APPENDIX C

ARB ETS Air Monitoring Study

California Environmental Protection Agency

AIR RESOURCES BOARD

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Near-Source Ambient Air Monitoring of Nicotine as A Marker for Environmental Tobacco Smoke

Prepared by
Special Purpose Monitoring
Air Quality Surveillance Branch
Monitoring and Laboratory Division

October 14, 2003

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Executive Summary

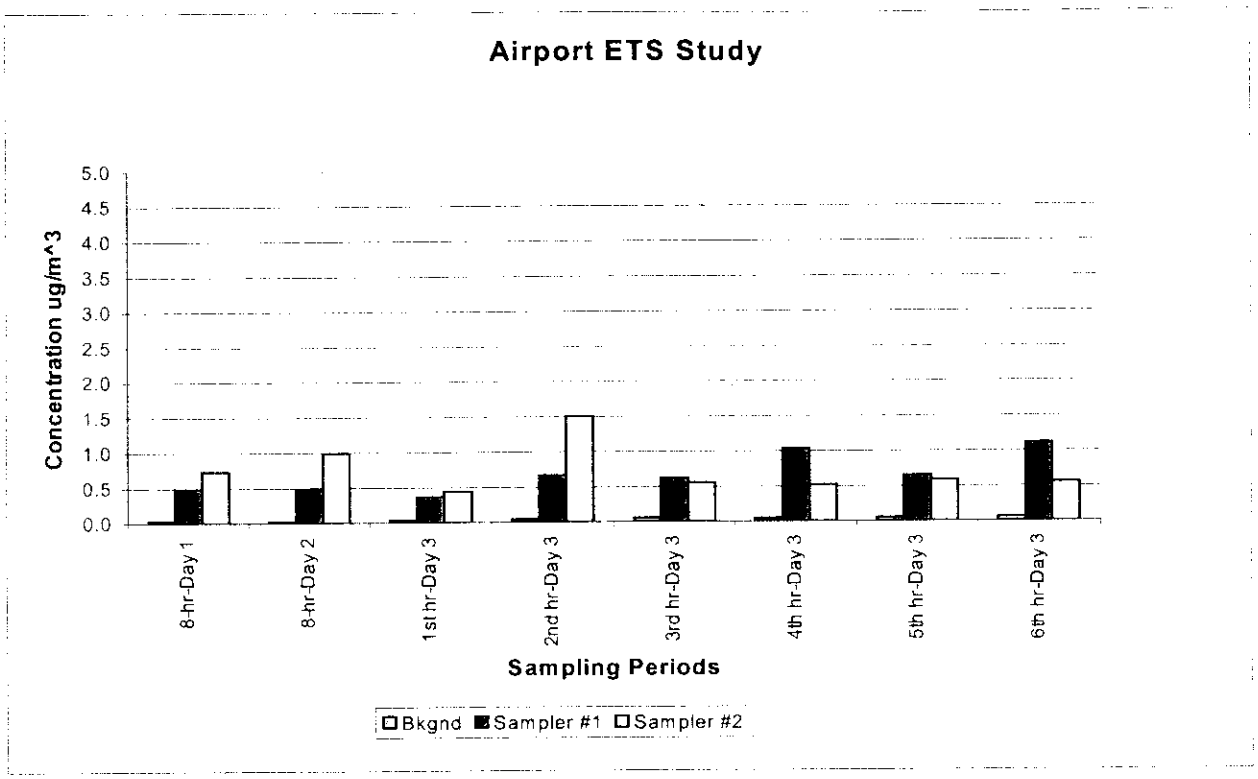
Near-Source Ambient Air Monitoring of Nicotine as A Marker for Environmental Tobacco Smoke

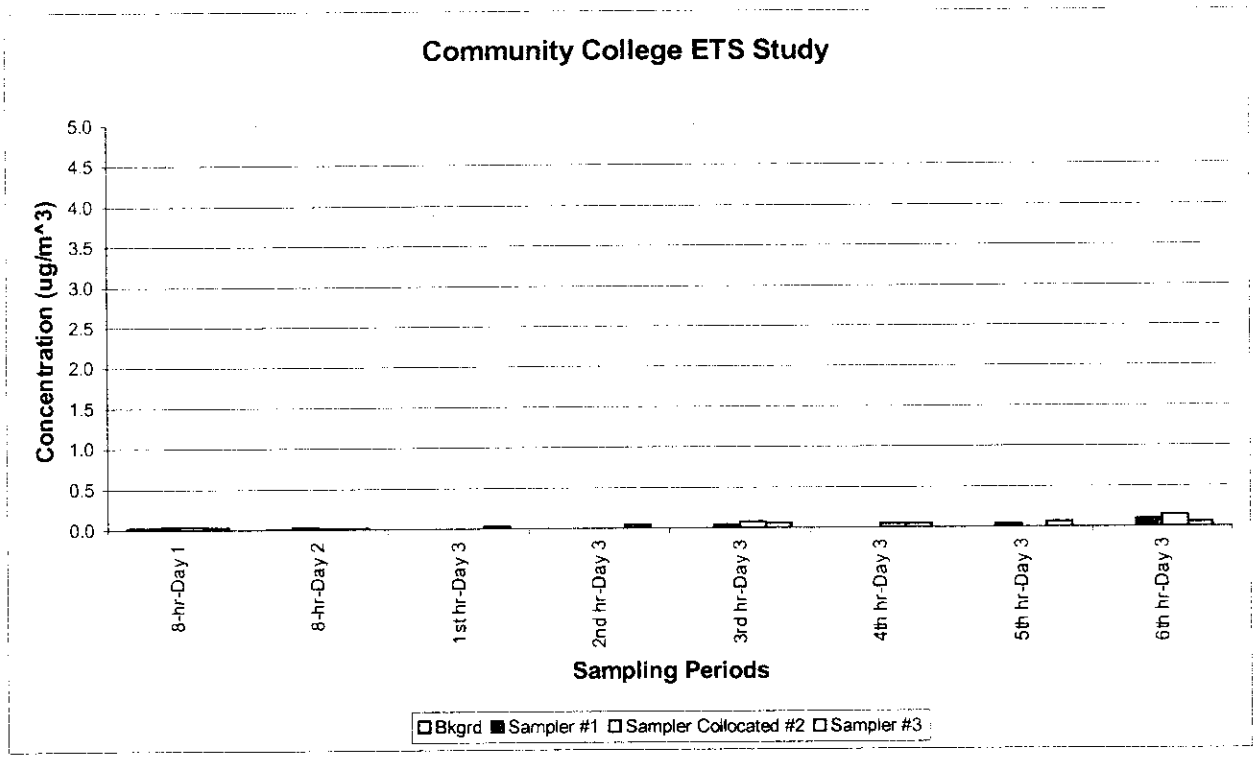
This report presents the results of near-source ambient air monitoring of nicotine as a marker for environmental tobacco smoke (ETS) in California. The objective of the ETS study is to measure ambient outdoor ETS, to which the public is exposed, as part of an evaluation by the Air Resources Board of ETS as a possible toxic air contaminant.

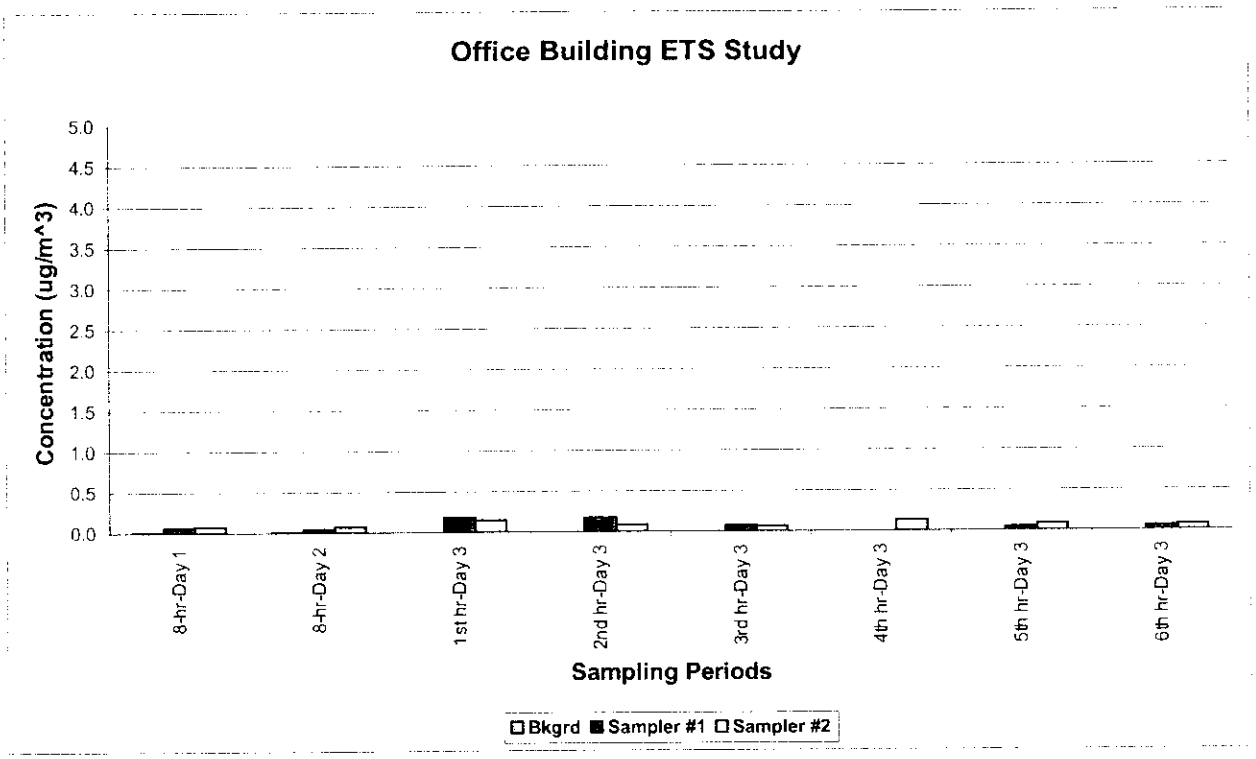
Several outdoor smoking areas were used in the monitoring including an airport, community college, two office buildings, and an amusement park.

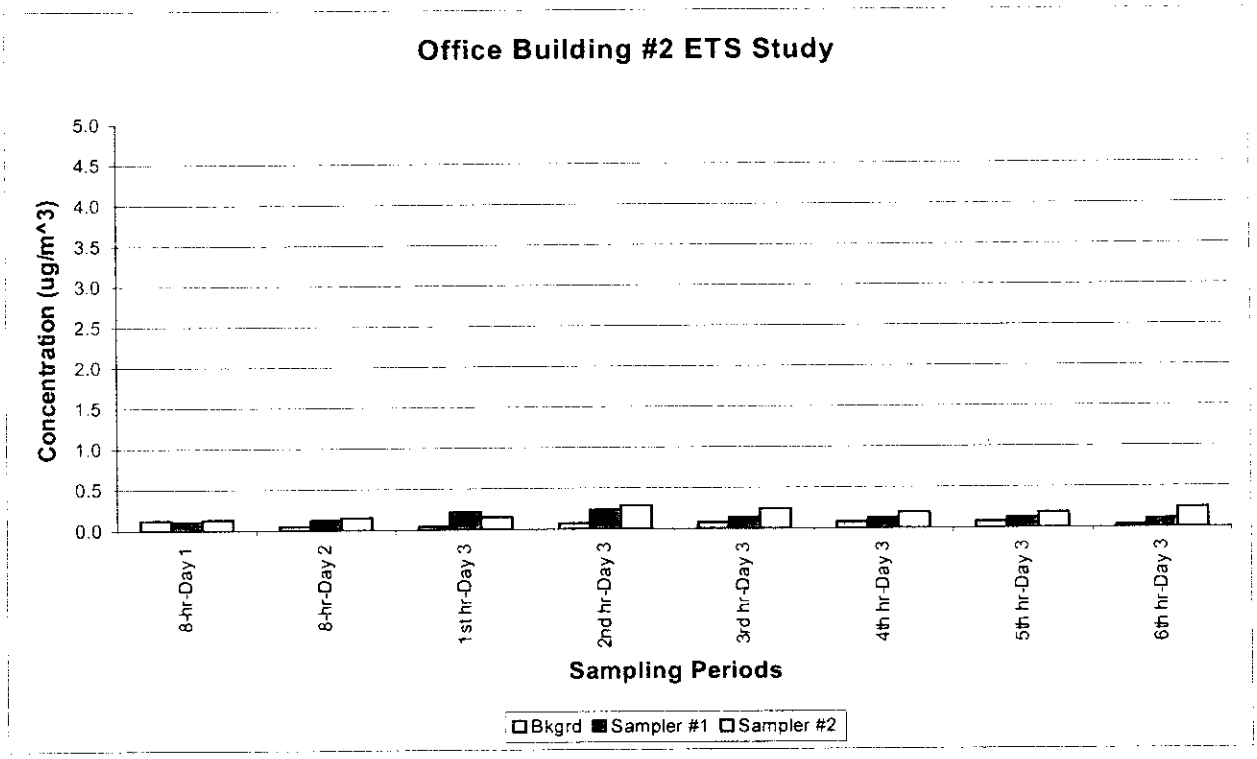
The duration of sampling at each ETS monitoring site took place during a three-day period, and included two days of 8-hour sampling and one day of six consecutive 1-hour sampling. Samples were collected on XAD-4 adsorbent resin cartridges and were analyzed by gas chromatography with a mass selective detector. The monitoring scenarios used were: normal, collocated, and spiked sampling. Normal sampling has two samplers adjacent to the smoking area and one for background (i.e., a sampler located upwind from the environmental tobacco smoke). Collocated sampling is the same except it incorporates another sampler collocated next to one of the two samplers within the smoking area, and spiked sampling includes an extra sampler placed next to the background sampler, which is spiked with known amounts of nicotine.

