



The Cleaner Air Partnership

SACRAMENTO REGION AIR QUALITY BASIN: “SPARE THE AIR” CAMPAIGN 2004 EVALUATION



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Final Report – Evaluation of the 2004 Spare the Air Campaign

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EXECUTIVE HIGHLIGHTS – 2004 SPARE THE AIR CAMPAIGN EVALUATION

Awareness:

- ◆ Public awareness of the Spare the Air public education program has remained relatively stable over the past five years. In 2004 over half (56%) of all respondents in the region were aware of Spare the Air in general, and this was significantly higher than the 30% of respondents who were specifically aware of being asked not to drive the previous day due to unhealthy air.
- ◆ Significantly more respondents heard, read, or saw advertisements about Spare the Air on Spare the Air days than on Control days in all districts – one indication of the program’s success in raising public awareness of air quality issues.
- ◆ 406,200 drivers in the region as a whole noticed the advisory in general on the average Spare the Air day, and 284,185 drivers were specifically aware of the request not to drive on the average Spare the Air day during the 2004 season.

Driving Reduction:

- ◆ Fifteen percent of regional respondents this year said they drove “less” on Spare the Air days. Spare the Air respondents reported driving significantly “less” than Control respondents.
- ◆ Only 1.4% of all respondent drivers in the entire basin 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 five years.
- ◆ About 18,950 drivers purposefully made fewer trips on the average Spare the Air day in 2004 in order to reduce air pollution.
- ◆ The drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.6 single trips each. This translates into a total of 68,220 trips purposefully avoided on the average Spare the Air day during the 2004 season.

Estimated Emission Reductions:

- ◆ The 2004 Spare the Air program was successful in reducing air pollution in the Sacramento air basin region by an estimated 1.16 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.

Health Effects:

- ◆ Poor air quality contributed to household health problems: breathing difficulties and burning eyes were experienced by more households in the region on and following Spare the Air days than on Control days. The percentage of respondents reporting breathing difficulties in the region on Spare the Air days has stayed about the same for the region as a whole during the last five years.
- ◆ An additional 29,270 households in the Sacramento basin experienced breathing problems during Spare the Air days specifically due to air pollution compared to Control days.

- ◆ *There was a statistical link between objective air quality measurements and perceived breathing difficulties: data from the past three years indicated that significantly more households experienced breathing difficulties when the AQI was more than 101 (Unhealthy for Sensitive Groups) than when the AQI was less than 101 (Good or Moderate days.)*

Employer Participation:

- ◆ *This year, 16% of employed respondents in the Sacramento region as a whole said their employer encourages them to drive less on days of poor air quality.*
- ◆ *E-mail notification by the employer remains the most frequently used information channel to notify employees of Spare the Air days at 10%. Eight percent of employers post signs about poor air quality and 4% ask their employees to sign up for Air Alert notification.*
- ◆ *Employer participation remained the same as last year, at 16%. The percentages of employers using e-mail to notify their employees and posting signs also did not differ from last year. However, the percentage who asked their employees to sign up to Air Alert notifications increased significantly this year. Although still low at only 4% participation, this is nevertheless significantly different from the 2% of employers last year who asked their employees to subscribe to Air Alert.*

Seasonal Trip Reductions:

- ◆ *Over a third (36%) of all respondents are seasonal driving reducers – they say they usually reduce the amount of driving they do during the summer to avoid adding to air pollution.*
- ◆ *These reducers reported entering their cars significantly fewer times (mean of 3.4) than those respondents who said they did not usually reduce driving during the summer (mean of 3.9.) In other words, seasonal driving reducers made an average of half a trip less per day than non-reducers.*
- ◆ *This could translate into substantial emission reductions (one estimate is that 4.15 tons of ozone precursors were reduced per summer day in 2004), and is therefore an area that warrants further consideration.*
- ◆ *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 five years, seasonal driving reducers made between half a trip to just over one trip per day less than non-reducers.*
- ◆ *The emission reduction quantification for seasonal trip reduction should therefore be further investigated to determine if it contributes to avoidance of ozone build-up and thus avoidance of Spare the Air days.*

PROJECT BACKGROUND

Spare the Air was created in 1995 as an outreach program to engage the general public in helping to solve the problem of air pollution. It provides residents in the Sacramento region with information and resources to protect their health during the summer smog season by encouraging them to be aware of ozone levels and asking motorists to reduce their driving on days when the monitoring stations around the region predict unhealthy air.

The trigger for calling a Spare the Air day is based on meteorological forecasts -- 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 advisory was triggered. The public is notified the day before, using a variety of communication channels including paid-for announcements on radio and television, electronic signs, e-mail alerts, news broadcasts, the Spare the Air website, employer alert systems, and the Weather Channel.

Annual evaluations (with the exception of 1997) have been conducted since 1995 to assess the effectiveness of the Spare the Air program. As has been done in the past, 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. Lamare¹ in case there is a tendency for individuals to overstate their driving reduction on Spare the Air days.

METHODOLOGY

A random sample of 1,989 respondents was interviewed following each of the six Spare the Air days (August 10 and 11, August 31, and September 7, September 8, and September 9) of the 2004 season, which ran from May through September. This included 254 interviews conducted with residents of El Dorado² Air Quality Management District (AQMD), 507 with residents of Placer AQMD, 527 with residents of the Yolo-Solano AQMD, and 701 with residents of Sacramento County.

Control day interviewing took place on matched days of the week, but on non Spare the Air days. A total of 1,452 Control interviews were conducted: 248 in El Dorado AQMD, 400 in Placer AQMD, 401 in Yolo-Solano AQMD, and 403 in Sacramento County. Results were weighted appropriately for the region³ as a whole, both including and excluding El Dorado. Drivers from both groups were asked if they had reduced the number of trips they made the day before. 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 therefore provides a validation check and results can be used as a correction factor.

It should be noted that the trigger for alerting the population of a Spare the Air day for the following day is based on forecasted estimates of the Air Quality Index (AQI), recorded at

¹ Judith Lamare, Ph.D. The Cleaner Air Partnership, Sacramento, CA.

² This was the first year residents in the El Dorado air quality district were interviewed. Therefore, any regional analyses that compare results from one year to the next will exclude El Dorado responses. The air quality district in El Dorado includes residents from El Dorado Hills, Placerville, Shingle Springs, Georgetown, Cool, and the following unincorporated zip codes: 95613, 95619, 95623, 95633, 95635, 95651, 95664, and 95672.)

³ Excludes El Dorado County as there is no historical data from that district – this was the first year interviews were conducted in El Dorado.

different stations throughout the region. However, because they are forecasts, the actual AQI for a given day can vary from the estimate, and sometimes a Spare the Air day will have been called although the AQI for the day in question never actually reaches the trigger. In fact, this was the case for every Spare the Air day in the 2004 season – none actually reached the trigger AQI of 127.⁴ The other point to mention is that a Spare the Air day may be called for the Sacramento air basin region as a whole, but certain counties within the basin may not experience the same conditions. This may partly account for the anomalous results from Placer AQMD this year.

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, Cleaner Air Partnership, the Sacramento Air Quality Management District (AQMD), Yolo-Solano AQMD, Placer AQMD and El Dorado AQMD; or their policies, products, or staff. The Client (Cleaner Air Partnership) shall be solely responsible for any modifications, revisions, or further disclosure/distribution of this report.

⁴ 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. Maximum AQIs for each district on each day were obtained from a spreadsheet sent by Jamie Amo of the SMAQMD to Jude Lamare on October 13, 2004.

RESULTS & CONCLUSIONS

Awareness of the 2004 Spare the Air Campaign

Objectives

Spare the Air is a program designed to encourage the voluntary participation of residents to help reduce ozone in the air during summer days of particularly poor air quality. Specifically, Spare the Air encourages drivers to reduce the number of vehicle trips they make on Spare the Air days. The program has been in place in the Sacramento Air Quality Basin since 1995. 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), recorded at different stations throughout the region. If it is estimated that the AQI will be 127⁵ or higher the next day, a Spare the Air advisory is issued. The advisory involves radio and television announcements, e-mail based Air Alert notifications, and employer networks. The objectives for this section are to:

- A. measure awareness of the 2004 Spare the Air campaign using two questions and determine if awareness is similar or different among four air quality districts in the Sacramento region (Sacramento, Yolo-Solano, Placer, and El Dorado).
- B. determine if specific awareness during summer Spare the Air seasons has increased, decreased, or stayed the same from 2000 to the present
- C. compare awareness between respondents interviewed following Spare the Air days and those interviewed on Control (non-Spare the Air) days, and
- D. extrapolate to the population by estimating the number of **drivers** in the Sacramento Air Quality Basin who were aware of the 2004 Spare the Air campaign.

Two questions assessed awareness – the first is the wording proposed by the Air Resources Board (ARB) and added to the questionnaire in 2002, and the latter is the wording that has been used in the evaluation questionnaire for the past nine years. They were asked in random order:

- 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:

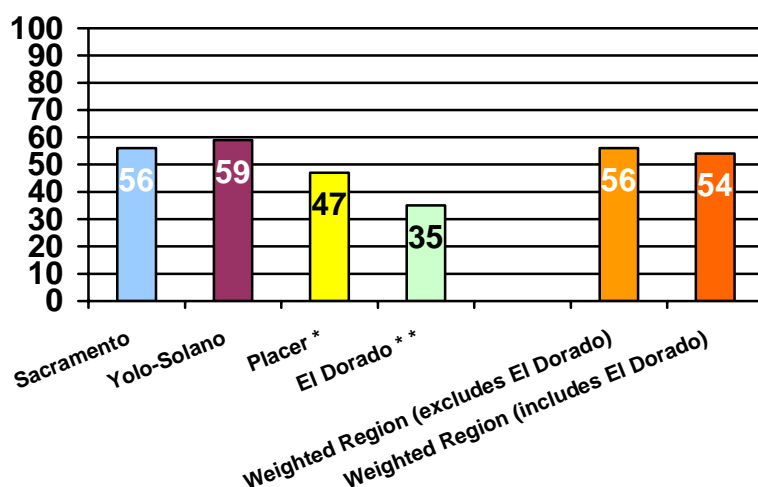
Significantly more respondents in the region were aware of Spare the Air in general (approximately 56%) than were specifically aware of being asked not to drive the previous day due to unhealthy air (approximately 30%). Awareness (both types) was significantly higher in Sacramento County and Yolo-Solano AQMD than in Placer AQMD or El Dorado AQMD, but further investigation showed this might be episode-specific.

⁵ 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.

General Awareness:

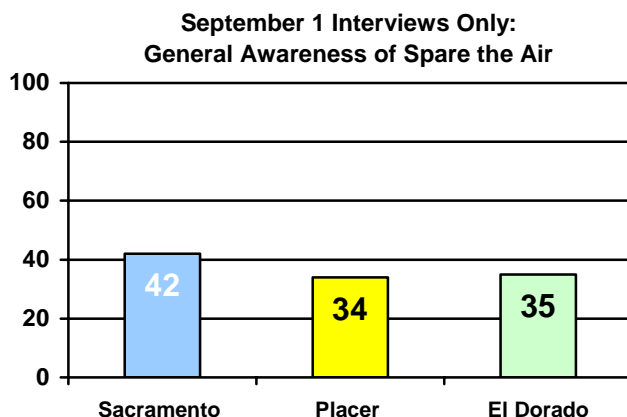
The percentages of respondents who said in the past two days they had heard, read, or seen advertisements or news broadcasts about Spare the Air (the general awareness question) are presented in the next chart. When results from El Dorado are excluded, it can be seen that 56% of respondents in the region as a whole were aware of Spare the Air in general. It can also be seen that awareness was highest in Yolo-Solano AQMD (59%) and Sacramento County (56%). Awareness in Placer AQMD was significantly lower at 50%, and lowest of all among residents in El Dorado AQMD (35%).

