



SACRAMENTO REGION AIR QUALITY BASIN: “SPARE THE AIR” CAMPAIGN 2005 EVALUATION



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January, 2006



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Final Report – Evaluation of the 2005 Spare the Air Campaign

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EXECUTIVE HIGHLIGHTS – 2005 SPARE THE AIR CAMPAIGN EVALUATION

Awareness:

- ◆ Public awareness of Spare the Air in general increased this year: over six-in-ten respondents in the Sacramento Core Region had heard, read, or seen advertisements about Spare the Air in the 2005 season, up significantly from last year. Specific awareness of the request not to drive the previous day due to unhealthy air, however, has remained unchanged (except for 2002) over the past six years, at approximately three-in-ten respondents.
- ◆ Significantly more respondents were aware of Spare the Air (both in general and specifically) on Spare the Air days than on Control days in the region as a whole and the three individual air quality management districts – a continuing indication of the program’s success in raising public awareness about air quality issues.
- ◆ An average of 552,240 drivers in the region as a whole noticed the general advisory on the fourteen Spare the Air days during the 2005 season, and 321,070 drivers were specifically aware of the request not to drive. [Estimates include control day correction factors.]

Driving Reduction:

- ◆ Nearly a quarter (24%) of all respondents in the region said they drove “less” on Spare the Air days, the highest percentage in the past six years. Significantly more Spare the Air respondents reported driving “less” than Control respondents did.
- ◆ That being said, however, only 1.4% of all respondent drivers in the entire region purposefully reduced their driving on Spare the Air days because they wanted to improve air quality in the region and had heard or seen advertisements within the past two days about Spare the Air. The percentage of reducers has stayed approximately the same over the last six years.
- ◆ About 17,980 drivers purposefully made fewer trips on average each Spare the Air day in 2005 in order to reduce air pollution.
- ◆ The drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.0 single trips each. Correcting for Control day interviewing, this translates into an average of 37,490 trips purposefully avoided on each Spare the Air day during the 2005 season.

Estimated Emission Reductions:

- ◆ The 2005 Spare the Air program was successful in reducing air pollution in the Sacramento Core Region by an estimated 0.27 tons of ozone precursors per day. This is due specifically to drivers purposefully reducing the number of trips they took on Spare the Air days for air quality reasons. The reduction in tons reduced compared to prior years is due to changes in vehicle emissions rates in the ARB inventory, not to participation in the Spare The Air program.

Health Effects:

- ◆ Despite differences between air districts in terms of peak ozone concentrations, the health effects of ozone air pollution are experienced throughout the whole Sacramento Core Region. Poor air quality contributed to household health problems - breathing difficulties and burning eyes were experienced by significantly more



households in the Core Region on and following Spare the Air than Control days. In addition, households in Placer County APCD experienced more coughing and those in Yolo-Solano AQMD experienced significantly more headaches on Spare the Air than on Control days.

- ◆ The percentage of households reporting breathing difficulties in the region on Spare the Air days has stayed the same from 2000 to the present, at an average of 13% of all households during the past six years (and 12% this year).
- ◆ An additional 60,070 households in the Sacramento Core Region experienced breathing problems during Spare the Air days specifically due to ozone air pollution. This is double the number of affected households from last year due to a significant decrease this year in the percentage of households reporting respiratory problems on control days. Potentially, this could be due to improved air quality on control days, random variation, or it may be simply an anomaly.

Employer Participation:

- ◆ Eighteen percent of employed respondents in the region as a whole said their employer encourages them to drive less on days of poor air quality.
- ◆ Employers notified employees about Spare the Air days via e-mail (11%), by posting signs (8%), and by asking them to sign up for Air Alert notifications (4%).
- ◆ Employer participation, although higher this year at 18% is not significantly different from the previous two years (both 16%). E-mail notification and the percent of employers posting signs about Spare the Air days have also not changed in three years. Also unfortunate, the percent of employers who ask employees to register to receive AirAlert notifications has not expanded beyond last year's increase. Further efforts to increase employer participation are warranted.

Seasonal Trip Reductions:

- ◆ Thirty-six percent of all respondents in the region were seasonal reducers - they said they usually reduce the amount of driving they do during the summer to avoid adding to air pollution. They did so by making fewer trips, staying home, using alternative transportation, consolidating trips, carpooling, and telecommuting.
- ◆ These reducers reported entering their cars significantly fewer times than those respondents who said they did not usually reduce driving during the summer. In other words, seasonal driving reducers in the region reported an average of half a trip less per day than non-reducers on both Spare the Air and control days.
- ◆ This could translate into 1.6 tons of emission reductions per summer day in 2005.
- ◆ For the past six years, the percentage of seasonal trip reducers has remained relatively stable, at just under four-in-ten of all respondents.



Final Report – Evaluation of the 2005 Spare the Air Campaign

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PROJECT BACKGROUND

For the past ten years, the Sacramento Metropolitan Air Quality Management District (SMAQMD) has implemented a public education program called “Spare the Air” from May through October of each year. This program is designed to encourage the voluntary participation of residents to help reduce the amount of ozone in the air during summer days of particularly poor air quality. More specifically, Spare the Air encourages drivers to reduce the number of vehicle trips they make on Spare the Air days.

The trigger for alerting the population of a Spare the Air day for the next day is based on forecasted estimates of the Air Quality Index (AQI), provided by Sonoma Technology Inc. Estimates are derived using mathematical predictive modeling procedures on actual measurements obtained by local air districts and the California Air Resources Board at different stations throughout the region. If it is estimated that the AQI will be 127¹ or higher the next day, a Spare the Air advisory is issued by the SMAQMD. This advisory involves radio and television announcements, e-mail based Air Alert notifications, and employer networks. The 2005 Spare the Air public education program changed emphasis from previous years in that it focused primarily on health issues related to high ozone and poor air quality and only secondarily on encouraging residents to drive less on summer days of particularly poor air quality:² the radio and television advisory commercials produced by Crocker/Flanagan featured a primary health effects message followed by a request to reduce driving.

“The Sacramento region's 2005 summer was a scorcher, especially in July. A total of 14 Spare The Air days were called this season: 10 in July and 4 in August.”³

Annual evaluations have been conducted since 1995⁴ to assess the effectiveness of the Spare the Air program. In keeping with previous evaluations, two groups of respondents were interviewed, one following Spare the Air days, and the other following non-Spare the Air (or Control) days. This type of experimental design was first introduced by Dr. J. Lamare⁵ to control for any possible overstatements of driving reduction on Spare the Air days.

¹ If the next day's ozone forecast predicted a .095 parts per million level of ozone anywhere in the region for at least one hour, then a Spare the Air day was triggered. This is the equivalent of an AQI of 127.

² E-mail message from Lori Kobza-Lee, SMAQMD dated January 19, 2006.

³ Spare the Air website: <http://www.sparetheair.com/news.cfm>

⁴ The only exception was in 1997, when no evaluation was conducted.

⁵ Judith Lamare, Ph.D. Formerly of The Cleaner Air Partnership, Sacramento, CA.

METHODOLOGY

A sample of 1,144 (572⁶ when proportionally weighted to represent the Sacramento Core Region as a whole) randomly selected respondents was interviewed following all but the last of the **fourteen** Spare the Air days⁷ (July 1, July 14 through July 19, July 25 through July 27, and August 4 through August 7) of the 2005 season, which ran from May through October. This included 342 completed interviews with residents of Placer County APCD, 399 with residents of the Yolo-Solano AQMD, and 403 with residents of Sacramento County. Control day interviewing took place on matched days of the week, but on non Spare the Air days (August 16, 17, 18, 21, 22; and September 9, 12, 13, 16, 17, 18, 19, 22, and 26, 2005). A total of 1,203 (569 when weighted) Control interviews were conducted: 402 in Placer County APCD, 400 in Yolo-Solano AQMD, and 401 in Sacramento County. When discussing the Sacramento Core Region as a whole, interview results will have been weighted appropriately.⁸ All respondents were drivers: they were initially screened for having driven a vehicle (a car, truck, or van) within the last week.

All surveys were conducted using a Computer Assisted Telephone Interviewing (CATI) system. The average interview lasted about 4 minutes.

CAVEAT

The sole purpose of this report is to provide a collection, categorization and summary of public opinion data. Aurora Research Group intends to neither endorse nor criticize the Spare the Air program, Crocker/Flanagan, the Cleaner Air Partnership, the Sacramento Air Quality Management District (AQMD), Yolo-Solano AQMD, Placer Air Pollution Control District, or El Dorado AQMD; or their policies, products, or staff. The Clients shall be solely responsible for any modifications, revisions, or further disclosure/distribution of this report.

⁶ Since the beginning evaluation in 1995, the methodology for weighting has been to set Sacramento County interviews as 1, and down-weight interviews from all other counties appropriately, depending on the size of their populations. This is why the weighted totals of completed interviews are less than the combined raw totals.

⁷ Interviewing did not take place following the Sunday, August 7 Spare the Air episode because there was no media buy to alert the general population about that particular day.

⁸ Based on 2005 estimates from the 2000 US Census (www.dof.ca.gov/HTML/DEMOGRAP/E-1table.xls), the total population in the entire SMAQMD [excluding El Dorado AQMD, which was not included in this year's report] is 1,944,286: [Sacramento County (70%) - 1,369,855; Yolo-Solano AQMD (16%) - 308,494 (this includes the total 187,743 from Yolo County and 120,751 from the Dixon, Rio Vista and Vacaville areas of Solano County); and Placer County APCD (14%) - 265,937 (this figure represents the 87% of Placer County's 305,675 residents who do not live in zip codes north or east of Auburn.)

RESULTS & CONCLUSIONS

Awareness of the 2005 Spare the Air Campaign

Objectives

The objectives of this section of the report are to:

- A. measure awareness of the 2005 Spare the Air campaign using two questions and determine if awareness was similar or different among drivers in three air quality districts in the Sacramento Core Region (Sacramento County, Yolo-Solano AQMD, and Placer County APCD),
- B. determine if awareness during summer Spare the Air seasons has increased, decreased, or stayed the same from one year to the next,
- C. compare awareness between respondents interviewed following Spare the Air days and those interviewed on Control (non-Spare the Air) days, and
- D. extrapolate the results to the population by estimating the number of **drivers** in the Sacramento Core Region⁹ who were aware of the 2005 Spare the Air campaign (correcting for Control days).

In keeping with an innovation that was introduced in the 2002 questionnaire, two questions were used to assess overall awareness of the Spare the Air campaign – one with a more general wording (proposed by the Air Resources Board (ARB)), and the other with wording that has been used in the evaluation questionnaire for the past ten years (measuring a more specific awareness of the alert itself). They were asked in random order so as to eliminate any possible order-response bias:

- *General Awareness:* “In the past two days have you heard, read, or seen any advertisements or news broadcasts about Spare the Air, or poor air quality, or requests to drive less in this area?”
- *Specific Awareness:* “Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?”

Results

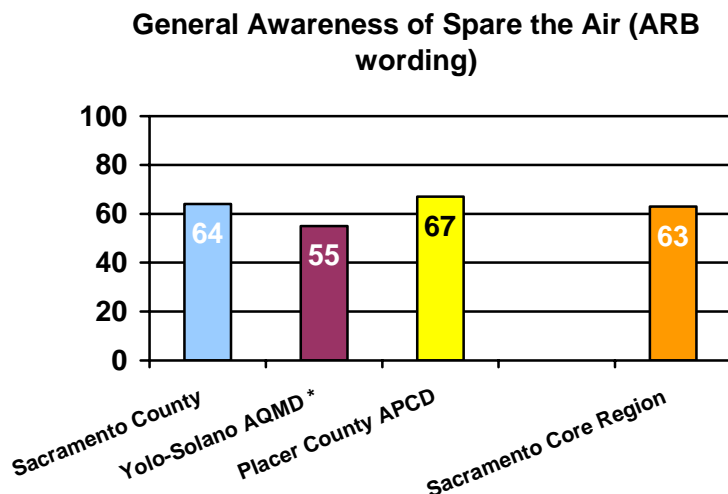
OBJECTIVE A:

Over six-in-ten respondents (63%) in the region said they had heard about Spare the Air in the previous two days, but only three-in-ten (29%) specifically remembered being asked not to drive the previous day. General awareness was significantly higher in both Sacramento County and Placer County APCD than in Yolo-Solano AQMD. There were no differences among the air districts in terms of levels of specific awareness of Spare the Air.

⁹ Throughout this report, the “Sacramento Core Region” refers to the Sacramento NonAttainment Area in which interviews were conducted: Sacramento County, parts of Placer County, Yolo County, and parts of Solano County. It excludes the primarily rural areas of El Dorado County and Sutter (which are actually part of the jurisdiction). All results referring to the Sacramento Core Region have been proportionally weighted. (See methodology section for further details.)

General Awareness:

The percentages of respondents who said that in the past two days they had heard, read, or seen advertisements or news broadcasts about Spare the Air (the general awareness question) are presented in the next chart. It can be seen that 63% of respondents in the Sacramento Core Region as a whole were aware of Spare the Air in general. It can also be seen that awareness was significantly higher in both Placer County APCD (67%) and in Sacramento County (64%) than in Yolo-Solano AQMD (55%).

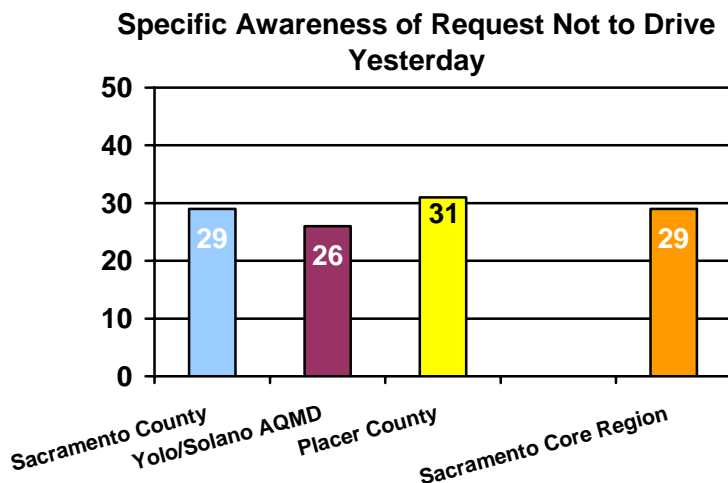


* significant difference between Yolo-Solano and all others

Specific Awareness:

The percentages of respondents who recalled “being asked not to drive yesterday because our area was experiencing a period of unhealthy air” (the specific awareness question) are presented in the next chart. It should be noted, first of all, that significantly fewer respondents were aware of Spare the Air when the question was worded this way (29% in the region as a whole) than when it was asked more generally (63%). However, this could in part be due to the nature of the 2005 Spare the Air campaign itself: according to Lori Kobza-Lee of the SMAQMD, “this season’s advisory messages focused on the air quality being unhealthy and the health risks associated with high ozone. The ‘request not to drive’ was a secondary message point in the 2005 campaign.”¹⁰ Specific awareness, although highest in Placer County APCD (31%), was not significantly different from either Sacramento County (29%) or Yolo-Solano AQMD (26%).