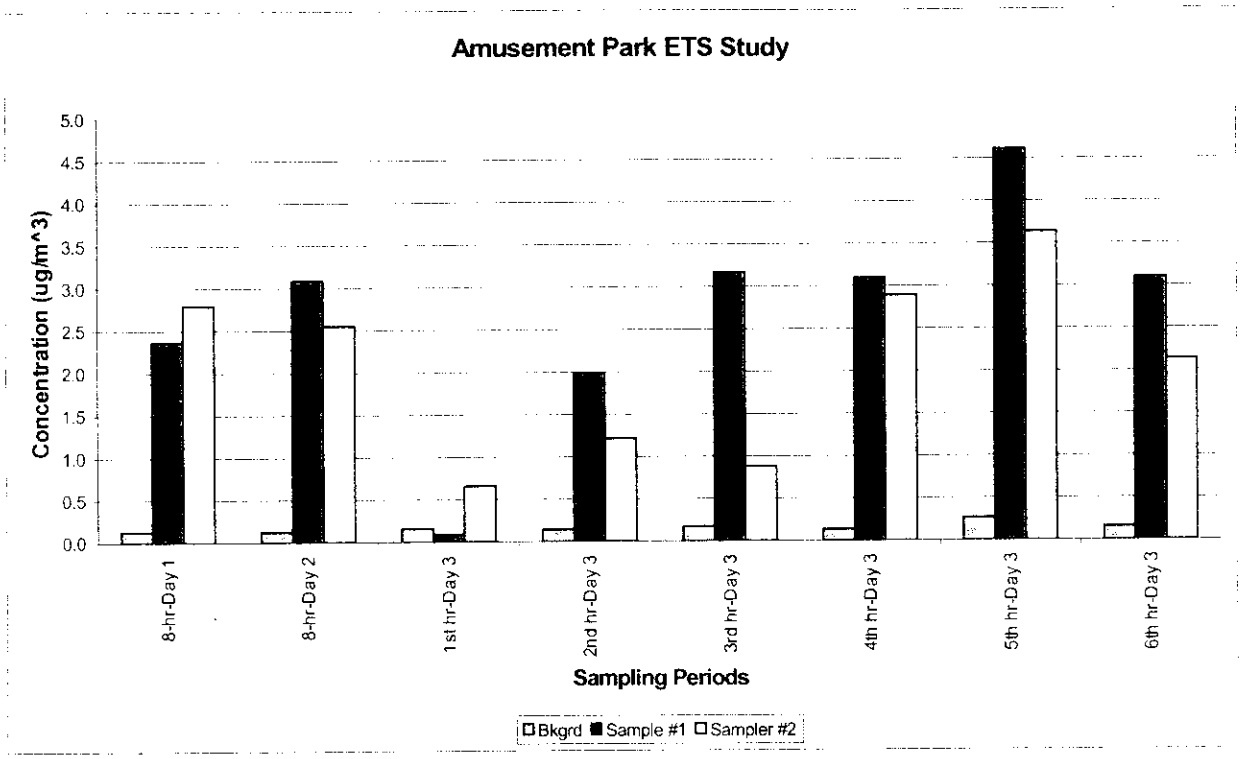
The method detection limit (MDL) used for the 1-hour samples were 0.0058 $\mu g/m^3$ and for the 8-hour samples were 0.00073 $\mu g/m^3$. The quantitative limit (EQL) used for the 1-hour samples were 0.029 $\mu g/m^3$ and 0.0036 $\mu g/m^3$ for the 8-hour samples. Any nicotine concentrations between the MDL and the EQL are considered Trace level. Concentrations measured below the MDL were reported as non-detect. Of the 85 samples collected within the smoking areas (spikes, blanks, and background samples excluded), 81 samples had measurable quantities of nicotine present, while 4 had trace level. The highest 1-hr concentration of nicotine, 4.6 $\mu g/m^3$, and the highest 8-hour concentration, 3.1 $\mu g/m^3$, were observed adjacent to a smoking area at the amusement park. All results are displayed in graphs at the end of this summary.


Airport ETS Study
Concentration ug/m^3
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8-hr-Day 1
8-hr-Day 2
1st hr-Day 3
2nd hr-Day 3
3rd hr-Day 3
4th hr-Day 3
5th hr-Day 3
6th hr-Day 3
Sampling Periods
Bkgnd
Sampler #1
Sampler #2


Community College ETS Study
Concentration (ug/m^3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8-hr-Day 1
8-hr-Day 2
1st hr-Day 3
2nd hr-Day 3
3rd hr-Day 3
4th hr-Day 3
5th hr-Day 3
6th hr-Day 3
Sampling Periods
Bkgrd
Sampler #1
Sampler Collocated #2
Sampler #3


Office Building ETS Study
Concentration (ug/m^3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8-hr-Day 1
8-hr-Day 2
1st hr-Day 3
2nd hr-Day 3
3rd hr-Day 3
4th hr-Day 3
5th hr-Day 3
6th hr-Day 3
Sampling Periods
Bkgrd
Sampler #1
Sampler #2


Office Building #2 ETS Study
Concentration (ug/m^3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8-hr-Day 1
8-hr-Day 2
1st hr-Day 3
2nd hr-Day 3
3rd hr-Day 3
4th hr-Day 3
5th hr-Day 3
6th hr-Day 3
Sampling Periods
Bkgrd
Sampler #1
Sampler #2


Amusement Park ETS Study
Concentration (ug/m^3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8-hr-Day 1
8-hr-Day 2
1st hr-Day 3
2nd hr-Day 3
3rd hr-Day 3
4th hr-Day 3
5th hr-Day 3
6th hr-Day 3
Sampling Periods
Bkgrd
Sample #1
Sampler #2

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I. Monitoring Report Approval

Near-Source ambient air monitoring of nicotine as a marker for environmental tobacco smoke in Sacramento County, and southern California – 2003

Prepared by: Steven Aston, Air Resources Engineer, Monitoring and Laboratory Division

Approval: The following monitoring report has been reviewed and approved by the Monitoring and Laboratory Division

Dennis Goodenow, Manager
Special Purpose Monitoring

10-4-03
Date

Kenneth R. Stroud, Chief
Air Quality Surveillance Branch

10-15-03
Date

William V. Loscutoff, Chief
Monitoring and Laboratory Division

10-16-03
Date

II. ACKNOWLEDGEMENTS

We wish to acknowledge the individuals at each of the study locations that assisted in gaining permission for us to conduct these monitoring studies. Staff Jerry Wehling, Andy Cowell, and Steve Aston of the MLD-AQSB collected the ambient samples. We would also acknowledge Jim Stebbins, Robert Krieger, and Lynn Baker of SSD for their assistance with selecting the study locations, counting the number of smokers during each sampling period, and with developing the study design.

Air Monitoring Program for Environmental Tobacco Smoke in California – 2003

III. Introduction

At the request of the Stationary Source Division (SSD) of the Air Resources Board (ARB), the Monitoring and Laboratory Division (MLD) staff conducted five near-source, ambient air monitoring studies for Environmental Tobacco Smoke (ETS) using nicotine as a marker. The purpose of the study was to gather information to evaluate ETS as a Toxic Air Contaminant (TAC). The studies were conducted in Sacramento County, and in southern California between January 15, 2003 and June 19, 2003. This report presents the results of near-source ambient air monitoring of nicotine as a marker for Environmental Tobacco Smoke at smoking areas at an airport, community college, two office buildings, and an amusement park.

IV. Sampling

Air samples were collected by passing a measured volume of ambient air through an XAD-4 adsorbent resin-sampling cartridge, following the monitoring protocol contained in Attachment I. The XAD-4 resin sampling cartridges were stored in an ice chest (on dry ice). The flow rate of 15 slpm was measured pre- and post-sampling using a certified transfer standard. The exact operating interval for each sample was recorded in the sampling equipment's memory and was recorded on the filter media transfer sheets. The cartridges were protected from direct sunlight and positioned at least 1.5 meters above the ground. At the end of each sampling period the cartridges were placed in zip-lock bags and placed on dry ice. At the end of each ETS study the cartridges, on dry ice, along with the filter media transfer sheets, were taken directly to Trace Analytical Laboratory in the Department of Environmental Toxicology at UC Davis to perform the analysis.

Three different monitoring scenarios were used: normal, collocated, and spiked sampling (see the following and Figure 1):

Normal sampling: One sampler is placed within the smoking area and one sampler is placed on the perimeter of the smoking area, in the expected downwind direction. The third sampler is placed away from the smoking area in what is expected to be upwind location, referred to as a background sampler (three total samplers).

Collocated sampling: This is the same as normal sampling except an additional sampler is collocated next to one of the two samplers within the smoking area (four total samplers).

Spiked sampling: This is the same as collocated sampling except the additional sampler is collocated next to the background sampler and the XAD-4 sample media is spiked with known quantities of nicotine (four total samplers).

The sites did not comply with all the siting criteria for ambient air monitoring, but every effort was made to meet the micro-scale monitoring siting criteria in 40 CFR Part 58, Appendix E, and Volume II of ARB Quality Assurance Manual. A portable meteorological station was placed at or near the downwind sampler(s) when logistically possible. No meteorological data was collected at the second office building site or at the amusement park. Ambient temperature, scalar wind speed, vector wind direction, and relative humidity were measured continuously and reported in 15-minute averages. The height above ground of the sensors on the portable meteorological station is approximately 2.5 meters. Data is presented using wind rose graphs to show wind patterns and speeds. Air monitoring was not conducted if rain or strong winds occurred or were expected before the sampling period would end.

A. Sampling Equipment

Each sampler consisted of an XAD-4 adsorbent cartridge, Teflon tubing which was placed inside 11/4" PVC pipe, PVC sun shield, a tripod, and a 12-volt DC external battery powering a BGI PQ-100 air sampling pump which was stored in a Rubbermaid tub (see Figure 2). The XAD-4 spiked cartridges were removed from the ice chest containing dry ice and immediately connected to the Teflon tubing then covered by the PVC sun shield during sampling periods. The PQ-100 sampler's flow rate was pre-set at 15 slpm by using a certified volumetric flow meter. Samplers were leak checked prior to each sampling period, with sampling tubes installed. A Met-One meteorological station was set-up prior to sampling.

B. Monitoring and Duration

Several outdoor smoking areas were used in the monitoring including an airport (spiked sampling), college (collocated sampling), two office buildings (normal and spiked sampling), and an amusement park (normal sampling). These outdoor sites provided a broad variety of smoking areas.

Each study took place over a 3-day period, with sampling periods as follows:

- Two sampling days, which consisted of 8-hour sampling from 9:00 a.m. to 5:00 p.m.

- One sampling day, which consisted of 1-hour sampling for 6 consecutive hours from 9:00 a.m. to 3:00 p.m.

The number of monitors and filters depended on the sampling scenario used.

Smoking activity at each study was observed and documented during sampling periods by SSD staff. All activity data resides in SSD files.

V. Analytical Analysis

UC Davis Department of Environmental Toxicology's, Trace Analytical Lab (TAL) prepared the XAD-4 adsorbent cartridges, and analyzed the samples for nicotine using GC/MS. See Attachment II for full UCD analytical report.

VI. Monitoring Results

Wind speed and direction ' wind rose' diagrams for each of the study's sampling periods are shown Figures 3 through 11. Sample results for each sampling site, for each period, are included with the 'wind roses'. The method detection limit (MDL) used for the 1-hour samples were 0.0058 $\mu g/m^3$ and for the 8-hour samples were 0.00073 $\mu g/m^3$. The quantitative limit (EQL) used for the 1-hour samples were 0.029 $\mu g/m^3$ and 0.0036 $\mu g/m^3$ for the 8-hour samples. Any nicotine concentrations between the MDL and the EQL are considered Trace level. Concentrations measured below the MDL were reported as non-detect (ND). Of the 85 samples collected within the smoking areas (spikes, blanks, and background samples excluded), 81 samples had measurable quantities of nicotine present, while 4 had trace level. The highest 1-hr concentration of nicotine, 4.6073 $\mu g/m^3$, and the highest 8-hour concentration, 3.0958 $\mu g/m^3$, were observed adjacent to a smoking area at the amusement park. A summary of site data as follows:

Airport 1/15-17/2003	High Concentration $\mu g/m^3$ within smoking area 1hr = 1.4982 Low Concentration $\mu g/m^3$ within smoking area 1hr = .3622 Background High Concentration $\mu g/m^3$ 1hr = .0565 Background Low Concentration $\mu g/m^3$ 8hr = .0185
Community College 4/1,2,7/2003	High Concentration $\mu g/m^3$ within smoking area 1hr = .1463 Low Concentration $\mu g/m^3$ within smoking area 1 & 8hr = Trace Background High Concentration $\mu g/m^3$ 8hr = .0183 Background Low Concentration $\mu g/m^3$ 1hr = Trace
Office Building 4/9-11/2003	High Concentration $\mu g/m^3$ within smoking area 1hr = .1756 Low Concentration $\mu g/m^3$ within smoking area 1hr = .0387 Background High Concentration $\mu g/m^3$ 8hr = .0102 Background Low Concentration $\mu g/m^3$ 1hr = Trace
Office Building II 5/20-22/2003	High Concentration $\mu g/m^3$ within smoking area 1hr = .2824 Low Concentration $\mu g/m^3$ within smoking area 1hr = .1020 Background High Concentration $\mu g/m^3$ 8hr = .1240 Background Low Concentration $\mu g/m^3$ 1hr = .0321

Amusement park
6/17-19/2003

High Concentration μg/m³ within smoking area 1hr= **4.6073**
Low Concentration μg/m³ within smoking area 1hr = .6602
Background High Concentration μg/m³ 1hr= .2630
Background Low Concentration μg/m³ 8hr = .1216

VII. Field Quality Assurance

Field quality assurance for the monitoring included the following:

A. Trip Blank

Trip blanks for nicotine were obtained from UCD, labeled, recorded on the filter media transfer sheets, and transported along with the samples for every study.