General Awareness of Spare the Air (ARB wording)



* significant difference between Placer and all others
** significant difference between El Dorado and all others

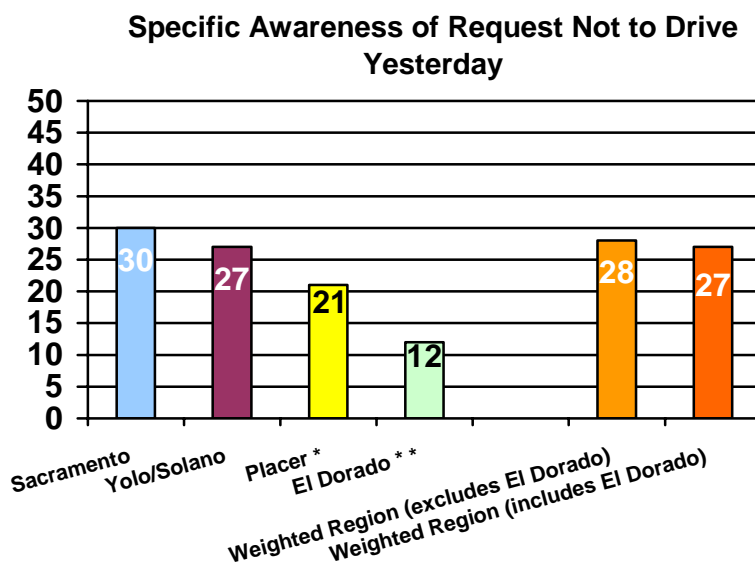
A possible explanation for the El Dorado findings is that all the Spare the Air day interviews took place on just one day (September 1, following the August 31 Spare the Air episode.) Interviews in the other air districts took place on multiple days, following each of the six Spare the Air days. To test this hypothesis, we re-analyzed the awareness results, comparing El Dorado responses with those from September 1 only in Sacramento County and Placer AQMD (no interviews on that date took place in Yolo-Solano AQMD). Results, presented in the next chart, indicate that awareness was down on that date in all three districts, and there was no significant difference among the three districts. It is possible that the outreach and the advertising dollars spent on the August 31 episode differed from other Spare the Air days in the season – a question that could be answered by the organizers. Another explanation is that in the past, awareness of Spare the Air has been higher on multiple-day episodes than on single-day episodes. August 31 was a single day episode.



No significant differences among the districts.

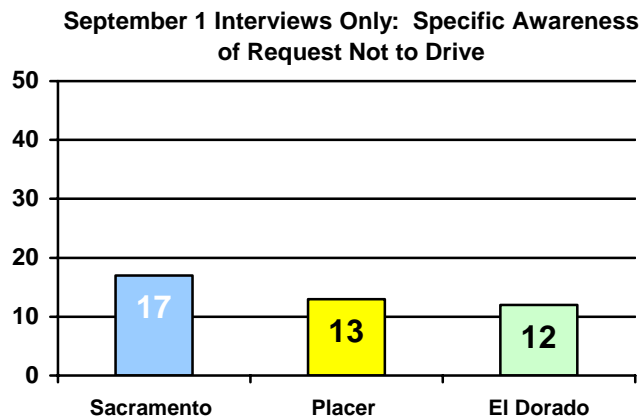
Specific Awareness:

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 can be seen, first of all, that fewer respondents were aware of Spare the Air when the question was worded this way than when it was asked more generally. Specific awareness was highest in Sacramento County (30%) and Yolo-Solano AQMD (27%). Awareness in Placer AQMD was significantly lower at 21%.



* significant difference between Placer and all others
** significant difference between El Dorado and all others

Once again, awareness was lowest of all among residents in El Dorado AQMD (12%), but was not significantly lower when only September 1 results from the other air districts were examined (i.e. 17% in Sacramento and 13% in Placer).



No significant differences among the districts.

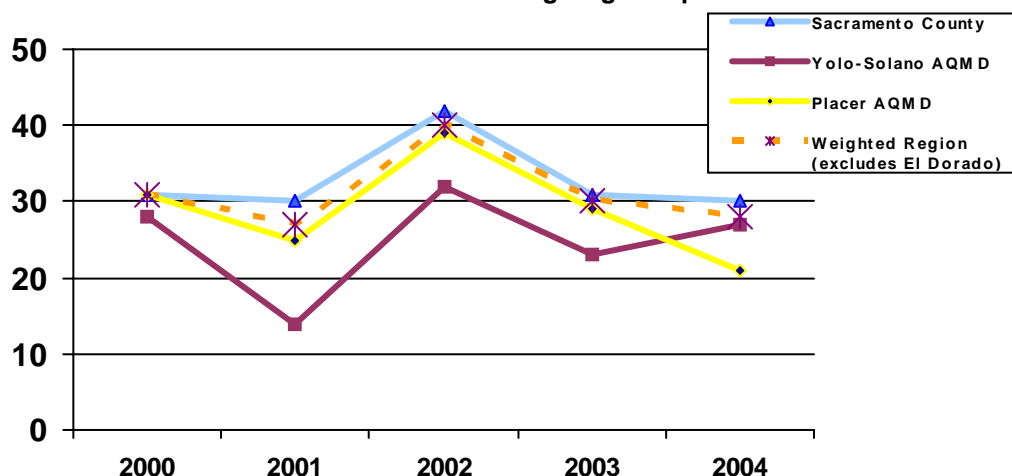
OBJECTIVE B:

With the exception of 2002 (a very poor air quality season), awareness of Spare the Air in the region has essentially stayed the same at about 30% for the past five years.

Results for the last five years from the question measuring specific awareness (Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?) are plotted in the next chart. (El Dorado AQMD results were excluded from this analysis as this was the first year El Dorado respondents were surveyed.) It can be seen that in terms of the region (weighted) as a whole, awareness in all years except 2002⁶ was stable, at approximately 30%.

⁶ 2002 was an exceptional year with high temperatures and multiple-day Spare the Air episodes.

Year-by-Year Comparison of Percent of STA respondents who were "aware" of STA using original question



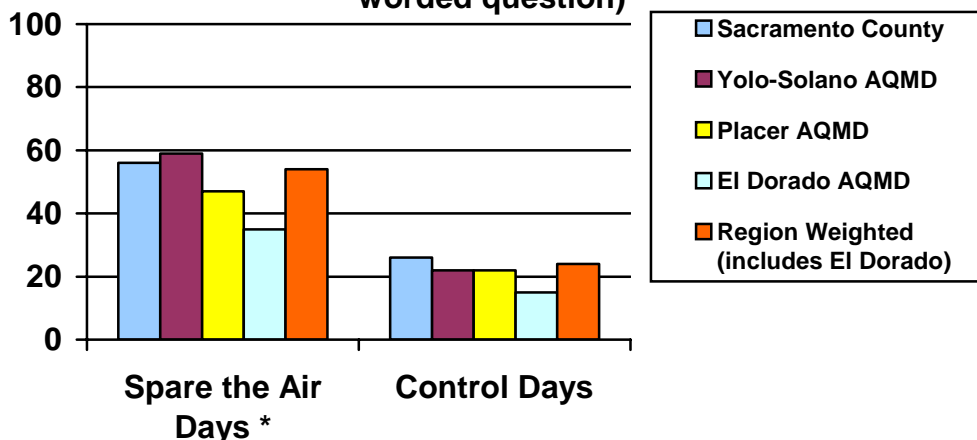
Awareness in Sacramento County mirrored that of the region at 30% (2002 again being the exception), which is not surprising as Sacramento County contains the largest proportion (71%) of the regional population. In Yolo-Solano AQMD, the anomalous year was 2001 when awareness was significantly lower (14%) than in the other districts. There were no significant differences in awareness between last year and this year in Yolo-Solano. Results from Placer County were similar to those of the region and of Sacramento County for all years except the current year, when the level of awareness was significantly lower at 21%. A possible explanation is that over half of all the Placer interviews took place on the day following the August 31 Spare the Air episode. It has already been shown that awareness was lower in all districts interviewed on that particular day (Sacramento County, Placer AQMD and El Dorado AQMD – no interviews took place in Yolo-Solano AQMD on that date). In fact, specific awareness in Placer was only 13% following the single-day Spare the Air episode, compared with a high of 40% on August 12 (following a two-day Spare the Air episode).

OBJECTIVE C:

The Spare the Air message is noticed: significantly more respondents heard, read, or saw advertisements about Spare the Air on Spare the Air days than on Control days in all districts.

One purpose of conducting interviews on non-Spare the Air days is to test for possible response bias – in the current example, this meant that it was important to verify that the percentage of respondents said they had heard or seen the Spare the Air announcements was significantly higher following Spare the Air days than on Control days. Results for each district and the weighted region are presented in the next chart.

Spare the Air vs Control Days: Percent of respondents who had heard, read or seen STA (ARB-worded question)



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

In terms of general awareness, 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), nearly six in ten 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. The same findings were found when specific awareness was measured – and the percentages of specific awareness on Spare the Air and Control days can be viewed in the second table in the next section.

OBJECTIVE D:

The 54% of respondents who were aware of Spare the Air in general translates into 731,000 drivers in the region as a whole noticed the advisory. Correcting for Control day responses, that is, the percentage respondents who said they noticed the advisory when one was not issued, this means that 406,220 drivers were aware of the 2004 Spare the Air campaign. In terms of specific awareness, this represented 284,185 drivers.

There are an estimated 1,353,250 drivers in the Sacramento region⁷ this year. It will be remembered that 54% of all respondents (region weighted) 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 (the ARB-worded question). Extrapolating to the

⁷ The number of drivers in the Sacramento region for 2004 was estimated, using the number of driver licenses by county for 2003, 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 2003 to 2004 (<http://www.dof.ca.gov/HTML/DEMOGRAP/e-table.xls>). The estimated number of licensed drivers for the total Sacramento region in 2004 was 1,353,250: Sacramento County: total 876,480 + Placer County: 223,300 * 87% for Air Quality district = 194,275; Yolo-Solano: total of 192,540 (116,540 in Yolo + 76,000 in Solano; El Dorado County: 132,270 * 68% for Air Quality district = 89,940.) Excluding El Dorado AQMD, the total number of estimated drivers in the region is 1,263,300.

population of drivers means that approximately 731,000 drivers in the region said they had heard the advertisements. However, we also know from Control day interviewing that some respondents (24% - see previous section in this report) said they had heard about Spare the Air when in fact no advisory had been issued. Correcting for Control day responses through subtraction, then, means that **406,220 drivers in the region as a whole** were aware of the 2004 Spare the Air campaign. The table below indicates the calculations and estimated number of aware (using the general question) drivers for each air district and the weighted region, both including and excluding El Dorado AQMD.

<i>Air District</i>	<i>Total Number of Drivers</i>	<i>Percent Aware of STA (in general) STA / Control</i>	<i>Estimated Number of Drivers Aware of STA (STA - Control)</i>
Sacramento County	876,480	56% / 26%	490,825 – 227,885 = 262,940
Yolo-Solano AQMD	192,540	59% / 22%	113,600 – 42,360 = 71,240
Placer AQMD	194,275	47% / 22%	91,300 – 42,740 = 48,560
El Dorado AQMD	89,940	35% / 15%	31,500 – 13,500 = 18,000
Weighted Region (excludes El Dorado)	1,263,300	56% / 25%	707,500 – 315,825 = 391,675
Weighted Region (includes El Dorado)	1,353,250	54% / 24%	731,000 – 324,780 = 406,220

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 levels of general awareness, have remained relatively stable over the course of the last five years⁸, at about 30%. On a regional level (including El Dorado), and correcting for Control day responses, this translates into an estimated **284,185 drivers** in the Sacramento region this year who were specifically aware of the Spare the Air message.

⁸ The 2002 season was the exception, when 40% were aware of STA.