¹⁰ E-mail message from Lori Kobza-Lee, SMAQMD, dated October 13, 2005.



OBJECTIVE B:

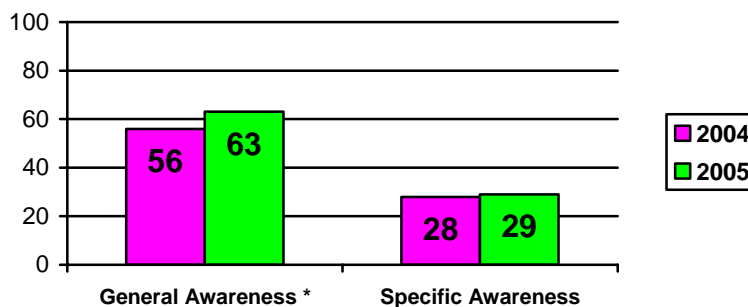
In terms of general awareness, there was a significant increase in the region as a whole from 2004, but awareness remained statistically highest in 2002, a very poor air quality season.

In terms of specific awareness, there was no significant increase in the region as a whole from 2004. In fact, with the exception of 2002, regional levels have essentially stayed the same at about 30% for the last six years.

There are a few noteworthy differences in levels of awareness within individual air districts over time.

First of all, in comparing levels of awareness between last year and this year, it can be seen in the next chart that general awareness increased significantly from 2004 to 2005 for the region as a whole (56% vs. 63%, respectively), but specific awareness did not (28% vs. 29%).

Sacramento Core Region: 2004 vs 2005 Levels of Awareness

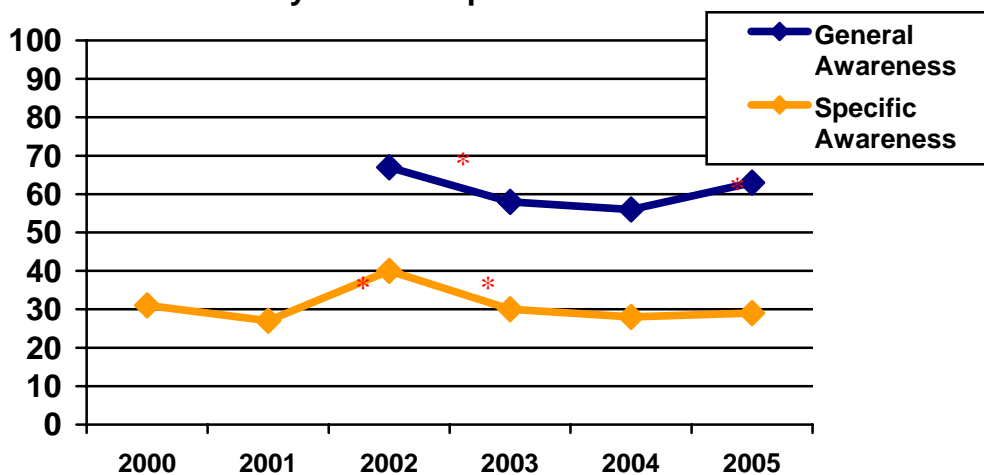


* indicates a statistically significant difference between the years

General awareness can be tracked from 2002, the year the question was first introduced. Results for all years, shown in the next line graph, indicate that for the Core Region as a whole, awareness was significantly highest in 2002 at 67%, a very poor air quality season. Awareness was significantly lower in all other years – at 58% in 2003; 56% in 2004, and 63% in 2005. That being said, there was also a significant increase in general awareness this year compared with both 2003 and 2004 levels.

In terms of specific awareness, results for all years since 2000 are plotted in the same graph on the following page. It can be seen that in terms of the Core Region as a whole, awareness in all years except 2002¹¹ was stable, at approximately 30%.

**Sacramento Core Region:
Year-by-Year Comparison of Awareness**



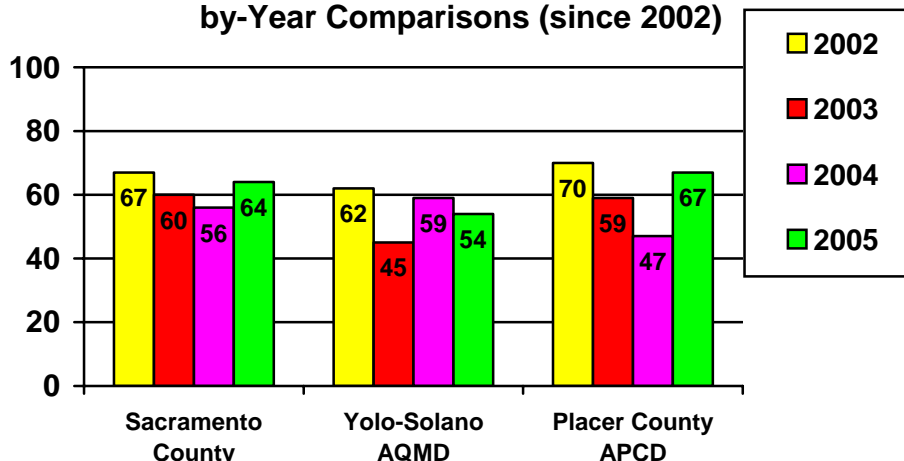
* indicates a statistically significant difference between the years

Results from the individual air districts are presented in the next two charts. In terms of general awareness, results were highest in all three air districts in 2002. Within each air quality district, most of the differences from year-to-year were significant¹², indicating that this measure is quite specific to each season.

¹¹ 2002 was an exceptional year with high temperatures, multiple-day Spare the Air episodes, and the greatest number of STA days (22) of all six years.

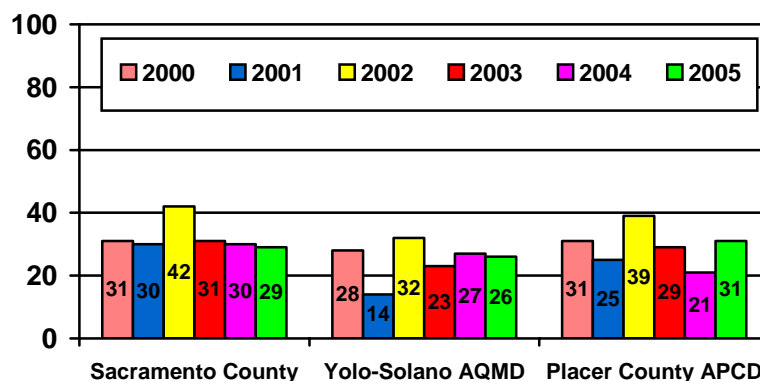
¹² One exception was in Sacramento County, where the difference between 2003 and 2004 was not significant. Another exception occurred in Yolo-Solano AQMD, where the difference between 2004 and 2005 was not statistically significant.

General Awareness: Individual Air Districts - Year-by-Year Comparisons (since 2002)



Results were more stable in individual air districts in terms of specific awareness, with the notable exception of 2002, a very poor air quality season. It can be seen in the next chart that about three-in-ten respondents in Sacramento County were aware of the specific request not to drive in all years but 2002. In Yolo-Solano AQMD, there was an anomaly in 2001 when awareness was significantly lower at 14% than in any of the other districts. There were no significant differences in awareness in the past three years Yolo-Solano. Results in Placer County APCD were similar to those in Sacramento County at about three-in-ten respondents for all years except 2004, when the level of awareness was significantly lower at 21%.¹³

Specific Awareness: Individual Air Districts - Year-by-Year Comparisons (since 2000)



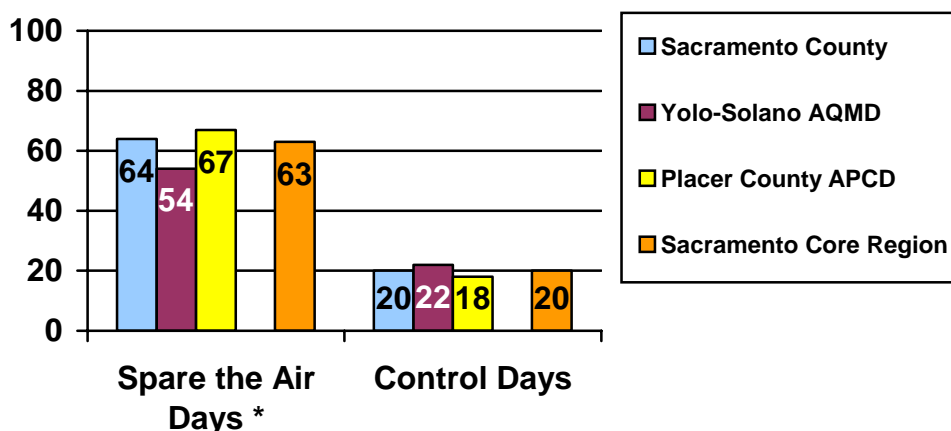
OBJECTIVE C:

Control-day interviewing insures that respondents interviewed following Spare the Air days are not simply giving “socially-acceptable” responses: levels of both types of awareness were significantly higher on Spare the Air days than on Control days in all districts.

¹³ The reader is referred to the 2004 Spare the Air Evaluation Report for possible explanations.

One purpose of conducting interviews on non-Spare the Air days is to test for a possible response bias – it is important to verify that the percentage of respondents who said they had heard or seen the Spare the Air announcements was significantly higher following Spare the Air days than on Control days. General awareness results for each district and the Core Region are presented in the next chart. It can be seen that although approximately two in ten Control day respondents in the region said they had heard STA advertisements (and thus were wrong), over six in ten STA respondents said they had heard them prior to actual Spare the Air days (and thus were correct.) All differences were statistically significant, indicating, as in past years, that the program is effective in reaching drivers about the specific alert days.

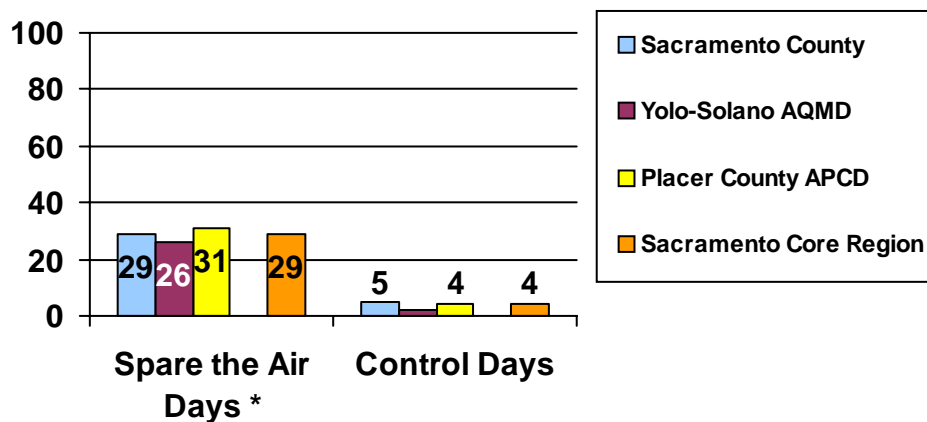
Spare the Air vs Control Days: General awareness



* indicates statistically significant differences between Spare the Air and Control percentages in all air districts

The same findings were found when specific awareness was measured – it can be seen in the next chart that significantly more respondents in each air district were aware of the specific request not to drive on Spare the Air days than on Control days:

Spare the Air vs Control Days: Specific awareness



* indicates statistically significant differences between Spare the Air and Control percentages in all air districts

OBJECTIVE D:

Between 321,070 and 552,240 drivers in the Sacramento Core Region were aware of Spare the Air: the 63% of respondents who were aware of Spare the Air in general translates into 809,100 drivers in the region as a whole who noticed the advisory on average for each of the fourteen Spare the Air days. Correcting for Control day responses, that is, the percentage respondents who said they noticed the advisory when one was not issued, this means that 552,240 drivers were aware of the 2005 Spare the Air campaign. In terms of specific awareness, and again correcting for Control day responses, this represented 321,070 drivers who on average noticed the request not to drive.

There are an estimated 1,284,284 drivers in the Sacramento Core Region¹⁴ this year. It will be remembered that 63% of all respondents said that in the past two days they had heard, read or seen advertisements or news broadcasts about Spare the Air, or poor air quality, or requests to drive less in this area (general awareness). Extrapolating to the population of drivers means that approximately 809,100 drivers in the region said they had heard the advertisements. However, we also know from Control day interviewing that 20% of respondents said they had heard about Spare the Air when in fact no advisory had been issued. Correcting for Control day responses through subtraction indicates that **552,240 drivers in the region as a whole** were aware of the 2005 Spare the Air campaign in general. The table below demonstrates the calculations and estimated number of aware (using the general awareness question) drivers for each air district and the Core Region as a whole.

Air District	Total Number of Drivers	Percent Aware of STA (in general) STA / Control	Estimated Number of Drivers Aware of STA (STA - Control)
Sacramento County	887,100	64% / 20%	567,740 – 177,420 = 390,320
Yolo-Solano AQMD	195,835	55% / 22%	107,710 – 43,080 = 64,630
Placer County APCD	201,350	67% / 18%	134,900 – 36,240 = 98,660
Sacramento Core Region	1,284,280	63% / 20%	809,100 – 256,860 = 552,240

The same calculations were also made in terms of specific awareness (i.e. do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air), and are presented in the next table. It will be recalled that levels of specific awareness, although lower than

¹⁴ The number of drivers in the Sacramento region for 2005 was estimated, using the number of driver licenses by county for 2004, obtained from the California Department of Motor Vehicles database at http://www.dmv.ca.gov/about/profile/dl_outs_by_county.htm, and calculating the percentage increase, based on county population figure increases from 2004 to 2005 (<http://www.dof.ca.gov/HTML/DEMOGRAP/e-1table.xls>). The estimated number of licensed drivers for the total Sacramento Core Region in 2005, therefore, was 1,284,284: Sacramento County: total 887,103 + Placer County: 231,432 * 87% for Air Quality district = 201,346; Yolo-Solano: total of 195,835 (117,308 in Yolo + 78,527 in Solano).

levels of general awareness, have remained relatively stable over the course of the last five years¹⁵, at about 30%. On a regional level, and correcting for Control day responses, this translates into an estimated **321,070 drivers** in the Sacramento Core Region this year that were specifically aware of the Spare the Air message.

