle sizes in each size bin, a particle density of 1.1 g cm^{-3}, and a lognormal particle size distribution with a mass median diameter of 0.2 µm and a geometric standard deviation of 2.[14]

We estimated the error associated with readings of a given monitor by computing the ratio of 1-min values for matched instruments of the same type. We also estimated the error associated with conversion of native PAS, GRIMM, NEPH, and SIDEPAK readings to RSP mass units by computing the ratio of the estimated 1-min average RSP mass units for each monitor to the native RSP mass values measured by the PZB. The results of these calculations showed generally good consistency for intrainstrument and interinstrument comparisons, with the bulk of errors <10–20%.

On-Site Monitoring Visits

To establish typical OTS levels, we conducted 15 on-site field visits to 10 public outdoor locations containing smokers, including restaurant and pub patios, cafés, airport sidewalks, and a public park (see Tables 3 and 4 and the location schematics in Figure 1). These visits were designed so that we could measure the average particle exposure attributable to emissions from real smokers that might occur during a meal at an outdoor establishment or while waiting on a sidewalk or in some other public area.

During each on-site visit, we made real-time measurements of airborne particles using the GRIMM and/or the PAS instrument or the SIDEPAK instrument. We used the PZB as a supplemental instrument during a single visit. We used the GRIMM, PAS, and SIDEPAK for the visits because they are more portable and unobtrusive than the PZB and NEPH monitors. For each visit, we measured OTS levels during periods with active smoking. To provide background levels, we also measured during times when no tobacco sources were active.

For nine of the visits (S1–S9), we measured OTS particle levels using the PAS and/or GRIMM while sitting or standing on each patio or sidewalk and observing the activity of nearby cigarette and cigar smokers, but, because patrons engaged in uncontrolled smoking, we were not able to make precise measurements of the distance between smokers and the monitoring instruments. The monitors were generally positioned at breathing height (4–6 ft) or table height (~3 ft). The inlets of the GRIMM and PAS monitors were placed within 12 in. of each other where possible. The time spent near active smokers ranged from 0.5 to 3.4 hr per visit.

For three on-site visits to outdoor patios (OC1–OC3), we smoked or smolder-smoked cigarettes or cigars near the monitoring positions for smoking periods of 0.1 and 0.5 hr. We used the GRIMM and/or PAS to measure OTS particles during these visits.

Finally, during three site visits to sidewalk patios (OP1–OP3), we measured OTS levels using the SIDEPAK at precise distances from active cigarettes, which were either smolder smoked or human smoked, for periods ranging from 0.6 to 1.7 hr. We also measured temperature, air speed, and RH continuously during these visits.

Matched Monitor Experiments

To quantify the relationship between distance from the smoker and OTS concentration, that is, the proximity effect, and to make direct comparisons between OTS and indoor SHS levels, we performed controlled experiments on four days (E1–E4) at a private residence (Tables 3 and 4 and BP1 in Figure 1) using pairs of matched PAS, NEPH, and GRIMM instruments at different distances from burning cigarettes. We smolder smoked successive cigarettes both on the outdoor patio and inside the residence. For most experiments, we made continuous measurements of air speed, temperature, and RH.

The E1 experiments consisted of six outdoor patio experiments on a single day in which a cluster of single PAS, NEPH, and GRIMM monitors were surrounded by five burning cigarettes at distances of 2, 4, or 6 ft and heights of 3–4 ft for periods of 10 min per experiment. The cigarettes were positioned in concentric pentagonal arrangements so that cigarettes surrounded the monitors at equal distances for each experiment. This arrangement was expected to diminish the impact of wind direction on measured concentrations. In addition to the six cigarette experiments, we conducted two experiments in which a single cigar was smoked for 20–30 min at a distance of 4 ft from the monitor cluster. For all of the experiments, a second, identical cluster of particle monitors, which was intended to provide continuous background levels, was positioned ~28 ft (8.5 m) from the first cluster and around the corner of the house.

For experiments E2–E4, we built two mobile particle monitoring assemblies containing PAS, NEPH, and SIDEPAK instruments fastened to wheeled chairs. On each day, we created seven to nine periods of smolder-smoked cigarette activity lasting 30–50 min, using three to five individual cigarettes burned successively. The monitoring inlets and burning cigarettes were both at an approximate

Table 3. Summary of OTS on-site surveys and experiments.

[a]Name	[b]Location(s)	[c]Sources	[d]Duration (hr)	[e]Overall Average OTS RSP Concentration ($\mu g\ m^{-3}$)
On-site surveys with uncontrolled human smokers				
S1	PP1, PP2	H, CG, C	3.3	64 (PAS)
S2	PP2	H, CG, C	1.0	50 (PAS)
S3	PP1	H, CG, C	1.3	29 (PAS), 51 (GRIMM)
S4	RC	H, C	3.0	6 (PAS)
S5	RC	H, C	3.4	10 (PAS)
S6	PP3	H, CG, C	1.1	30 (PAS), 42 (GRIMM)
S7	PP3	H, C	1.4	26 (GRIMM)
S8	AP	H, C	0.6	31 (PAS), 30 (GRIMM)
S9	AP	H, C	0.5	56 (PAS), 15 (GRIMM)
On-site surveys with controlled smolder-smoked cigarettes or a controlled smoker				
OC1	PP3	H, CG, C	0.5	62 (PAS) 17 (GRIMM)
OC2	PK	S, C	0.4	67 (PAS), 23 (GRIMM), 60 (PZB)
OC3	BP2	H, C	0.1	27 (GRIMM)
On-site proximity experiments with controlled smolder-smoked cigarettes or a controlled smoker				
OP1	SC1, SC3	S, C	1.7	133 (SIDEPAK)
OP2	RP	S, C	0.6	106 (SIDEPAK)
OP3	SC2	H, C	1.4	109 (SIDEPAK)
Private patio experiments with controlled smolder-smoked cigarettes or machine-smoked cigars				
E1	BP1	S, C	2.0	48 (PAS), 19 (GRIMM), 10 (NEPH)
E2	BP1	S, C	3.7	47 (PAS), 28 (GRIMM), 10 (NEPH)
E3	BP1	S, C	3.9	61 (PAS), 29 (GRIMM), 22 (NEPH)
E4	BP1	S, C	2.5	38 (PAS), 18 (GRIMM), 16 (NEPH)