B. Collocated Samples

Collocated samples were taken at the community college.

C. Trip Spikes

Trip spikes for nicotine were obtained from UCD, labeled, recorded on the filter media transfer sheets, and transported along with the samples for every study.

D. Field Spikes

Field spikes for nicotine were obtained, labeled, recorded on the filter media transfer sheets, and transported along with the samples for every study.

VIII. Quality Assurance Results

A. Trip Blank Sampling Results

The trip blanks results were from trace level to ND, corresponding to a concentration between 0.0058 and 0.029 μg/m^3 for 1-hour samples and between 0.00073 and 0.0036 μg/m^3 for 8-hour samples.

B. Background Sampling Results

Background samples were collected for every study and located in predominant upwind direction. The background levels ranged from .2630 μg/m³ to trace levels. The same concentration limits above were used for all filter media. See page 4 for summary of monitoring results.

C. Collocated Sampling Results

There were two 8-hour and two 1-hour collocated sampling periods with quantifiable levels of nicotine. The comparison of collocated samples (calculated as the difference between the two collocated samples divided by the mean of the two samples) ranged from 32-58% for the 8-hour samples and was 42-54% for the 1-hour sample, as shown in Table 1.

Nicotine Collocated Results (µg/m³)

Sampling Period	Sampler #1	Sampler #2 col	Mean	RPD %
4/1/2003 8-hrs.	0.0316	0.0437	0.0377	32%
4/2/2003 8-hrs.	0.0273	0.0151	0.0212	58%
4/7/2003 1st hr.	Trace	Trace	NA	NA
4/7/2003 2nd hr.	Trace	Trace	NA	NA
4/7/2003 3rd hr.	0.0434	0.0752	0.0593	54%
4/7/2003 4th hr.	INVALID	0.0484	NA	NA
4/7/2003 5th hr.	Trace	INVALID	NA	NA
4/7/2003 6th hr.	0.096	0.1463	0.1212	42%

Table 1

D. Trip and Field Spike Results

Trip and field spikes are prepared for each individual study ranging from 400 µg to 10 µg of nicotine. The spikes are prepared in sets to allow statistics to be applied if necessary to evaluate differences in the results of the sets.

Once the spikes are received they are immediately placed on dry ice and kept there until extraction and analysis. The trip spike samples are kept on dry ice in an ice chest (the same one used for samples) during transportation to the field and at all times while in the field.

The field spike samples are kept on dry ice in an ice chest (the same one used for samples) during transportation to and from the field and at all times while in the field except for the sampling period. Field spikes were subjected to the same environment and experimental conditions (i.e. flow rates) as those occurring at the time of ambient sampling. The field spikes were obtained by sampling ambient air through the previously spiked cartridge and were collocated with a background sample. The percent recovery for the trip spikes ranged from 72% to 89% and the field spikes ranged from 76% to 87%.

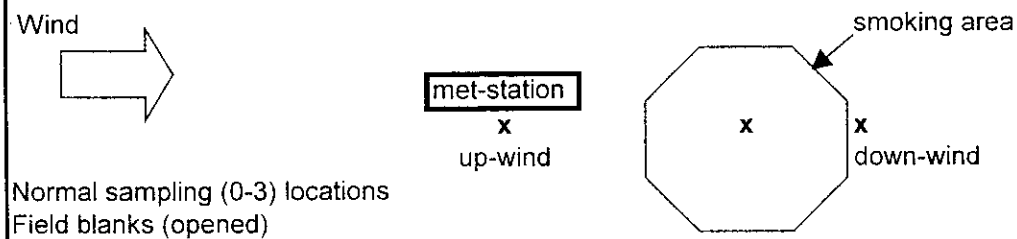
All trip and field spikes for the studies were prepared by UC Davis Department of Environmental Toxicology's Trace Analytical Lab (TAL).

ETS Sampling Scenarios

Normal Sampling

note: **x** represents samplers/locations
note: **xc** represents collocated sampler
note: **xs** represents spiked sampler

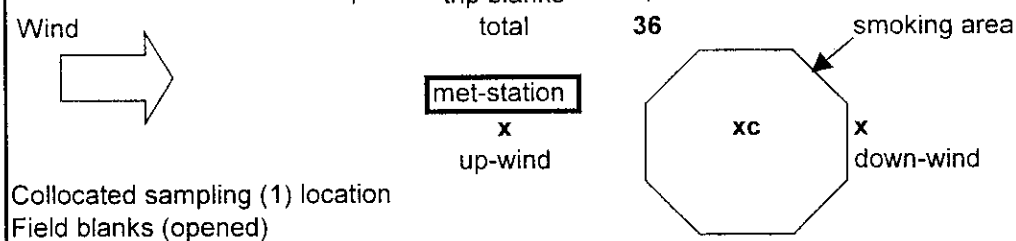
1st Day	2nd Day	3rd Day		
3	3	18	samples	24
		2	spares	2
		1	field blanks	1
		1	trip blanks	1
			total	**28**



Normal sampling (0-3) locations
Field blanks (opened)
Trip blanks (not opened)

Collocated Sampling

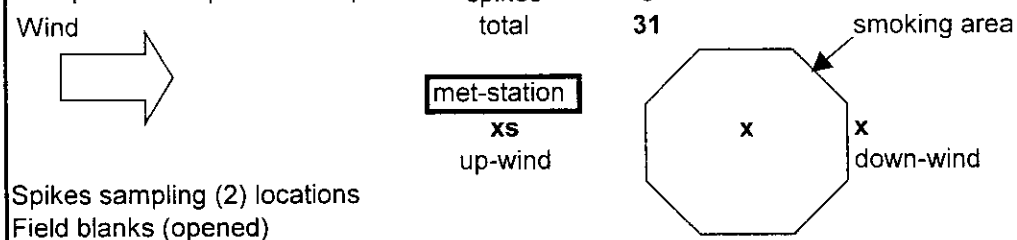
1st Day	2nd Day	3rd Day		
3	3	18	samples	24
1	1	6	collocated	8
		2	spares	2
		1	field blanks	1
		1	trip blanks	1
			total	**36**



Collocated sampling (1) location
Field blanks (opened)
Trip blanks (not opened)

Spiked Sampling

1st Day	2nd Day	3rd Day		
3	3	18	samples	24
		2	spares	2
		1	field blanks	1
		1	trip blanks	1
1	1	1	spikes	3
			total	**31**



Spikes sampling (2) locations
Field blanks (opened)
Trip blanks (not opened)

Figure 1

ETS AMBIENT AIR MONITOR

Figure 2

ARB/Nicotine Samples Set #1 AIRPORT
Samples received on 1/17/2003
Date Extracted: 1/21/2003
Date Analyzed: 1/24/2003

Limits Used for µg/m3:
1 hour 0.0058 µg/m3 £ Trace < 0.029 µg/m3
8 hours 0.00073 µg/m3 £ Trace < 0.0036 µg/m3

Nicotine

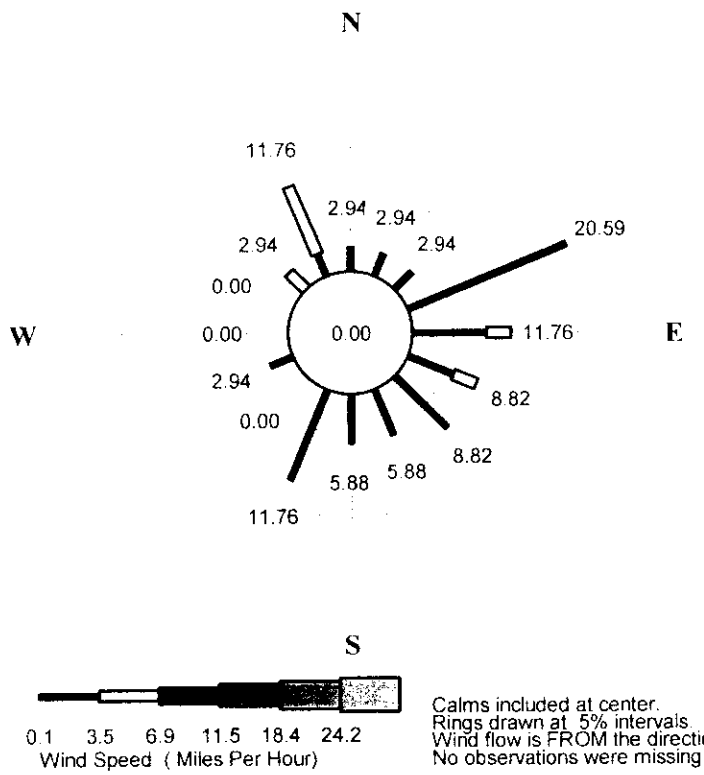
Sample ID	Fortification Level (µg)	µg found	%Rec	Ave %Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC133C		Trace								
NIC102TB		Trace								
NIC103FB		Trace								
NIC134CR400R1	400.0	366.164	92%							
NIC135CR400R2	400.0	378.494	95%							
NIC136CR400R3	400.0	353.990	88%	92%	3%					
										sampler
NIC104FS400R1	400.0	341.906	85%			480	15	7200	7.20	4
NIC105FS400R2	400.0	349.841	87%			480	15	7200	7.20	4
NIC106FS400R3	400.0	344.127	86%	86%	1%	60	15	900	0.90	4
				sampler	date					
NIC132		3.4598		1	15th	480	15	7200	7.20	0.4805
NIC131		5.2664		2	15th	480	15	7200	7.20	0.7314
NIC130		0.1641		3	15th	480	15	7200	7.20	0.0228
NIC129		3.5275		1	16th	480	15	7200	7.20	0.4899
NIC128		7.1266		2	16th	480	15	7200	7.20	0.9898
NIC127		0.1334		3	16th	480	15	7200	7.20	0.0185
NIC125		0.3260		1	17th-1hr	60	15	900	0.90	0.3622
NIC126		0.3949		2	17th-1hr	60	15	900	0.90	0.4388
NIC124		0.0320		3	17th-1hr	60	15	900	0.90	0.0355
NIC123		0.5972		1	17th-2hr	60	15	900	0.90	0.6636
NIC122		1.3484		2	17th-2hr	60	15	900	0.90	1.4982
NIC121		0.0375		3	17th-2hr	60	15	900	0.90	0.0417
NIC119		0.5578		1	17th-3hr	60	15	900	0.90	0.6198
NIC120		0.4978		2	17th-3hr	60	15	900	0.90	0.5531
NIC118		0.0473		3	17th-3hr	60	15	900	0.90	0.0525
NIC116		0.9290		1	17th-4hr	60	15	900	0.90	1.0323
NIC117		0.4655		2	17th-4hr	60	15	900	0.90	0.5172
NIC115		0.0409		3	17th-4hr	60	15	900	0.90	0.0454
NIC113		0.5843		1	17th-5hr	60	15	900	0.90	0.6492
NIC114		0.5294		2	17th-5hr	60	15	900	0.90	0.5882
NIC112		0.0425		3	17th-5hr	60	15	900	0.90	0.0472
NIC110		0.9857		1	17th-6hr	59	15	885	0.89	1.1137
NIC111		0.5001		2	17th-6hr	60	15	900	0.90	0.5557
NIC109		0.0508		3	17th-6hr	60	15	900	0.90	0.0565

C = Resin Blank
TB = Trip Blank
FB = Field Blank
CR = Concurrent Recovery
FS = Field Spike

Sampler #1 northside (closest to terminal B)
Sampler #2 southside (closest to terminal A)
Sampler #3 Background grass area between terminal A and B

Table 2

WIND ROSE
AIRPORT ETS STUDY
JANUARY 15, 08:45 TO 17:00 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	2.94	0.00	0.00	0.00	0.00	0.00
NNE	2.94	0.00	0.00	0.00	0.00	0.00
NE	2.94	0.00	0.00	0.00	0.00	0.00
ENE	20.59	0.00	0.00	0.00	0.00	0.00
E	8.82	2.94	0.00	0.00	0.00	0.00
ESE	5.88	2.94	0.00	0.00	0.00	0.00
SE	8.82	0.00	0.00	0.00	0.00	0.00
SSE	5.88	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 34 MISSING OBS = 0