<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	876,480	30% / 7%	262,950 – 61,350 = 201,600
Yolo-Solano AQMD	192,540	27% / 4%	52,000 – 7,700 = 44,300
Placer AQMD	194,275	21% / 4%	40,800 – 7,770 = 33,030
El Dorado AQMD	89,940	12% / 4%	10,800 – 3,600 = 7,200
Weighted Region (excludes El Dorado)	1,263,300	28% / 6%	353,725 – 75,800 = 277,925
Weighted Region (includes El Dorado)	1,353,250	27% / 6%	365,380 – 81,195 = 284,185

Purposeful Driving Reduction

Objectives

Awareness of the program is one indicator of the program's success. However, it is one thing to be aware of a program and another to actually change one's behavior because of it. In fact, the Air Resources Board (ARB) has a much more stringent standard 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.

The main objective of this section is therefore to measure the success of the Spare the Air program using the strict ARB standard. Specific objectives are to:

- E. determine the percentage of respondents who reported driving "less" the previous day and compare with results from the previous four 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

- and determine if the percentage of reducers is similar or different among four air quality districts in the Sacramento region (Sacramento, Yolo-Solano, Placer, and El Dorado)
- 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 Air Quality Basin who purposefully reduced the number of trips they made on Spare the Air days in 2004
 - I. estimate the number of **single trips** avoided by purposeful reducers, and
 - J. compare percentages of reducers between the group of respondents interviewed following Spare the Air days and the group interviewed on Control (non-Spare the Air) days.

The following questions were used to calculate 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 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

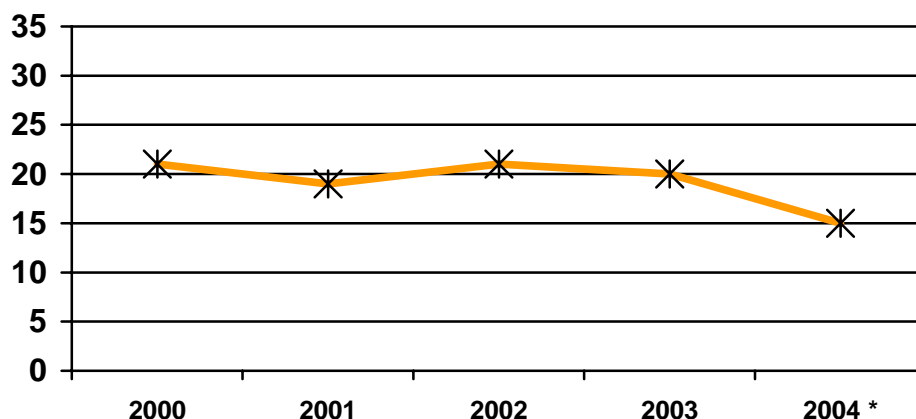
OBJECTIVE E:

Fifteen percent of regional respondents (excluding El Dorado AQMD) this year said they drove “less” on Spare the Air days. This is down significantly from each of the previous four years.

The first step in calculating driver reducers involved examining the percentage of respondents who said they drove “less” on a Spare the Air day (the day previous to the interview day). The exact wording of the question 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]?” Results from this year and the previous four years for the Sacramento air quality basin as a whole⁹ are presented in the next graph.

⁹ El Dorado AQMD is excluded from this analysis in order to make year-to-year comparisons.

Year-by-Year Comparison of Percent of STA respondents who drove "less" on Spare the Air days: Weighted Sacramento Region (excludes El Dorado)



* indicates a statistically significant difference from all other years

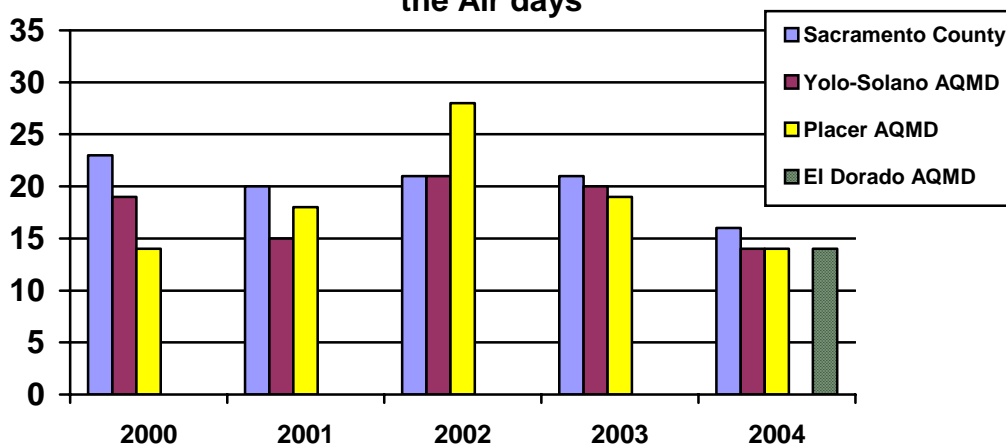
It can be seen that self-reported driving reduction from 2000 to 2003 was fairly stable, with about 20% of respondents saying they drove less on Spare the Air days. However, for the first time, this year the percentage of drivers in the region who said they drove less on a Spare the Air day was significantly lower at 15% than in all previous years. However, this decline in the percentage who said they drove less did not necessarily mean that respondents drove "more" on Spare the Air days in 2004 – it will be recalled that the question asked if respondents drove the "same", "more" or "less" the previous day. Further investigation revealed that the decline in the percentage who drove "less" was accounted for by a significant increase compared to previous years¹⁰ in the percentage of respondents who said they drove the "same." This year, 69% of respondents said they did not change their driving habits on Spare the Air days. It is possible that some respondents may already be driving less during Sacramento summers, precisely because the Spare the Air program has been in place for so long that it is now routine to reduce driving during the summer months (and therefore not have to make more efforts specifically on Spare the Air days.) This hypothesis was first proposed by Dr. Jude Lamare of the Cleaner Air Partnership.¹¹ Another possible explanation for the decline is that the 2004 season was relatively mild in terms of temperature and poor ozone air quality and in fact the first Spare the Air advisory was only issued in August, although the season typically starts in May. It is possible that high heat and high ozone are related to driving less and 2004 was also cooler on Spare the Air days compared to earlier years.

¹⁰ This was true for all previous years with the exception of 2001, where the 66% of respondents who said they drove the same did not differ from the 69% this year.

¹¹ See introductory letter accompanying the "Sacramento Region Air Quality Basin –'Spare the Air' Campaign 2003 Evaluation", available online at: www.cleanerairpartnership.org/images/STA03Eval.pdf.org/. "Those drivers who are voluntarily reducing driving on a regular basis to avoid air pollution do not count as "Spare the Air reducers," since our methodology specifically asks whether the driver drove less than he or she usually does. Drivers who routinely cut back on their driving would typically answer "no" to the question whether they drove less. To the extent that drivers have a regular program of cutting back on driving during the summer smog season, their contributions to air quality go unrecognized in this evaluation."

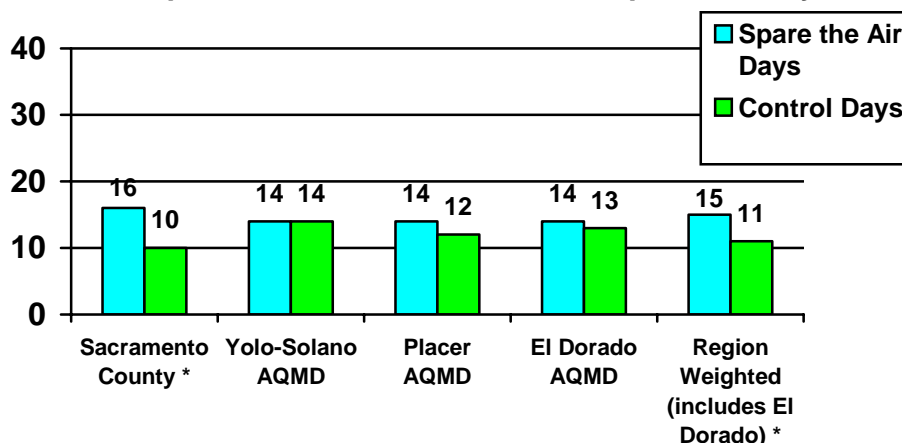
In terms of the individual air quality districts, results are presented in the next chart. Results for El Dorado AQMD are only available for this year, and indicate that 14% of respondents said they drove less on a Spare the Air day. It can be seen that there was a little more fluctuation within the individual jurisdictions from one year to the next than for the region as a whole (previous graph). The percentage of respondents who reported driving less in Sacramento County was down significantly this year (16%) from all previous years. In Yolo- Solano AQMD, results from this year (14%) were similar to those from 2001 (15%); and both were significantly lower than in either 2002 (21%) or 2003 (20%). In Placer AQMD, the highest (28%) percentage of drivers who said they drove less the previous day occurred in 2002, a particularly poor season air-quality wise. This year's 14% was significantly lower than last year's reported 19% of respondents, but not significantly different from the 14% in 2000 or the 18% in 2001.

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



The research methodology first developed by Dr. Jude Lamare of the Cleaner Air Partnership includes interviewing a group of respondents from the same jurisdictions on Control days (i.e. non Spare the Air days). This important cross-check feature allows us to correct for possible bias in the responses given by respondents about Spare the Air days. The next chart shows the percentage of respondents interviewed 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 in Sacramento County as well as the weighted region (including El Dorado), significantly more respondents in the Spare the Air group said they drove less the previous day (16% in Sacramento and 15% in the region) than in the Control group (10% and 11%, respectively). But in the three other air districts, namely Yolo-Solano, Placer, and El Dorado, no differences were found between the percentage who reported driving less on Spare the Air versus Control days.

2004 Spare the Air vs Control Days: Percent of respondents who drove "less" the previous day



* indicates a statistically significant difference

Last year, there were no significant differences between Spare the Air and Control groups of respondents in Sacramento County, and it was hypothesized at the time that perhaps the effectiveness of the program was fading. Results for Sacramento County for the last five years are presented in the next table. This year, although it is encouraging to see that the difference is once again significant, nevertheless, the overall decline in the percentage reporting driving reductions may be cause for concern: last year 21% of respondents in Sacramento County said they drove less on Spare the Air days, compared with only 16% this year. [In terms of Control day interviewing, 18% said they drove less the previous day in 2003 versus 10% this year.]

Year	Percentage of Spare the Air respondents who drove "less" yesterday: Sacramento County	Percentage of Control respondents who drove "less" yesterday: Sacramento County	Difference	Statistically Significant Difference?
2000	23%	12%	11%	Yes
2001	20%	14%	6%	Yes
2002	21%	17%	4%	Yes
2003	21%	18%	3%	No
2004	16%	10%	6%	Yes

OBJECTIVE F:

Additional efforts to influence actual driving reduction are needed: only 1.4% of all respondent drivers in the entire basin (including El Dorado AQMD) 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 did not differ significantly from one air district to the next, with the exception of El Dorado AQMD, which had no 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 question¹²). Results from each air district and for the weighted region as a whole are presented in the next table. It can be seen that for the entire region (including El Dorado), only 1.4% of all Spare the Air respondent drivers (15 out of 1046) met the strict ARB standard for purposeful driving reduction. The percentage was highest in Sacramento County at 1.6%, followed by Placer AQMD at 1.4%, and Yolo-Solano AQMD at 1.1%. However, none of these percentages were significantly different. The only jurisdiction that showed a difference was El Dorado AQMD: there were no (0%) purposeful driving reducers found in El Dorado. However, it should be pointed out that all 254 interviews in that district took place on just one interviewing day, (September 1, following the August 31 Spare the Air event) whereas interviewing in the other air districts was spread over the six 2004 season Spare the Air days.

<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>
Sacramento County	11	701	1.6%
Yolo-Solano AQMD	6	527	1.1%
Placer AQMD	7	507	1.4%
El Dorado AQMD	0	254	0%
Weighted Region (excludes El Dorado)	15	987	1.5%
Weighted Region (includes El Dorado)	15	1046	1.4%

¹² There were two questions in the survey that measured awareness of Spare the Air. The one referred to here measured general awareness and was proposed by the ARB (i.e. "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?"). It was introduced only in 2002. Comparisons of reducers with years prior to 2002 used another question to measure awareness, which was more specific (i.e. "Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?") It has been included in all evaluations since 1999. Typically, more respondents indicate general awareness of Spare the Air than specific awareness the previous day. Results of both kinds of awareness in 2004 are available from Jude Lamare, Ph.D. of the Cleaner Air Partnership in the "Report – Awareness of the 2004 Spare the Air Campaign" by N. Holobow, Ph.D. for Aurora Research Group.