Notes: [a]S1–S9 = on-site visits (surveys) to patios and sidewalk areas with human smokers; OC1–OC3 = on-site controlled visits (surveys) for which the investigators controlled the smoking or smolder smoking of one or more cigarettes or cigars near the monitors; OP1–OP3 = on-site proximity experiments with controlled smolder- or human-smoked cigarettes positioned at precise distances from the monitoring positions; E1–E4 = controlled experiments performed at a private residence (patio, living room, bedroom) with smolder-smoked cigarettes positioned at precise distances from two separate monitoring positions. [b]Codes refer to one of the outdoor locations listed in Table 4. SC1, SC2, and SC3 = sidewalk cafés; PP1, PP2, and PP3 = pub patios; RC = resort café; RP = restaurant patio; PK = park plaza; AP = airport sidewalk; BP1 and BP2 = private backyard patio. [c]H = human smoked, S = smolder smoked, CG = cigars, C = cigarettes or cigarillos. [d]Duration of the monitoring period during which OTS sources were intermittently or continuously active. [e]The estimated average OTS RSP concentration in $\mu g\ m^{-3}$ determined by converted measurements of a PAS, GRIMM, NEPH or SIDEPAK instrument (indicated in parentheses) taken during times when cigarettes or cigars were active. Background levels were subtracted. PAS = Ecochem photoelectric aerosol sensor; GRIMM = Grimm laser particle counter; PZB = Kanomax or TSI PZB; NEPH = Radiance integrating nephelometer; SIDEPAK = TSI Sidepak laser photometer. Results for S1–S9 include time when smokers were intermittently active at a location. Results for OC1–OC3, OP1–OP3, and E1–E4 include times when a cigarette or cigar was smoked or smolder smoked by the investigators near the monitoring position. Although experiments E2–E4 included indoor SHS measurements, they were not included in the calculated average OTS particle concentrations shown in the table.

height of 3–4 ft. To provide accurate background levels, we measured particle concentrations during intermediate time periods with no cigarette activity, which were of similar duration as the smoking periods. For each period of smoking activity, the two monitoring assemblies were placed on opposite sides of the source at distances of 0.25, 0.5, 1, 2, or 4 m. On day 4, the PZB instrument was added to the suite of monitoring instruments.

Immediately after five to six periods of controlled outdoor cigarette combustion on the backyard patio (BP1 location; E2–E4 experiments), we moved the monitoring assemblies indoors and performed several experiments in the bedroom or living room of the residence. The design of the indoor experiments was nearly identical to the outdoor experiments, except that only distances of 0.25 and 0.5 m from the burning cigarette were monitored, and the experiments were performed inside the house where all of the exterior doors and windows were closed during periods of smoking activity. In addition, for one of the two living room experiments, a small fan was introduced to explore the effect of controlled air directionality. The fan blew air at a rate of ~0.4 m sec^{-1} from the source toward one set of monitors. The airflow because of the fan was approximately equal to the average ground-level outdoor airflow rate that we observed during the patio experiments and on-site surveys (see below).

RESULTS AND DISCUSSION

Measured concentrations of OTS consistently showed sharp spikes in airborne particle levels during periods when cigars or cigarettes were active. The structure of the peaks could be observed using the NEPH and SIDEPAK instruments, which provided readings at intervals of 2 and 10 sec, respectively (see Figure 2). Some peaks exceeded 1000 $\mu g\ m^{-3}$. Transitory peaks of this nature, which are seen in close proximity to activity

Table 4. Characteristics of OTS monitoring locations.

Site	Abbreviation	[a]Width (m)	[a]Depth (m)	[b]Building Height (m)	[c]Distance to Building (m)	[c]Distance to Street (m)	[d]No. of Tables or Benches	[d]Seating Capacity
Sidewalk café 1	SC1	12	5	7	2	5	10	22
Sidewalk café 2	SC2	5	5	6	1	5	3	10
Sidewalk café 3	SC3	26	25	9	3	22	38	133
Pub patio 1	PP1	6	9	6	3	5	6	25
Pub patio 2	PP2	12	9	9	5	15	20	50
Pub patio 3	PP3	15	12	3	5	12	15	100
Restaurant patio	RP	12	5	7	3.7	35	9	43
Resort café	RC	9	7	4	2	320	2	8
Park plaza	PK	26	30	7	16	12	9	61
Airport sidewalk	AP	56	4	3		4	12	> 50
Backyard patio 1	BP1	11	5	6	2	11	–	–
Backyard patio 2	BP2	6	4	2.4	2	300	–	–

Notes: See Figure 1 for schematics of each location. [a]The approximate width and depth of the sidewalk or patio area intended for sitting or standing that is associated with the location. [b]The approximate height of the building facade immediately adjacent to the sidewalk or patio at each location. [c]The approximate distances from the monitoring position to the front of the nearest building and to the nearest roadway (farthest monitoring position of all those used). [d]The approximate number of tables or benches that were present at each location during the day of monitoring and the estimated number of seats (maximum occupancy).

sources, have been attributed to "microplumes" by previous investigators,[28] who observed them within 2 m of indoor point sources of pollution. Microplumes are defined as thin concentrated streams of smoke, or some other air pollutant, that follow complex trajectories during periods of release. When the microplumes impinge on a monitor inlet, the monitor momentarily registers a high peak in concentration. Over time and at further distance from the source indoors, the microplumes dissipate, and pollution becomes well mixed in an interior space, persisting long after the source has been extinguished. In contrast to persistent and mixed indoor levels, which exhibit smooth rises and decays in concentration, OTS consists entirely of periods characterized by microplumes. There is no period where OTS is well mixed, and OTS disappears almost instantly when tobacco sources are extinguished.