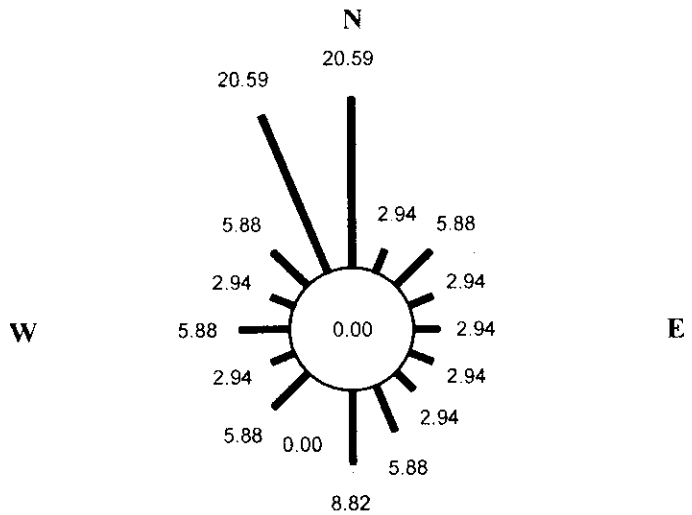
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	5.88	0.00	0.00	0.00	0.00	0.00
SSW	11.76	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00
WSW	2.94	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	2.94	0.00	0.00	0.00	0.00
NNW	2.94	8.82	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 3

WIND ROSE
AIRPORT ETS STUDY
JANUARY 16, 2003 FROM 08:45 TO 17:00 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	20.59	0.00	0.00	0.00	0.00	0.00
NNE	2.94	0.00	0.00	0.00	0.00	0.00
NE	5.88	0.00	0.00	0.00	0.00	0.00
ENE	2.94	0.00	0.00	0.00	0.00	0.00
E	2.94	0.00	0.00	0.00	0.00	0.00
ESE	2.94	0.00	0.00	0.00	0.00	0.00
SE	2.94	0.00	0.00	0.00	0.00	0.00
SSE	5.88	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 34 MISSING OBS = 0

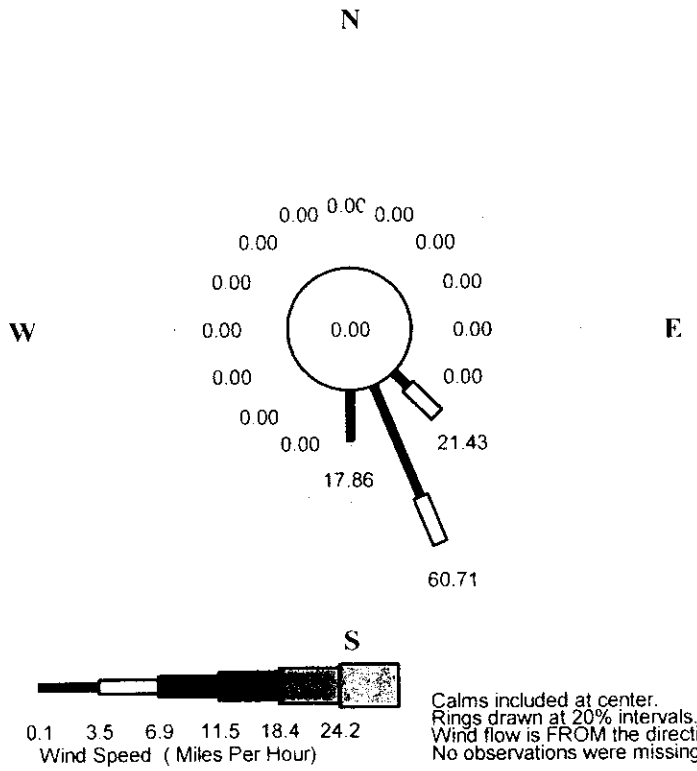
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	8.82	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	5.88	0.00	0.00	0.00	0.00	0.00
WSW	2.94	0.00	0.00	0.00	0.00	0.00
W	5.88	0.00	0.00	0.00	0.00	0.00
WNW	2.94	0.00	0.00	0.00	0.00	0.00
NW	5.88	0.00	0.00	0.00	0.00	0.00
NNW	20.59	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 4

WIND ROSE
AIRPORT ETS STUDY
JANUARY 17, 2003 FROM 08:45 TO 15:30 HRS. (15 MIN. AVG.)



PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	7.14	14.29	0.00	0.00	0.00	0.00
SSE	42.86	17.86	0.00	0.00	0.00	0.00

TOTAL OBS = 28 MISSING OBS = 0

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	17.86	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 5

ARB/Nicotine Samples Set #2 Community College
Samples received on 4/8/2003
Date Extracted: 4/8/2003
Date Analyzed: 4/9/2003

Limits Used for µg/m3:
1 hour 0.0058 µg/m3 £ Trace < 0.029 µg/m3
8 hours 0.00073 µg/m3 £ Trace < 0.0036 µg/m3

Nicotine

Sample ID	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC176C		Trace								
NIC137TB		Trace								
NIC177CR100R1	100.0	79.1105	79%							
NIC178CR100R2	100.0	74.4450	74%							
NIC179CR100R3	100.0	81.5101	82%	78%	4%					
NIC175FS100R1	100.0	83.3829	83%							
NIC138TS100R1	100.0	82.2737	82%							
				sampler	date					
NIC139		0.2279		1	1st	480	15	7200	7.20	0.0316
NIC140		0.3147		2	1st	480	15	7200	7.20	0.0437
NIC141		0.2131		3	1st	480	15	7200	7.20	0.0296
NIC142		0.1320		4	1st	480	15	7200	7.20	0.0183
NIC143		0.1962		1	2nd	480	15	7200	7.20	0.0273
NIC144		0.1090		2	2nd	480	15	7200	7.20	0.0151
NIC145		0.0930		3	2nd	480	15	7200	7.20	0.0129
NIC146		0.0341		4	2nd	480	15	7200	7.20	0.0047
NIC147		0.0222		1	7th-1hr	60	15	900	0.90	Trace
NIC148		0.0209		2	7th-1hr	60	15	900	0.90	Trace
NIC149		0.0323		3	7th-1hr	60	15	900	0.90	0.0359
NIC150		0.0127		4	7th-1hr	60	15	900	0.90	Trace
NIC151		0.0156		1	7th-2hr	60	15	900	0.90	Trace
NIC152		0.0169		2	7th-2hr	60	15	900	0.90	Trace
NIC153		0.0339		3	7th-2hr	60	15	900	0.90	0.0377
NIC154		0.0188		4	7th-2hr	60	15	900	0.90	Trace
NIC155		0.0391		1	7th-3hr	60	15	900	0.90	0.0434
NIC156		0.0676		2	7th-3hr	60	15	900	0.90	0.0752
NIC171		0.0500		3	7th-3hr	60	15	900	0.90	0.0556
NIC158		0.0235		4	7th-3hr	60	15	900	0.90	Trace
NIC160		0.0436		2	7th-4hr	60	15	900	0.90	0.0484
NIC161		0.0416		3	7th-4hr	60	15	900	0.90	0.0462
NIC162		0.0179		4	7th-4hr	60	15	900	0.90	Trace
NIC163		0.0399		1	7th-5hr	60	15	900	0.90	0.0444
NIC165		0.0585		3	7th-5hr	60	15	900	0.90	0.0650
NIC166		0.0198		4	7th-5hr	60	15	900	0.90	Trace
NIC167		0.0864		1	7th-6hr	60	15	900	0.90	0.0960
NIC168		0.1316		2	7th-6hr	60	15	900	0.90	0.1463
NIC169		0.0473		3	7th-6hr	60	15	900	0.90	0.0525
NIC170		0.0245		4	7th-6hr	60	15	900	0.90	Trace

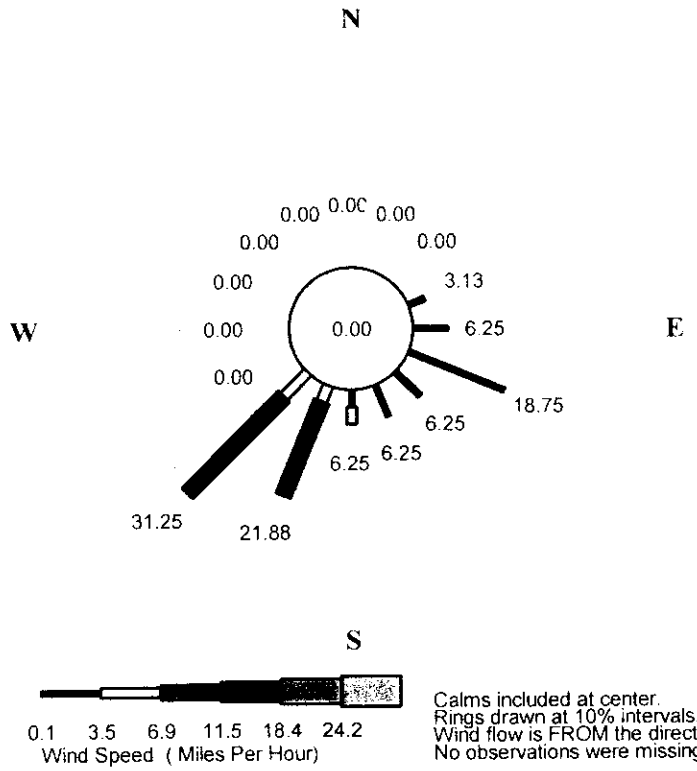
C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike

sampler #1 Eastside of smoking area near BBQ pit
sampler #2 Collocated next to sampler #1
sampler #3 Westside of smoking area
sampler #4 Background Southside of smoking area

sampler #4 Background Southside of smoking area

Table 3

WIND ROSE
COMMUNITY COLLEGE ETS STUDY
APRIL 1, 2003 FROM 09:00 TO 17:00 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3.13	0.00	0.00	0.00	0.00	0.00
E	6.25	0.00	0.00	0.00	0.00	0.00
ESE	18.75	0.00	0.00	0.00	0.00	0.00
SE	6.25	0.00	0.00	0.00	0.00	0.00
SSE	6.25	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 32 MISSING OBS = 0

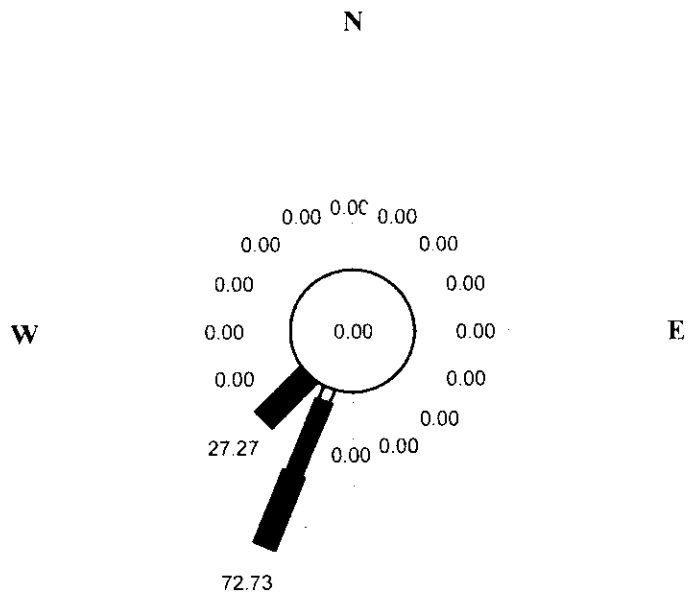
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

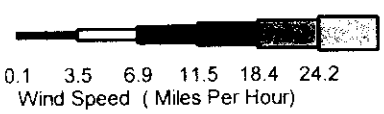
DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	3.13	3.13	0.00	0.00	0.00	0.00
SSW	0.00	3.13	18.75	0.00	0.00	0.00
SW	0.00	6.25	25.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 6

WIND ROSE
COMMUNITY COLLEGE ETS STUDY
APRIL 2, 2003 FROM 09:00 TO 17:00 HRS. (15 MIN. AVG.)