<i>Air District</i>	<i>Total Number of Drivers</i>	<i>Percent Aware of STA (specific) STA / Control</i>	<i>Estimated Number of Drivers Aware of STA (STA - Control)</i>
Sacramento County	887,100	29% / 5%	257,260 – 44,355 = 212,905
Yolo-Solano AQMD	195,835	26% / 2%	50,920 – 3,920 = 47,000
Placer County APCD	201,350	31% / 4%	62,420 – 8,055 = 54,365
Sacramento Core Region	1,284,280	29% / 4%	372,440 – 51,370 = 321,070

Purposeful Driving Reduction

Objectives

As has already been mentioned, the 2005 Spare the Air public education program changed emphasis from previous years in that it focused primarily on health issues related to high ozone and poor air quality and only secondarily on encouraging residents to drive less on summer days of particularly poor air quality. The previous section (Awareness of the 2005 Spare the Air Campaign) has shown a significant increase from last year in terms of general awareness of Spare the Air – from 56% in 2004 to 63% this year – perhaps due to this change of emphasis, although it could also be due to a hotter summer, with more multiple-day Spare the Air episodes than last year.

Although awareness is obviously one indicator of the program's success, it is also important to show corresponding changes in behavior, and for the purposes of this report, changes in driving behavior in particular. The Sacramento Metropolitan Air Quality Management District requires that only trip reductions reported by drivers who say they drove less than usual will be counted. This requirement is consistent with the project goal of reducing driving on Spare the Air days. The Air Resources Board (ARB) has an even more stringent standard¹⁶ for measuring the success of the Spare the Air program – it requires not only that drivers be aware of the program, but that they actually make fewer vehicle trips on Spare the Air days, and further, that they say they do so purposefully to help reduce air pollution on Spare the Air days.

¹⁵ The 2002 season was the exception, when 40% were aware of STA.

¹⁶ The ARB strict standard was first introduced in 2002 and has been applied in all subsequent evaluations of the Spare the Air program.

The main objective of the current section is to measure the success of the Spare the Air program by calculating purposeful driving reduction within the Sacramento Core Region using the strict ARB standard. Specific objectives are to:

- E. report the percentage of respondents who reported driving “less” the previous day and statistically compare with results from the previous five years
- F. calculate the percentage of purposeful “reducer” drivers, that is, those who:
 - i. made fewer vehicle trips on Spare the Air days, and
 - ii. did so purposefully to help reduce air pollution in the region, and
 - iii. were aware of the Spare the Air campaign (general awareness)and determine if the percentage of reducers is similar or different among three air quality districts in the Sacramento Core Region (Sacramento County, Yolo-Solano AQMD, and Placer County APCD)
- G. determine if the percentage of reducers has increased, decreased, or stayed the same from 2000 to the present,
- H. extrapolate to the population by estimating the number of **drivers** in the Sacramento Core Region who purposefully reduced the number of trips they made on Spare the Air days in 2005
- I. estimate the number of **single trips** avoided by purposeful reducers, and
- J. compare percentages of reducers between those respondents interviewed about Spare the Air days and those interviewed on Control (non-Spare the Air) days.

The following questions were used in the calculation of purposeful reducers.

- *“Yesterday, did you drive your car, truck or van the same, more, or less frequently than you normally do on a [day of the week]?”*
- *“Why did you make that change or those changes?” [This question was asked only of drivers who said they drove less the previous day.]*
- *“In the past two days have you heard, read, or seen any advertisements or news broadcasts about Spare the Air, or poor air quality, or requests to drive less in this area?” [This question assessed general awareness of the Spare the Air program and was proposed by the ARB. It was added to the questionnaire in 2002.]*
- *“About how many SINGLE TRIPS in your car did you avoid driving yesterday to reduce air pollution? And by a SINGLE trip, I mean getting in your car, driving from one place to another and then stopping. For example, leaving your house and going to the store is one trip. Leaving the store and going to work or coming back home is another trip. (PROBE: Give me a reasonable approximation --a round number.)” [This question was asked only of drivers who said they drove less for air quality reasons.]*

Results

OBJECTIVE E:

About one quarter (24%) of the regional respondents said they drove “less” on Spare the Air days, the highest percentage in the past six years. This represents a significant increase from 2001, 2003, and from last year.

The first step in calculating purposeful driving reductions is to examine the percentage of respondents who said they drove “less” on a Spare the Air day (that is, the day before the interview). Results from the last six years for the Sacramento Core Region as a whole are presented in the next graph.

Year-by-Year Comparison of Percent of respondents who drove "less" on Spare the Air days: Sacramento Core Region



* indicates a statistically significant difference between years

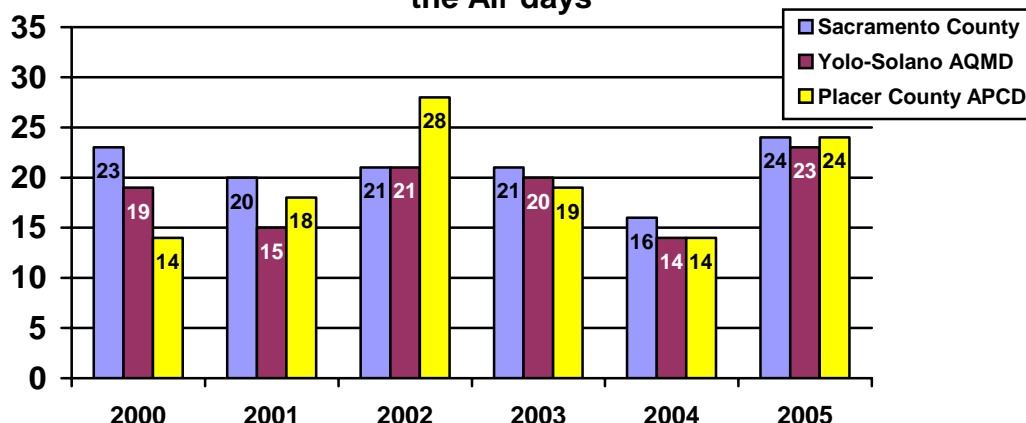
It can be seen that self-reported driving reduction on Spare the Air days from 2000 to 2003 was fairly stable, with 19% to 21% of respondents saying they drove less on Spare the Air days. In 2004, however, the 15% of drivers in the region who said they drove less on a Spare the Air day was significantly lower than in all previous years. (The 2004 season was cooler on Spare the Air days relative to earlier years -- milder in terms of temperature and poor ozone air quality. In fact the first Spare the Air advisory in the 2004 season was issued in August, although the season starts in May.) This year, the percentage who said they drove less on Spare the Air days (24%) was the highest of all six years and significantly higher than in 2001, 2003, and 2004. A possible explanation is that the rising cost of gasoline might have contributed to a more general trend to drive less. To test this hypothesis, we examined the verbatim comments respondents gave for driving less¹⁷ between 2004 and 2005, and compared the number of specific references to the high cost of fuel between the two years. Results indicated that in 2004, 5% of the comments were gas-related, while in 2005, 26% of the reasons for driving less the previous day were due to the high cost of gas. In other words, the rising price of gas is a contributing factor to driving reduction, although it is not the only reason.

In terms of the individual air quality districts, results from all six years are presented in the next chart. It can be seen that there was a little more fluctuation within Yolo-Solano and Placer air districts from one year to the next than there was in Sacramento County. With the exception of 2004, the percentage of respondents who reported driving less in Sacramento County was not significantly different from one year to the next. In Yolo-Solano AQMD, results from 2001 and 2004 were significantly lower than results in all other years. In Placer County APCD, the percentage of drivers who said they drove less in 2005 was significantly higher than the percentage in 2000, 2001, and 2004. However, 2002 was the most notable year -- the

¹⁷ Those respondents who drove less were asked an open-ended question: "Why did make that change or those changes?"

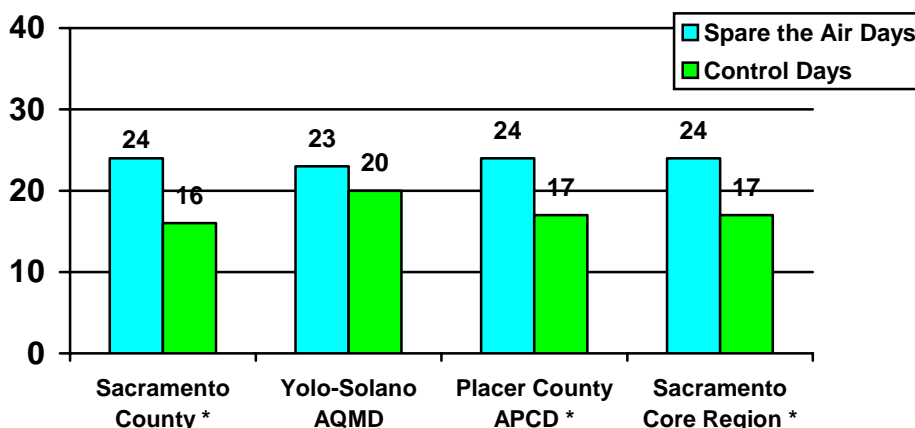
percentage that said they drove less was significantly higher at 28% than in all other years except for this year.

Year-by-Year Comparison of Percent of STA respondents who self-reported driving "less" on Spare the Air days



Many years ago, Dr. Jude Lamare, former project manager of the Cleaner Air Partnership, introduced a control procedure into the evaluation methodology of Spare the Air. This involved interviewing a group of respondents from the same jurisdictions on the same days of the week as Spare the Air interviews, but on cooler, non Spare the Air days in the season. This feature allows us to correct for possible respondent exaggeration about driving behavior on Spare the Air days. The next chart shows the percentage of respondents interviewed in 2005 about both Spare the Air and Control days who said they drove "less" the previous day. Statistical tests of proportion determined whether or not the differences between the two groups were significant. It can be seen that, with the one exception of Yolo-Solano AQMD, significantly more respondents in the Spare the Air groups said they drove less the previous day than in the Control groups.

2005 Spare the Air vs Control Days: Percent of respondents who drove "less" the previous day



* indicates a statistically significant difference

The results are encouraging. From 2000 to 2003, it appeared that the difference or “spread” between Spare the Air and Control percentages was declining¹⁸ in Sacramento County. In 2003, it was even hypothesized that the effectiveness of the program might be fading. However, last year showed an increase in the spread, along with a concomitant significant difference between the two groups of respondents, and this was replicated in the current year’s results. The next table shows results in Sacramento County from 2000 to the present.

<i>YEAR</i>	<i>PERCENTAGE OF SPARE THE AIR RESPONDENTS WHO DROVE “LESS” YESTERDAY: SACRAMENTO COUNTY</i>	<i>PERCENTAGE OF CONTROL RESPONDENTS WHO DROVE “LESS” YESTERDAY: SACRAMENTO COUNTY</i>	<i>DIFFERENCE (OR “SPREAD”)</i>	<i>STATISTICALLY SIGNIFICANT DIFFERENCE?</i>
<i>2000</i>	23%	12%	11%	Yes
<i>2001</i>	20%	14%	6%	Yes
<i>2002</i>	21%	17%	4%	Yes
<i>2003</i>	21%	18%	3%	No
<i>2004</i>	16%	10%	6%	Yes
<i>2005</i>	24%	16%	8%	Yes

Results comparing Spare the Air versus Control respondents who drove less in Yolo-Solano AQMD, have been fairly consistent over time: it can be seen in the next table that, with the exception of 2002, there were no significant differences between the two groups in any year, including this year. In other words, in Yolo-Solano AQMD, about the same number of respondents said they drove “less” the previous day, regardless of whether or not it had been a Spare the Air day.

<i>YEAR</i>	<i>PERCENTAGE OF SPARE THE AIR RESPONDENTS WHO DROVE “LESS” YESTERDAY: YOLO-SOLANO AQMD</i>	<i>PERCENTAGE OF CONTROL RESPONDENTS WHO DROVE “LESS” YESTERDAY: YOLO-SOLANO AQMD</i>	<i>DIFFERENCE</i>	<i>STATISTICALLY SIGNIFICANT DIFFERENCE?</i>
<i>2000</i>	19%	15%	4%	No
<i>2001</i>	15%	18%	-3%	No
<i>2002</i>	21%	13%	8%	Yes
<i>2003</i>	20%	17%	3%	No
<i>2004</i>	14%	14%	0%	No
<i>2005</i>	23%	20%	3%	No

¹⁸ Percentage differences between STA and Control responses were nevertheless significant for all years except 2003.

A possible explanation is that Yolo-Solano AQMD may be least likely to be affected by poor air quality, as it is the furthest west in the Sacramento Core Region. Although Spare the Air advisories were issued on 14 days during the summer for the region as a whole this year, the actual Air Quality Index (AQI) in Yolo-Solano AQMD never reached the trigger of 127 on any of those days. (In fact, the highest AQI reached was 104.) In other words, it may be that there were no differences between Spare the Air and Control percentages because Yolo-Solano AQMD experienced fewer days of noticeably poor air quality.

Results from Placer County APCD are presented in the next table. It can be seen that significantly more respondents said they drove less on Spare the Air days than on Control days in 2002 and 2005.

<i>YEAR</i>	<i>PERCENTAGE OF SPARE THE AIR RESPONDENTS WHO DROVE "LESS" YESTERDAY: PLACER COUNTY APCD</i>	<i>PERCENTAGE OF CONTROL RESPONDENTS WHO DROVE "LESS" YESTERDAY: PLACER COUNTY APCD</i>	<i>DIFFERENCE</i>	<i>STATISTICALLY SIGNIFICANT DIFFERENCE?</i>
<i>2000</i>	<i>14%</i>	<i>17%</i>	<i>-3%</i>	<i>No</i>
<i>2001</i>	<i>18%</i>	<i>15%</i>	<i>3%</i>	<i>No</i>
<i>2002</i>	<i>28%</i>	<i>19%</i>	<i>9%</i>	<i>Yes</i>
<i>2003</i>	<i>19%</i>	<i>15%</i>	<i>4%</i>	<i>No, but almost</i>
<i>2004</i>	<i>14%</i>	<i>12%</i>	<i>2%</i>	<i>No</i>
<i>2005</i>	<i>24%</i>	<i>17%</i>	<i>7%</i>	<i>Yes</i>

OBJECTIVE F:

Only 1.4% of all respondent drivers in the entire Sacramento Core Region could be classified as having purposefully driven less on Spare the Air days because they wanted to improve air quality in the region and were aware of the Spare the Air advisories in general. The percentage of reducers did not differ significantly among air districts. Further efforts to increase the number of reducers may be needed.

In measuring purposeful reducers, the next step was to calculate the percentage of all drivers interviewed following Spare the Air days who said they drove less, did so specifically for air quality reasons, and, further, were also aware of Spare the Air in general (using the ARB question). Results from each air district and for the Sacramento Core Region as a whole are presented in the next table. It can be seen that for the entire region, only 1.4% of all Spare the Air respondent drivers (8 out of 572) met the strict ARB standard for purposeful driving reduction. The percentage in both Sacramento County and Placer County APCD was 1.5%, and in Yolo-Solano AQMD, 1.3% of the total number of respondents interviewed on Spare the Air days could be classified as purposeful reducers.