We analyzed the OTS data in terms of raw concentration readings, 1-min average concentrations, and averages on a per-visit, per-experiment, or overall basis. All of the results presented are for periods of continuous (experiments) or intermittent (surveys) active smoking. Before averaging and data analysis, we subtracted background levels for each day's worth of data from each monitor. We created a consistent and integrated database by calculating 1-min averages for each monitor and by converting the native units of each monitor into units of RSP mass concentration ($\mu g\ m^{-3}$) using the mean conversion factors in Table 2. The quantitative discussion of variation in OTS levels during each monitoring episode refers to either peak values over intervals as low as 2 or 10 sec or to 1-min average levels. During nearly all of the outdoor monitoring periods on patios and sidewalks where RH was measured, it was fairly low, averaging ~40% with a range of 20–65%. Therefore, correction of OTS levels because of high RH was deemed unnecessary. Where measured, outdoor temperatures averaged 26 °C with a range of 10–38 °C and outdoor ground-level wind speeds (~1 m above ground) averaged 0.41 m sec^{-1} with a range of ~0–1.2 m sec^{-1}.

Typical OTS Levels

Tables 3 and 5 contain overall average OTS particle mass concentrations for periods of smoking during the outdoor on-site field visits and for breakdowns by various factors. Note that the results presented in Table 5 are not meant to imply direct comparisons of concurrent measurements for the different instruments, because not all of the monitors were used during a given visit.

As determined from PAS instrument measurements during the on-site visits with natural and controlled smoking (S1–S6, S8–S9, and OC1–OC2), average estimated RSP mass concentrations of OTS particles on a given day ranged from 6 to 67 $\mu g\ m^{-3}$ with an overall average of 33 $\mu g\ m^{-3}$. The estimated GRIMM RSP levels for similar visits to outdoor patios (S3, S6–S9, and OC1–OC3) ranged from 17 to 51 $\mu g\ m^{-3}$ with an average of 34 $\mu g\ m^{-3}$. The PZB levels from a single visit with controlled smoking near the monitor (OC2) averaged 60 $\mu g\ m^{-3}$ (0.4-hr averaging period).

In general, the variation in 1-min average OTS levels (Table 5) was very high, with overall RSDs of 1.7 for the PAS and GRIMM instruments. This variation results from the occurrence of sharp spikes in the OTS concentration time series because of swirling microplumes. Peaks in 1-min average OTS levels during site visits were observed to reach as high as 300–600 $\mu g\ m^{-3}$ as measured by the PAS and GRIMM instruments.

The estimated RSP mass concentrations determined from PAS measurements in the present work may have been influenced by nontobacco sources or differences in PAH emissions for different types of tobacco products or smoking styles relative to what we used during the calibration experiments. Ott and Siegmann[23] report very different PAH concentrations for different combustion sources. In the current study, we found that the PAS monitor was more sensitive to