Calms included at center.
Rings drawn at 20% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 33 MISSING OBS = 0

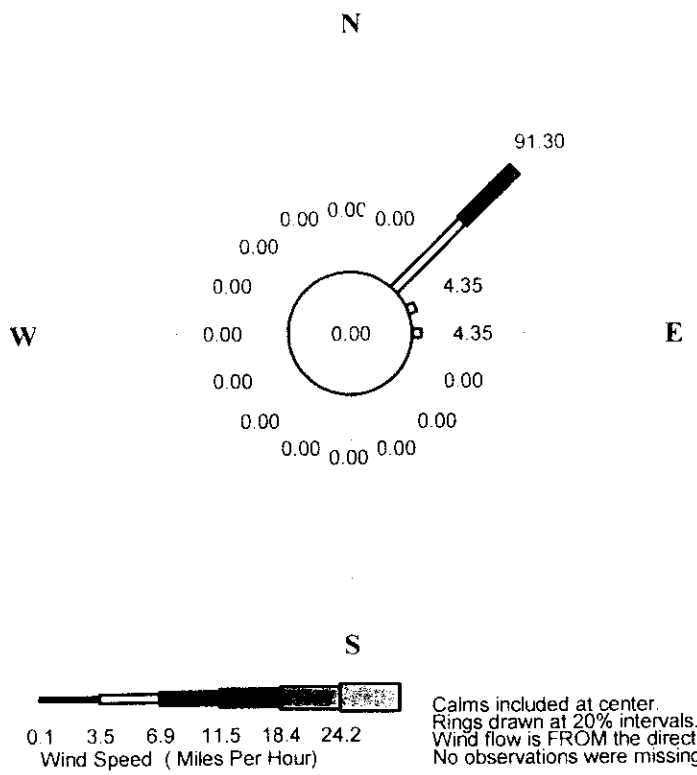
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	6.06	33.33	33.33	0.00	0.00
SW	0.00	0.00	0.00	27.27	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 7

WIND ROSE
COMMUNITY COLLEGE ETS STUDY
APRIL 7, 2003 FROM 09:00 TO 14:30 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 20% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	52.17	39.13	0.00	0.00	0.00
ENE	0.00	4.35	0.00	0.00	0.00	0.00
E	0.00	4.35	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 23 MISSING OBS = 0

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 8

ARB/Nicotine Samples Set #3 Office Building
Samples received on 4/14/2003
Date Extracted: 4/14/2003
Date Analyzed: 4/14/2003

Limits Used for µg/m3:
1 hour 0.0058 µg/m3 £ Trace < 0.029 µg/m3
8 hours 0.00073 µg/m3 £ Trace < 0.0036 µg/m3

Nicotine

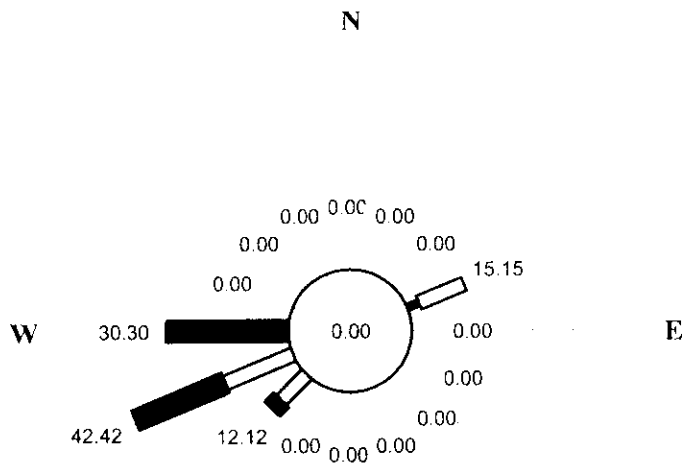
Sample ID	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC206C		ND								
NIC102TB		ND								
NIC207CR50R1	50.0	47.5140	95%							
NIC208CR50R2	50.0	44.7014	89%							
NIC209CR50R3	50.0	47.0994	94%	93%	3%					
NIC182FS50R1	50.0	38.0002	76%							
NIC181TS50R1	50.0	44.6704	89%							
				sampler	date					
NIC172		0.4262		1	9th	480	15	7200	7.20	0.0592
NIC173		0.5261		2	9th	480	15	7200	7.20	0.0731
NIC174		0.0734		3	9th	480	15	7200	7.20	0.0102
NIC183		0.3006		1	10th	480	15	7200	7.20	0.0417
NIC184		0.4856		2	10th	480	15	7200	7.20	0.0674
NIC185		0.0555		3	10th	480	15	7200	7.20	0.0077
NIC186		0.1581		1	11th-1hr	60	15	900	0.90	0.1756
NIC187		0.1302		2	11th-1hr	60	15	900	0.90	0.1447
NIC188		0.0249		3	11th-1hr	60	15	900	0.90	Trace
NIC189		0.1551		1	11th-2hr	60	15	900	0.90	0.1724
NIC190		0.0717		2	11th-2hr	60	15	900	0.90	0.0797
NIC191		0.0199		3	11th-2hr	60	15	900	0.90	Trace
NIC192		0.0632		1	11th-3hr	60	15	900	0.90	0.0702
NIC193		0.0541		2	11th-3hr	60	15	900	0.90	0.0601
NIC194		0.0187		3	11th-3hr	60	15	900	0.9	Trace
NIC195		ND		1	ND	NA	NA	NA	NA	NA
NIC196		0.1178		2	11th-4hr	60	15	900	0.90	0.1309
NIC197		0.0150		3	11th-4hr	60	15	900	0.90	Trace
NIC198		0.0348		1	11th-5hr	60	15	900	0.90	0.0387
NIC199		0.0740		2	11th-5hr	60	15	900	0.90	0.0822
NIC200		ND		3	11th-5hr	60	15	900	0.90	ND
NIC201		0.0417		1	11th-6hr	60	15	900	0.90	0.0463
NIC202		0.0632		2	11th-6hr	60	15	900	0.90	0.0702
NIC203		0.025		3	11th-6hr	60	15	900	0.90	Trace

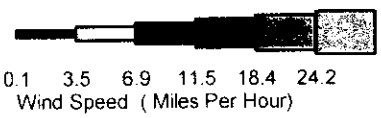
C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike

sampler #1 Eastside of smoking area next to tree
sampler #2 Westside of smoking area in between benches
sampler #3 Background west of smoking area on lawn

Table 4

WIND ROSE
OFFICE BUILDING ETS STUDY
APRIL 9, 2003 FROM 09:00 TO 17:00 HRS. (15 MIN. AVG.)





Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3.03	12.12	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 33 MISSING OBS = 0

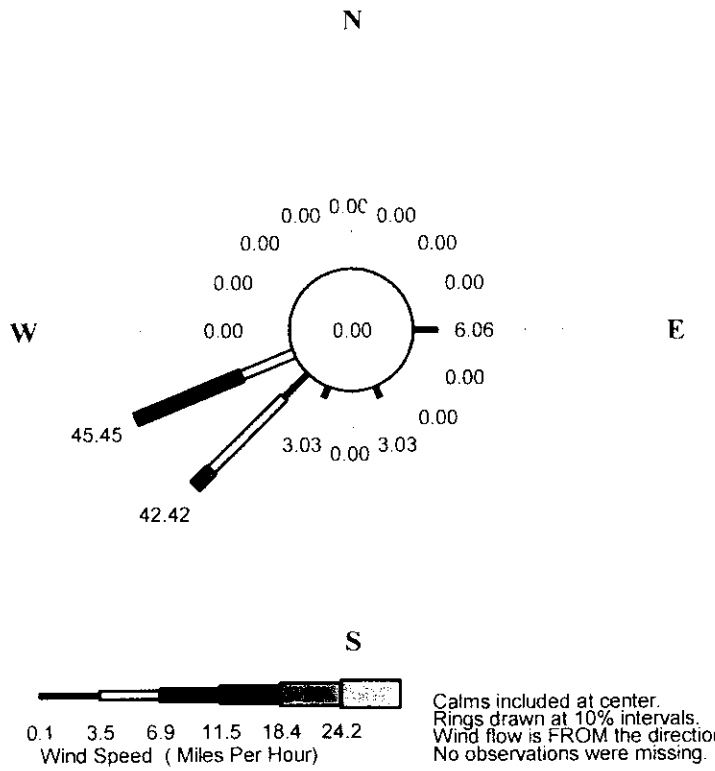
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	9.09	3.03	0.00	0.00	0.00
WSW	0.00	18.18	24.24	0.00	0.00	0.00
W	0.00	0.00	30.30	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 9

WIND ROSE
OFFICE BUILDING ETS STUDY
APRIL 10, 2003 FROM 09:00 TO 17:00 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	6.06	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	3.03	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 33 MISSING OBS = 0

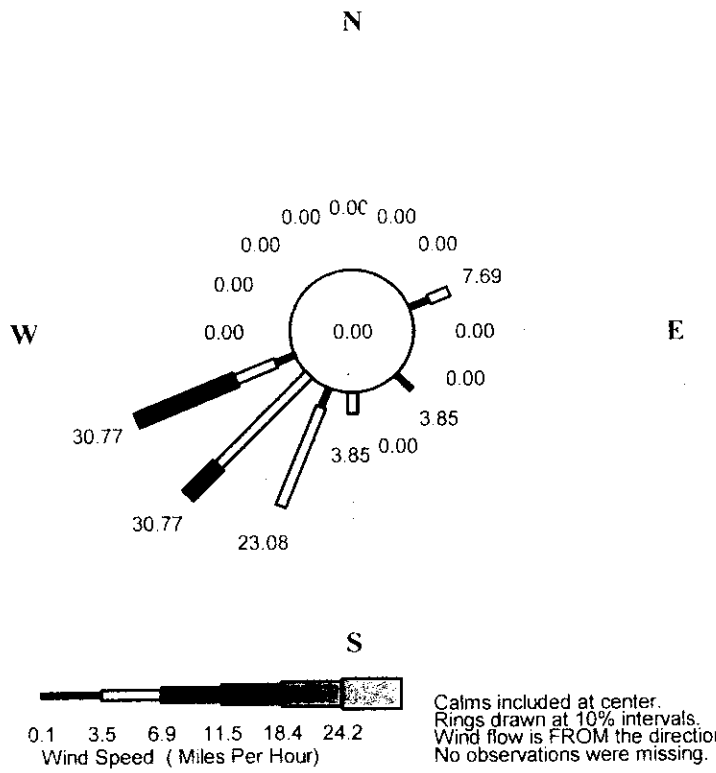
PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	3.03	0.00	0.00	0.00	0.00	0.00
SW	9.09	27.27	6.06	0.00	0.00	0.00
WSW	0.00	15.15	30.30	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 10

WIND ROSE
OFFICE BUILDING ETS STUDY
APRIL 11, 2003 FROM 09:00 TO 15:15 HRS. (15 MIN. AVG.)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE. Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3.85	3.85	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	3.85	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 26 MISSING OBS = 0

PERCENT OCCURRENCE Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.1	3.5	6.9	11.5	18.4	24.2
S	0.00	3.85	0.00	0.00	0.00	0.00
SSW	3.85	19.23	0.00	0.00	0.00	0.00
SW	0.00	23.08	7.69	0.00	0.00	0.00
WSW	3.85	7.69	19.23	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 11

ARB/Nicotine Samples Set #4 Office Building #2
Samples received on 5/23/2003
Date Extracted: 5/27/2003
Date Analyzed: 5/27/2003
Nicotine

Limits Used for µg/m3:
1 hour 0.0058 µg/m3 £ Trace < 0.029 µg/m3
8 hours 0.00073 µg/m3 £ Trace < 0.0036 µg/m3
* Questionable Data

Sample ID	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC242C		ND								
NIC210TB		ND								
NIC211FB		ND								
NIC243CR25R1	25.0	21.9654	88%							
NIC244CR25R2	25.0	22.1027	88%							
NIC245CR25R3	25.0	21.5859	86%	88%	1%					
NIC212FS25R2	25.0	20.0483	*80%							
NIC213FS25R1	25.0	14.1321	*57%							
NIC214FS25R3	25.0	19.9731	80%							
NIC215TS25R1	25.0	20.6914	83%							
				sampler	date					
NIC216		0.7533		1	20th	480	15	7200	7.20	0.1046
NIC217		0.9167		2	20th	480	15	7200	7.20	0.1273
NIC218		0.8927		3	20th	480	15	7200	7.20	0.1240
NIC219		0.8682		1	21st	480	15	7200	7.20	0.1206
NIC220		1.0956		2	21st	480	15	7200	7.20	0.1522
NIC221		0.3562		3	21st	480	15	7200	7.20	0.0495
NIC222		0.1913		1	22nd-1hr	60	15	900	0.90	0.2126
NIC223		0.1362		2	22nd-1hr	60	15	900	0.90	0.1513
NIC224		0.0353		3	22nd-1hr	60	15	900	0.90	0.0392
NIC225		0.2120		1	22nd-2hr	60	15	900	0.90	0.2356
NIC226		0.2541		2	22nd-2hr	60	15	900	0.90	0.2824
NIC227		0.0643		3	22nd-2hr	60	15	900	0.90	0.0715
NIC228		0.1253		1	22nd-3hr	60	15	900	0.90	0.1392
NIC229		0.2183		2	22nd-3hr	60	15	900	0.90	0.2426
NIC230		0.0651		3	22nd-3hr	60	15	900	0.90	0.0724
NIC231		0.1088		1	22nd-4hr	60	15	900	0.90	0.1209
NIC232		0.1747		2	22nd-4hr	60	15	900	0.90	0.1941
NIC233		0.0655		3	22nd-4hr	60	15	900	0.90	0.0728
NIC234		0.1118		1	22nd-5hr	60	15	900	0.90	0.1242
NIC235		0.1687		2	22nd-5hr	60	15	900	0.90	0.1874
NIC236		0.0686		3	22nd-5hr	60	15	900	0.90	0.0762
NIC237		0.0918		1	22nd-6hr	60	15	900	0.90	0.1020
NIC238		0.2176		2	22nd-6hr	60	15	900	0.90	0.2417
NIC239		0.0289		3	22nd-6hr	60	15	900	0.90	0.0321

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike

sampler #1 Next to the west Bank
sampler #2 Next to the east Bank
sampler #3 Background Behind Planter corner of quad area next to alleyway

Table 5

ARB/Nicotine Samples Set #5 Amusement Park
Samples received on 6/20/2003
Date Extracted: 6/23/2003
Date Analyzed: 6/24/2003