OBJECTIVE G:

For Sacramento County and the weighted region as a whole, the percentage of reducers has stayed the same over the last five years (an average of 1.8% of all drivers interviewed following Spare the Air days). This was largely true in Yolo-Solano AQMD and Placer AQMD as well, with the exception of 2002, a season that produced more reducers than other years.

Tests of proportion were run comparing the percentage of reducers¹³ each year with every other year, within each air district and for the weighted region as a whole (excluding El Dorado AQMD as there were no historical data for that jurisdiction.) Results are presented in the next table. It can be seen, first of all, that in terms of the weighted region as a whole and Sacramento County in particular, the percentage of reducers has not changed significantly from one year to the next. For the region, the average percentage of all respondent drivers who were aware of Spare the Air and reduced driving specifically for air quality reasons on Spare the Air days over the past four years is 1.8%.

Spare the Air: purposeful aware reducers	2000	2001	2002	2003	2004	Significant Differences between years?
Sacramento County	2.0%	2.1%	2.3%	1.2%	1.6%	No
Yolo-Solano AQMD	1.3%	0.2%	3.5%	1.2%	1.1%	Yes – 2002 significantly higher than 2001, 2003 and 2004
Placer AQMD	1.0%	0.9%	3.9%	2.3%	1.4%	Yes – 2002 significantly higher than 2000, 2001, and 2004
Weighted Region (excludes El Dorado)	1.8%	1.7%	2.7%	1.4%	1.5%	No

It can be seen that in both Yolo-Solano AQMD and Placer AQMD, 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.]

¹³ Results from 2000 and 2001 were recalculated and 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 5 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.

OBJECTIVE H:

*Although the percentage of reducers is small at 1.4%, when extrapolated to the population of drivers in the region, it means that about **18,950** drivers purposefully made fewer trips on Spare the Air days in order to reduce air pollution.*

There are an estimated 1,353,250 drivers in the Sacramento region¹⁴ this year. Extrapolating to the population of drivers, the 1.4% of regional purposeful reducers means that approximately **18,950** 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.

<i>Air District</i>	<i>Total Number of Drivers</i>	<i>Percent of Purposeful Reducers</i>	<i>Estimated Number of Purposeful Reducers</i>
Sacramento County	876,480	1.6%	14,025
Yolo-Solano AQMD	192,540	1.1%	2,115
Placer AQMD	194,275	1.4%	2,720
El Dorado AQMD	89,940	0%	0
Weighted Region (excludes El Dorado)	1,263,300	1.5%	18,950
Weighted Region (includes El Dorado)	1,353,250	1.4%	18,950

OBJECTIVE I:

*For the weighted region as a whole, the drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.6 single trips each. This translates into a total of **68,220 trips** purposefully avoided on Spare the Air days during the 2004 season.*

¹⁴ The number of drivers in the Sacramento region for 2004 was estimated, using the number of driver licenses by county for 2003, 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 2003 to 2004 (<http://www.dof.ca.gov/HTML/DEMOGRAP/e-table.xls>). The estimated number of licensed drivers for the total Sacramento region in 2004 was 1,353,250: Sacramento County: total 876,480 + Placer County: 223,300 * 87% for Air Quality district = 194,275; Yolo-Solano: total of 192,540 (116,540 in Yolo + 76,000 in Solano; El Dorado County: 132,270 * 68% for Air Quality district = 89,940.) Excluding El Dorado AQMD, the total number of estimated drivers in the region is 1,263,300.

Drivers who said they drove less on Spare the Air days were also asked how many single trips in their car they avoided driving on the Spare the Air day in order to reduce air pollution. The mean number of single trips avoided by the 15 reducer drivers in the region as a whole was 3.6.¹⁵ Extrapolated to the estimated 18,950 drivers who purposefully reduced on Spare the Air days, this translates into an estimated **68,220** single trips that were avoided on Spare the Air days during the summer of 2004, 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>
Sacramento County	14,025	3.7	51,890
Yolo-Solano AQMD	2,115	3.3	6,980
Placer AQMD	2,720	2.5	6,800
El Dorado AQMD	0	0	0
Weighted Region (excludes El Dorado)	18,950	3.6	68,220
Weighted Region (includes El Dorado)	18,950	3.6	68,220

OBJECTIVE J:

In the weighted region as a whole and in Sacramento County, significantly higher percentages of drivers reduced driving for air quality reasons on Spare the Air days than on Control days, arguing positively for the continuation of the Spare the Air program – although the overall percentage of reducers is not high, at least some drivers are reducing the number of trips they might otherwise have made on Spare the Air days. In the other air quality districts, however, the percentages of reducers on Spare the Air and Control days were not significantly different this year.

¹⁵ The mean was 3.6, with a standard deviation of 2.68, the median was 3, and the range was 1 to 12 trips avoided.

Drivers interviewed on Control days were also asked if they had reduced the number of trips they made the day before. 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 therefore provides a validation check. [Among Control respondents, we obviously dropped the criterion of awareness of Spare the Air criterion and included only those respondents who said they drove less for air quality reasons.] The percentages of Control day drivers who said they made fewer trips the day before specifically for air quality reasons are presented in the next table, along with the percentages of already-described Spare the Air reducers. It can be seen that there were no individuals in Sacramento who reduced the number of trips they made for air quality reasons on Control days. Because Sacramento County carries the largest weight in the region as a whole, both regional analyses also indicated statistically significant differences between Spare the Air and Control percentages of reducers. This argues well for the continuation of the Spare the Air program, in that although overall percentages are not high, at least some drivers are reducing the number of trips they take on Spare the Air 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>
Sacramento County	1.6%	0%	Yes
Yolo-Solano AQMD	1.1%	0.7%	No
Placer AQMD	1.4%	0.5%	No
El Dorado AQMD	0%	0.4%	No
Weighted Region (excludes El Dorado)	1.5%	0.2%	Yes
Weighted Region (includes El Dorado)	1.4%	0.2%	Yes

Results were not quite so clear-cut in the other air districts, however. In Yolo-Solano AQMD, even though there were twice as many reducers on Spare the Air days (6 drivers) as on Control days (3 drivers), when the numbers were converted to percentages and a test of proportion run, the difference was not significant. This was also the case in Placer AQMD. In El Dorado, there was one individual who drove less in the Control group, versus none in the Spare the Air group. These results are consistent with those comparing the percentage of drivers who said they drove “less” on both Spare the Air and Control days (see page 3 of this report) – no significant differences were found in Yolo-Solano, Placer, or El Dorado.

A possible explanation for the individual district results is that the Spare the Air season this year was relatively mild – even though it was estimated that the AQI on the six Spare the Air days which were called would hit 127 or higher, none of the days actually realized the AQI of 127. In fact, the maximum AQI that occurred on a Spare the Air day was 116, on August 10, in Sacramento County. That same day, the AQI in Yolo-Solano AQMD was only 72, and in Placer, it was 101. It is possible that respondents may be more likely to take action on Spare the Air advisory days if in fact they directly experience soaring temperatures and poor air quality on the actual day in their air district. A separate report¹⁶ dealing with health issues during the 2004 season discusses this issue in more detail.

Estimated Emission Reductions

Objectives

As previous demonstrated (Purposeful Driving Reduction in the 2004 Spare the Air Season), only **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, it means that about **18,950 drivers** purposefully made fewer trips on Spare the Air days in order to reduce air pollution.

The main objective of this section in the report is to take this information a step further and estimate how many tons of ozone emissions were reduced during the 2004 season that could be attributed directly to the Spare the Air program. In order to do this, a correction factor based on Control day interviewing will be applied, in order not to overestimate possible reductions. The results will therefore be the most conservative possible.

Specifically, this will involve:

- K. 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,
- L. using the latest approved standard EMFAC2002 model (V2.2) run on the 2004 summer season to calculate 2004 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,
- M. doing this for each air quality management district that showed a significant difference in terms of the percentage drivers reporting driving less between Spare the Air and Control days, as well as the region as a whole, and
- N. comparing the emissions reductions estimated from last year with current results.

The calculation of purposeful reducers and the number of trips avoided by these respondents who reduced driving for air quality reasons came from the following questions in the survey:

¹⁶ See "Draft Report of Household Health Issues 2004 (10-31)", by Naomi E. Holobow, Ph.D. for Aurora Research Group, October 2004.

- “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?”¹⁷
- “About how many SINGLE TRIPS in your car did you avoid driving yesterday to reduce air pollution?” [This question was asked only of drivers who said they drove less for air quality reasons.]

Results

OBJECTIVES K, L, M, AND N:

The 2004 Spare the Air program was successful in reducing air pollution in the Sacramento air basin region (including El Dorado AQMD) by an estimated 1.16 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 methodology for calculating emission reductions is conservative as it eliminates many respondents from consideration (such as those who might have reduced their driving but for reasons other than air quality, or those who had the habit of driving less to reduce pollution but were not aware of the specific STA request not to drive). Results from the weighted region as a whole (including El Dorado) are used to illustrate the procedure, described next:

1. Calculate the percentage of drivers who said they were aware of the Spare the Air program¹⁸, and who also said they drove less than normal on Spare the Air days specifically for air quality reasons. For the weighted region as a whole (including El Dorado AQMD), this was 1.4% (15/1046) of all respondents interviewed following Spare the Air days.
2. These purposeful reducers were asked to estimate the number of single trips they avoided making on the Spare the Air day. Record the mean (average) number of single trips they avoided for air quality reasons on Spare the Air Days. For the weighted region, the mean was 3.6 single trips avoided, with a standard deviation of 2.68, and a median of 3. Answers ranged from 1 to 12 single trips avoided.
3. Extrapolate to the total number of drivers in the region¹⁹ this year: the percentage of

¹⁷ This question assessed awareness of the Spare the Air program and was proposed by the ARB. It was added to the questionnaire in 2002. An alternative measure of awareness used prior to that time continues to be tracked but did not yield different results.

¹⁸ Using the ARB-worded question for measuring general awareness of Spare the Air: “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?”

¹⁹ The number of drivers in the Sacramento region for 2004 was estimated, using the number of driver licenses by county for 2003, 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 2003 to 2004 (<http://www.dof.ca.gov/HTML/DEMOGRAP/e-table.xls>). The estimated number of licensed drivers for the total Sacramento region in 2004 was 1,353,250: Sacramento County: total 876,480 + Placer County: 223,300 * 87% for Air Quality district = 194,275; Yolo-Solano: total of 192,540 (116,540 in Yolo + 76,000 in Solano; El Dorado County: 132,270 * 68% for Air Quality district = 89,940.) Excluding El Dorado AQMD, the total number of estimated drivers in the region is 1,263,300.

STA reducers therefore represents 18,950 drivers in the Sacramento region, and the number of single trips avoided was 68,220 (18,950 drivers x 3.6 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 weighted region as a whole, there were no individuals who reduced driving trips on Control days for air quality reasons. Therefore, no control adjustment will be made.
5. Multiply the number of trips avoided by a per trip emission reduction average of 15.46 grams of ozone precursors²⁰ [this includes a combined total of ROG (3.63 grams per trip for light duty passenger cars and 4.53 grams per trip for light duty trucks) plus NOx (2.72 grams per trip for light duty passenger cars and 4.58 grams for 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 weighted region, this amounts to 1,054,680 grams of ozone precursors (68,220 single trips avoided x 15.46 grams per trip).
6. Convert to tons.²¹ For the Sacramento basin as a whole, this results in an estimated total of 1.16 tons of pollutants reduced per Spare the Air day. (And in this example, 0 tons reduced per Control day.)