<i>SPARE THE AIR: PURPOSEFUL REDUCERS</i>	<i>NUMBER OF RESPONDENTS WHO REDUCED DRIVING FOR AIR QUALITY REASONS AND WERE AWARE OF STA IN GENERAL</i>	<i>TOTAL NUMBER OF RESPONDENTS ON DAYS FOLLOWING SPARE THE AIR</i>	<i>% OF TOTAL RESPONDENTS WHO REDUCED FOR AIR QUALITY REASONS AND WERE AWARE OF STA IN GENERAL</i>
<i>Sacramento County</i>	6	403	1.5%
<i>Yolo-Solano AQMD</i>	5	399	1.3%
<i>Placer County APCD</i>	5	342	1.5%
<i>Sacramento Core Region</i>	8	572	1.4%

OBJECTIVE G:

The percentage of reducers has basically remained the same since 2000. Although seemingly low at 1.4%, the percentage of drivers who purposefully reduced driving this year is not significantly less than in each of the previous five years in Sacramento County or the region as a whole. The percentage of reducers in Yolo-Solano AQMD and Placer County APCD has also stayed the same, with the exception of 2002.

Over the last six years, an average of 1.8% of all drivers in the region as a whole purposefully reduced driving on Spare the Air days in order to help improve air quality.

Tests of proportion were run to compare the percentage of reducers¹⁹ each year with every other year. Results are presented in the next table. It can be seen that the percentage of reducers has not changed significantly from one year to the next in terms of the Sacramento Core Region as a whole and Sacramento County in particular. In both Yolo-Solano AQMD and Placer County APCD, the percentage of reducers was significantly higher in 2002 than in most other years. In fact, 2002 was an exceptional year with high temperatures and multiple-day Spare the Air episodes. [The percentages of reducers in Sacramento County and the region as a whole were also higher in 2002 than in other years; however, the differences were not statistically significant.]

¹⁹ Results from 2000 and 2001 were recalculated but still are not directly comparable, as two of the questions were not the same – the measure of STA awareness was the stricter specific question (see footnote 9 above) and the number of round trips avoided was asked rather than single trips avoided. Single trips were therefore calculated by doubling responses from those two years. Results should therefore be treated with some caution.

<i>SPARE THE AIR: PURPOSEFUL REDUCERS</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>SIGNIFICANT DIFFERENCES BETWEEN YEARS?</i>	<i>AVERAG E</i>
<i>Sacramento County</i>	2.0%	2.1%	2.3%	1.2%	1.6%	1.5%	No	1.8%
<i>Yolo-Solano AQMD</i>	1.3%	0.2%	3.5%	1.2%	1.1%	1.3%	Yes – 2002 significantly higher than 2001, 2003, 2004, and 2005	1.4%
<i>Placer County APCD</i>	1.0%	0.9%	3.9%	2.3%	1.4%	1.5%	Yes – 2002 significantly higher than 2000, 2001, 2004, and 2005	1.8%
<i>Sacramento Core Region</i>	1.8%	1.7%	2.7%	1.4%	1.5%	1.4%	No	1.8%

It can also be seen that, averaged over six years, 1.8% of all drivers in the region as a whole purposefully reduced driving on Spare the Air days, specifically in order to help improve air quality.

OBJECTIVE H:

When extrapolated to the population of drivers, about 17,980 drivers in the region could be said to have purposefully made fewer trips on average each Spare the Air day in order to reduce air pollution.

There are an estimated 1,284,280 drivers in the Sacramento Core Region²⁰ this year. Extrapolating to the population of drivers, the 1.4% of regional reducers means that approximately **17,980** drivers purposefully made fewer trips on Spare the Air days for air quality reasons. Estimates for the region as a whole as well as for the individual air districts are presented in the next table.

²⁰ The number of drivers in the Sacramento region for 2005 was estimated, using the number of driver licenses by county for 2004, obtained from the California Department of Motor Vehicles database at www.dmv.ca.gov/about/profile/dl_outs_by_county.htm, and calculating the percentage increase, based on county population figure increases from 2004 to 2005 (www.dof.ca.gov/HTML/DEMOGRAP/e-1table.xls). The estimated number of licensed drivers for the total Sacramento region in 2005, therefore, was 1,284,284: Sacramento County: total 887,103 + Placer County: 231,432 * 87% for Air Quality district = 201,346; Yolo-Solano: total of 195,835 (117,308 in Yolo + 78,527 in Solano).

<i>AIR DISTRICT</i>	<i>TOTAL NUMBER OF DRIVERS</i>	<i>PERCENT OF PURPOSEFUL REDUCERS</i>	<i>ESTIMATED NUMBER OF PURPOSEFUL REDUCERS</i>
<i>Sacramento County</i>	887,100	1.5%	13,310
<i>Yolo-Solano AQMD</i>	195,835	1.3%	2,550
<i>Placer County APCD</i>	201,350	1.5%	3,020
<i>Sacramento Core Region</i>	1,284,280	1.4%	17,980

OBJECTIVE I:

For the Sacramento Core Region as a whole, drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.0 single trips each. This translates into a total of 53,940 trips purposefully avoided on average each Spare the Air day during the 2005 season.

Those respondents who were classified as purposeful reducers were asked how many single trips they had avoided driving on the Spare the Air day. The mean number of single trips avoided by the 8 reducer drivers in the region was 3.0.²¹ Extrapolated to the estimated 17,980 drivers who purposefully reduced on Spare the Air days, this translates into an estimated **53,940** single trips that drivers avoided making on Spare the Air days during the summer of 2005, specifically to help reduce air pollution in the region. Results for the region as a whole as well as for the individual air districts are presented in the next table.

<i>AIR DISTRICT</i>	<i>ESTIMATED NUMBER OF DRIVERS WHO PURPOSEFULLY REDUCED</i>	<i>MEAN # OF TRIPS AVOIDED FOR AIR QUALITY REASONS</i>	<i>ESTIMATED NUMBER OF SINGLE TRIPS REDUCED</i>
<i>Sacramento County</i>	13,310	3.0	39,930
<i>Yolo-Solano AQMD</i>	2,550	3.0	7,650
<i>Placer County APCD</i>	3,020	3.0	9,060
<i>Sacramento Core Region</i>	17,980	3.0	53,940

²¹ The mean was 3.0, with a standard deviation of 1.51, the median was 2.5, and the range was 1 to 6 trips avoided.

OBJECTIVE J:

There were significantly more respondents who purposefully reduced driving on Spare the Air days than on Control days in Sacramento County, Placer County APCD, and the region as a whole. This means that, although the overall percentage of reducers is not high, the program has been successful in convincing at least some drivers to avoid trips they might otherwise have made, specifically on days of poor air quality. In Yolo-Solano AQMD, the percentage of reducers was the same on both Spare the Air and Control days; however, this may have been because the district experienced fewer days of poor air quality.

Respondents interviewed on Control days were also asked if they had reduced the number of trips they made the day before, and if so, why. If the same percentage of drivers claimed to have reduced their driving on Control days for air quality reasons as on Spare the Air days, it would be difficult to credit the Spare the Air program as the cause of driving reduction. Control day interviewing can therefore be used as a validation check. [For Control interviews, reducers were classified as those respondents who said they drove less the previous day for air quality reasons.] Results of percentages of Control day reducers along with Spare the Air reducers are presented in the next table. It can be seen that in Sacramento County, Placer County APCD, and the Sacramento Core Region as a whole, the percentage of respondents who reduced the number of trips they made for air quality reasons on Control days was significantly less than the percentage that reduced on Spare the Air days. This argues well for the continuation of the Spare the Air program, for, despite the relatively small percentages of reducers, at least some drivers are reducing trips on Spare the Air days, and significantly more do so on Spare the Air than on Control days.

<i>AIR DISTRICT</i>	<i>% OF TOTAL RESPONDENTS WHO REDUCED FOR AIR QUALITY REASONS AND WERE AWARE ON STA DAYS</i>	<i>% OF TOTAL RESPONDENTS WHO REDUCED FOR AIR QUALITY REASONS ON CONTROL DAYS</i>	<i>SIGNIFICANT DIFFERENCE?</i>
<i>Sacramento County</i>	1.5%	0.2%	Yes
<i>Yolo-Solano AQMD</i>	1.3%	1.3%	No
<i>Placer AQMD</i>	1.5%	0.0%	Yes
<i>Sacramento Core Region</i>	1.4%	0.4%	Yes

Results in Yolo-Solano AQMD as a whole indicated no significant difference between Spare the Air and Control day reducers. It has previously been mentioned that, although Spare the Air advisories are issued for the entire Sacramento Core Region, the actual quality of air experienced in the individual air districts can vary. In the case of Yolo-Solano AQMD, in 2005 the season was relatively mild. It is possible that respondents may be more likely to take action on Spare the Air advisory days if they directly experience soaring temperatures and poor air quality in their air district. Another possible explanation as to why STA and Control day percentages are not different is that Solano County is part of another media market and many drivers work in the Bay Area.

A final factor to consider regarding the relatively low percentage of purposeful reducers on Spare the Air days is that this is probably a very conservative estimate. Those individuals who already typically reduce the amount of driving they do during the summer months are not included in our calculations of purposeful reducers – only those who said they drove “less” enter into the calculation. In other words, seasonal reducers may have already limited the number of trips they make on hot days and are unable to drive even less on Spare the Air days. A further report will assess the impact of such seasonal driving reduction.

Estimated Emission Reductions

Objectives

Because the majority of air pollution problems are caused by car and truck emissions,²² the major focus of the program has been to issue advisories asking residents to drive less by delaying trips, working at home, carpooling, using transit, biking and walking. Other helpful suggestions include the proper maintenance of vehicles, including regular tune-ups and changing of air filters, as well as avoiding the use of gas-powered lawn mowers, leaf blowers, and chain saws. A previous section (Purposeful Driving Reduction in the 2005 Spare the Air Season) demonstrated that **1.4% of all the drivers in the region** interviewed following Spare the Air days reported making fewer trips on Spare the Air days because they were aware of the advisories and specifically wanted to reduce air pollution. (This is a strict definition of purposeful driving reduction, and was proposed by the Air Resources Board (ARB).) Although the percentage is small, when extrapolated to the population of drivers in the Sacramento Core Region as a whole, it means that about **17,980 drivers** purposefully made fewer trips on Spare the Air days in order to reduce air pollution.

The main objective of the current section is to take this information a step further and estimate how many tons of ozone precursor emissions [Reactive Organic Gases (ROG) and Nitrogen Oxides (NOx)] were reduced during the 2005 season that could be attributed directly to the Spare the Air program. In order not to overestimate possible reductions, a correction factor based on Control day interviewing will be applied. Results, therefore, will be conservative.

Specifically, the calculation of emission reductions involves:

- subtracting the estimated number of single trips avoided by purposeful reducers on Control (non Spare the Air) days from the estimated number of single trips avoided by purposeful reducers on Spare the Air days, and
- using the latest approved standard EMFAC2002 model (V2.2) run on the 2005 summer season to calculate 2005 ROG and NOx starting and running emissions factors. This will be used to estimate the number of tons of ozone precursors we can confidently say were reduced specifically due to the Spare the Air program.

Specific objectives are to:

- K. do this for each air quality management district that showed a significant difference in terms of the percentage drivers who reported driving less the previous day between Spare the Air and Control days, as well as for the region as a whole, and
- L. compare the estimated ozone precursor emissions reductions from 2000 to the present.

²² Source: Sacramento Region 2005 Mobile Source Emissions Inventory: www.airquality.org/cleanairplan/2005OzoneEI.shtml#2005MSROG.

Respondents interviewed following Spare the Air days as well as on Control days were asked if they drove more, the same, or less than normal the previous day,²³ and those who said they drove less were asked why. Those who said it was to help improve air quality were then asked how many single trips they avoided.²⁴ It would be difficult to credit the Spare the Air program as the cause of driving reduction if the same percentage of drivers on both Spare the Air as well as Control days claimed to have reduced their driving for air quality reasons. Control day interviewing therefore provides a validation check as well as a correction factor. Respondents were also asked if they had heard, read, or seen any advertisements or news broadcasts about Spare the Air, or poor air quality, or requests to drive less in the area in the past two days.²⁵ “Purposeful reducers” were therefore identified as those drivers who drove less on Spare the Air days because they had heard a Spare the Air advisory and wanted to help improve air quality in the region.

The methodology for calculating emission reductions is conservative as it eliminates many respondents from consideration (such as those who reduced their driving for reasons other than air quality, those who drove less but were not aware of the specific STA advisory not to drive, or those seasonal reducers who generally make fewer trips during the summer to help air quality and so may not have been able to drive even less on specific STA days). Results from the Core Region as a whole are used to illustrate the procedure according to the following steps:

1. Calculate the percentage of purposeful reducers, that is, drivers who said they were aware of the Spare the Air program,²⁶ and who also said they drove less than usual on Spare the Air days specifically for air quality reasons. For the Core Region as a whole, this was **1.4%** (8/572) of all respondents interviewed following Spare the Air days.
2. Record the mean (average) number of single trips they avoided for air quality reasons on Spare the Air Days. These purposeful reducers were asked to estimate the number of single trips they avoided making on the Spare the Air day. For the Core Region, the mean was **3.0** single trips avoided.²⁷
3. Extrapolate to the total number of drivers in the region²⁸ this year: the percentage of STA reducers therefore represents **17,980** drivers in the Sacramento Core Region, and the number of single trips avoided was **53,940** (17,980 drivers x 3.0 trips avoided on average.)
4. Record the mean number of trips avoided by the respondents who drove less for air quality reasons on Control days. In the Core Region as a whole, there were **2** individuals (or 0.4% of all Control day respondents) who reduced an average of **3.2**²⁹ driving trips on Control days for air quality reasons. Extrapolated to the total population, therefore, this means that **5,140** drivers on control days avoided a total

²³ The exact wording was: “Yesterday, did you drive your car, truck or van the same, more, or less frequently than you normally do on a [day of the week]?”

²⁴ “About how many SINGLE TRIPS in your car did you avoid driving yesterday to reduce air pollution?”

²⁵ Assessing general awareness of the Spare the Air program, this question was proposed by the ARB, and was added to the questionnaire in 2002.

²⁶ Using the ARB-worded question for measuring general awareness of Spare the Air.

²⁷ The standard deviation was 1.51; the median was 2.5; and answers ranged from 1 to 6 single trips avoided.

²⁸ The number of drivers in the Sacramento region for 2005 was estimated, using the number of driver licenses by county for 2004, (obtained from the California Department of Motor Vehicles database at www.dmv.ca.gov/about/profile/dl_outs_by_county.htm) and calculating the percentage increase, based on county population figure increases from 2004 to 2005 (www.dof.ca.gov/HTML/DEMOGRAP/e-1table.xls). The estimated number of licensed drivers for the total Sacramento region in 2005 was 1,284,284: Sacramento County: total 887,103 + Placer County: 231,432 * 87% for Air Quality district = 201,346; Yolo-Solano: total of 195,835 (117,308 in Yolo + 78,527 in Solano).

²⁹ The standard deviation was 1.52; and answers ranged from 1 to 5 single trips avoided.