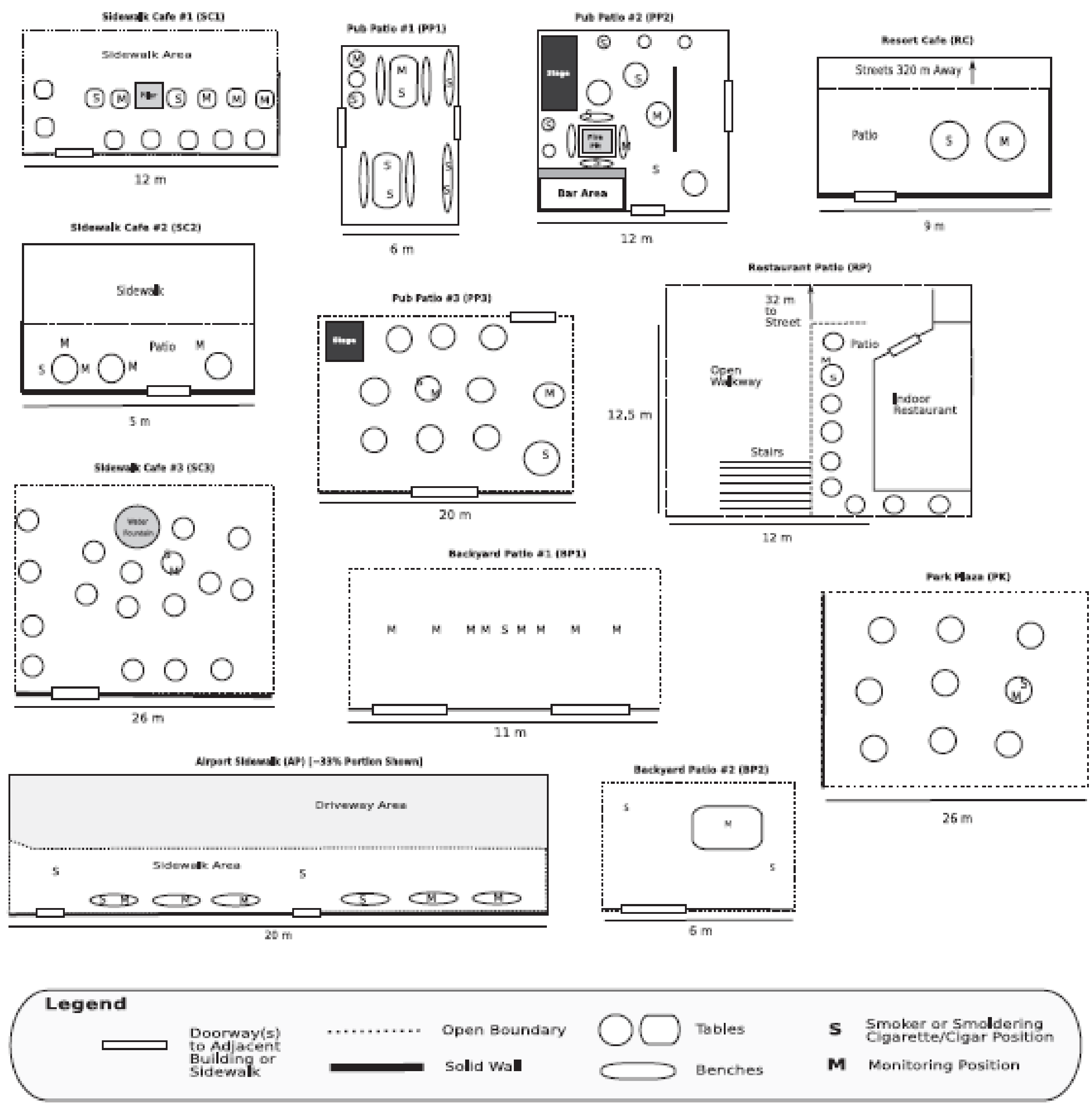

Figure 1. Rough schematic diagrams of patios and sidewalks where OTS particle levels were monitored in proximity to smokers or burning cigarettes. All of the patios had at least an open roof, and many were open on three sides. Broken lines represent open boundaries, and solid lines indicate a surrounding wall or an adjacent building. Tables and benches are represented by circles or ovals, and rectangles indicate doorways to buildings or an opening in the wall or fence surrounding a patio. The approximate positions of active smokers and monitors during one or more visits are indicated by the letters "S" and "M," respectively. See Table 4 for dimensions and other characteristics of each OTS monitoring location.

some non-OTS particles, such as diesel exhaust and soot from some types of candles, than the other instruments, because these emissions can be high in PAH. We minimized bias in the PAS measurements caused by other sources by including only levels for the PAS when no non-OTS sources or unexplained concentrations were observed.

Despite possible interference from other sources, the general validity of the PAS results (and their applicability to estimating OTS RSP) is supported by their generally good agreement with the estimated RSP levels derived from the GRIMM instrument. Some of the differences that we observed between the two instruments may have resulted from microplume effects, in which localized peaks in particle concentration occurred near only one monitor's inlet at a given instant.

To facilitate direct comparisons to PAS measurements performed in other studies, the estimated RSP values reported here can be converted back to the native units

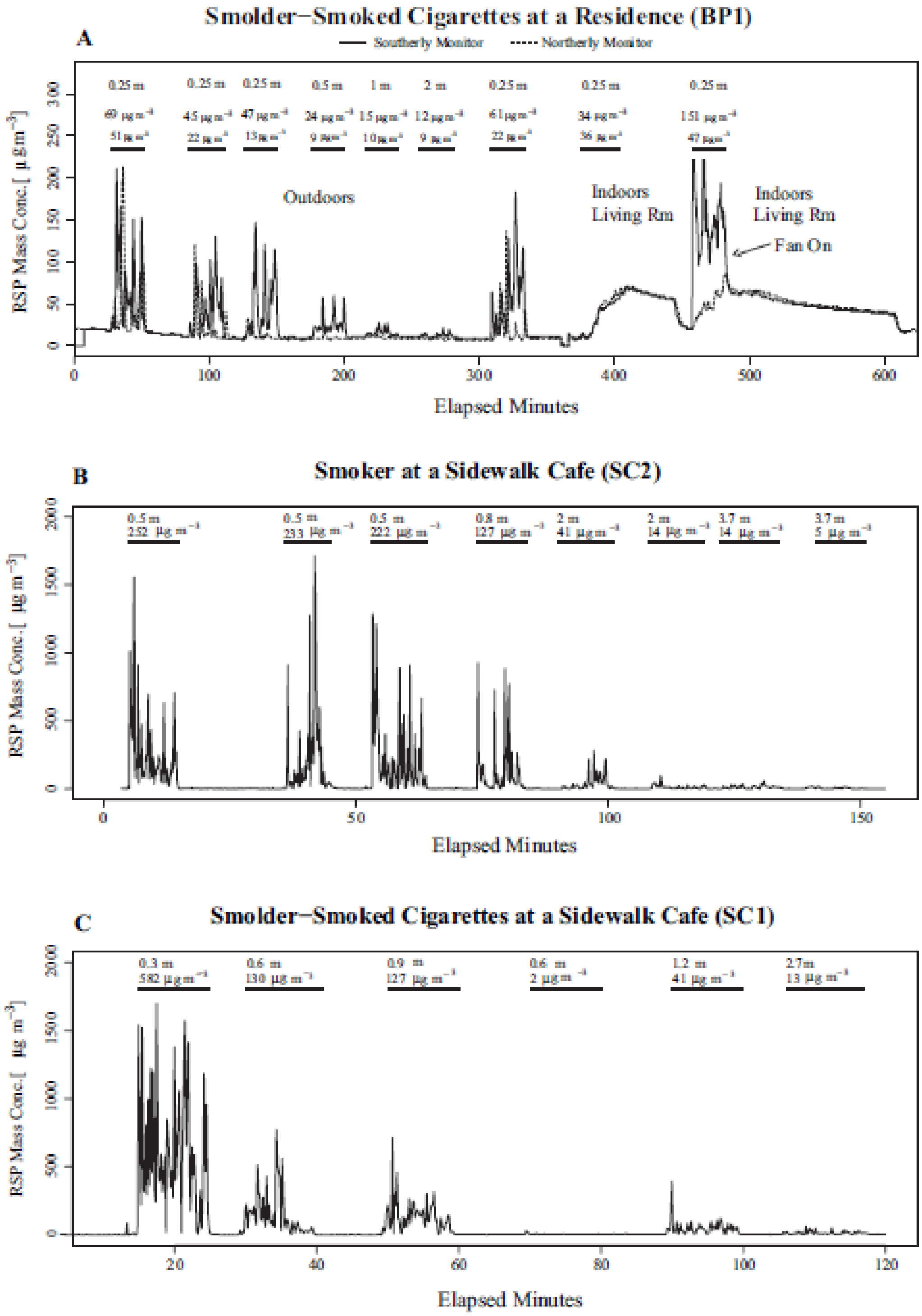
A
Smolder−Smoked Cigarettes at a Residence (BP1)
Southerly Monitor
Northerly Monitor
RSP Mass Conc. [μg m⁻³]
Elapsed Minutes
Outdoors
Indoors Living Rm
Indoors Living Rm
Fan On
0.25 m
0.5 m
1 m
2 m
B
Smoker at a Sidewalk Cafe (SC2)
RSP Mass Conc. [μg m⁻³]
Elapsed Minutes
0.5 m 252 μg m⁻³
0.5 m 233 μg m⁻³
0.5 m 222 μg m⁻³
0.8 m 127 μg m⁻³
2 m 41 μg m⁻³
2 m 14 μg m⁻³
3.7 m 14 μg m⁻³
3.7 m 5 μg m⁻³
C
Smolder−Smoked Cigarettes at a Sidewalk Cafe (SC1)
RSP Mass Conc. [μg m⁻³]
Elapsed Minutes
0.3 m 582 μg m⁻³
0.6 m 130 μg m⁻³
0.9 m 127 μg m⁻³
0.6 m 2 μg m⁻³
1.2 m 41 μg m⁻³
2.7m 13 μg m⁻³

Table 5. Observed OTS particle concentrations during patio and sidewalk café on-site visits in RSP mass units ($\mu g\ m^{-3}$).