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

Emissions Reduction Estimate for 2004 in the Sacramento Region

Weighted Sacramento Region (including El Dorado)	Percent of all respondent drivers who drove less for Air Quality reasons ²²	x Number of licensed drivers in Sacramento Region (1,353,250 total)	x Mean Number of single trips Reduced per day	x 15.46 grams of ozone precursors per trip (EMFAC 2002)	= Estimated Tons per day of ozone precursors reduced
Spare the Air Days	1.4% (15/1046)	18,950	x 3.6= 68,220	1,054,680 grams	1.16 tons
Estimated tons of ozone precursors reduced per day: (STA day reductions – Control day reductions)					1.16 tons

²⁰ Based on EMFAC2002 V2.2 SMAQMD spreadsheet figures provided by Peter Christensen, SMAQMD, December 3, 2004. Models were run for the summer of 2004. The total ROG as well as NOx tons for light duty passenger cars as well as light duty trucks were converted to lbs. (multiply by 2,000) and then to grams (multiply by 454) before dividing by the total number of trips, (i.e. 3,111,990 for light duty passenger cars, and 1,764,410 for light duty trucks) in order to obtain the average grams per trip. These are the figures considered most accurate at this point in time.

²¹ There are 907,200 grams in a ton.

²² 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 awareness question).

7. Next, apply a correction factor in the form of subtracting the Control day air quality emission reduction from the Spare the Air day reduction. This ensures that only purposeful driving reduction due to the Spare the Air program is counted in the estimate of emission reduction.
8. The correction for the Control days in this instance is 0 tons of ozone precursors, which, when subtracted from the 1.16 tons reduced on Spare the Air days, leaves a balance of **1.16 tons of ozone precursors reduced per Spare the Air day in 2004.**

Individual Air Quality Management Districts

Only in Sacramento County were there significant differences between Spare the Air day and Control day reports of driving less. Therefore emission reductions from Spare the Air driving reduction for other individual air districts were not calculated.

It can be seen in the next table that in Sacramento County, air pollution was reduced by an estimated **0.88 tons of ozone precursors** per Spare the Air day, specifically due to residents driving less.

Emissions Reduction Estimate for 2004 in Sacramento County

Sacramento County	Percent of all respondent drivers who drove less for Air Quality reasons ²³	x Number of licensed drivers in Sacramento County (876,480 total)	x Mean Number of single trips Reduced per day	x 15.46 grams of ozone precursors per trip (EMFAC 2002)	= Estimated Tons per day of ozone precursors reduced
Spare the Air Days	1.6% (11/701)	14,0250	x 3.7= 51,890	802,220 grams	0.88 tons
Estimated tons of ozone precursors reduced per day:					0.88 tons

Summary of Sacramento County Results:

The 2004 Spare the Air program was successful in reducing air pollution in the Sacramento County by an estimated 0.88 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.

²³ 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 awareness question).

Comparison with Previous Year

The estimated emission reductions from last year²⁴ and this year for Sacramento County and the weighted region (excluding El Dorado) are presented in the next table. It can be seen that, relative to last year, there has been an increase in the amount of emissions reduced this season through drivers purposefully driving less on Spare the Air days.

<i>Estimated Tons of Ozone Precursors Reduced on Spare the Air Days</i>	<i>2003</i>	<i>2004</i>
Sacramento County	.55 tons	.88 tons
Weighted Region (excludes El Dorado)	0.84 tons	1.16 tons

Health Issues

Objectives

It is known that air pollution can cause many people “to experience symptoms such as watery eyes, coughing, or wheezing. Even for healthy people, polluted air can cause respiratory irritation or breathing difficulties during exercise or outdoor activities.”²⁵ The main objective of the current report is to document the relationship between poor air quality and the perceived health effects experienced by residents of the Sacramento Air Quality Basin during the summer of 2004.

Additional objectives are to:

- O. compare 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
- P. estimate the number of households in the Sacramento Air Quality Basin whose health was affected by poor air quality specifically due to air pollution on Spare the Air days in 2004
- Q. determine if reported health problems during summer Spare the Air seasons have increased, decreased, or stayed the same from 2000 to the present,
- R. see whether health problems are similar or different among three air quality districts in the Sacramento region (Sacramento, Yolo-Solano, Placer), and

²⁴ In 2003 although there were significant differences between purposeful reducers on STA versus Control days in all air districts and the region as a whole, the percentages who said they drove “less” were not significantly different. This was felt to be an anomaly and therefore this year, we used the original criteria of estimating emission reductions in only those jurisdictions where significantly more STA respondents said they drove “less” than Control respondents.

²⁵ Spare the Air website at: <http://www.sparetheair.com/index.cfm?page=aqi>

- S. determine the incidence of health related problems in El Dorado²⁶ this year.

Included in the questionnaire used to measure the effectiveness of the Spare the Air campaign during the last 5 years is the following health-related question:

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

This year, a few additional health-related questions immediately followed:

- “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?
 - d. Allergy symptoms?”

Results

OBJECTIVE O:

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

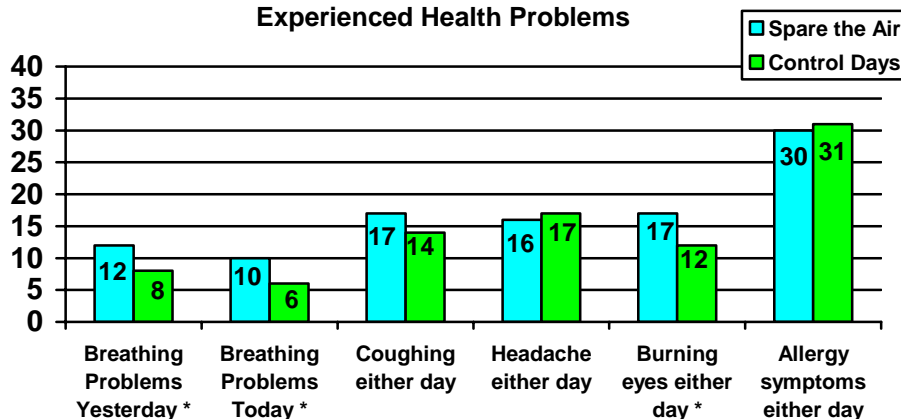
The next chart indicates the percentage of respondents interviewed following Spare the Air days and on Control days who said they or someone in their household experienced health problems,²⁷ for the region as a whole (excluding El Dorado AQMD). It can be seen that a significantly higher percentage of Spare the Air versus Control respondents experienced breathing problems on the Spare the Air day (12% vs. 8%) as well as on the day of the interview (10% vs. 6%), and burning eyes on either day (17% vs. 12%).

The percentage of households in which someone experienced allergy symptoms was about 30% - allergy symptoms did not appear to be worse on Spare the Air days. In other words, households did not experience more allergy symptoms due to poor air quality on Spare the Air days. This was also true in terms of the percentages of households experiencing coughing and headaches – there was no significant difference between Spare the Air and Control day results.

²⁶ In previous years, the El Dorado air quality district was not included in the evaluation. This year a total of 502 interviews were conducted in El Dorado – 254 following Spare the Air days, and 248 on Control days. Results will be treated separately.

²⁷ Excludes responses of don't know/undecided.

Spare the Air vs Control Groups: Percent of Sacramento Air Quality Basin Respondents (weighted) whose Households Experienced Health Problems



* indicates a statistically significant difference

OBJECTIVE P:

Correcting for Control days, an additional 29,270 households in the Sacramento basin experienced breathing problems during Spare the Air days specifically due to air pollution.

This year 12% of respondents in the region (excluding El Dorado) claimed that someone in their household experienced breathing problems on a Spare the Air day. Extrapolated to the number of households in the region,²⁸ this means that an estimated 87,770 households experienced breathing problems on Spare the Air days. Eight percent of respondents reported health problems on Control days, or 58,500 households. Correcting for Control days through subtraction, then, this means that an additional **29,270** households experienced breathing problems due specifically to air pollution.

Using the same methodology of correcting for Control day responses, the number of additional households who still experienced breathing problems on the interview day was 29,250, and the number of households with burning eyes was 36,600.

OBJECTIVE Q:

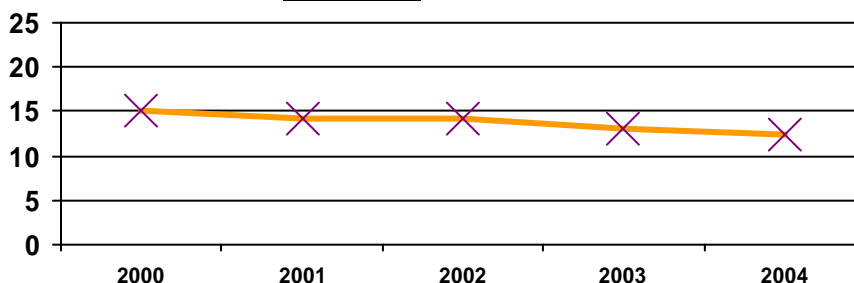
The percentage of respondents reporting breathing difficulties in the region on Spare the Air days has stayed the same for the region as a whole during the last five years.

The next graph plots the percentage of respondents in the region (again, excluding El Dorado for the moment) who said someone in their household had trouble breathing on a Spare the Air day from 2000 to the present. It can be seen that five years ago, 15% of respondents had

²⁸ 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, 2004, Revised 2001-2003, with 2000 DRU Benchmark. Sacramento, California, May 2004. Available online at: <http://www.dof.ca.gov/HTML/DEMOGRAP/E-5a.xls> The estimated number of households for the entire Sacramento region air quality basin is 731,423 (Sacramento County: 512,912 + (Placer County: 129,311 * 87% = 112,500) + Yolo-Solano : 106,011 (Yolo: 67,027; Solano (Dixon, Rio Vista & Vacaville: 38,984).

difficulty, followed by two years where 14% experienced problems, and last year in 2003, 13% of respondents experienced health problems. Tests of proportion indicated that there were no significant differences among the years – the reported level of breathing difficulty caused by air pollution on Spare the Air days has remained stable over the last five years.

Year-by-Year Comparison of Percent of respondents whose households experienced breathing trouble on STA days: Weighted Region

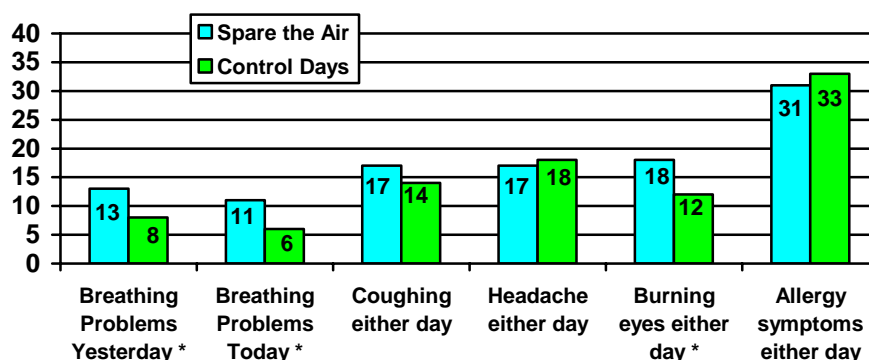


OBJECTIVE R:

*Respondents in Sacramento County and Yolo-Solano AQMD had similar health issues – the percentages reporting **breathing difficulties** (13% in both districts) and **burning eyes** (about 18%) on Spare the Air days was significantly higher than on Control days. There was an anomaly in Placer AQMD and when results were re-analyzed by actual AQI levels, it could be seen that the immediate health effects of unhealthy air were reported increases in **coughing**, **headaches**, and **burning eyes**. Allergy symptoms seem not to be aggravated by poor air quality in all three counties – perhaps because medication modulates symptoms.*