- of **16,450** single trips (5,140 drivers x 3.2 trips avoided.)
5. Multiply the number of trips avoided by a per trip emission reduction average of **6.60 grams of ozone precursors**³⁰ [this includes a total of ROG (3.56 grams per trip for light duty passenger cars plus two categories of light duty trucks) plus NOx (3.04 grams per trip for light duty passenger cars and light duty trucks) emissions.] EMFAC2002 V2.2 is the latest update to the EMFAC model for use by California state and local governments to meet Clean Air Act (CAA) requirements. EMFAC2002 defines trips as vehicle starts and calculates them separately as a function of vehicle population (derived from vehicle registration data), based on ARB and US EPA instrumented vehicle studies. For the Core Region, this amounts to **356,004 grams** of ozone precursors (53,940 single trips avoided x 6.60 grams per trip).
 6. Convert to tons.³¹ For the Sacramento Core Region a whole, this translates to an estimated total of **0.39 tons of pollutants reduced** per Spare the Air day. (And in this example, 108,570 grams or 0.12 tons reduced per Control day.)
 7. Apply the correction factor. To ensure that only purposeful driving reduction due to the Spare the Air program is counted in the estimate of emission reduction, we subtract the Control day air quality emission reduction from the Spare the Air day reduction. The correction for the Control days in this instance is 0.12 tons of ozone precursors, which, when subtracted from the 0.39 tons reduced on Spare the Air days.
 8. Result: **0.27 tons of ozone precursors reduced per Spare the Air day in 2005.**

The procedure described above is summarized in the table that follows:

³⁰ Based on summer 2005 EMFAC2002 V2.2 SMAQMD spreadsheet figures provided by Peter Christensen and Bruce Katayama, SMAQMD, October 14, 2005. Models were run for the summer of 2005. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (19.61 + 9.71 + 6.71) were converted to pounds (multiplied by 2,000) and then to grams (multiplied by 454) before dividing by the combined total number of trips (i.e. 5,607,914 for light duty passenger cars + 1,929,592 for light duty trucks1 + 1,643,152 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (14.68 + 7.81 + 8.25) x 2000 x 454 / (5,607,914 + 1,929,592 + 1,643,152). ROG grams and NOx grams were then combined (3.56 + 3.04) to obtain 6.60 grams per trip of emission precursors in the region as a whole. These are the figures considered most accurate at the time this report was written.

³¹ There are 907,200 grams in a ton.

Emissions Reduction Estimate for 2005 in Sacramento County

Sacramento Core Region	Percent of respondent drivers who drove less for Air Quality reasons ³²	x Number of licensed drivers in Sacramento Core Region (1,284,280 total)	x Mean Number of single trips Reduced per day	x 6.60 grams of ozone precursors per trip (EMFAC 2002 V2.2)	= Estimated Tons per day of ozone precursors reduced
Spare the Air Days	1.4% (8/572 ³³)	17,980	x 3.0 = 53,940	356,004 grams	0.39 tons
Control Days	0.4% (2/569)	5,140	x 3.2 = 16,450	108,570 grams	0.12 tons
Estimated tons of ozone precursors reduced per day: (STA day reductions less Control day reductions)					0.27 tons

Results

OBJECTIVE K:

The 2005 Spare the Air program was successful in reducing air pollution in the Sacramento Core Region by an estimated 0.27 tons of ozone precursors per day. This is due specifically to drivers purposefully reducing the number of trips they took on Spare the Air days for air quality reasons. In Sacramento County, an estimated .25 tons of ozone precursors were reduced and in Placer County APCD, the reduction was .07 tons per Spare the Air day.

Individual Air Quality Management Districts:

This year (as in previous years), there were no significant differences in Yolo-Solano AQMD between the percentages of drivers who drove less on Spare the Air days versus Control days. Therefore, emission reductions will be calculated only for Sacramento County and Placer County APCD. Results from the individual districts should not be combined as they are unweighted. The Sacramento Core Region results just discussed should be used when describing the emission precursors reduced in the entire area, as they are appropriately weighted.

It can be seen in the next table that in Sacramento County, air pollution was reduced by an estimated **0.25 tons of ozone precursors** per Spare the Air day, specifically due to residents driving less on Spare the Air days.

³² In addition, in the case of STA respondents, these drivers had to say they were aware that the previous day was a STA day (according to the ARB general awareness question).

³³ Please note that total number of completed interviews for the Core Region as a whole (i.e. 572) is less than the total number of completed interviews within the counties. This is because Sacramento County represents the largest percentage of the regional population at 70%, and therefore the number of completed interviews in Placer and Yolo-Solano AQMDs effectively are downweighted in the regional analysis. In other words, the Core Regional results are not the simple sum of the individual air districts.

Emissions Reduction Estimate for 2005 in Sacramento County

Sacramento County	Percent of respondent drivers who drove less for Air Quality reasons	x Number of licensed drivers in Sacramento County (887,100 total)	x Mean Number of single trips Reduced per day	x 6.60 grams of ozone precursors per trip (EMFAC 2002 V2.2)	= Estimated Tons per day of ozone precursors reduced
Spare the Air Days	1.5% (6/403)	13,310	x 3.0= 39,930	263,540 grams	0.29 tons
Control Days	0.2% (1/401)	1,770	x 3.0= 5,310	35,046 grams	0.04 tons
Estimated tons of ozone precursors reduced per day: (STA day reductions – Control day reductions)					0.25 tons

The next table indicates that, in Placer County APCD, air pollution was reduced by an estimated **0.07 tons of ozone precursors** per Spare the Air day. This is due specifically to drivers purposefully reducing the number of trips they took on Spare the Air days for air quality reasons.

Emissions Reduction Estimate for 2005 in Placer County APCD

Placer County APCD	Percent of respondent drivers who drove less for Air Quality reasons	x Number of licensed drivers in Placer County (201,350 total)	x Mean Number of single trips Reduced per day	x 6.60 grams of ozone precursors per trip (EMFAC 2002 V2.2)	= Estimated Tons per day of ozone precursors reduced
Spare the Air Days	1.5% (5/342)	3,020	x 3.0= 9,060	59,800 grams	0.07 tons
Control Days	0% (0/402)	0	x 0= 0	0 grams	0.00 tons
Estimated tons of ozone precursors per day: (STA day reductions – Control day reductions)					0.07 tons

OBJECTIVE L:

The Spare the Air program has been successful each year in reducing the amount of ozone precursors in the air.

Comparison with Previous Years: Sacramento County:

The estimated emission reductions³⁴ from the last five years for Sacramento County only³⁵ are presented in the next table; however it is important to note that results are not directly comparable.

<i>Estimated Tons of Ozone Precursors Reduced on Spare the Air Days</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>
Sacramento County	1.32³⁶ tons (.69ROG + .63 NOx)	0.99³⁷ tons (.52ROG + .47 NOx)	.26³⁸ tons (.14 ROG + .12 NOx)	.42³⁹ tons (.23ROG + .19 NOx)	.25 tons (.13ROG + .12 NOx)

This is due not only to differences in yearly estimated ROG and NOx emission factors per trip, but also to changes in the number of drivers, the percentage of purposeful reducers, the average number of trips reduced, the severity of conditions and the number of Spare the Air days experienced during each summer season. What is consistent, however, is that the Spare the Air program has been successful each year in reducing the amount of ozone precursors in

³⁴ The estimated emissions reductions shown in the current table differ from those presented in the annual Spare the Air evaluation reports, in order to conform to the methodology established in the SMAQMD 2003 Triennial Report. The detailed explanations per year will be included in the next few footnotes, but the basic concept is that different ozone precursor grams per trip multiplication factors based on EMFAC models were used in the 2001 to 2004 reports.

³⁵ Over the years, reductions could often not be calculated for Placer County APCD and Yolo-Solano AQMD as there were sometimes no significant differences between Spare the Air and Control day drivers who said they drove less.

³⁶ This figure is a recalculation of 2001 results, and corresponds to the estimate contained in Table 9-1 of the SMAQMD 2003 Triennial Report, Community Education Programs, Page 9-2 (www.airquality.org/stateplan/2003TriennialReportFinal.pdf). In the 2001 report, the estimate was based on EMFAC7G on-road motor vehicle emission factors (i.e. 12.25 grams of ozone precursors per trip). The current recalculation is based on emission factors from the now – adopted model EMFAC2002, V2.2 for average emissions per trip for Sacramento County light duty automobiles and light duty truck categories for 2001 (i.e. 5.38 grams/trip of ROG and 4.96 grams/trip of NOx, x 115,963 STA daily trips reduced = 1,199,057 grams = 1.32 tons per day of ozone precursors).

³⁷ This figure is a recalculation of 2002 results, and corresponds to the estimate contained in Table 9-1 (see previous footnote) of the SMAQMD 2003 Triennial Report. In the 2002 report, the estimate was based on EMFAC2000 on-road motor vehicle emission factors (i.e. 12.0 grams of ozone precursors per trip). The current recalculation is based on emission factors from the now-adopted model EMFAC2002, V2.2 for average emissions per trip for Sacramento County light duty automobiles and light duty truck categories for 2002 summer day (i.e. 4.81 grams/trip of ROG and 4.35 grams/trip of NOx, x 98,712 STA daily trips reduced = 904202 grams = 0.99 tons per day of ozone precursors).

³⁸ This figure is a recalculation of results in the 2003 report, which, although based on EMFAC2002 V2.2, had calculated emissions reduced per trip separately for light duty automobiles and light duty trucks. Reductions were then combined. (i.e. ROG: 4.06 grams per trip for light duty passenger cars ((13.53 tons x 2000 lbs/ton x 454 grams/lb) / 3,023,910 trips) and 4.88 grams per trip for light duty trucks ((9.24 tons x 2000 lbs/ton x 454 grams/lb) / 1,720,878 trips); plus NOx: 3.10 grams per trip for light duty passenger cars and 5.12 grams for light duty trucks for a total of 17.16 grams of ozone precursors). The estimates for 2003 contained in Table 9-1 of the Triennial Report, however, were based on a totalled average of cars and trucks (i.e. ROG = ((13.53 tons for cars + 5.32 tons for light duty trucks₁ + 3.92 tons for light duty trucks₂) x 2000 lbs/ton x 454 grams/lb) / (3,023,910 trips for cars + 880,536 trips for light duty trucks₁ + 840,342 trips for light duty trucks₂) = 4.36 grams/trip). Similarly, the combined average for NOx was 3.83 grams/trip. Under this scenario, the combined ROG plus NOx for 2003 is therefore 8.19 grams per trip of ozone precursors reduced per day. The rationale for preferring to use an average of the total vehicles combined rather than separate calculations for cars and trucks is “because the trips reduced from Spare The Air do not distinguish between autos or light duty trucks” – e-mail dated November 10, 2005 from Bruce Katayama, SMAQMD. Mr. Katayama prepared Table 9-1 in the Triennial Report and responded to the comments and questions raised in the public inquiry in March 2005. The Report was finalized and tabled in April, 2005, in compliance with the California Clean Air Act.

³⁹ The number of single trips reduced on Spare the Air days was 51,890. The averaged ROG was 3.95 grams/trip ((12.43 tons for cars + 5.01 for trucks₁ + 3.80 for trucks₂) x 2000 lbs/ton x 454 grams/lb) / (3,111,990 trips for cars + 904,402 trips for trucks₁ + 860,047 trips for trucks₂). The averaged NOx was 3.39 grams/trip ((9.32 tons for cars + 4.12 tons for trucks₁ + 4.77 tons for trucks₂) x 2000 lbs/ton x 454 grams/lb) / (3,111,990 trips for cars + 904,402 trips for trucks₁ + 860,047 trips for trucks₂). The combined ozone precursors reduced was therefore 51,890 x 7.34 grams/trip = 380,873 grams, or .42 tons per summer day.

the air. The reduction in tons reduced compared to prior years' reports is due to changes in vehicle emissions rates in the ARB inventory, not to participation in the Spare the Air program.

Health Issues

Objectives

It is known that exposure to ozone is associated with increases in respiratory disorders; makes our eyes water, burn and itch; and can lead to premature death. Children are particularly vulnerable. In healthy people, polluted air can cause respiratory irritation or breathing difficulties during exercise or outdoor activities.⁴⁰ The Sacramento Metropolitan Air Quality Management District (SMAQMD) estimates that about 75% of the Sacramento region's ozone air pollution is caused by emissions from mobile sources.⁴¹ The main objective of the current section is to document the relationship between poor air quality and the perceived health effects experienced by residents of the Sacramento Core Region during the summer of 2005.

Specific objectives of the current section are to:

- M. compare levels of perceived health effects due to poor air quality between respondents interviewed following Spare the Air days and those interviewed on Control (non-Spare the Air) days,
- N. estimate the number of households in the Sacramento Core Region whose health was affected by poor air quality specifically due to ozone air pollution on Spare the Air days in 2005,
- O. determine if levels of reported health problems during summer Spare the Air seasons have increased, decreased, or stayed the same from 2000 to the present, and
- P. compare the incidence of reported health problems among three air quality districts in the Sacramento Core Region (Sacramento County, Yolo-Solano AQMD, Placer County APCD).

Household breathing problems during the Spare the Air season have been tracked since 2000 using the following question:

- "Did you or did anyone else in your household have difficulty breathing yesterday because of unhealthy air yesterday?"

Last year a few additional health-related questions were added and were included in this year's survey as well:

- "And what about today?"
- "Did you or did anyone else in your household experience any of the following conditions either yesterday or today because of unhealthy air yesterday?
 - a. Coughing?
 - b. Headache?
 - c. Burning eyes?"⁴²

⁴⁰ Spare the Air website at: <http://www.sparetheair.com/index.cfm?page=ajq>.

⁴¹ Source: Sacramento Region 2005 Mobile Source Emissions Inventory: <http://www.airquality.org/cleanairplan/2005OzoneEI.shtml>

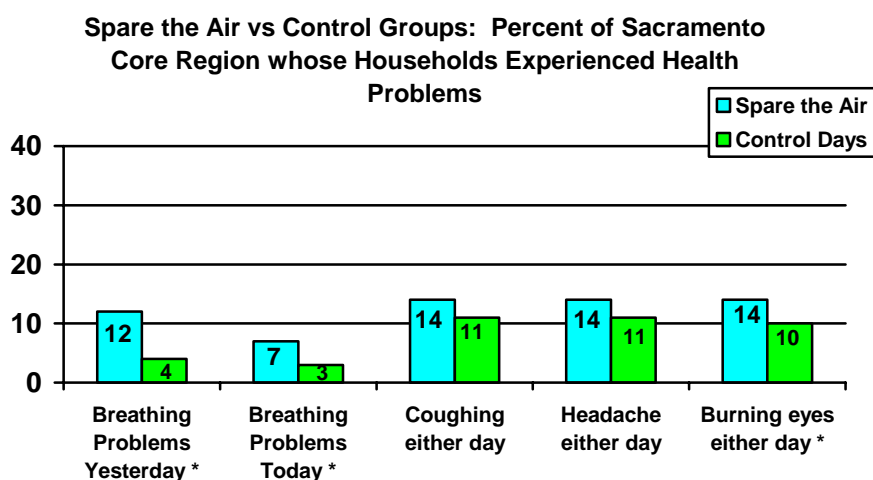
⁴² Last year a question about allergies was also asked, but was not included in this year's questionnaire, because there were no significant differences in allergy symptoms between STA and control days for the Sacramento Core Region or for subregional samples.