Limits Used for µg/m3:
1 hour 0.0058 µg/m3 £ Trace < 0.029 µg/m3
8 hours 0.00073 µg/m3 £ Trace < 0.0036 µg/m3

Nicotine

Sample ID	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC275C		ND								
NIC246TB		ND								
NIC276CR10R1	10.0	7.7992	78%							
NIC277CR10R2	10.0	7.6141	76%							
NIC278CR10R3	10.0	7.7762	78%	77%	1%					
NIC247TS10R1	10.0	7.1726	72%							
				sampler	**date**					
NIC248		16.9996		1	17th	480	15	7200	7.20	2.3611
NIC249		20.1031		2	17th	480	15	7200	7.20	2.7921
NIC250		0.8938		3	17th	480	15	7200	7.20	0.1241
NIC252		22.2234		1	18th	480	15	7200	7.20	3.0866
NIC253		18.3371		2	18th	480	15	7200	7.20	2.5468
NIC254		0.8754		3	18th	480	15	7200	7.20	0.1216
NIC255		0.7734		1	19th-1hr	60	15	900	0.90	0.8593
NIC256		0.5942		2	19th-1hr	60	15	900	0.90	0.6602
NIC257		0.1399		3	19th-1hr	60	15	900	0.90	0.1554
NIC258		1.7816		1	19th-2hr	60	15	900	0.90	1.9796
NIC259		1.0900		2	19th-2hr	60	15	900	0.90	1.2111
NIC260		0.1262		3	19th-2hr	60	15	900	0.90	0.1403
NIC261		2.8501		1	19th-3hr	60	15	900	0.90	3.1668
NIC262		0.7930		2	19th-3hr	60	15	900	0.90	0.8812
NIC263		0.1524		3	19th-3hr	60	15	900	0.90	0.1694
NIC264		2.7863		1	19th-4hr	60	15	900	0.90	3.0959
NIC265		2.6020		2	19th-4hr	60	15	900	0.90	2.8911
NIC266		0.1210		3	19th-4hr	60	15	900	0.90	0.1344
NIC267		4.1466		1	19th-5hr	60	15	900	0.90	4.6073
NIC268		3.2723		2	19th-5hr	60	15	900	0.90	3.6359
NIC269		0.2367		3	19th-5hr	60	15	900	0.90	0.2630
NIC270		2.7862		1	19th-6hr	60	15	900	0.90	3.0958
NIC271		1.9208		2	19th-6hr	60	15	900	0.90	2.1342
NIC272		0.1407		3	19th-6hr	60	15	900	0.90	0.1564

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
TS = Trip Spike

sampler #1 Lamppost next to water
sampler #2 Entry sign to smoking area
sampler #3 Background Lamppost near fenceline

Table 6

ATTACHMENT I

SAMPLING PROTOCOL

California Environmental Protection Agency

AIR RESOURCES BOARD

MONITORING PROTOCOL FOR NEAR-SOURCE AMBIENT AIR MONITORING OF NICOTINE AS A MARKER FOR ENVIRONMENTAL TOBACCO SMOKE

Monitoring and Laboratory Division

October 1, 2002

The following protocol has been reviewed and approved by the Air Resources Board (ARB) staff. Approval of this protocol does not necessarily reflect the views and policies of ARB, nor does the mention of trade names or commercial products constitute endorsement of recommendation for use.

Sampling Plan Identification and Approval

Title: Near-Source Ambient Air Monitoring of Nicotine as a Marker for Environmental Tobacco Smoke

Approval: The following sampling plan for monitoring nicotine as a surrogate for environmental tobacco smoke (ETS) in several locations in California is recommended for approval.

Signatures:

9/30/02

Kenneth R. Stroud, Chief — Date
Air Quality Surveillance Branch
Air Resources Board

10/11/02

Janette Brooks, Chief — Date
Air Quality Measures Branch
Air Resources Board

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2.0 Project Objective

Stationary Source Division (SSD) of the Air Resources Board (ARB) has requested that the Monitoring and Laboratory Division (MLD) conduct near-source ambient air sampling for environmental tobacco smoke (ETS). The ARB has contracted with the Trace Analytical Laboratory in the Department of Environmental Toxicology at UC Davis to perform the analytical work. The purpose is to gather data from potential near-source or hot spot areas to which the public is exposed to evaluate ETS ambient air exposure. The information gained in this study will help in ARB's assessment of ETS as a TAC. To do this, the ARB is planning to use nicotine as a marker for the constituents of ETS. Nicotine is a unique marker for the presence of ETS and has been monitored in numerous indoor air studies related to ETS.

3.0 Location

Several potential outdoor smoking areas are being considered for the near-source ETS monitoring study. Some of these potential areas include:

- office building with outdoor smoking area
- amusement park smoking area where children are present
- high school or college outdoor eating/smoking area
- stadium during a sporting event
- apartment or condominium complex

4.0 Sampling Design and Method

The air monitoring for this project will include three samplers per smoking area. Siting criteria permitting, priority will be given to placing at least one sampler within the smoking area and at least one sampler on the perimeter of the smoking area, in the expected downwind direction. The third sampler will be placed away from the smoking area in what is expected to be an upwind location. The samplers, BGI PQ100s, will run at 15 lpm using XAD-4 absorbent sampling media with quantitation limits of 0.01- 0.05 μg/m^3. There will be one collocated sampler at one of the sampling locations chosen by SSD. The sites need not comply with the siting criteria for ambient air monitoring, but every effort will be made to meet the micro-scale monitoring siting criteria in 40 CFR Part 58, Appendix E, and Volume II of ARB's Quality Assurance Manual (Table 1). The flow rates will be checked pre and post following each sample day (Table 2).

Table 1

Item/ Influence	Requirements
Height of Inlet	2 to 7 meters above the ground
Spacing Between Inlets (Collocated)	Within 4 meters, but at least 1 meter apart.
Obstacles	Distance between samplers and obstacles must be at least 2 times the height the obstacle protrudes above the sampler.
Tree Dripline	Inlet must be 10 meters from dripline if tree represents an obstruction.
Walls, Parapets, etc.	Inlet must be 2 meters from the walls, parapets, etc.
Air Flow Arc	Unrestricted 270 degree arc that must include predominant wind direction for seasonal high pollutant; samplers located on the side of a building require 180-degree clearance.
Traffic	5 to 15 meters from roadway

**From 40 CFR Part 58, Appendix E, and ARB Quality Assurance Manual, Vol. II, section 2.0.4 (Feb. 2000)*

A portable meteorological station will be placed at or near the samplers. Ambient temperature, scalar wind speed, scalar wind direction, and relative humidity will be measured continuously and reported in hourly averages. The height above ground of the sensors on the portable meteorological station is approximately 2.5 meters. Data will be presented using wind rose graphs to shows wind patterns and speeds.

Samples will not be collected if rain or strong wind is occurring or expected before the sampling period would end. Also, sampling will not be conducted near greenhouses, due to potential use of nicotine as an insecticide in greenhouses.

5.0 Frequency and Duration of Monitoring

For each ETS study location, a minimum of 3 days, with sampling periods as follows:

- On two sampling days, collect 8-hour samples at the three monitoring locations (approximately 8:30 a.m. to 4:30 p.m. for a total of 6 samples).
- On one sampling day, collect approximately consecutive 1-hour samples for 6-hours at the three monitoring locations between 9:00 a.m. and 4:00 p.m. (total of 18 samples).

6.0 Analysis

The Trace Analytical Laboratory in the Department of Environmental Toxicology at UC Davis will analyze the XAD-4 samples for nicotine. Analysis will be by gas chromatography with mass selective detector.

7.0 Quality Control

Field QC procedures are critical to ensuring the data collected is accurate, relevant, and defensible. So to ensure these measures a National Institute of Standard Technology (NIST)-traceable transfer standard will be used to, calibrate, and verify flow rates, for the BGI PQ-100s and the Meteorological equipment (Auto-Met). Following the end of the study a pre and post calibration form will be used to verify the accuracy of the equipment used in the study (Table 2,3).

Each XAD-4 sampling cartridge will be assigned a sample report which consists of site name, sampler ID, field operator, filter ID/Code, start/end date and time, elapsed time, target flow rate, volume, observed conditions, operator comments, and filter/sample transfer information (Table 4).

Following sampling, XAD-4 samples will be placed with the sample report in an ice chest containing dry ice, until transfer to the UC Davis lab for analysis.

In addition, three field cartridge spikes will be used at two locations, and one trip blank cartridge and one field blank cartridge will be carried to and from the field at all locations. The field blank will be opened in the field, but the trip blank will not be opened.

8.0 Schedule

The near-source monitoring is tentatively scheduled for the fall and winter of 2002.

9.0 Roles and Responsibilities

SSD will pick the sampling sites and obtain approval for site access. SSD will also collect and monitor smoking activity and frequency during each sampling day at each location. All data analysis will be done by SSD.

The UC Davis lab will provide sampling media and media transfer documentation. The lab will perform analysis of sample media and report findings.

The Special Purpose Monitoring Section (SPM) will write the ETS sampling protocol. SPM will also, work with the client on site logistics, pick-up and transport sample media to and from the field, perform air sampling, and write the final ETS report. The final ETS report will include maps, and photos of the smoking areas with sampler locations and meteorological data, and include the UC Davis analytical report as an attachment.

Sampler Flow Check Log

Transfer Standard Information:

*MFM Make & Model:*_____ *Flow Range:*_____

*I.D.(Bar Code):*_____ *Calibration Date:*_____

Flow Check Data:

		Pre-Sampling Flow Check		**Post-Sampling Flow Check**		
Date	Sampler I.D.	Transfer Standard Flow Rate (slpm)	Sampler Flow Rate (slpm)	Transfer Standard Flow Rate (slpm)	Sampler Flow Rate (slpm)	Comments

Table 2

Auto Met X1042 ›sultant Wind Direction
Station Number: Sensor Number: A6978 Cal. Date: 05/17/02

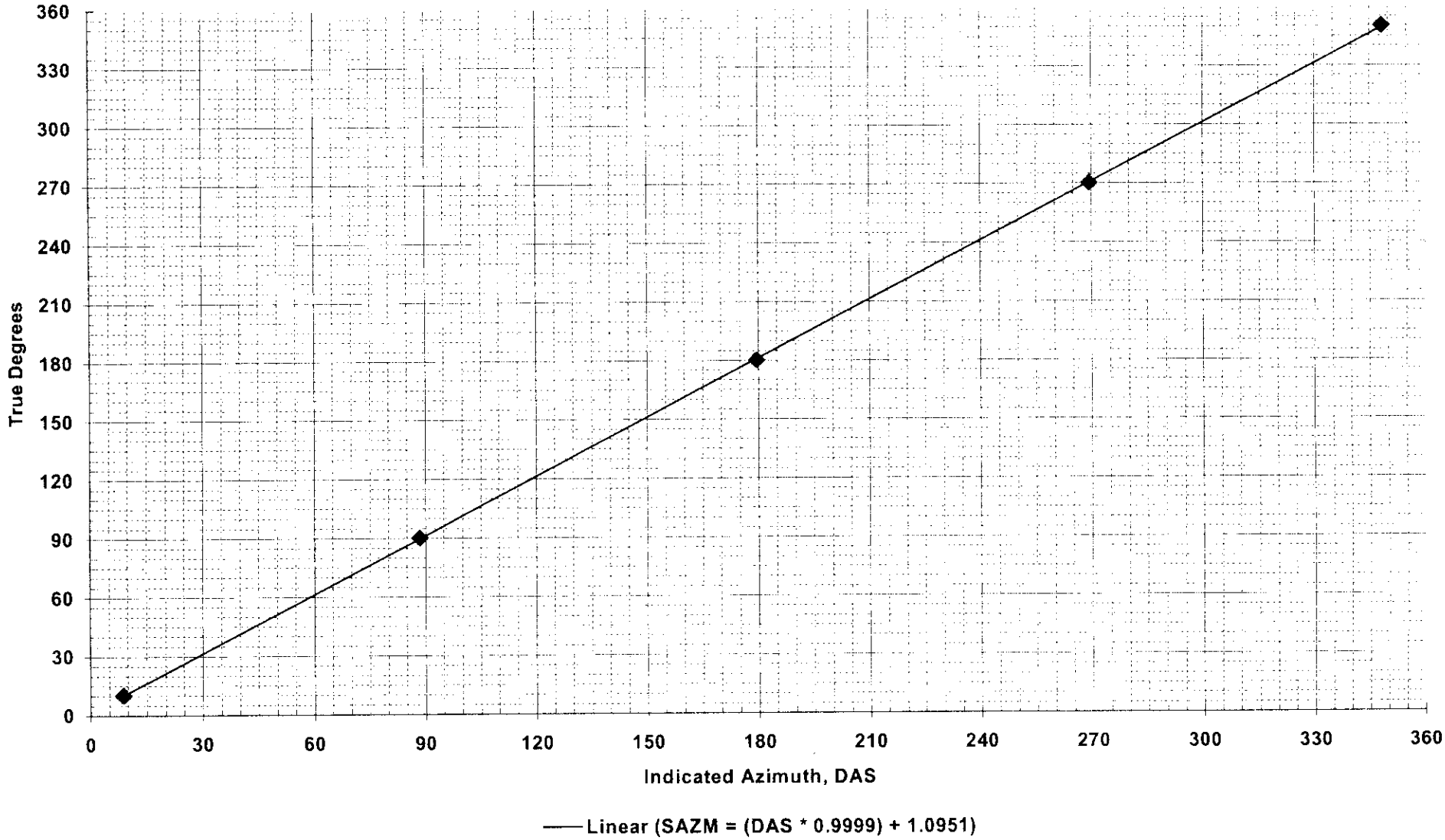

Table 3

Media Sample Report

Project Name: _____

Site Name: _____

Sampler I.D.: _____

Field Operator _____

Filter I.D. or Code: _____

Start Date / Time: _____

End Date / Time: _____

Sample Summary:

Elapsed Time (min)	Target Flow Rate (lpm)	Total Volume Sampled (liters)	Observed Conditions

Observed Conditions

A. No Unusual Conditions
B. Rain / Snow
C. Fog
D. Nearby Smoke / Fire
E. Construction
F. Sampler dysfunction
G. Other (state)

Operator Comments:

_____

_____

_____

Filter / Sample Transfer:

Action	Date	Time	Name		Comments
			Released	Taken	
(Media transferred from lab to site operator					
(Media transfer)					
(Media transfer)					
(Media transfer)					
(Media transferred from site operator to lab					

Table 4

ATTACHMENT II

UCD ANALYTICAL REPORT

FINAL REPORT

September 22, 2003

ANALYSIS OF NICOTINE IN CALIFORNIA
AIR SAMPLES FROM XAD-4 RESIN

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Laboratory Research Director

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INTRODUCTION

Nicotine is unique to tobacco, is a major constituent of its smoke, and has been used as a marker for environmental tobacco smoke (ETS), also known as second-hand smoke [1,2]. Staff of the Air Resources Board of California (ARB), in an effort to improve estimates of Californians' exposures to ETS, conducted an air sampling study with analysis of nicotine. The Trace Analytical Laboratory (TAL) in the Department of Environmental Toxicology, University of California, Davis was selected to provide air sampler cartridges and analysis of nicotine in air samples. Nicotine is present at >95% vapor phase in ETS [3]. Filter capture, problems with nicotine degradation, extraction, and analysis need to be overcome for efficient estimates of nicotine in air. Several methods of capturing nicotine for analysis from air sampling have been proposed such as filter packs, sorbent beds, annular denuders and passive samplers [2]. The California ARB staff collected air-samples using XAD-4 resin in five different locations in California. Samplers were run at 1 and 8 hour-intervals with 3 or 4 samplers at each location. Sample cartridges were placed on dry ice and transported back to TAL for quantitative nicotine analysis by gas chromatography/mass spectrometry (GC/MS). Trapping efficiencies, method detection limits, concurrent recoveries and storage stabilities were determined to aid the ARB investigation.

MATERIALS AND METHODS

Standard Preparation. Nicotine (98.5%, Lot#267-54A) reference standard, was obtained from Chem Service (Cat. #PS-85, 660 Tower Lane, West Chester, PA), and stored frozen at approx. -20°C except when in use. All solvents and reagents were residue grade or better. Stock solution (1mg/mL) was prepared by dissolving 0.0509 g nicotine into 50 mL acetone. Stock solution was stored frozen.

Calibration standards for GC/MS analysis were prepared in the presence of matrix. For each calibration standard solution, solvent was prepared through the method and the resin extract used for final dilution with 40/40/20 acetone/ethyl acetate/methanol. Dilution of 2, 1, 0.5, 0.2, 0.1 and 0.05 mL of stock solution (1 mg/mL) in 10 mL of 40/40/20 acetone/ethyl acetate/methanol resin extract produced 200, 100, 50, 20, 10 and 5 pg/µL calibration standard solutions. Calibrations standards were stored in the refrigerator (<5°C) and were prepared fresh every two weeks for the course of the study.

XAD-4 Resin Preparation. XAD-4 (Rohm and Haas, Amberlite, Philadelphia, PA, 100-120 mesh), a macro reticular resin, was employed as the trapping medium. XAD-4 resin was prepared prior to use according to Seiber et al. [4] with modifications described below. Resin (~18.7 L) was initially rinsed with methanol in an ~ 40 L container. The fines were removed by placing a hose at the bottom of the container, overfilling with deionized water and stirring vigorously. Two liters of 0.25 *N* hydrochloric acid were added and the resin was stirred for 30 min. Again, water was added and fines with excess water was decanted. The water steps above were repeated until the water above the resin was clear and the pH was that of the deionized water. The resin was then transferred with methanol to gallon bottles. The resin was Soxhlet

extracted once with fresh methanol and ~ 100mL of pyridine for 24 hours, then extracted again with fresh methanol for 24 hours, then extracted twice with fresh ethyl acetate for 24 hours. This pyridine clean up step was added to the original method to clean resin for nicotine capture and subsequent extraction with 0.01% pyridine in acetone/ethyl acetate/methanol. The resin was dried in a vacuum oven (25 in. Hg) until thoroughly dried. Resin batches were numbered and stored at room temperature in clean, dry jars with Teflon®-lined lids. Each solvent step is important for thorough cleanup of the XAD-4 resin.

Trapping Efficiency Test. Preparation of cartridges is described in Hall et al., 1997 [5]. The resin cartridge consisted of a resin bed (~30 mL) held in position with a stainless steel mesh screen. The cartridges were connected in tandem with Teflon® tubing. Tygon® tubing was connected to a Staplex high-volume air pump fitted with a manifold that allowed a flow rate of 15 L per min (Lpm).

Nicotine standard solution was applied directly to the resin bed at 50 μg. Air samples were collected for 1 and 8-hr intervals, (n=4). Resin was extracted as described below and analyzed as described in the quantitation section.

Determination of Method Detection Limit (MDL) and Estimated Quantitation Limit (EQL). Eight samples each were fortified with 0.10μg nicotine for a 1-hr and an 8-hr air sampling interval. Samples were extracted and quantified as below in a final volume of 10 mL. For quantitation at pg/μL, values below MDL were non-detect (ND), values above or equal to MDL but below EQL were trace (TR), and values above EQL were reported at two significant figures. EQL was determined using 10 mL

samples while actual samples were analyzed in 5 mL, so the pg/μL level was the deciding point for non-detect and trace amounts reported.

Storage Stability. Jars with 30 mL of pyridine washed XAD-4 resin were each fortified with 1 μg of nicotine. Six jars were analyzed through the method below on Day 0 and the remaining jars were stored at –20±6°C. Six jars were removed and analyzed as below on Day 29.

Collection of Air Samples. Air samplers were placed at various sites in California and samples were taken for 1-hr and 8-hr periods. Usually 3 air pumps were used at a site, and cartridges changed for the appropriate time interval. Cartridges were stored in freezer boxes after collection and delivered to the TAL facility. Samples were assigned unique numbers and analyzed as below.

Extraction of Air Samples. The cap and screen were removed from the resin cartridge and poured into a 4 oz. jar. The remaining resin was transferred by carefully rinsing the cartridge using 75 mL of 0.01% of pyridine in 40/40/20 acetone/ethyl acetate/methanol (extraction solvent) into the jar and capping with a Teflon®-lined lid. Concurrent fortifications were prepared at this point by adding clean resin to a jar, then adding appropriate standard and 75 mL of extraction solvent. Jars are mechanically swirled, on a rotary platform shaker for one hour at a moderate speed. The extraction solvent was decanted into a 500-mL round bottom flask (RBF) through a funnel with glass wool. The resin was re-extracted with an additional 75 mL of extraction solvent and swirled for 30 min. Pooling the decanted extraction solvent from the jar, resin was re-extracted a final time with 75 mL extraction solvent for 30 min. The pooled extract in the RBF was concentrated to 1-2 mL using a rotary evaporator with an ~35°C water bath.

The sample was diluted to an appropriate volume for GC/MS analysis with 40/40/20 acetone/ethyl acetate/methanol.

Instrumentation and Quantitation. Nicotine analysis was performed using a Hewlett Packard (HP, Avondale, PA) 6890, equipped with a 30 m x 0.25 mm DB-17ms column (0.25 μm film thickness, J&W Scientific, Folsom, CA) and Mass Selective Detector (MSD) Model 5973, in Selective Ion Monitoring (SIM) Mode. The inlet was in pulsed splitless mode with the injection pressure pulse 50 psi for 1 min and the injector purge at 50 mL/min for 0.95 min. A HP 6890 autosampler was used to make 3 μl injections. The injector was heated at 250°C, the MSD interface at 280°C, MSD source at 230°C, the MSD quadrapole at 150°C and the column at 80°C for 1 min then ramped up by 20°C/min to 280°C. The retention time was 6.44 min for nicotine. The quantitation ion (m/z, mass/charge ratio) was 84 (Dwell time = 50 milliseconds x 2) and the confirmation ion (m/z) was 162. Prior to each analytical set, the analyst performed an autotune and a tune evaluation of the MSD to insure proper function. In addition, calibration standards were injected with each run to check GC/MS performance.

The data system was HP ChemStation® G1701BA version B.01.00. Peak areas from calibration standards were used to generate a linear standard curve (nicotine response vs. concentration pg/μL). The average of replicate injections of each sample was reported. Average peak areas from samples were converted to pg/μL by using the linear regression from the standard curve. The sample concentration was multiplied by the final sample volume resulting in μg/sample. Fortified samples yielded a percent recovery by dividing the μg/sample by the fortification amount. If the peak area for nicotine was 10% larger than the highest standard value, the sample was diluted and

reinjected. For sample values above EQL, 10% of the samples were assessed by ion ratio comparison for nicotine.

RESULTS AND DISCUSSION

Difficulties with trapping efficiencies for nicotine were curtailed by addition of pyridine to the extraction solvent and pre-washing the XAD-4 collection resin with dilute pyridine. Trapping efficiencies were 82 ± 6% for the 1-hour study and 69 ± 3% for the 8-hour study, with 90 ± 1% concurrent recoveries (fortified at extraction). These trapping efficiencies were sufficient and comparable to other XAD-4 studies [2,6].

The method detection limit (MDL) is considered to be the t-value (2.998 for n=8) times the standard deviation. Results for the 1-hour air sampling study showed an average of 9.14 ± 0.35 pg/μL recovered. MDL was calculated as 1.05 pg/μL (0.35 × 2.998). Estimated quantitation limit (EQL) was calculated as 5.25 pg/μL (MDL × 5): thus, non detect (ND) < 1.05 < Trace <5.25 pg/μL. When calculated for 5 mL samples, the limits used for 1-hour were ND < 0.0058 ≤ Trace <0.029 μg/m^3 and for 8-hour ND < 0.00073 ≤ Trace <0.0036μg/m3. Results for the 8-hour air sampling study showed an average recovery of 10.22 ± 0.18 pg/μL, an MDL of 0.53 pg/μL and an EQL of 2.66 pg/μL. Because the standard deviation for the 8-hour set was significantly less than the 1-hour set, and when calculated was well below our actual instrument sensitivity, the MDL and EQL at pg/μL for the 1-hour set was used throughout the study.

Storage stability samples were analyzed 29 days after fortification. Recovery averaged 103 ± 5% for n=6. Concurrent recoveries run with those samples averaged 89 ± 4% for n=6. No apparent degradation of nicotine occurred in spiked frozen cartridges over 29 days.

For each set of samples received from ARB, concurrent recoveries were run. For the entire study concurrent recoveries averaged 85 ± 7%. Trip/field spikes, which were fortified by TAL, averaged 80 ± 9% recovery.

Results from samples collected by staff of the California ARB are presented in Table 1, for 1-hour and 8-hour sampling intervals. (The raw data sheets from each of the monitoring locations are presented in Attachment A.) General locations were an airport, a junior college, a local government building, an office building, and an amusement park. Samples taken at the amusement park had the highest levels of nicotine. The highest 1-hr sample was 4.607 $\mu g/m^3$ nicotine; the highest 8-hr sample was 3.096 $\mu g/m^3$. The lowest values were found at junior college.

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Table 1. Results of analysis of nicotine in air samples from 5 different California locations in μg/m^3.