Factor	PAS[b]				GRIMM[b]				PZB[c]			
	N	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$
Overall[d]	852	33	55	1.7	339	34	57	1.7	9	60	46	0.8
Cigarettes[e]	434	16	32	2.0	178	25	43	1.7	9	60	46	0.8
Cigars and cigarettes[f]	418	50	66	1.3	161	43	67	1.6	–	–	–	–
Closed area[g]	326	52	69	1.3	75	51	75	1.5	–	–	–	–
Open area[h]	526	21	40	1.9	264	29	49	1.7	9	60	46	0.8

Notes: This table contains grouped descriptive statistics calculated from 1-min average OTS particle measurements observed during nine onsite visits S1–S9, where natural smoking of cigarettes and cigars by smokers occurred (intermittent smoking), and three onsite visits OC1–OC3, during which one or more cigarettes or cigars were smolder smoked by the investigators near the monitor(s) (continuous smoking). The RSP mass units for the PAS and GRIMM were estimated using conversion factors from native PZB RSP values based on the results of controlled collocation experiments using all of the monitors and a cigarette source (see text). Background levels were subtracted from all of the instrument measurements. The monitors are abbreviated as follows: PAS = Ecochem photoelectric aerosol sensor; GRIMM = Grimm laser particle counter; and PZB = Kanomax or TSI PZB; The abbreviations for statistics are: n = sample size of 1-min average values; $\bar{x}$ = RSP sample mean in $\mu g\ m^{-3}$; s = RSP sample standard deviation in $\mu g\ m^{-3}$; and $s/\bar{x}$ = RSP relative standard deviation (dimensionless). [b]The PAS and GRIMM were used together for 6 of 13 visits (see Table 3). [c]The PZB was only present at the OC2 visit (see Table 3). [d]Results taken over all 13 visits. [e]Results for time periods when only cigarettes were observed to be active. [f]Results for time periods when both cigars and cigarettes were observed to be active. [g]Closed areas are patios located at restaurants or pubs and enclosed with a fence or wall on all sides so that directional air flow was effectively impeded (PP1 and PP2). [h]Open areas were sidewalks, sidewalk cafés, or parks where, although there may have been trees, umbrellas, and low barriers, there was enough open space that a potential "street canyon" effect could occur whereby air flow was channeled across the patio because of the presence of surrounding buildings (SC1, SC2, SC3, BP2, PK, RC, RP, and AP).

(nanograms per meter cubed) of the PAS instrument by using the conversion factor of 0.83 ng μg^{-1} presented above. For example, the average per-visit particle-bound PAH concentrations measured during on-site surveys where smoking occurred were 5–56 ng m^{-3} with an overall average of 27 ng m^{-3}, which is similar to the particulate PAH concentrations reported by Ott and Siegmann[23] using the same PAS 2000CE monitor.

As shown in Table 5, overall average OTS concentrations for time periods when both cigarettes and cigars were active (50 and 43 $\mu g\ m^{-3}$ for PAS and GRIMM, respectively) were 40–70% higher than those when only cigarettes were active (16 and 25 $\mu g\ m^{-3}$). This result may have occurred because cigars are active over a longer period of time than are individual cigarettes. In addition, average OTS concentrations measured by the PAS and GRIMM instruments during visits to outdoor patios that were enclosed by fences or walls (PP1 and PP2 locations) were 50% and 43% higher, respectively, than those observed in more open areas (52 and 51 $\mu g\ m^{-3}$ vs. 21 and 29 $\mu g\ m^{-3}$). In the more open patios (SC1–SC3, BP2, PK, RC, RP, and AP locations in Figure 1), which may have contained tables, chairs, umbrellas, and low fences, air could flow across the patio, perhaps influenced by a "street canyon" effect characterized by air movement in a consistent direction along building boundaries. In contrast, the enclosed patios had walls on four sides that protected patrons from wind and may have contained OTS emissions to a greater degree.

Outdoor versus Indoor Concentrations

The 3 days of monitoring at a residence (E2–E4), during which parallel measurements were performed indoors and outdoors using the PAS, GRIMM, NEPH, and PZB instruments, provide data for direct comparisons between OTS levels and indoor SHS levels. Tables 3 and 6 summarize the average OTS and indoor SHS particle concentrations observed during periods of active smoking for these experiments. Figure 2A shows the complete time series of one set of experiments (E3) for the NEPH instrument.

The effect of accumulation of cigarette emissions indoors and the effect of room volume were plainly evident during the experiments. Although OTS concentrations