Results

OBJECTIVE M:

Results indicate that breathing difficulties and burning eyes were experienced by significantly more households on and following Spare the Air days than on and following Control days.

It can be seen in the next chart that significantly more households experienced breathing problems and burning eyes on Spare the Air (12%) and on the day of the interview (that is, the day after the Spare the Air advisory (7%)) than on (4%) and following (3%) Control days in the Sacramento Core Region as a whole.⁴³ There were no differences between Spare the Air and Control respondents in terms of the percentage of households experiencing coughing or headaches.



* indicates a statistically significant difference

OBJECTIVE N:

Correcting for Control days, an additional 60,070 households in the Sacramento Core Region experienced breathing problems during Spare the Air days specifically due to ozone air pollution. This is double the number of affected households from last year. The difference is due to a decrease in the percentage of Control households with respiratory problems.

There are an estimated 750,918⁴⁴ households in the Sacramento Core Region; therefore, the 12% of respondents who claimed that someone in their household experienced breathing problems on a Spare the Air day translates into **90,110 households**. The four percent of respondents who reported breathing problems on Control days translates into 30,040 households. Correcting for Control days through subtraction, this means that an additional

⁴³ Excludes responses of don't know/undecided.

⁴⁴ The measure used for households was the number of housing units. Reference: State of California, Department of Finance, E-5 City / County Population and Housing Estimates, 2005, Revised 2001-2004, with 2000 DRU Benchmark. Sacramento, California, May 2005. Available online at: <http://www.dof.ca.gov/HTML/DEMOGRAP/E-5a.xls> The estimated number of households for the entire Sacramento Core Region is 750,918 (Sacramento County: 524,648 + (Placer County: 134,896 * 87% = 117,360) + Yolo-Solano : 108,910 (Yolo: 68,537; Solano (Dixon, Rio Vista & Vacaville: 40,373).

60,070 households experienced breathing problems due specifically to ozone air pollution. This is double the number of affected households compared to last year (i.e. 29,270). However, the increase is due to a drop in the percentage of households reporting breathing difficulties on Control days (4% this year compared with 8% in 2004) because the percentage of households with health problems on Spare the Air days has stayed the same (12% both years).

The next table summarizes the methodology of correcting for Control day responses and indicates the number of households affected by health problems due to ozone air pollution on Spare the Air days for the Core Region as a whole (results have been weighted appropriately). It can be seen that the number of additional households who still experienced breathing problems on the interview day was 30,030, and the number of additional households with burning eyes either the day before or the day of the interview was 30,040.

<i>Sacramento Core Region as a Whole (750,918 households)</i>	<i>Number of Households Affected: Spare the Air respondents</i>	<i>Number of Households Affected: Control respondents</i>	<i>= Remaining Number of households affected specifically due to ozone air pollution</i>
<i>Breathing difficulties yesterday</i>	<i>12% = 90,110</i>	<i>4% = 30,040</i>	<i>60,070</i>
<i>Breathing difficulties today</i>	<i>7% = 52,560</i>	<i>3% = 22,530</i>	<i>30,030</i>
<i>Burning eyes yesterday or today</i>	<i>14% = 105,130</i>	<i>10% = 75,090</i>	<i>30,040</i>

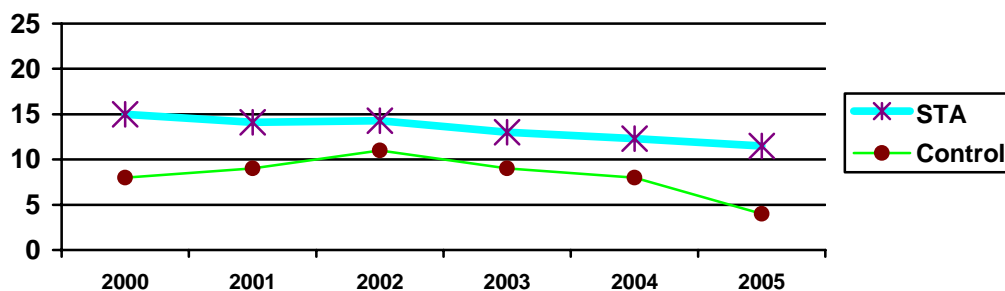
OBJECTIVE O:

The percentage of households reporting breathing difficulties in the Sacramento Core Region on Spare the Air days has stayed the same from 2000 to the present, at an average of 13% of all households during the past six years. The percentage of households reporting breathing difficulties on Control days declined significantly this year compared with the previous five years. Potentially, this could be due to improved air quality on control days, random variation, or it may be simply an anomaly.

The next graph plots the percentage of respondents in the Core Region as a whole who said someone in their household had trouble breathing on Spare the Air and Control days from 2000 to the present. Although it appears that there might be a slight downward trend in terms of households affected on Spare the Air days, the differences are not statistically significant. It can be seen that six years ago (in 2000), 15% of respondents had difficulty breathing, followed by two years where 14% experienced problems, followed by 13% in 2003 and 12% in the last two years. The six year average is 13% of households. Basically, the reported level of breathing difficulty caused by ozone air pollution on Spare the Air days has remained stable over the last six years. In terms of Control day interviewing, the percent of households who reported breathing difficulties

has also remained relatively stable at about 9%, with the notable exception of this year, when the percentage significantly declined to 4%. Whether this is due to improved air quality in the region or is simply an anomalous result is unclear at this point. It will be interesting to see what percentage of households experience breathing difficulties on Control day interviewing next year.

Year-by-Year Comparison of Percent of respondents whose households experienced breathing difficulties on STA days: Sacramento Core Region

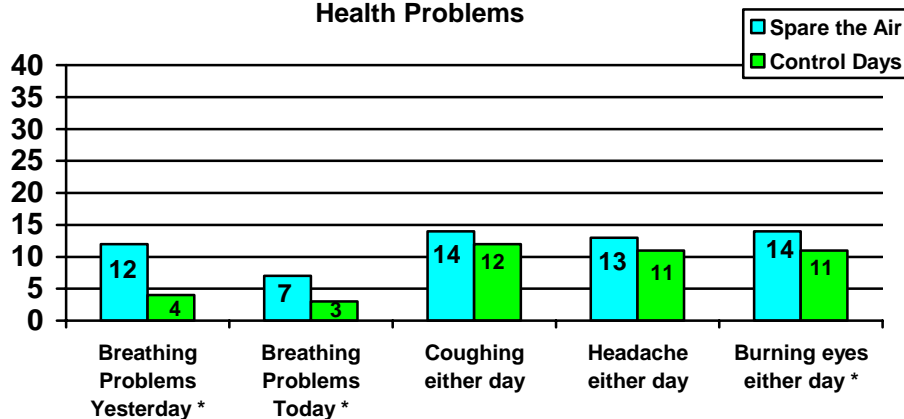


OBJECTIVE P:

Households in all three air quality districts experienced significantly more breathing difficulties and burning eyes on Spare the Air days than on Control days. In addition, significantly more households in Yolo-Solano AQMD had headaches on Spare the Air days, and in Placer County APCD, significantly more households experienced coughing on Spare the Air than on Control days.

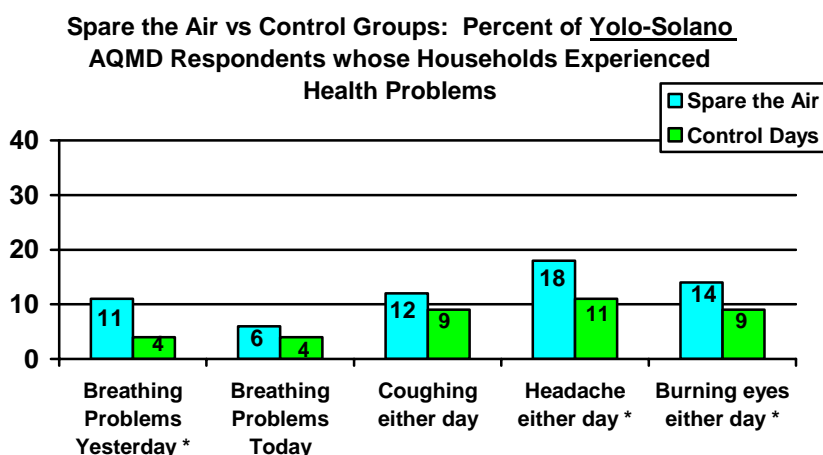
In terms of the individual counties, results from Sacramento County were similar to those for the Core Region as a whole – more households experienced breathing difficulties and burning eyes in the Spare the Air group than in the Control group of respondents. Response percentages are presented in the next chart.

Spare the Air vs Control Groups: Percent of Sacramento County Respondents whose Households Experienced Health Problems



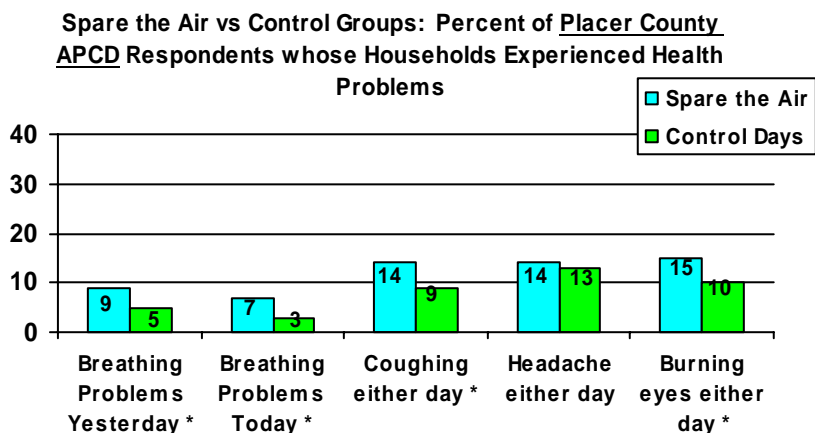
* indicates a statistically significant difference

The next chart shows results from respondents in Yolo-Solano AQMD. It can be seen that significantly more households experienced breathing problems, headaches, and burning eyes on Spare the Air days than on Control days. Further examination of the four individual areas within this AQMD (Woodland, Davis, Vacaville and Dixon/Rio Vista) revealed that the significant difference in terms of breathing difficulties was due mainly to the impact of Woodland: where significantly more respondents (15%) experienced breathing difficulties on Spare the Air days than on Control days (5%). In the other cities, the difference was not significant. In terms of headaches, the difference was significant in both Woodland and Vacaville. It is not clear why such a high percentage (18%) of headaches should have been experienced in Yolo-Solano households on Spare the Air days: it did not appear to be related to a particular Spare the Air day, nor to the day of the week, nor to the actual Air Quality Index recorded on those days, nor to a specific location within the AQMD. The significant difference between Spare the Air and Control days in terms of burning eyes occurred mainly in Vacaville (17% vs. 8%).



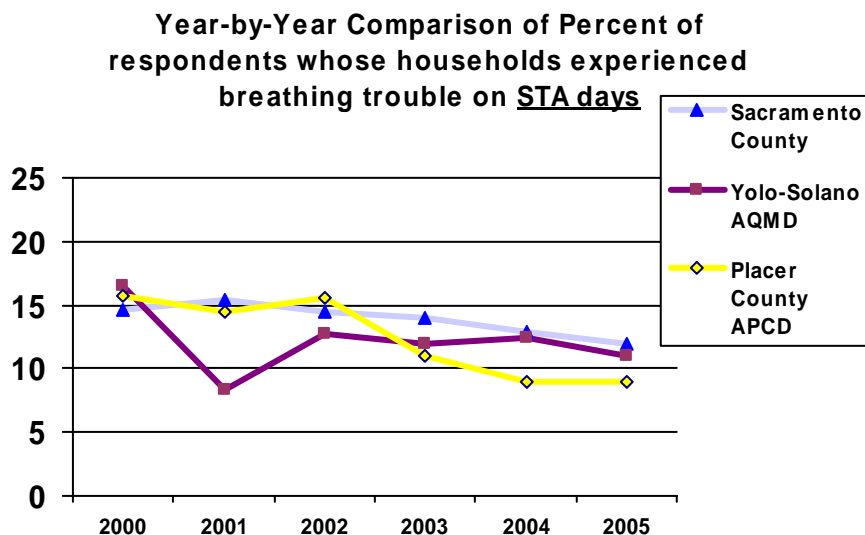
* Indicates a statistically significant difference

Results from Placer County APCD are presented in the next chart. It can be seen that Placer households experienced significantly more health problems in the Spare the Air group than in the Control group in terms of breathing difficulties (both the day before and the day of the interview), coughing, and burning eyes.



* Indicates a statistically significant difference

The percentages of households experiencing breathing difficulties (the only health question tracked since 2000) on Spare the Air days in each district for the last six years are plotted in the next graph. It can be seen that the percentage has remained relatively stable among the three air quality districts from one year to the next with the notable exception that in Yolo-Solano in 2001, significantly fewer households experienced difficulties than in other districts. This year there was no significant difference among the three air quality districts in terms of the percentage of households who experienced breathing difficulties on Spare the Air days.



Employer Participation

Objectives

Sacramento region businesses are also encouraged to participate by belonging to the Spare the Air Employer Network. Member company representatives receive Spare The Air Advisories at their work sites via email. The representative then notifies employees when a Spare The Air day has been issued, directly through e-mail, or through signs about Spare the Air days, or by asking them to sign up individually with AirAlert⁴⁵. This way, the employee can reduce driving in an effort to improve air quality, or may decide to curb outdoor activities for health-related reasons. Employer Network participating companies also receive special announcements from the Sacramento Metropolitan Air Quality Management District regarding new programs, incentives and exclusive special offers.

The objectives of the current section are to:

- Q. assess employer participation in Spare the Air through the percentage of employed drivers who say their employer encourages them to drive less on days of poor air quality,

⁴⁵ AirAlert is a free service that automatically notifies subscribers by their choice of email, text pager, and/or digital cellular phone when a Spare the Air day has been forecast for the region ozone reaches unhealthy levels in the Sacramento region. In addition, the AirAlert program offers subscribers (www.myAirAlert.net) the option to receive Daily Air Quality forecasts, real-time monitoring site readings at the Unhealthy for Sensitive Groups, Unhealthy, or Very Unhealthy levels, and even short AirAlerts for text pagers and digital cellular phones.

- R. measure participation by information channel – e-mail, signs, or asking employees to sign up for Air Alert notifications, and
- S. test whether employer participation has increased, decreased, or stayed the same since 2003.