ND = non detect , TR = Trace, NP = No Pump (malfunction).
Limits Used for μg/m^3:

1 Hour ND < 0.0058≤ Trace< 0.029 μg/m^3

8 Hour ND < 0.00073≤ Trace< 0.0036 μg/m^3

	Airport			Junior College				Local Government Center			Office Complex			Amusement Park		
Site/Pump	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	3
1 Hour	1.114	0.556	0.0565	TR	TR	0.0359	TR	0.176	0.145	TR	0.213	0.151	0.0392	0.859	0.660	0.155
	0.649	0.588	0.0472	TR	TR	0.0377	TR	0.172	0.0797	TR	0.236	0.282	0.0715	1.980	1.211	0.140
	1.032	0.517	0.0454	0.0434	0.0752	0.0556	TR	0.0702	0.0601	TR	0.139	0.243	0.0724	3.167	0.881	0.169
	0.620	0.553	0.0525	NP	0.0484	0.0462	TR	NP	0.131	TR	0.121	0.194	0.0728	3.096	2.891	0.134
	0.663	1.498	0.0417	0.0444	NP	0.0650	TR	0.0387	0.0822	ND	0.124	0.187	0.0762	4.607	3.636	0.263
	0.362	0.439	0.0355	0.0960	0.146	0.0525	TR	0.0463	0.0702	TR	0.102	0.242	0.0321	3.096	2.134	0.156
8 Hour	0.490	0.990	0.0185	0.0316	0.0437	0.0296	0.0183	0.0592	0.0731	0.0102	0.105	0.127	0.124	2.361	2.792	0.124
	0.480	0.731	0.0228	0.0273	0.0151	0.0129	0.00474	0.0417	0.0674	0.00771	0.121	0.152	0.0495	3.087	2.547	0.122

Attachment A

ARB/Nicotine Samples Set #1
Samples received on 1/17/2003 **Airport**
Date Extracted: 1/21/2003
Date Analyzed: 1/24/2003
Nicotine

Sample ID	Sampler #	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC133C			Trace								
NIC102TB			Trace								
NIC103FB			Trace								
NIC134CR400R1		400.0	366.164	92%							
NIC135CR400R2		400.0	378.494	95%							
NIC136CR400R3		400.0	353.990	88%	92%	3%					
NIC104FS400R1		400.0	341.906	85%			480	15	7200	7.20	
NIC105FS400R2		400.0	349.841	87%			480	15	7200	7.20	
NIC106FS400R3		400.0	344.127	86%	86%	1%	60	15	900	0.90	
NIC109	3		0.0508				60	15	900	0.90	0.0565
NIC110	1		0.9857				59	15	885	0.89	1.1137
NIC111	2		0.5001				60	15	900	0.90	0.5557
NIC112	3		0.0425				60	15	900	0.90	0.0472
NIC113	1		0.5843				60	15	900	0.90	0.6492
NIC114	2		0.5294				60	15	900	0.90	0.5882
NIC115	3		0.0409				60	15	900	0.90	0.0454
NIC116	1		0.9290				60	15	900	0.90	1.0323
NIC117	2		0.4655				60	15	900	0.90	0.5172
NIC118	3		0.0473				60	15	900	0.90	0.0525
NIC119	1		0.5578				60	15	900	0.90	0.6198
NIC120	2		0.4978				60	15	900	0.90	0.5531
NIC121	3		0.0375				60	15	900	0.90	0.0417
NIC122	2		1.3484				60	15	900	0.90	1.4982
NIC123	1		0.5972				60	15	900	0.90	0.6636
NIC124	3		0.0320				60	15	900	0.90	0.0355
NIC125	1		0.3260				60	15	900	0.90	0.3622
NIC126	2		0.3949				60	15	900	0.90	0.4388
NIC127	3		0.1334				480	15	7200	7.20	0.0185
NIC128	2		7.1266				480	15	7200	7.20	0.9898
NIC129	1		3.5275				480	15	7200	7.20	0.4899
NIC130	3		0.1641				480	15	7200	7.20	0.0228
NIC131	2		5.2664				480	15	7200	7.20	0.7314
NIC132	1		3.4598				480	15	7200	7.20	0.4805

C = Resin Blank
TB = Trip Blank
FB = Field Blank
CR = Concurrent Recovery
FS = Field Spike

Limits Used for µg/m^3:

1 hour 0.0058 µg/m3 ≤ Trace < 0.029 µg/m3

8 hours 0.00073 µg/m3 ≤ Trace < 0.0036 µg/m3

ARB/Nicotine Samples Set #2
Samples received on 4/8/2003
Date Extracted: 4/8/2003
Date Analyzed: 4/9/2003
Nicotine

Junior College

Sample ID	Sampler #	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC176C			Trace								
NIC137TB			Trace								
NIC177CR100R1		100.0	79.110	79%							
NIC178CR100R2		100.0	74.445	74%							
NIC179CR100R3		100.0	81.510	82%	78%	4%					
NIC175FS100R1		100.0	83.383	83%							
NIC138TS100R1		100.0	82.274	82%							
NIC139	1		0.2279				480	15	7200	7.20	0.0316
NIC140	2*		0.3147				480	15	7200	7.20	0.0437
NIC141	3		0.2131				480	15	7200	7.20	0.0296
NIC142	4		0.1320				480	15	7200	7.20	0.0183
NIC143	1		0.1962				480	15	7200	7.20	0.0273
NIC144	2*		0.1090				480	15	7200	7.20	0.0151
NIC145	3		0.0930				480	15	7200	7.20	0.0129
NIC146	4		0.0341				480	15	7200	7.20	0.00474
NIC147	1		0.0222				60	15	900	0.90	Trace
NIC148	2*		0.0209				60	15	900	0.90	Trace
NIC149	3		0.0323				60	15	900	0.90	0.0359
NIC150	4		0.0127				60	15	900	0.90	Trace
NIC151	1		0.0156				60	15	900	0.90	Trace
NIC152	2*		0.0169				60	15	900	0.90	Trace
NIC153	3		0.0339				60	15	900	0.90	0.0377
NIC154	4		0.0188				60	15	900	0.90	Trace
NIC155	1		0.0391				60	15	900	0.90	0.0434
NIC156	2*		0.0676				60	15	900	0.90	0.0752
NIC158	4		0.0235				60	15	900	0.90	Trace
NIC160	2		0.0436				60	15	900	0.90	0.0484
NIC161	3		0.0416				60	15	900	0.90	0.0462
NIC162	4		0.0179				60	15	900	0.90	Trace
NIC163	1		0.0399				60	15	900	0.90	0.0444
NIC165	3		0.0585				60	15	900	0.90	0.0650
NIC166	4		0.0198				60	15	900	0.90	Trace
NIC167	1		0.0864				60	15	900	0.90	0.0960
NIC168	2*		0.1316				60	15	900	0.90	0.1463
NIC169	3		0.0473				60	15	900	0.90	0.0525
NIC170	4		0.0245				60	15	900	0.90	Trace
NIC171	3		0.0500				60	15	900	0.90	0.0556

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike
* = Collocated Sample

Limits Used for µg/m^3:

1 hour	0.0058 µg/m3 ≤ Trace < 0.029 µg/m3
8 hours	0.00073 µg/m3 ≤ Trace < 0.0036 µg/m3

ARB/Nicotine Samples Set #3
Samples received on 4/14/2003
Date Extracted: 4/14/2003
Date Analyzed: 4/14/2003
Nicotine

Govt Center

Sample ID	Sampler #	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC206C			ND								
NIC102TB			ND								
NIC207CR50R1		50.0	47.51	95%							
NIC208CR50R2		50.0	44.70	89%							
NIC209CR50R3		50.0	47.10	94%	93%	3%					
NIC182FS50R1		50.0	38.00	76%							
NIC181TS50R1		50.0	44.67	89%							
NIC172	1		0.4262				480	15	7200	7.20	0.0592
NIC173	2		0.5261				480	15	7200	7.20	0.0731
NIC174	3		0.0734				480	15	7200	7.20	0.0102
NIC183	1		0.3006				480	15	7200	7.20	0.0417
NIC184	2		0.4856				480	15	7200	7.20	0.0674
NIC185	3		0.0555				480	15	7200	7.20	0.00771
NIC186	1		0.1581				60	15	900	0.90	0.1756
NIC187	2		0.1302				60	15	900	0.90	0.1447
NIC188	3		0.0249				60	15	900	0.90	Trace
NIC189	1		0.1551				60	15	900	0.90	0.1724
NIC190	2		0.0717				60	15	900	0.90	0.0797
NIC191	3		0.0199				60	15	900	0.90	Trace
NIC192	1		0.0632				60	15	900	0.90	0.0702
NIC193	2		0.0541				60	15	900	0.90	0.0601
NIC194	3		0.0187				60	15	900	0.90	Trace
NIC195	1		ND				NA	NA	NA	NA	NA
NIC196	2		0.1178				60	15	900	0.90	0.1309
NIC197	3		0.0150				60	15	900	0.90	Trace
NIC198	1		0.0348				60	15	900	0.90	0.0387
NIC199	2		0.0740				60	15	900	0.90	0.0822
NIC200	3		ND				60	15	900	0.90	ND
NIC201	1		0.0417				60	15	900	0.90	0.0463
NIC202	2		0.0632				60	15	900	0.90	0.0702
NIC203	3		0.0249				60	15	900	0.90	Trace

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike

Limits Used for µg/m^3:

1 hour	0.0058 µg/m3 ≤ Trace < 0.029 µg/m3
8 hours	0.00073 µg/m3 ≤ Trace < 0.0036 µg/m3

ARB/Nicotine Samples Set #4
Samples received on 5/23/2003
Date Extracted: 5/27/2003
Date Analyzed: 5/27/2003
Nicotine

Office Complex

Sample ID	Sampler #	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC242C			ND								
NIC210TB			ND								
NIC211FB			ND								
NIC243CR25R1		25.0	21.97	88%							
NIC244CR25R2		25.0	22.10	88%							
NIC245CR25R3		25.0	21.59	86%	88%	1%					
NIC212FS25R2		25.0	20.05	80%							
NIC213FS25R1		25.0	14.13	57%							
NIC214FS25R3		25.0	19.97	80%							
NIC215TS25R1		25.0	20.69	83%							
NIC216	341		0.7533				480	15	7200	7.20	0.1046
NIC217	353		0.9167				480	15	7200	7.20	0.1273
NIC218	347		0.8927				480	15	7200	7.20	0.1240
NIC219	341		0.8682				480	15	7200	7.20	0.1206
NIC220	353		1.0956				480	15	7200	7.20	0.1522
NIC221	347		0.3562				480	15	7200	7.20	0.0495
NIC222	341		0.1913				60	15	900	0.90	0.2126
NIC223	353		0.1362				60	15	900	0.90	0.1513
NIC224	347		0.0353				60	15	900	0.90	0.0392
NIC225	341		0.2120				60	15	900	0.90	0.2356
NIC226	353		0.2541				60	15	900	0.90	0.2824
NIC227	347		0.0643				60	15	900	0.90	0.0715
NIC228	341		0.1253				60	15	900	0.90	0.1392
NIC229	353		0.2183				60	15	900	0.90	0.2426
NIC230	347		0.0651				60	15	900	0.90	0.0724
NIC231	341		0.1088				60	15	900	0.90	0.1209
NIC232	353		0.1747				60	15	900	0.90	0.1941
NIC233	347		0.0655				60	15	900	0.90	0.0728
NIC234	341		0.1118				60	15	900	0.90	0.1242
NIC235	353		0.1687				60	15	900	0.90	0.1874
NIC236	347		0.0686				60	15	900	0.90	0.0762
NIC237	341		0.0918				60	15	900	0.90	0.1020
NIC238	353		0.2176				60	15	900	0.90	0.2417
NIC239	347		0.0289				60	15	900	0.90	0.0321

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
FS = Field Spike
TS = Trip Spike
FB = Field Blank

Limits Used for µg/m^3:

1 hour 0.0058 µg/m3 ≤ Trace < 0.029 µg/m3

8 hours 0.00073 µg/m3 ≤ Trace < 0.0036 µg/m3

ARB/Nicotine Samples Set #5
Samples received on 6/20/2003
Date Extracted: 6/23/2003
Date Analyzed: 6/24/2003
Nicotine

Amusement Park

Sample ID	Sampler #	Fortification Level (µg)	µg found	% Rec	Ave % Rec	Stdev	Run Time (min.)	Flow (L/min.)	Vol (L)	Vol (m^3)	µg/m^3
NIC275C			ND								
NIC246TB			ND								
NIC276CR10R1		10.0	7.80	78%							
NIC277CR10R2		10.0	7.61	76%							
NIC278CR10R3		10.0	7.78	78%	77%	1%					
NIC247TS10R1		10.0	7.17	72%							
NIC248	1		16.9996				480	15	7200	7.20	2.3611
NIC249	2		20.1031				480	15	7200	7.20	2.7921
NIC250	3		0.8938				480	15	7200	7.20	0.1241
NIC252	1		22.2234				480	15	7200	7.20	3.0866
NIC253	2		18.3371				480	15	7200	7.20	2.5468
NIC254	3		0.8754				480	15	7200	7.20	0.1216
NIC255	1		0.7734				60	15	900	0.90	0.8593
NIC256	2		0.5942				60	15	900	0.90	0.6602
NIC257	3		0.1399				60	15	900	0.90	0.1554
NIC258	1		1.7816				60	15	900	0.90	1.9796
NIC259	2		1.0900				60	15	900	0.90	1.2111
NIC260	3		0.1262				60	15	900	0.90	0.1403
NIC261	1		2.8501				60	15	900	0.90	3.1668
NIC262	2		0.7930				60	15	900	0.90	0.8812
NIC263	3		0.1524				60	15	900	0.90	0.1694
NIC264	1		2.7863				60	15	900	0.90	3.0959
NIC265	2		2.6020				60	15	900	0.90	2.8911
NIC266	3		0.1210				60	15	900	0.90	0.1344
NIC267	1		4.1466				60	15	900	0.90	4.6073
NIC268	2		3.2723				60	15	900	0.90	3.6359
NIC269	3		0.2367				60	15	900	0.90	0.2630
NIC270	1		2.7862				60	15	900	0.90	3.0958
NIC271	2		1.9208				60	15	900	0.90	2.1342
NIC272	3		0.1407				60	15	900	0.90	0.1564

C = Resin Blank
TB = Trip Blank
CR = Concurrent Recovery
TS = Trip Spike

Limits Used for µg/m^3:

1 hour 0.0058 µg/m3 ≤ Trace < 0.029 µg/m3

8 hours 0.00073 µg/m3 ≤ Trace < 0.0036 µg/m3