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Figure 2. (A) Real-time OTS and indoor SHS RSP mass concentrations determined from raw 2-second NEPH instrument readings during a suite of patio experiments (E3) performed in the backyard of a residence using smolder-smoked cigarettes. Average RSP mass concentrations are shown for each period when cigarettes were active, indicated by solid horizontal bars, for both northerly and southerly monitoring positions at source-receptor distances of 0.25, 0.5, 1, and 2 m. The southerly average concentrations, shown in larger typeface, were consistently higher than the northerly ones for outdoor measurements, likely because the prevailing winds were in the southerly direction. Outdoor air speed averaged 0.5 m sec^{-1} on the patio during times that cigarettes were active. The indoor air speed was close to zero. (B) Real-time OTS RSP mass concentrations determined from raw 10-second SIDEPAK instrument readings during an on-site proximity experiment (OP3) performed on a sidewalk patio with a human smoker. Average mass concentrations during periods of smoking are indicated by solid horizontal bars. The distance of the monitor from the smoker, which ranged over four values between 0.5 and 3.7 m, is also given. Air speed averaged 0.16 m sec^{-1} during times that cigarettes were active. (C) Real-time OTS RSP mass concentrations determined from raw 10-second SIDEPAK instrument readings during an on-site proximity experiment (OP1) performed on a sidewalk patio where cigarettes were smolder smoked at five different distances from the instrument, ranging from 0.3 m (1 ft) to 2.7 m (9 ft). Average mass concentrations during periods of smoking are indicated by solid horizontal bars. During this set of experiments, wind was consistently blowing in a single direction along the sidewalk. All of the concentrations were monitored in the downwind direction, except for the second cigarette at 0.6 m, for which concentrations were monitored in the opposite (upwind) direction. Air speed averaged 0.5 m sec^{-1} during times that cigarettes were active.

Table 6. Observed OTS and indoor SHS particle concentrations during controlled experiments E1–E4 and OP1–OP3 in RSP mass units (μg m^{-3}).

Factor	PAS[a]				GRIMM[a]				NEPH[a]				PZB[a]				SIDEPAK[b]			
	n	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$	n	$\bar{x}$	s	$s/\bar{x}$
Outdoor[c]	1029	50	113	2.3	1052	22	50	2.3	1052	15	26	1.7	–	–	–	–	220	120	181	1.5
Living room[c]	235	33	33	1.0	235	30	35	1.2	235	32	22	0.7	30	35	12	0.3	–	–	–	–
Bedroom[c]	22	46	48	1.0	22	106	105	1.0	22	95	80	0.8	11	105	74	0.7	–	–	–	–
[0.25, 0.5) m[d]	328	108	175	1.6	332	45	76	1.7	332	35	38	1.1	–	–	–	–	104	177	228	1.3
[0.5,1) m[d]	202	43	72	1.7	202	16	21	1.3	202	11	11	1.0	–	–	–	–	51	128	126	1.0
[1,2) m[d]	301	19	25	1.3	310	12	34	2.9	310	7	8	1.3	–	–	–	–	32	32	30	0.9
[2,4] m[d]	198	8	9	1.1	208	4	5	1.3	208	2	2	0.9	–	–	–	–	33	11	7	0.6
Northerly[e]	465	28	76	2.7	465	17	54	3.3	465	12	26	2.2	–	–	–	–	–	–	–	–
Southerly[e]	451	72	144	2.0	465	27	45	1.6	465	20	28	1.4	–	–	–	–	–	–	–	–
Downwind[f]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	52	175	238	1.4
Upwind[f]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	2.5	1.0	0.4

Notes: This table contains grouped descriptive statistics calculated from 1-min average OTS particle measurements observed during four controlled day-long experiments at a residence (E1–E4) and three on-site proximity experiments (OP1–OP3), for which distance from continuously active tobacco sources was recorded precisely. The RSP mass units for PAS, GRIMM, NEPH, and SIDEPAK instruments are estimated based on conversion factors to PZB RSP mass concentration units that were calculated from the results of controlled cigarette smoking experiments performed using the collocated monitoring instruments. Background levels were subtracted. The monitors are abbreviated as follows: PAS = Ecochem photoelectric aerosol sensor; GRIMM = Grimm laser particle counter; NEPH = Radiance integrating nephelometer; PZB = Kanomax PZB; and SIDEPAK = TSI laser photometer. The abbreviations for statistics are: n = sample size of 1-min average values; $\bar{x}$ = RSP sample mean in μg m^{-3}; s = RSP sample standard deviation in μg m^{-3}; and $s/\bar{x}$ = relative standard deviation (dimensionless). [a]The PAS, GRIMM, and NEPH were used together for the E1–E4 day-long experiments (see Table 3). The PZB was only used during the indoor portion of the E4 experiments. [b]The SIDEPAK was only used (by itself) during the OP1–OP3 proximity experiments (see Table 3). [c]The "Outdoor" row contains statistics calculated from OTS levels across all of the experiments. The "Living Room"' and "Bedroom" rows contain indoor SHS results for the two indoor locations when the fan was off or monitors were upwind from the fan. Indoor SHS levels were only measured at distances of 0.25 and 0.5 m from the monitoring positions. Apart from the two rows labeled "Living Room'" and "Bedroom," all of the rows in the table are for OTS levels only. [d]The distance from the source in four groupings for OTS levels only. [or] indicates left or right limit is inclusive, and) indicates right limit is exclusive. [e]For three outdoor experiments on the residential patio (E2–E4), groups of monitors were placed in northerly and southerly directions. [f]For these outdoor results (OP1), the plume of the cigarette emissions was observed to move in a single direction for the entire duration of the experiment, either toward the monitor (Downwind results) or away from the monitor (Upwind results).

dropped immediately to background levels when the cigarette sources were extinguished, indoor SHS concentrations persisted at relatively high levels and slowly decayed for hours until the doors were opened to ventilate the house.

As expected, the smaller bedroom with a volume of 44 m^3 had larger average indoor SHS particle concentrations during smoking (105 μg m^{-3} from PZB) than the living room (35 μg m^{-3} from PZB), which had a volume of >400 m^3 (see Table 6). The average indoor SHS levels observed in this study were similar to those observed by Özkaynak et al.,[29] who report that secondhand smoke contributes approximately 30 μg m^{-3} on average to indoor particle levels in homes. In the present study, we observed PZB particle mass peaks in the living room and bedroom of approximately 50 and 200 μg m^{-3}, respectively, which are similar to peak values that we observed in previous real-time monitoring studies of cigar and cigarette smoking in homes.[26,30]

The average OTS particle concentrations that we observed during each experiment across all of the distances were 10–22 μg m^{-3} for the NEPH, 18–29 μg m^{-3} for the GRIMM, and 38–61 μg m^{-3} for the PAS, with overall averages of 15, 22, and 50 μg m^{-3}, respectively (as shown in Table 6). The overall average indoor SHS concentrations, when the fan was not operating and at distances of 0.25 and 0.5 m only, were 30–35 μg m^{-3} in the living room and 46–106 μg m^{-3} in the bedroom for the different types of instruments. The higher levels measured outdoors and lower levels measured indoors by the PAS instrument may be because of emission of different numbers of fine particles containing PAH, resulting from different cigarette combustion conditions.