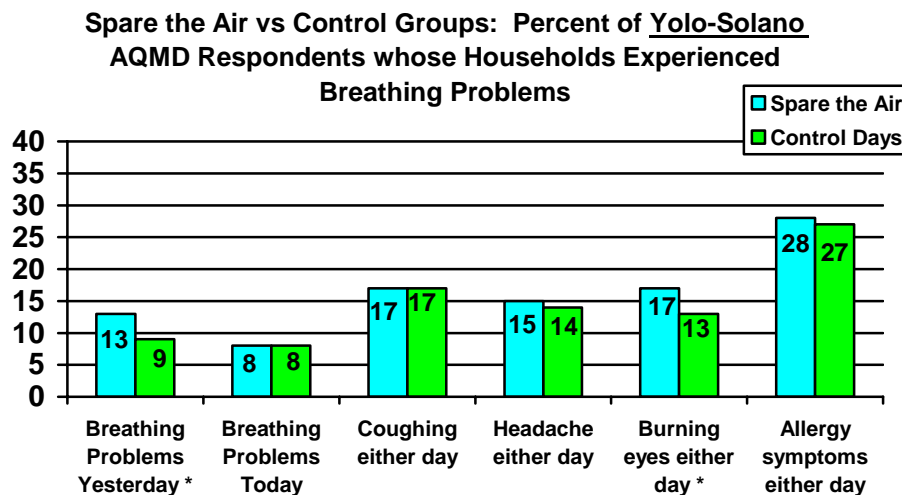
In terms of the individual counties, results from Sacramento County were similar to those for the region as a whole – more households experienced breathing difficulties and burning eyes in the Spare the Air group than in the Control group of respondents. Response percentages are presented in the next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

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



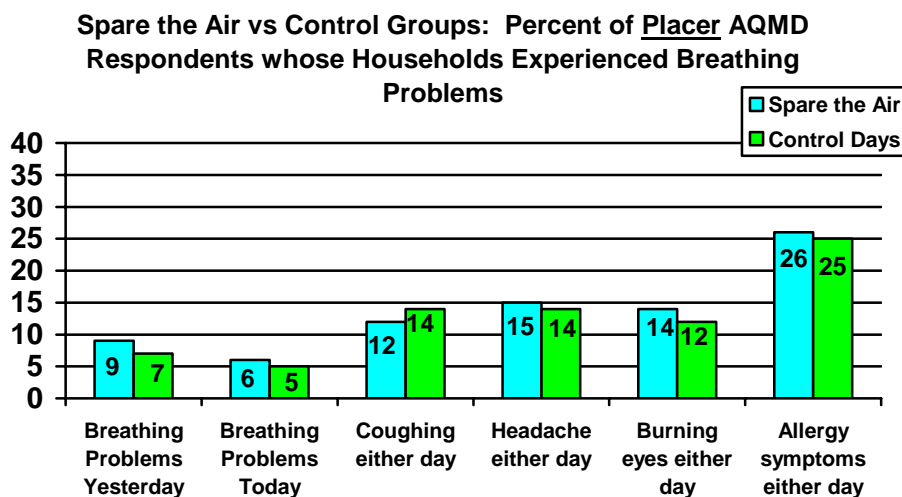
* indicates a statistically significant difference

Results from respondents in the Yolo-Solano AQMD are presented in the next chart. It can be seen that a higher percentage of households in the Spare the Air group versus the Control group experienced breathing difficulties on the Spare the Air day and burning eyes either on the Spare the Air day or on the day of the interview.



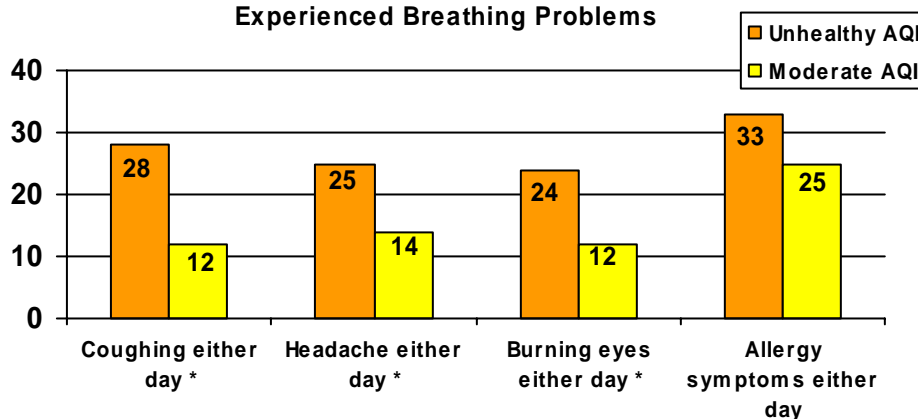
* Indicates a statistically significant difference

Placer AQMD results are presented in the next chart. It can be seen that only 9% of households experienced breathing difficulties on Spare the Air days (this is significantly lower than the 13% in Sacramento County households), and also that there were no significant differences between Spare the Air and Control group responses:



Further examination indicated an interesting anomaly which took place in Placer AQMD. It was previously mentioned that the trigger for calling a Spare the Air day relied on forecasted AQI estimates. August 11 was advertised as a Spare the Air day; however, the actual AQI in Placer on August 11 was only 61 (Moderate). Interviewing took place on the following day (i.e. August 12), when, extraordinarily, the AQI registered 145 (Unhealthy for Sensitive Groups). As this was the highest recorded AQI for the entire season, it warranted further study. We created two new groups of Placer respondents: those who were interviewed on the day the AQI hit 145 versus all others (where the AQI ranged from 41, or Good; to 90, or Moderate). In other words, this new grouping was based only on the AQI of the day of interview – regardless of whether respondents were in Spare the Air or Control groups.²⁹ Results were re-analyzed and are presented in the next chart. It can be seen that the percentage of households reporting specific events of coughing, headaches, and burning eyes (“either yesterday or today”) on the day the AQI hit 145 increased to over a quarter of all those interviewed, and was significantly higher than on the good or moderate AQI interviewing days. In other words, there is evidence from Placer respondents that poor air quality (as measured by an AQI of well over 100) contributed directly to increases in health problems manifested by coughing, headaches and burning eyes.

**Unhealthy for Sensitive Groups versus Moderate AQI Groups:
Percent of Placer Respondents whose Households
Experienced Breathing Problems**

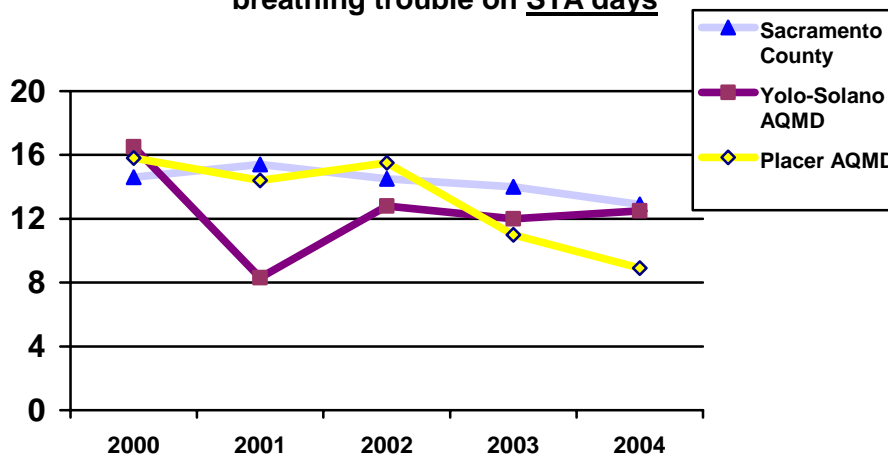


* Indicates a statistically significant difference

Year-by-year results of the percentages of respondents who had trouble breathing on Spare the Air days by sub-regions are plotted in the next graph. It can be seen that the percentage of households reporting breathing problems on Spare the Air days has remained relatively stable among the three air quality districts from one year to the next with two notable exceptions: there was an anomaly in Yolo-Solano in 2001 when significantly fewer households experienced difficulties than in other districts, and in Placer - significantly fewer households this year than in 2000, 2001, and 2002 experienced breathing difficulties (a possible explanation was described above).

²⁹ In fact, except for August 12, the AQI on all the other interviewing days following Spare the Air days ranged between 43 (good) and 90 (moderate). The AQI range for Control day interviewing was about the same: 41 (good) to 90 (moderate). It is important to remember that this particular analysis is about the AQI on the day of the interview, and not the AQI of the day before. The question asked about health problems “either yesterday or today”, and therefore is still appropriate for this analysis of an unusual interviewing day in Placer AQMD.

Year-by-Year Comparison of Percent of respondents whose households experienced breathing trouble on STA days



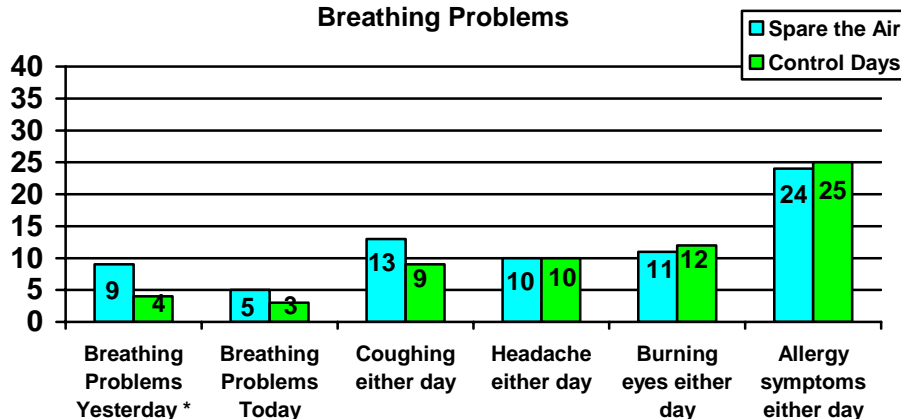
OBJECTIVE S:

Significantly more households experienced trouble breathing on the Spare the Air day than on Control days in El Dorado, and this percentage (9%) was not significantly different from the other three air quality districts. The percentages of households reporting more specific health problems were more similar to those of Placer respondents on moderate AQI days than they were to Sacramento or Yolo-Solano households following Spare the Air days. In fact, the lowest AQI (40) occurred on the interviewing day following a Spare the Day.

This year interviews were also conducted in El Dorado air quality district³⁰ - 254 following the August 31 Spare the Air Day and 248 on Control days (Sept 22, Sept 29, Oct 6, and Oct 7). Results are presented in the next chart. It can be seen that significantly more households experienced breathing difficulties on the Spare the Air day (9%) than on the Control days (4%).

³⁰ The air quality district in El Dorado includes residents from El Dorado Hills, Placerville, Shingle Springs, Georgetown, Cool, and the following unincorporated zip codes: 95613, 95619, 95623, 95633, 95635, 95651, 95664, and 95672.)

Spare the Air vs Control Groups: Percent of El Dorado AQMD Respondents whose Households Experienced Breathing Problems



* Indicates a statistically significant difference

The actual AQI on the Spare the Air day was 101, the start of the scale for Unhealthy Air for Sensitive Groups. The 9% of households reporting difficulties is not significantly different from the 9% in Placer, nor the 13% reported in Sacramento and Yolo-Solano AQMD. However, the percentages from the other health-related questions tended to be significantly lower than those reported in Sacramento and Yolo-Solano. In fact, they more closely resembled those reported in Placer on “Moderate” AQI days (see the additional Placer analysis reported above). Further examination revealed this to be a plausible explanation: not only was the AQI considered “Moderate” on all the interviewing days in El Dorado; it was actually the lowest (40) on the day following the Spare the Air event.

Employer Participation

Objectives

Part of the “Spare the Air” program is an Employer Network, which encourages Sacramento region businesses to participate by communicating Spare the Air advisories to their work forces. Subscribing companies receive notification of the current Spare the Air episode electronically, and they in turn have a choice as to whether to inform their employees directly through e-mail, or through signs about Spare the Air days, or to ask them to sign up individually with AirAlert³¹. Last year, approximately 120 employer companies participated in the Employer Network.