Questions relating to employer participation were introduced to the Spare the Air evaluation questionnaire in 2003. The following questions were asked only of those respondents in the Sacramento Core Region who were employed:

- “Does your employer encourage you to drive less on poor air quality days?”
- “I am going to read you a list and I’d like you to just tell me, yes or no, if your employer does any of the following **to inform you about poor air quality days**. Does your employer:
 - a. Send emails to employees about poor air quality days?
 - b. Post signs about poor air quality days?
 - c. Ask employees to sign up for Air Alert notification?”

Results

OBJECTIVE Q:

Eighteen percent of employed respondents in the Sacramento Core Region as a whole said their employer encourages them to drive less on days of poor air quality.

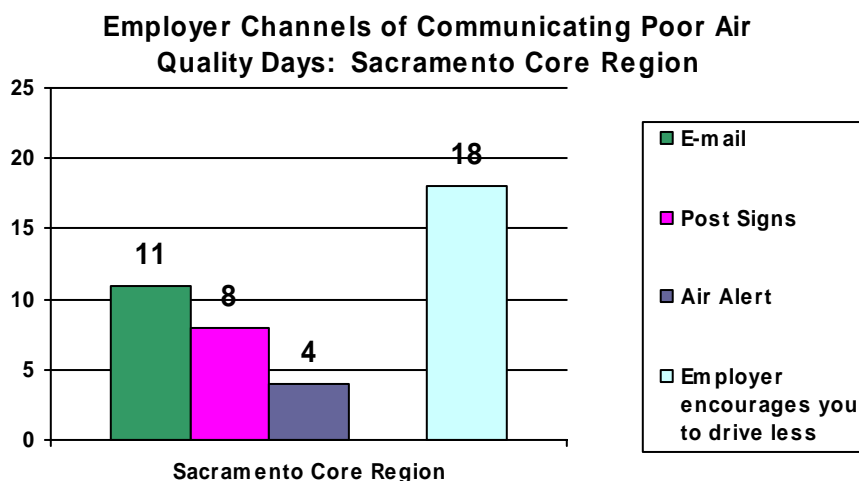
Only weighted results for the Sacramento Core Region as a whole will be discussed as respondents were identified by where they resided, and not where they worked. It is quite likely that many respondents live in one air district in the region, but work in another. This year, 18% of employed respondents in the region as a whole said their employer encourages them to drive less on poor air quality days.⁴⁶ Although this level of employer participation is quite good, there is obviously room for much greater participation.

OBJECTIVE R:

Employers notified employees about Spare the Air days via e-mail (11%), by posting signs (8%), and by asking them to sign up for Air Alert notifications (4%).

It can be seen in the next chart that the most common method used by regional employers to notify their employees about Spare the Air days was via e-mail (11%). Eight percent of employed respondents said their employer posted signs about poor air quality days, and only 4% said they were encouraged to sign up to Air Alert notifications.

⁴⁶ For this analysis, self-employed respondents and those who were undecided or refused to answer were excluded.

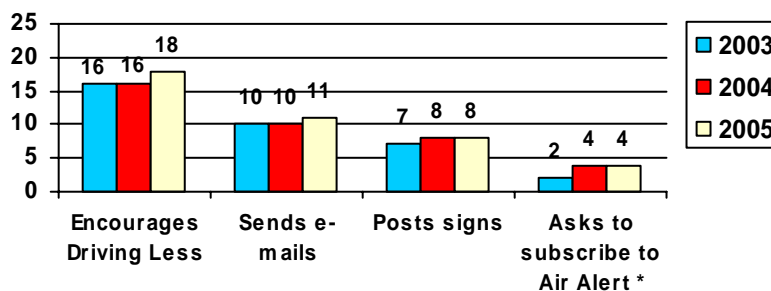


OBJECTIVE S:

Employer participation, although higher this year at 18% is not significantly different from the previous two years (16%). E-mail notification and the percent of employers posting signs about Spare the Air days have also not changed in three years. Also unfortunate, the percent of employers who ask employees to register to receive AirAlert notifications has not expanded beyond last year's increase.

Employer participation in Spare the Air has only been tracked in the annual evaluation since 2003. Results for the Core Region are presented in the next graph. Although participation is higher at 18% this year than the previous two years (both 16%), the increase is not statistically significant. It can be seen that, generally speaking, the communication channels have not changed from one year to the next. The only significant difference was fewer employers (2%) asked their employees to subscribe to Air Alerts in 2003 than in 2004 and 2005 (4%). At only 4%, further efforts should be made to encourage employers to have their workers subscribe to Air Alerts.

Employer Participation since 2003 (Sacramento Core Region)



* significant difference between 2003 and 2004

Seasonal Trip Reductions

Objectives

A previous section (Estimated Emission Reductions during the 2005 Spare the Air Season in the Sacramento Region) indicated that drivers who purposefully drove less on Spare the Air days reduced air pollution by an estimated **.27 tons** of ozone precursors per day. This is a measure of driving reduction that is **directly** attributable to the Spare the Air program.

However, there is another group of drivers who help contribute to improved air quality in the region – those who routinely drive less during the summer months. They are not counted in the above estimate of ozone precursors reduced because our evaluation methodology specifically asks whether the driver drove less than usual the previous day.⁴⁷ In other words, drivers who already cut back on their driving during the summer may have already adjusted their driving behavior to drive less, and so a Spare the Air day would not necessarily trigger a greater reduction in terms of the number of trips these respondents took.

The significance of seasonal driving reductions is that reductions on the average summer day can have an impact on the build-up of the pollution load in the region, thus slowing the formation of ozone leading to Spare the Air conditions. Last year was the first time we looked more closely at the issue of seasonal driving reduction and suggested that emission reductions from this particular group of drivers could be estimated and possibly claimed by the Sacramento regions' air quality districts. The main objective of the current report is to repeat the analysis, by assessing the impact of seasonal driving reduction in the Sacramento Core Region in the summer of 2005.

Specific objectives are to:

- T. test whether those drivers who say they usually reduce the amount of driving they do during the summer to avoid adding to air pollution actually do report making fewer trips than those who say they do not seasonally reduce driving
- U. calculate the percentage of seasonal trip reducers and the mean number of trips made this and in previous years' evaluations.

The following questions from the Spare the Air evaluation survey were used to describe seasonal trip reduction. First, the number of self-reported vehicle trips made by respondent drivers in the region was assessed using the following question:

- “Thinking just about yesterday, how many different TIMES did you get into a car, truck, or van to drive?”

[Probe: “Give me a reasonable approximation – a round number.”]

[INTERVIEWER – IF NEEDED: for this question, we are interested in just how many times the respondent opened the door and got into the car as the driver, not in how many trips they may have made while driving.]

The percentage of seasonal (summer) trip reducers was measured by asking:

- “Do you usually reduce the amount of driving you do during the summer to avoid adding to air pollution?”

⁴⁷ The methodology for calculating purposeful driving reducers was episode-specific and included only those drivers who: said they drove “less” on Spare the Air days, were aware of Spare the Air (according to an Air Resources Board worded-question), and did so specifically for reasons of air quality. This is the strict ARB definition of purposeful driving reduction, and has been used in annual Spare the Air evaluations.

Last year another question was introduced and was asked again this year:

- IF YES, “And how have you reduced driving this summer to decrease air pollution?”

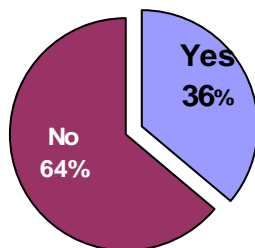
Results

OBJECTIVE T:

Thirty-six percent of all respondents in the Sacramento Core Region are seasonal reducers -they usually reduce the amount of driving they do during the summer to avoid adding to air pollution. They reported entering their cars significantly fewer times than those respondents who said they did not usually reduce driving during the summer, making on average, half a trip less per day than non-reducers. This could translate into 1.6 tons per day of emission precursor reductions.

For the purpose of this analysis, both Spare the Air and Control responses were combined, as the seasonal trip reduction questions were not dependent on the specific interviewing days. The next pie chart indicates that in the region as a whole, 36% of all respondents said they usually reduce the amount of driving they do during the summer to avoid adding to air pollution.

Seasonal Driving Reducers: 2005 Results,
Sacramento Core Region



As can be seen in the next table, the respondents who seasonally reduce driving reported entering their cars the previous day an average of 3.06 times. Those who said they did not usually reduce the amount of driving they do during the summer reported entering their cars an average of 3.54 times. An analysis of variance indicated that these means were statistically different from each other:⁴⁸ In other words, drivers who said they usually drive less in the summer actually reported making significantly fewer trips than those who did not. **On average, then, seasonal driving reducers made one-half a trip less per day than non-reducers (3.54 – 3.06 = 0.48 trips).**

	<i>SEASONAL DRIVING REDUCERS: MEAN # TIMES ENTERED VEHICLE</i>	<i>NON-REDUCERS: MEAN # TIMES ENTERED VEHICLE</i>	<i>STATISTICALLY SIGNIFICANT DIFFERENCE?</i>
<i>Sacramento Core Region</i>	3.06	3.54	Yes

⁴⁸ F (1,1109) = 3.06, p= .08

This could translate into substantial emission reductions. Although the methodology would have to be agreed upon, one way of estimating the tons of ozone precursors reduced is to apply a similar methodology to that used to estimate emission reductions on Spare the Air days, and is summarized in the next table. It can be seen that the half trip a day (.48) on average that seasonal reducers avoid could mean an estimated **1.6 tons** of ozone precursors reduced per summer day. [A recalculation⁴⁹ of last year's estimated emissions reductions indicated 1.97 tons of ozone precursors reduced per summer day in 2004.]

	Percent of respondent drivers who drive less during the summer for air quality reasons	x Number of licensed drivers in Sacramento Core Region (1,284,280 total ⁵⁰)	X Mean Number of trips Reduced per day compared to non-reducers	x 6.60 grams of ozone precursors per trip ⁵¹ (EMFAC 2002 V2.2)	= Estimated Tons ⁵² per day of ozone precursors reduced
Sacramento Core Region					
Spare the Air and Control Day Interviews	36%	462,340	x 0.48 = 221,920	1,464,670 grams	1.6 tons

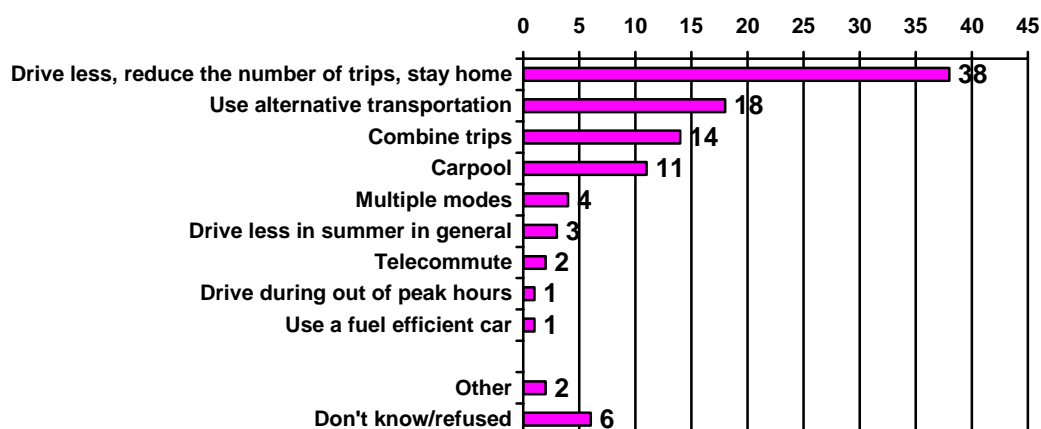
The seasonal driving reducers were asked to specify what they had done to reduce driving this summer to decrease air pollution. Their comments were entered, categorized, and results are presented in the next graph. It can be seen that nearly four in ten (38%) of these respondents said they made fewer trips or stayed home. Another 18% used alternative transportation and a further 14% said they regularly planned their days to combine trips. Eleven percent said they carpooled to decrease air pollution.

⁴⁹ The agreed-upon methodology for 2005 is based on totaled average ROG and NOx calculations for light duty cars and trucks, provided by Bruce Katayama, SMAQMD (see footnote 9). The same logic was then applied to 2004 results (that is, combined ROG and NOx were 7.34 grams per trip rather than 15.46). Recalculations indicated that an estimated 1.97 tons of ozone precursors were reduced in 2004 (and not 4.15 tons): 36% of 1,353,250 drivers x .5 single trips reduced per day x 7.34 grams of ozone precursors per trip / 907,200 grams = 1.97 tons.

⁵⁰ The number of drivers in the Sacramento region for 2005 was estimated, using the number of driver licenses by county for 2004, (obtained from the California Department of Motor Vehicles database at www.dmv.ca.gov/about/profile/dl_outs_by_county.htm) and calculating the percentage increase, based on county population figure increases from 2004 to 2005 (www.dof.ca.gov/HTML/DEMOGRAP/e-1table.xls). The estimated number of licensed drivers for the total Sacramento region in 2005 was 1,284,284: Sacramento County: total 887,103 + Placer County: 231,432 * 87% for Air Quality district = 201,346; Yolo-Solano: total of 195,835 (117,308 in Yolo + 78,527 in Solano).

⁵¹ Based on summer 2005 EMFAC2002 V2.2 SMAQMD spreadsheet figures provided by Peter Christensen and Bruce Katayama, SMAQMD, October 14, 2005. Models were run for the summer of 2005. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (19.61 + 9.71 + 6.71) were converted to pounds (multiplied by 2,000) and then to grams (multiplied by 454) before dividing by the combined total number of trips (i.e. 5,607,914 for light duty passenger cars + 1,929,592 for light duty trucks1 + 1,643,152 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (14.68 + 7.81 + 8.25) x 2000 x 454 / (5,607,914 + 1,929,592 + 1,643,152). ROG grams and NOx grams were then combined (3.56 + 3.04) to obtain 6.60 grams per trip of emission precursors in the region as a whole. These are the figures considered most accurate at the time this report was written.

⁵² There are 907,200 grams in a ton.