Although the overall average OTS particle levels were lower than the indoor SHS levels when taken over all of the distances, except for the PAS instrument, the OTS levels at distances <0.5 m were roughly equal to or greater than the average indoor living room levels for all of the instruments. In addition, during other experiments on sidewalk cafés or restaurant patios (OP1–OP3) where wind effects were evident, average OTS levels during smolder or human smoking for the SIDEPAK instrument were 106–133 μg m^{-3} for all of the distances, which are close to the levels observed in the bedroom during smoking. For individual cigarettes smoked or smoldered at a sidewalk café within 0.5 m of the monitor (OP1 and OP3; see Figure 2, B and C), average OTS particle levels measured by the SIDEPAK instrument during smoking exceeded 200 μg m^{-3} for several different cigarettes and 500 μg m^{-3} for another cigarette, indicating that circumstances can sometimes lead to short-term OTS levels that substantially exceed typical indoor SHS levels.

Wind Effect

The experiment in the living room of the residence, where a fan was used to blow the plume of a burning cigarette toward a set of monitors at an air speed of ~0.4 m sec^{-1}, demonstrates how wind can elevate OTS levels in downwind directions (Figure 2A). For this particular experiment, the fan increased average NEPH levels during smoking by approximately three times at a downwind monitor relative to an upwind monitor.

This effect is further illustrated by our observation that the two sets of monitors positioned on either side of the active cigarette sources on the outdoor residential patio recorded much different OTS particle levels. The average levels in the northerly direction were approximately 40–60% lower than those in the southerly direction (Table 6). From the time profiles for one set of measurements (Figure 2A), it is evident that outdoor levels could be higher than corresponding indoor (nonfan) levels in one direction but near zero in the opposite direction.

The clearest evidence that wind leads to extremely high OTS levels during smoking was provided by the results of the OP1 experiment at the first sidewalk café where six cigarettes were smolder smoked at five distances from the SIDEPAK monitor (Figure 2C). For this experiment, the wind was observed to consistently blow the smoke microplumes in a single direction at an average speed of 0.5 m sec^{-1} when cigarettes were active. Upwind levels were practically zero, whereas the average downwind particle levels during smoking were 582 μg m^{-3} at 0.3 m, and even at 1.2–2.7 m they were still elevated above background by 13–41 μg m^{-3}. The 10-sec spikes in the downwind OTS particle time series sometimes exceeded 1500 μg m^{-3}.

Proximity Effect

We observed a clear reduction in OTS levels as the distance from a tobacco source increased. Generally, average levels within 0.5 m from a single cigarette source were quite high and comparable to indoor levels, and OTS levels at distances greater than 1 or 2 m were much lower. However, during on-site proximity experiments OP1 and OP3, OTS was still detectable by the SIDEPAK at distances of approximately 3–4 m from a single cigarette on sidewalk patios. A NEPH instrument also registered slightly elevated particle concentrations at a distance of 8 m from a cluster of burning cigarettes and around the corner of the house during a backyard patio experiment (E1).

To summarize and quantify the proximity effect observed in our study, we fit curves to average OTS particle concentrations (y) as a function of the distance from the source (x). Figure 3 shows two curves with separate fits for data from the sidewalk cafés (OP1-OP3: $y = 44.4\,x^{-2} + 27\,x^{-1} + 4.1$) and the backyard patio (E1–E4: $y = -0.3\,x^{-2} + 16.8\,x^{-1} - 2.8$), where distances were measured precisely. Every point represents the overall average for a given distance across all of the smoking periods and instruments at a given type of location. The levels on the private patio were generally lower and dropped off by 1–2 m, whereas the café levels, where winds may have been stronger and/or more directional, started out approximately four times higher and did not entirely drop off by 4 m.

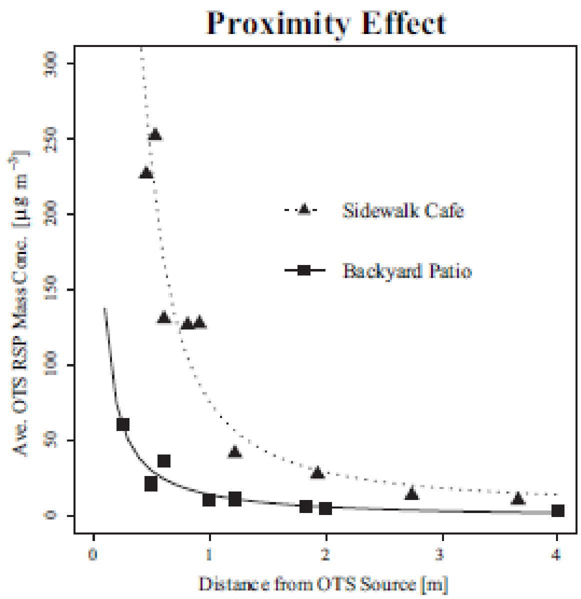

Figure 3. Overall average OTS RSP mass concentrations across all of the instruments as a function of proximity to the OTS source, calculated using levels measured during experiments on a backyard patio and two sidewalk cafés for which source proximity was recorded precisely (see E1–E4 and OP1–OP3 in Table 3). Background RSP levels were subtracted from all of the measurements. The backyard patio experiments used smolder-smoked cigarettes in an area shielded by fences and trees. The sidewalk café experiments used smolder- or human-smoked cigarettes.

Previous OTS Studies

Before the current study, few data on OTS levels have been available. In an unpublished study, the CARB measured 1- and 8-hr average nicotine concentrations, number of active cigarettes, and wind characteristics outside an airport, a college, a government center, an office complex, and an amusement park.[8] Average OTS nicotine concentrations were 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 observed 8-hr average OTS nicotine levels in locations with relatively stronger winds or a smaller number of smokers were ~0.1 μg m^{-3} or less. In locations with a larger number of smokers, the levels could reach 1 or 3 μg m^{-3}. These OTS levels are in the middle range of observed indoor SHS nicotine levels, which can average from 0.01 to 10 μg m^{-3}. Based on the CARB study, Californians who spend time close to outdoor smokers could potentially be exposed to OTS levels similar to those associated with indoor SHS concentrations.