The objectives of the current section are to:

- T. 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,

³¹ AirAlert is a free service that automatically notifies subscribers by e-mail, text pager, and/or digital cell phone text message any time ozone reaches unhealthy levels in the Sacramento region. Subscribers (www.myairalert.net) can choose the level of notification they require (“unhealthy for sensitive groups,” “unhealthy,” or “very unhealthy”). In addition, Spare the Air Day alerts are automatically sent to all subscribers a day in advance, to notify them of a Spare the Air day. Improvements made in 2003 included adding yesterday’s maximum AQI to AirAlert forecast e-mails; adding five-day forecasts, and allowing real-time AirAlert notifications to be disabled. In addition, a tool for employer network subscriptions was added.

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

Introduced in 2003 into a larger questionnaire designed to measure the effectiveness of the Spare the Air campaign, the following questions were again used to measure employer participation, and were asked only of those respondents 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:
 - i. Send emails to employees about poor air quality days?
 - ii. Post signs about poor air quality days?
 - iii. Ask employees to sign up for Air Alert notification?”

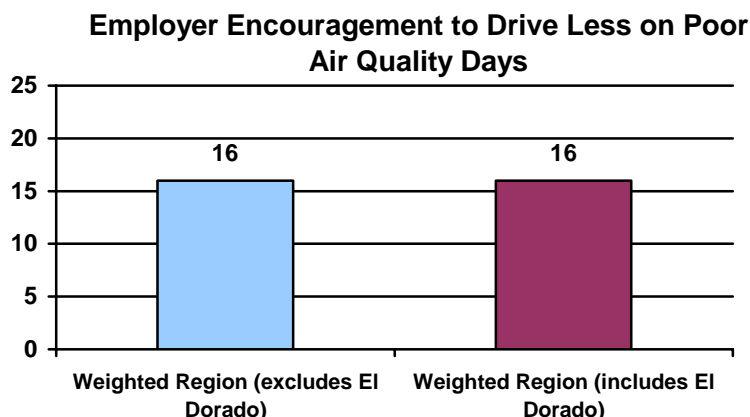
Results

OBJECTIVE T:

This year, 16% of employed respondents in the Sacramento region as a whole (both including and excluding El Dorado AQMD) said their employer encourages them to drive less on days of poor air quality.

The next chart plots the percentages of employed respondents who said their employer encourages them to drive less on poor air quality days³². Since we did not ask respondents what county they worked in, it would not be accurate to show results from each individual county, as they would be based on where the respondents resided. Only weighted results for the region as a whole will therefore be discussed. It can be seen in the next chart that for the weighted region as a whole (both including and excluding El Dorado), employer participation in Spare the Air was 16%. Given that the 2004 season had a relatively low profile in terms of Spare the Air announcements (only 6 advisories were issued this year), this level of employer participation is quite good, although there is obviously room for much greater participation.

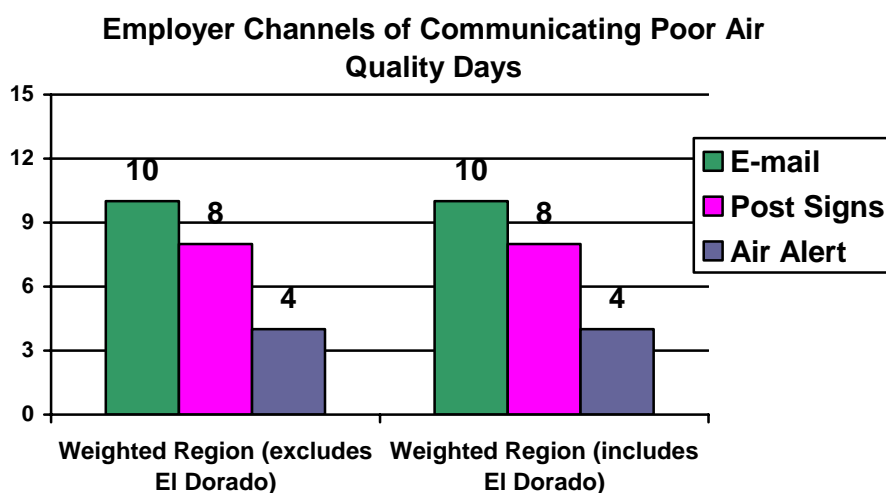
³² For this analysis, self-employed respondents and those who were undecided or refused to answer were excluded.



OBJECTIVE U:

E-mail notification by the employer remains the most frequently used information channel to notify employees of Spare the Air days at 10%. Eight percent of employers post signs about poor air quality and 4% ask their employees to sign up for Air Alert notification.

Respondents were then asked if their employer informed them of days of poor air quality by e-mail, or posted signs, or by asking them to sign up for Air Alert notification. Results are presented in the next chart. It can be seen that the most common method of notification was by e-mail, at 10%. This was followed by posted signs (8%). Only 4% of employers encouraged their employees to sign up for Air Alert notifications. There were no significant differences among the air quality districts in terms of information channels used by employers.

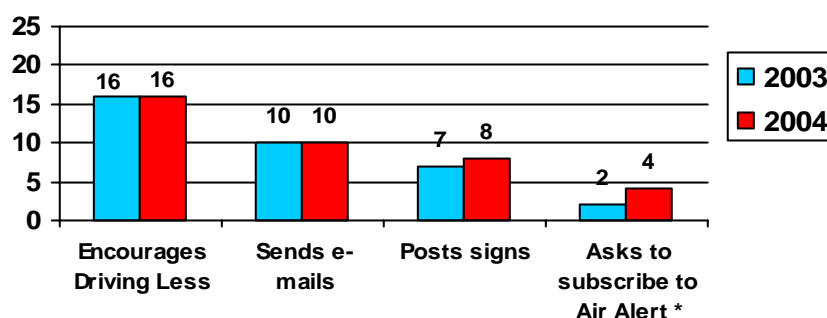


OBJECTIVE V:

Employer participation remained the same as last year, at 16%. The percentages of employers using e-mail to notify their employees and posting signs also did not differ from last year. However, the percentage who asked their employees to sign up to Air Alert notifications increased significantly this year. Although still low at only 4% participation, this is nevertheless significantly different from the 2% of employers last year who asked their employees to subscribe to Air Alert.

As 2003 was the first year we introduced employer participation questions into the survey, this year’s results can only be compared with last year. Results for the weighted region (excluding El Dorado) are presented in the next graph. The only significant difference between the years was in terms of encouraging subscriptions to Air Alert: this year 4% of employers asked employees to subscribe, compared with only 2% in 2003.

**Employer Participation: 2003 versus 2004
(Weighted Region)**



* significant difference between 2003 and 2004

Seasonal Trip Reductions

Objectives

Annual evaluations of the Spare the Air public education program were designed to measure episodic driving reduction – that is, to calculate the percentage of drivers who reduce the number of trips they make on Spare the Air days for air quality reasons, and use this to estimate the quantity of emissions reduced. In other words, only driving reduction **directly** attributable to the Spare the Air program is typically measured. However, this excludes another group of drivers, namely, those who routinely drive less during the summer but are never counted as Spare the Air reducers:

“Those drivers who are voluntarily reducing driving on a regular basis to avoid air pollution do not count as “Spare the Air reducers,” since our methodology specifically asks whether the driver drove less than he or she usually does. Drivers who routinely cut back on their driving would typically answer “no” when asked if they drove less. To the extent that drivers have a regular program of cutting back on driving during the

summer smog season, their contributions to air quality go unrecognized in this evaluation.”³³

There is a potentially large emission reduction from this particular group of drivers that could be claimed by the Sacramento regions’ air quality districts. This report represents a first attempt to raise awareness by addressing the issue of seasonal driving reductions, with a view to encouraging ways of estimating the emission reductions from this group in future evaluations. The specific objectives are to:

- W. 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.
- X. calculate the percentage of seasonal trip reducers and the mean number of trips made this and in previous years’ evaluations.

The incidence of seasonal trip reductions was calculated from answers to a series of questions that were asked as part of the larger survey designed to measure the effectiveness of the Spare the Air program. First, the number of self-reported vehicle trips made by respondent drivers on both Spare the Air and Control days 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?”

In 2004 only, the survey asked:

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

Results

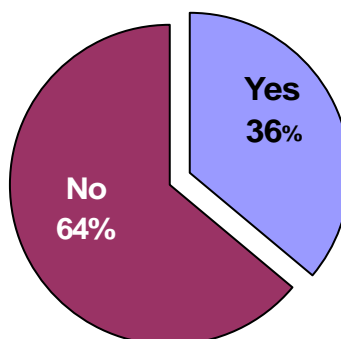
OBJECTIVE W:

Over a third of all respondents are seasonal driving reducers – they say they usually reduce the amount of driving they do during the summer to avoid adding to air pollution. These reducers reported entering their cars significantly fewer times (mean of 3.39) than those respondents who said they did not usually reduce driving during the summer (mean of 3.87.) In other words, seasonal driving reducers made an average of half a trip less per day than non-reducers. This could translate into substantial emission reductions.

³³ Jude Lamare, Ph.D., The Cleaner Air Partnership, February 2004., Introduction to the 2003 Spare the Air Campaign Evaluation.

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. All respondents were asked whether they usually reduced the amount of driving they do during the summer to avoid adding to air pollution. Results (weighted for the region, including El Dorado), shown in the next pie chart, indicate that 36% of all respondents said they seasonally reduce driving for air quality reasons.

Seasonal Driving Reducers: * 2004 Results, Including El Dorado



* Do you usually reduce the amount of driving you do during the summer to avoid adding to air pollution?"

It is possible that at least some of the drivers who said they normally reduced driving during summer months could represent, in one sense, the success of previous Spare the Air campaigns. They do not fit our strict criteria for measuring this year's Spare the Air purposeful driving reducers³⁴ because they 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.

In other words, these respondents represent a group who are reducing emissions on a daily basis, which is important. However, we have not previously attempted to quantify the precursor emissions reduced and include them in our estimates of emission reductions when measuring the effectiveness of the Spare the Air program because that calculation has so far been reserved only for purposeful driving reducers who heard the Spare the Air message not to drive (as suggested by the Air Resources Board). It is therefore very conservative.

However, as can be seen in the next table, our data indicate that the 36% of respondents who seasonally reduce driving reported entering their cars the previous day an average of 3.39 times. Those who said they did not usually reduce the amount of driving they do during the summer to avoid adding to air pollution reported entering their cars an average of 3.87 times. An analysis of variance indicated that these means were statistically different from each other:³⁵

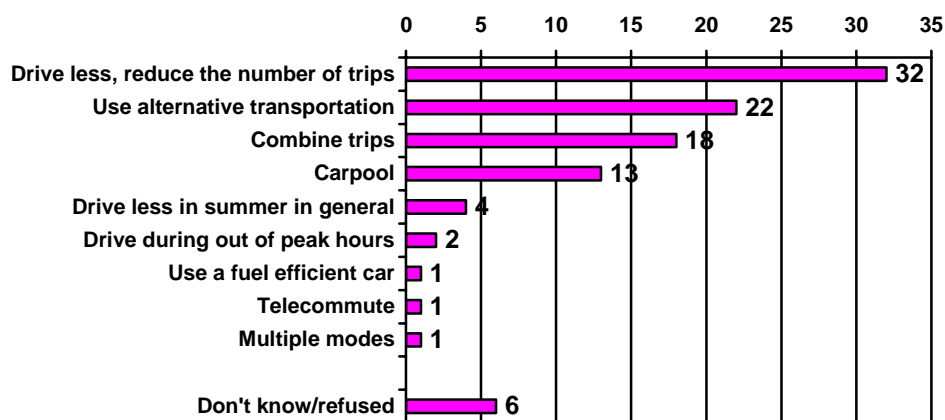
³⁴ The methodology for calculating purposeful driving reducers was episode-specific and included only those drivers who: said they drove "less" on Spare the Air days, were aware of Spare the Air (according to an ARB worded-question), and did so specifically for reasons of air quality.

³⁵ $F(1,1608) = 4.51, p < .05$

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.** This could translate into substantial emission reductions (one possible estimate indicates **4.15 tons** of ozone precursors reduced), should the air quality management districts wish to calculate the impact in the future.³⁶ This reduction is clearly much greater than the Spare the Air reduction (see 2004 report on Purposeful Driving Reduction: 1.4 % of all drivers purposefully avoided an average of 3.6 trips each on Spare the Air days). 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 air basin, thus slowing the formation of ozone leading to Spare the Air conditions.