A few representative comments⁵³ from those who said they drove less, reduced the number of trips, or stayed home are listed below:

- "Anytime those air advisory signs are out I try not to drive.
- Don't go places I normally would go to. I won't go shopping or go to the store. I will save it up for a couple of days. Instead of going to the store every day, I will go every three or four days.
- Decrease the number of trips to the store.
- By not taking trips when they are unnecessary.
- By not going anywhere except for necessities. Mainly we don't like to travel during the summer. We go in the off season on short trips. I am concerned about air pollution. We don't use our car daily; we don't like to get out in the heat.
- By staying home and swimming in my own pool. Just doing activities around here. Just activities at the house.
- I don't drive on the weekends. We only drive one vehicle. We limit our places that we go. We pre-plan and just drive to the destination and stay there all day.
- Avoid unnecessary driving, and I mean going to the store. I just avoid it. If I don't have to go, I won't.
- By thinking about if I really need to make that trip to the store, the post office, or to a friend's, and I just don't do it. I tell friends and family that walking is better. Just to think about the air quality.
- I don't take as many long trips as I did last year and I make short trips, I try to combine my errands for less time instead of getting in the car and going again. I get things done at night because there's less traffic.
- I drive 50 miles less a week. Because I come home and park and don't go back out. Whereas, in the winter, I would go back out. And I tune up the car. And I bicycle.
- I hardly go out at all. I try to make it local, also, not going to other cities. I don't go out unless I have to. I keep the car in the garage five days out of the week.
- I just don't go out and drive. I try not to use the vehicle. I just don't want to use it during the heat of the day, and don't want to cause pollution.
- I just drive to work and then home I don't go anywhere in the evening. Also do that to save gas with the prices so high. Usually I don't go anywhere on the weekends. If I do, then I walk.
- I try not to drive that much unless I really have to. Because it is really hot, and I would just rather stay home. I just do not like the heat, so I would rather stay home.
- I try to make fewer side trips to go to the store or whatever. That's basically it, just fewer side trips.

⁵³ The complete transcripts of all responses are available in the statistical file.

- I would have to say putting off trips or things. Trying to get things done all at one time. Just not driving as much, you know.
- Instead of taking my bills to pay them, I do it through the mail. When I go grocery shopping, I try to get every thing that I need. And not to mention the gas prices are making it harder to drive anywhere.
- Trying to cut down on the number of times I drive distances and to schedule things to make it the most efficient. If I'm going out to do one thing, I try to do as many things as possible in that one journey.
- We just don't go to as many places.
- Well, I go to the grocery store once a week. I make fewer trips. I don't go out as much, I stay home.
- When I go get my mail and stuff, I go once a week, instead of twice a week. When I go the grocery store, I get twice as much, so I only go half as many times.
- By not driving, and driving less, and less frivolous trips. Just more efficient driving habits."

A few representative comments from those who said they use alternative transportation include:

- "I only go to work and home, and then I try to walk everywhere else, or ride my bike or car pool if possible.
- I like to use light rail. We have one car less than we used to have. I bicycle more often. Try to cut down on the use of air conditioning as well.
- I just take the train. Walking and biking.
- Bikes. We ride our bikes to see family, instead of the car. We just don't travel a lot, we stay at home.
- I take public transportation when I can.
I do a lot more biking locally, here in town. I live in Davis. It's a very bike friendly city so I've done a lot more biking this summer. Walking the kids to school instead of driving them.
- It's a lot easier and safer for me to ride my bike in the summer because lighting isn't an issue. I think with the fuel costs it's still a small part of operating a vehicle. We still strive to minimize our travel and aggregate our trips.
- Not driving to work. Going by bike instead of by car. I walked instead of driving.
- Riding my bicycle and riding my motorcycle, walking to some extent.
- Take my bike, and also have an electric scooter.
- Take the bus quite often, public transportation. In fact, I made a decision not to buy a second car.
- Try to use Amtrak instead of driving. Make as many errands in one run so I am not running back and forth. We will car pool when we can. We try to ride our bikes.
- Use the bus, or carpooling, stuff like that. Walking and biking, also.
- Use bicycles to go to the gym and Post Office. You know. Short trips.
- I joined a train pool, and a bike pool. I bought a folding bike and commute on Amtrak, and instead of 400 miles a week, I drive less than 60. We just don't drive.
- By biking, walking places. Or carpooling. Or choosing not to go places. Everything but driving an electric vehicle."

Finally, a few comments from those who said they combine trips include:

- "All my errands are run on the same day. It would be good if they opened carpool lanes on Spare the Air days, so commuters can get to their destinations quicker.
- If I go to town, I try to do it in one trip instead of two. I live in a little town and I cut down the number of trips.
- Combining my errands and taking fewer trips. I try to combine my errands so I'm not making multiple trips.
- Consolidate trips. Do three and four errands in one trip, rather than separately.

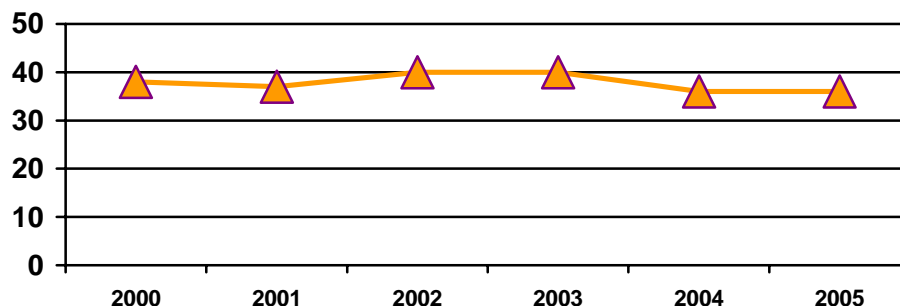
- I bundle errands so I'm not going here, and there, and someplace else. I bundle them, and I do them at night, when the air quality is better.
- I combine errands and I try to put them off or not do them at all until it is not A Spare The Air day. I just reschedule or avoid running errands and ride bikes to the store and we plan our errands. I do not run gas powered equipment when it is hot.
- I consolidated all my trips into as few trips as possible. If I have errands to do, I try to do them the best that I can. I drive a very good low mileage car and I have my family run errands when they go out.
- I had to go the doctor's today, so I try to coordinate necessary stops. Like, go to the grocery store, the doctor's, and my mother's. I keep my oil changed and car checked, so it's in good running order at all times.
- I just try to combine all my little trips together, and try not to run out to do my errands at the spur of the moment. I try to condense my trips.
- I planned my day and decided which order I would go in to stop at each stop. I try to think about everything I could stock up on, rather than making a number of small trips."

OBJECTIVE U:

For the past six years, the percentage of seasonal trip reducers has remained relatively stable, at just under four-in-ten of all respondents. Further, since 2000, drivers who said they usually reduced the amount of driving they did during the summer to avoid adding to air pollution reported making significantly fewer trips than those who said they did not reduce driving during the summer. In fact, during the past six years, seasonal driving reducers made between half a trip to just over one trip per day less than non-reducers. The impact is that air quality management districts may want to consider measuring and tracking the substantial emission reductions represented by this group of seasonal driving reducers in future evaluations.

The next graph indicates that the percentage of respondents who said they usually reduce the amount of driving they do during the summer to avoid adding to air pollution has remained relatively stable at just under four-in-ten from 2000 to the present.

Year-by-Year Comparison of Percent of respondents who seasonally reduce driving to avoid adding to air pollution: Sacramento Core Region



The next table shows the average number of trips reported by seasonal driving reducers and non-reducers in the region as a whole, since 2000. It can be seen, first of all, that in every year seasonal reducers reported making significantly fewer trips on the day prior to the interview than the group who said they do not reduce driving during the summer. It can also be seen that the average number of additional trips avoided by seasonal reducers (that is, the difference between reducers and non-reducers) ranged from half a trip per day to just over 1 trip per day. These results again support the idea that it may be beneficial to try to quantify the emission reductions by these drivers who may not qualify as episodic reducers on Spare the Air days for methodological reasons.

<i>YEAR</i>	<i>SEASONAL DRIVING REDUCERS: MEAN # TIMES ENTERED VEHICLE</i>	<i>NON-REDUCERS: MEAN # TIMES ENTERED VEHICLE</i>	<i>DIFFERENCE (MEAN NUMBER OF DAILY SINGLE TRIPS AVOIDED BY SEASONAL REDUCERS)</i>	<i>STATISTICALLY SIGNIFICANT DIFFERENCE?</i>
2000	3.6	4.1	0.5	Yes
2001	3.1	4.2	1.1	Yes
2002	3.1	4.1	1.0	Yes
2003	3.1	4.2	1.1	Yes
2004	3.4	3.9	0.5	Yes
2005	3.06	3.54	0.48	Yes

SUMMARY CONCLUSIONS

Awareness

- ❖ Over six-in-ten respondents (63%) in the region said they had heard about Spare the Air in the previous two days, but only three-in-ten (29%) specifically remembered being asked not to drive the previous day. General awareness was significantly higher in both Sacramento County and Placer County APCD than in Yolo-Solano AQMD. There were no differences among the air districts in terms of levels of specific awareness of Spare the Air.
- ❖ In terms of general awareness, there was a significant increase in the region as a whole from 2004, but awareness remained statistically highest in 2002, a very poor air quality season. In terms of specific awareness, there was no significant increase in the region as a whole from 2004. In fact, with the exception of 2002, regional levels have essentially stayed the same at about 30% for the last six years.
- ❖ Control-day interviewing insures that respondents interviewed following Spare the Air days are not simply giving “socially-acceptable” responses: levels of both types of awareness were significantly higher on Spare the Air days than on Control days in all districts.
- ❖ Correcting for Control day interviewing, and extrapolating to the population, it is estimated that between 321,070 and 552,240 drivers in the Sacramento Core Region were aware of Spare the Air on average for each of the fourteen Spare the Air days in 2005.

Purposeful Driving Reduction

- ❖ Nearly a quarter (24%) of all respondents in the region as a whole said they drove “less” on Spare the Air days, the highest percentage in the past six years. Also, significantly more respondents in Sacramento County, Placer County APCD, and the Sacramento Core Region said they had driven less on Spare the Air days than on non Spare the Air days, one measure of the success of the program.
- ❖ That being said, however, only 1.4% of all respondent drivers in the entire Sacramento Core Region could be classified as having purposefully driven less on Spare the Air days because they wanted to improve air quality in the region and were aware of the Spare the Air advisories in general. The percentage of reducers did not differ significantly among air districts. Further efforts to increase the number of purposeful reducers may be needed.
- ❖ The percentage of reducers has basically remained the same since 2000: although seemingly low at 1.4%, the percentage of drivers who purposefully reduced driving this year is not significantly less than in each of the previous five years in Sacramento County or the region as a whole. Also, the percentage of reducers in Yolo-Solano AQMD and Placer County APCD has stayed the same, with the exception of 2002.
- ❖ Over the last six years, an average of 1.8% of all drivers in the region as a whole purposefully reduced driving on Spare the Air days in order to help improve air quality.
- ❖ When extrapolated to the population of drivers, about 17,980 drivers in the region could be said to have purposefully made fewer trips on average each Spare the Air day in order to reduce air pollution.



- ❖ For the Sacramento Core Region as a whole, drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.0 single trips each. This translates into a total of 53,940 trips purposefully avoided on Spare the Air days during the 2005 season.
- ❖ There were significantly more respondents who purposefully reduced driving on Spare the Air days than on Control days in Sacramento County, Placer County APCD, and the region as a whole. This means that although the overall percentage of reducers is not high, the program has been successful in convincing at least some drivers to avoid trips they might otherwise have made, specifically on days of poor air quality.

Estimated Emissions Reductions

- ❖ The 2005 Spare the Air program was successful in reducing air pollution in the Sacramento Core Region as a whole (the proportional representation of Sacramento County, Placer County APCD and Yolo-Solano AQMD) by an estimated 0.27 tons of ozone precursors per day. This is due specifically to drivers purposefully reducing the number of trips they took on Spare the Air days for air quality reasons.
- ❖ The estimated emission reduction in Sacramento County attributed to the Spare the Air program was 0.25 tons per day, and in Placer County APCD it was .07 tons. Reductions in Yolo-Solano AQMD were not estimated as the percentage of drivers who said they drove less on Spare the Air days was not significantly higher than the percentage interviewed on Control days. Results from each of the individual air districts should not be combined as they are unweighted.

Health Issues

- ❖ Poor air quality contributes to household health problems: results indicate that breathing difficulties and burning eyes were experienced by significantly more households on and following Spare the Air days than on and following Control days.
- ❖ The 12% of respondents in the Sacramento Core Region who reported breathing difficulties on Spare the Air days translates into 90,110 affected households.
- ❖ Correcting for Control days, it can be said that 60,070 households in the Sacramento Core Region experienced breathing problems during Spare the Air days specifically due to ozone air pollution. This is double the number of affected households from last year due to a decrease in the percentage of Control households with respiratory problems.
- ❖ Despite differences between air districts in terms of peak ozone concentrations, the health effects of ozone air pollution are experienced throughout the whole Sacramento Core Region. Households in all three air quality districts; Sacramento, Yolo-Solano, and Placer experienced significantly more breathing difficulties and burning eyes on Spare the Air days than on Control days. In addition, significantly more households in Yolo-Solano AQMD had headaches on Spare the Air days, and in Placer County APCD, significantly more households experienced coughing on Spare the Air than on Control days.
- ❖ The percentage of households reporting breathing difficulties in the Sacramento Core Region on Spare the Air days has stayed the same from 2000 to the present, at an average of 13% of all households during the past six years. The percentage of households reporting breathing difficulties on Control days declined significantly this year compared with the previous five years. Potentially, this could be due to improved air quality on control days, random variation, or it may be simply an anomaly.

Employer Participation

- ❖ Eighteen percent of employed respondents in the Sacramento Core Region as a whole said their employer encourages them to drive less on days of poor air quality.
- ❖ Employers notified employees about Spare the Air days via e-mail (11%), by posting signs (8%), and by asking them to sign up for Air Alert notifications (4%).
- ❖ Employer participation, although higher this year at 18% is not significantly different from the previous two years (both 16%). E-mail notification and the percent of employers posting signs about Spare the Air days have also not changed in three years. Also unfortunate, the percent of employers who ask employees to register to receive AirAlert notifications has not expanded beyond last year's increase. Further efforts to increase employer participation are warranted.

Seasonal Trip Reductions

- ❖ Thirty-six percent of all respondents in the Sacramento Core Region were seasonal reducers - they said they usually reduce the amount of driving they do during the summer to avoid adding to air pollution. They did so by making fewer trips, staying home, using alternative transportation, consolidating trips, carpooling, and telecommuting.
- ❖ These reducers reported entering their cars significantly fewer times than those respondents who said they did not usually reduce driving during the summer. In other words, seasonal driving reducers in the Sacramento Core Region made an average of half a trip less per day than non-reducers.
- ❖ This could translate into 1.6 tons of emission reductions per summer day in 2005. A recalculation of last year's results indicated an estimated 1.97 tons reduced in 2004.
- ❖ For the past six years, the percentage of seasonal trip reducers has remained relatively stable, at just under four-in-ten of all respondents.
- ❖ Further, since 2000, drivers who said they usually reduced the amount of driving they did during the summer to avoid adding to air pollution reported making significantly fewer trips than those who said they did not reduce driving during the summer. In fact, during the past six years, seasonal driving reducers made between half a trip to just over one trip per day less than non-reducers. Although not presented here, the calculations for estimating tons of emissions reduced for the years prior to 2004 could be completed, if requested.
- ❖ The emission reduction quantification for seasonal trip reduction could be further investigated to determine if it contributes to avoidance of ozone build-up and thus avoidance of Spare the Air days.