The general findings of the CARB study are compatible with the findings of the current work. The CARB results establish the potential for relatively high OTS exposures in places where smokers congregate. The experiments in the current work go further to quantify potential exposures under specific wind and proximity conditions, focusing on single smokers. Extrapolation of our controlled experimental methods and results to multiple smokers is complex, because one must consider the relative positions between each source and the receptor. Generally, we would expect that exposure increases in proportion with the number of active smokers. The exact increase depends on the amount of time that the receptor spends downwind and at a given distance from each source.

Incremental Contributions to 24-hr Total Exposure

It is useful to calculate per-cigarette 24-hr incremental exposure (IE_{24}) concentrations for OTS, where IE_{24} is defined as the contribution of a given OTS-related event involving one cigarette to a person's 24-hr total particle exposure. For example, during on-site experiment OP1, we observed an average OTS particle concentration at a distance of 0.3 m from a cigarette of 582 $\mu g\ m^{-3}$ in the downwind direction. Because the cigarette lasted approximately 10 min, we calculate a per-cigarette 24-hr incremental exposure as follows: $IE_{24} = 582\ \mu g\ m^{-3} \times 10$ min/1440 min $= 4\ \mu g\ m^{-3}$. The calculation amounts to a weighting of the per-cigarette average concentration by the proportion of time that the cigarette lasts with respect to the 24-hr (1440 min) day.

The incremental exposure concept allows one to combine exposures for different events and to compare the total to health-related standards or other reference levels. For example, if a person experienced nine cigarette events over the course of their day (with each event similar to the one that occurred at 0.3 m in the OP1 experiments), then their overall 24-hr OTS particle exposure would be $9 \times 4\ \mu g\ m^{-3} = 36\ \mu g\ m^{-3}$. This exposure would just exceed the EPA 24-hr health-based ambient standard for fine particles, which is currently 35 $\mu g\ m^{-3}$. Note that the EPA standard was devised for ambient air pollution, which is likely to have substantially different composition than tobacco smoke pollution. However, because secondhand smoke contains many toxic compounds, including carcinogens, it is likely that, at a given airborne particle concentration, OTS carries the greater risk.

CONCLUSIONS

The measurement of OTS is a new area in terms of epidemiologic and human exposure investigations. The present work provides some of the first evidence that OTS levels can be substantial under certain conditions of wind and proximity. The major findings of our research are summarized below.

First, real-time particle instruments, especially those based on light scattering, are useful in characterizing the determinants of OTS levels, which fluctuate on a time scale of seconds. The different particle detection instruments provide consistent findings and support the general conclusion that significant OTS levels can occur near smokers.

Second, outdoor particle concentrations measured close to a cigar or cigarette exhibit multiple concentration spikes, or microplumes, which are similar to those that have been observed close to indoor particle sources.

Third, average OTS particle levels near active sources over the course of one or more cigarettes can be comparable with average well-mixed indoor SHS particle levels observed to occur in living rooms or bedrooms during smoking. Average OTS particle concentrations can reach hundreds of micrograms per meter cubed. Unlike indoor SHS levels, which decay slowly over a period of hours, OTS levels drop abruptly to zero when smoking ends.

Fourth, OTS levels are highly dependent on wind conditions. Upwind levels are likely to be very low, whereas downwind OTS levels during periods of active smoking can be very large with 10-second peak levels at the closest positions potentially exceeding 1500 $\mu g\ m^{-3}$ and average levels over the duration of a single cigarette potentially exceeding 500 $\mu g\ m^{-3}$.

Fifth, OTS levels are highly dependent on source proximity. Levels at 0.25–0.5 m can drop by half or more as the distance increases to 1–2 m. At distances >2 m, levels near single cigarettes were generally close to background. The concentrations at different distances are influenced by wind conditions. We found that it was possible for there to be detectable OTS levels at downwind positions of ≥4 m from a single active cigarette. Also, as the number of active cigarettes increases, the distance at which OTS is detectable is likely to increase.

Sixth, in outdoor restaurant patios and parks, where there may be multiple smokers, between 8 and 20 cigarettes smoked sequentially could cause an incremental 24-hr particle exposure greater than a threshold level of 35 $\mu g\ m^{-3}$ for a person who is within 0.5 m of the smokers. This threshold level is the 24-hr EPA health-based standard for fine particles.

Our results demonstrate that OTS can be high during periods of smoking in locations where persons are near active smokers. Therefore, it is possible for OTS to present a nuisance or hazard under certain conditions. Examples of scenarios where OTS levels might be high include eating dinner with a smoker on an outdoor patio, sitting at a table next to a smoker at a sidewalk café, sitting next to a smoker on a park bench, or standing near a smoker outside a building. Children who accompany a smoking parent or guardian may experience substantial exposure. Outdoor restaurant or pub workers who spend a significant portion of their time within a few feet of active smokers are also likely to receive relatively large total OTS exposures over the course of a day, possibly exceeding the EPA 24-hr health standard for fine particles. If one is upwind from a smoker, levels most likely will be negligible. However, if the smoker's position changes or one spends time downwind from a smoker, then moving to a distance of >2 m can reduce the likelihood of experiencing elevated particle exposure because of OTS. Future studies should measure OTS levels for dynamic situations with multiple smokers, including continuous measurements of personal OTS concentrations or biomarker levels for workers in outdoor locations.

Support for health-based OTS bans may lie in a potential acute effect on susceptible populations. Short-term OTS exposures might be life threatening for high-risk persons, because the human cardiovascular system is very sensitive to secondhand smoke.[31] A recent before-and-after smoking ban study showed a decreased chance of myocardial infarction when a ban was in place,[32] which suggests that there is an acute risk associated with SHS exposure for persons at increased risk of coronary heart disease or with known coronary artery disease.[33]

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