	<i>Seasonal Driving Reducers: Mean # Times Entered Vehicle</i>	<i>Non-Reducers: Mean # Times Entered Vehicle</i>	<i>Statistically Significant Difference?</i>
Weighted Region (Including El Dorado)	3.4	3.9	YES

We asked these seasonal driving reducers what they had done to reduce driving this summer to decrease air pollution. Their comments were entered and later categorized. Results are presented in the next graph. It can be seen that nearly a third of these respondents said they reduced the number of trips they made. Another 22% used alternative transportation and a further 18% combined trips. Thirteen percent said they carpoled to decrease air pollution.



³⁶ The methodology for estimating emission reductions would have to be agreed upon. However, if we applied a similar methodology to that used to calculate emission reductions for purposeful reducers (see 2004 Final Report – Estimated Emission Reductions), based on the EMFAC2002 V2.2 model, one possible estimate is that **4.15 tons** of ozone precursors were reduced through seasonal driving reduction behavior. [36% of 1,353,250 drivers x .5 single trips reduced per day x 15.46 grams of ozone precursors per trip / 907,200 grams = 4.15 tons].

A few representative comments³⁷ from those who said they drove less and reduced the number of trips they made are included below to give the reader a flavor of the kinds of responses:

- “By not leaving my office at lunchtime, and making fewer errand-type trips.
- Cut down my driving, less driving. I take care of my most important business first and my not important business last.
- Cut down on the amount of driving I have to do. Reroute.
- Driving only when I need to. On my days off, I don't drive.
- Go shopping less, walk, my husband and I drive together when we go out.
- I've just cut some of the further away destinations out.
- I avoid making trips out to eat by bringing my own food to work. I try to make errands in a loop to avoid extra out of the way driving.
- I just tried to make one trip to the grocery store twice a week instead of more than that.
- I try to drive less.
- Less trips to store, post office, that kind of thing.
- Whatever we need we can put off for a few days. I used to be a weatherman I know what pollution is.”

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

- “I carpool and use public transportation: carpooling with coworkers and taking a bus during the summer.
- Cycling and using public transit.
- By using public transportation, I ride the bus to Sacramento. I take the train to San Francisco.
- I walk and ride a bike.
- Sometimes I just bicycle to work.
- I don't drive that much in the summer. I walk, ride my bike, and carpool.
- I walk, ride my bike or roller blade.
- I take public transportation or I walk.”

A few comments from those who said they combine trips include:

- “By making trips more efficient. Doing multiple things on one day instead of going out as often.
- By trying to do multiple errands at the same time so I don't have to drive all over town.
- Combining errands or trips that need to be made.
- Drive trying to consolidate errands to one day or one trip.
- Limit errands to once, maybe twice a week in the evenings. Like shopping-type errands. It's more important to me because I have a daughter to think about, for her future. Teaching her good habits.
- Consolidating trips. Instead of making half a dozen I do it all at once or do it on a different day or do it at night.
- I make one trip. I just route where I'm going, so I don't have to backtrack.”

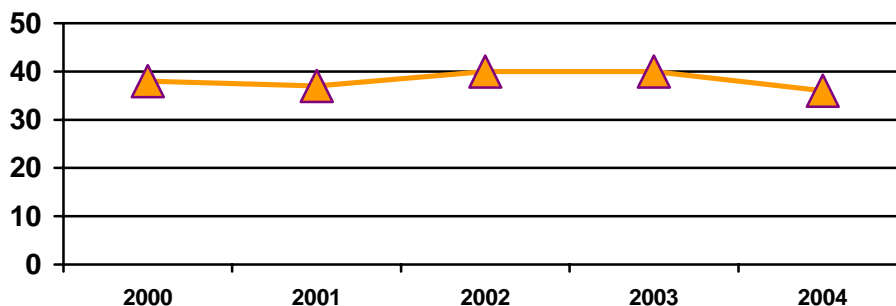
³⁷ The complete transcripts of all responses are available in the statistical file.

OBJECTIVE X:

For the past five years, the percentage of seasonal trip reducers has remained relatively stable; ranging from 36% to 40% 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 five 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 graph that follows indicates that over a third of all respondents in evaluations from the past five years said they usually reduce the amount of driving they do during the summer to avoid adding to air pollution. This indicates that a fairly stable percentage of drivers can be classified as seasonal reducers. As discussed previously in this report, such reductions are not “counted” in our evaluations of the effectiveness of the Spare the Air program, but perhaps attempts should be made in the future to quantify this group’s emissions reductions.

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



Further analyses comparing the mean number of times the seasonal reducers entered their cars versus their non-reducing counterparts also show consistency with this year’s results – in that seasonal reducers in each year 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. The next table shows the average number of trips reported for both groups of drivers (regional weighted results) since 2000. It can be seen that seasonal trip reductions ranged from half a trip per day (this year and in 2000) to just over 1 trip per day (2001 and 2003). 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.e. if they normally reduced the number of trips they made for air quality reasons during the summer months, they may not have told us that they drove “less” on the day prior to the interview because they were already making as few trips as possible. They would therefore not be asked further questions about the number of trips they reduced and so would not enter into the calculations of emission reductions.)

	Seasonal	Non-	

<i>Year</i>	<i>Driving Reducers: Mean # Times Entered Vehicle</i>	<i>Reducers: Mean # Times Entered Vehicle</i>	<i>Statistically Significant Difference?</i>
2000	3.6	4.1	Yes
2001	3.1	4.2	Yes
2002	3.1	4.1	Yes
2003	3.1	4.2	Yes
2004	3.4	3.9	Yes

SUMMARY CONCLUSIONS

Awareness

- ❖ Significantly more respondents in the region were aware of Spare the Air in general (approximately 56%) than were specifically aware of being asked not to drive the previous day due to unhealthy air (approximately 30%). Awareness (both types) was significantly higher in Sacramento County and Yolo-Solano AQMD than in Placer AQMD or El Dorado AQMD, but further investigation showed this might be episode-specific.
- ❖ With the exception of 2002 (a very poor air quality season), awareness of Spare the Air in the region as a whole and in Sacramento County has essentially stayed the same at about 30% for the past five years. Yolo-Solano AQMD results were also fairly stable, with the exception of 2001. Awareness in Placer AQMD was significantly lower this year than in previous years, but this could be due in part to a large number of interviews being conducted following the single-day Spare the Air episode at the end of August.
- ❖ Significantly more respondents heard, read, or saw advertisements about Spare the Air on Spare the Air days than on Control days in all districts. In other words, more respondents heard the advisory and did not just say they did.
- ❖ Extrapolating to the population of drivers and correcting for Control day interviewing indicates that 406,200 drivers in the region as a whole noticed the advisory in general, and 284,185 drivers were specifically aware of the request not to drive on Spare the Air days during the 2004 season.

Purposeful Driving Reduction

- ❖ Fifteen percent of regional respondents (excluding El Dorado AQMD) this year said they drove “less” on Spare the Air days. Although this is down significantly from each of the previous four years, Spare the Air respondents reported driving significantly “less” than Control respondents, indicating that the program is still able to influence driving behavior.
- ❖ Additional efforts to influence actual driving reduction are needed: only 1.4% of all respondent drivers in the entire basin (including El Dorado AQMD) 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 did not differ significantly from one air district to the next, with the exception of El Dorado AQMD, which had no reducers.
- ❖ For Sacramento County and the weighted region as a whole, the percentage of reducers has stayed the same over the last five years (an average of 1.8% of all drivers interviewed following Spare the Air days). This was largely true in Yolo-Solano AQMD and Placer AQMD as well, with the exception of 2002, a season that produced more reducers than other years.
- ❖ Although the percentage of reducers is small at 1.4%, when extrapolated to the population of drivers in the region, it means that about 18,950 drivers purposefully made fewer trips on Spare the Air days in order to reduce air pollution.

- ❖ For the weighted region as a whole, the drivers who purposefully reduced driving on Spare the Air days avoided making an average of 3.6 single trips each. This translates into a total of 68,220 trips purposefully avoided on Spare the Air days during the 2004 season.
- ❖ In the weighted region as a whole and in Sacramento County, significantly higher percentages of drivers reduced driving for air quality reasons on Spare the Air days than on Control days, arguing positively for the continuation of the Spare the Air program – although the overall percentage of reducers is not high, at least some drivers are reducing the number of trips they might otherwise have made on Spare the Air days. In the other air quality districts, however, the percentages of reducers on Spare the Air and Control days were not significantly different this year. This may be partially accounted for by the relatively mild 2004 season.

Estimated Emissions

- ❖ The 2004 Spare the Air program was successful in reducing air pollution in the Sacramento air basin region by an estimated 1.16 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 reductions in Sacramento County attributed to the Spare the Air program were 0.88 tons per day. Reductions in the other air quality management districts 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.
- ❖ Emission reductions were higher this year than last year in the region as a whole and in Sacramento County. However, the percentage of reducers was not different from last year, although the average number of reported trip reductions was higher this year than last year. The apparent “improvement” in emission reductions should therefore be treated with caution as the actual number of purposeful reducers is so small.

Health Issues

- ❖ Poor air quality contributes to household health problems: breathing difficulties and burning eyes were experienced by more households in the region on and following Spare the Air days than on Control days.
- ❖ Correcting for Control days, an additional 29,270 households in the Sacramento basin experienced breathing problems during Spare the Air days specifically due to air pollution.
- ❖ The percentage of respondents reporting breathing difficulties in the region on Spare the Air days has stayed the same for the region as a whole during the last five years.
- ❖ Respondents in Sacramento County and Yolo-Solano AQMD had similar health issues, and significantly more households experienced trouble breathing on Spare the Air than on Control days.

- ❖ There was an anomaly in Placer AQMD and when results were re-analyzed by actual AQI levels, it could be seen that the immediate health effects of unhealthy air were reported increases in coughing, headaches, and burning eyes.
- ❖ Significantly more households experienced trouble breathing on the Spare the Air day than on Control days in El Dorado, and this percentage (9%) was not significantly different from the other three air quality districts.
- ❖ Allergy symptoms seem not to be aggravated by poor air quality – perhaps because medication modulates symptoms. The percentage of households with allergy symptoms is about 30% of the regional population.

Employer Participation

- ❖ This year, 16% of employed respondents in the Sacramento region as a whole said their employer encourages them to drive less on days of poor air quality.
- ❖ E-mail notification by the employer remains the most frequently used information channel to notify employees of Spare the Air days at 10%. Eight percent of employers post signs about poor air quality and 4% ask their employees to sign up for Air Alert notification.
- ❖ Employer participation remained the same as last year, at 16%. The percentages of employers using e-mail to notify their employees and posting signs also did not differ from last year. However, the percentage who asked their employees to sign up to Air Alert notifications increased significantly this year. Although still low at only 4% participation, this is nevertheless significantly different from the 2% of employers last year who asked their employees to subscribe to Air Alert.

Season Trip Reductions

- ❖ Over a third (36%) of all respondents are seasonal driving reducers – they say they usually reduce the amount of driving they do during the summer to avoid adding to air pollution.
- ❖ These reducers reported entering their cars significantly fewer times (mean of 3.4) than those respondents who said they did not usually reduce driving during the summer (mean of 3.9.) In other words, seasonal driving reducers made an average of half a trip less per day than non-reducers.
- ❖ This could translate into substantial emission reductions (one estimate is that 4.15 tons of ozone precursors were reduced per summer day in 2004), and is therefore an area that warrants further consideration.
- ❖ For the past five years, the percentage of seasonal trip reducers has remained relatively stable, at over a third 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 five years, seasonal driving reducers made between half a trip to just over one trip per day less than non-reducers.
- ❖ The emission reduction quantification for seasonal trip reduction should therefore be further investigated to determine if it contributes to avoidance of ozone build-up and thus avoidance of Spare the Air days.