# Evaluation
# of the
# 2013 Sacramento Region
# Spare The Air Campaign

Prepared by

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## BACKGROUND & METHODOLOGY

### Background

The public outreach program **Spare The Air** was created in 1995 to engage the general public in voluntarily helping to solve the problem of ozone air pollution. The U.S. Environmental Protection Agency (EPA) designated the Sacramento region a **severe ozone nonattainment area** for the 1997 federal 8-hour ozone standard with an attainment deadline of June 2019. The region fails to meet the federal health based 8-hour ozone standard,[1] thus affecting the quality of life and health of area residents, particularly during the summer months. The Sacramento Nonattainment Area includes Sacramento County, Yolo County, and parts of Placer, Solano, El Dorado and Sutter Counties.

The Sacramento Metropolitan Air Quality Management District (SMAQMD) estimates that about 70% of the Sacramento region's air pollution is caused by emissions from vehicles and other mobile sources. Unhealthy levels of ground-level ozone are created when volatile organic compounds (VOC) and nitrogen oxides (NOx), primarily from cars, trucks, construction and agricultural equipment, lawn mowers, and other mobile sources, react in the presence of sunlight and form ozone in hot weather conditions. Ozone pollution is lowest in the morning and reaches its highest levels in the afternoon and early evening hours. The residential driving population is therefore a large contributor to the air quality problem in the region.

The Spare The Air program provides residents in the Sacramento region with information and resources to protect their health during the summer smog season (May to October) by encouraging them to be aware of ozone levels and by asking motorists to reduce their driving on days when unhealthy air is predicted. Outreach efforts included radio advertising featuring various air quality tips, a website (www.SpareTheAir.com) including "Scooter's Corner" for children, social media (Facebook and Twitter), as well as appearances at events, newsletter article placements, etc. 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), which are provided by Sonoma Technology Inc. Estimates are derived using mathematical predictive modeling procedures on actual measurements obtained by local air districts and the California Air Resources Board at air quality monitoring sites throughout the region. If it is estimated that the AQI will be above the threshold of 127 the next day, a Spare The Air advisory is issued by the Sacramento Metropolitan AQMD by 12:00 p.m. In previous years the AQI estimate was required to reach a threshold of 150 before a Spare The Air announcement was issued. The reduction in AQI threshold reflects the most recent statement issued by the Obama administration enforcing the latest federal ozone health standard. The Spare The Air advisory involves notifying the public through a variety of communication channels, including paid radio

[1] The latest federal ozone health standard is .075 parts per million averaged over 8 hours. This standard became effective May 27, 2008. From 1997 to May 2008, the federal 8-hour ozone standard was .08 parts per million averaged over 8-hours.

and television announcements, email Air Alerts, news broadcasts, the Spare The Air website, and the Sacramento Bee.

Spare The Air days are called for the Sacramento Nonattainment Area as a whole, but all air quality districts within the area may not have the same conditions. For example, foothill districts (such as Placer and El Dorado) sometimes experience poorer air quality than central plain districts such as Yolo-Solano. To some extent this is due to the fact that ozone created by all drivers in the region travels east into the foothills. It is, therefore, important that the Spare The Air message continue to involve everyone in the basin, although the air quality in individual districts on specific days may not be poor.

## Spare The Air 2013 Season

Air quality in the region is still improving. There were **two** Spare The Air days called during the summer smog season of 2013 which ran from May to October.[2] Comparatively, and considering the recent drop in AQI threshold for predicting a Spare The Air day, only two Spare The Air days is a significant indicator of improving conditions.

Further examination of the daily maximum Air Quality Index (AQI) for the Nonattainment Area revealed that the recorded actual AQI for ozone did not meet or exceed the 127 threshold on either of the two Spare The Air days. In other words, Spare The Air advisories were issued for days when the actual air quality turned out not to have been as poor as was expected, as can be seen in the table below.[3]

Even with the reduction of the AQI threshold from 150 to 127 between the 2011 and 2012 season, that 2013 included only two Spare The Air days is remarkable. It is clear that air quality is still improving in the Sacramento Nonattainment Area.

| *Spare The Air date* | *Forecast AQI* | *Actual Maximum AQI* | *Health Level for Actual AQI* | *Reporting Station of Actual Maximum AQI* |
|---|---|---|---|---|
| ***August 18*** | 127 | 109 | Unhealthy for Sensitive Groups | Placer |
| ***September 9*** | 127 | 104 | Unhealthy for Sensitive Groups | Sacramento |

[2] The two Spare The Air Days were Sunday, August 18; and Monday, September 9.

[3] AQI figures obtained from the Historical Data section at www.sparetheair.com .

## Media Buy

The 2013 Spare The Air paid advertising campaign consisted of radio, TV, small outdoor billboards and online banner ads to inform a broad audience of campaign messaging. For episodic advisories, addition to the TV and radio messages, website banner ads based on new creative and new advisory ads appeared during Spare The Air days.

### General Media Buy

In 2013, a total of $132,010 was spent on the general radio Spare The Air awareness campaign.[4] It ran from the first week of May to the last week of August,[5] and used radio and television commercials, small outdoor billboards and online web banner ads to reach residents. They were designed to create awareness of air quality issues and provide air improvement tips.

### Specific Episodic Media Buy

This year, a total of $25,890 was spent on episodic TV and radio commercials, 33 gas station radio stations, and Digi Boards for outdoor advertising on the two Spare The Air days.[6] The amount spent per episode was:

- August 18 episode = $11,030.00
- September 9 episode = $14,860.00

## Research Objectives

Annual evaluations (with the exception of 1997) have been conducted since 1995 to assess the effectiveness of the Spare The Air program. Levels of awareness, driving behaviors, health issues, and estimated emission reductions have been measured and tracked. In the early 2000s, numerous discussions took place between the Cleaner Air Partnership and staff of the California Air Resources Board (ARB) to arrive at an evaluation procedure acceptable to both. In 2002 an ARB-suggested question about general awareness was incorporated into the questionnaire in order to be able to calculate their definition of what qualifies as a "reduced" trip.[7]

The specific evaluation objectives were to:

1. Measure general awareness and the specific episodic request not to drive on Spare The Air days among drivers in the Sacramento Nonattainment Area.
2. Measure the effectiveness of the Spare The Air program in terms of reduced driving among drivers who were aware of the program and purposefully reduced the number of trips they made due to air quality reasons.
3. Estimate emission reductions from the trips reduced during Spare The Air episodes.[8]

[4] More money was spent on advertising this year than in 2012, but less than historical amounts. For example, the general media buy was $178K in 2008, compared to a general buy of $132K in 2013.

[5] Email message from Keri Dent, Katz & Associates, January 29, 2014.

[6] Email message from Keri Dent, Katz & Associates, January 29, 2014.

[7] The ARB recommended that only trip reductions from drivers who were aware of the Spare The Air program and purposefully reduced the number of trips they made on Spare The Air days specifically for air quality reasons should be counted in the measurement of the emissions reductions attributable to the program. This is the definition of a purposeful reducer.

[8] Methods for estimating ozone precursor reductions based on the survey data have been used in all evaluations conducted since 1999 but were based on different Emission Factor models over the years. Estimates were based on the Summer On-Road

4. Compare awareness of the Spare The Air campaign and driving reduction among the individual air quality management districts in the Sacramento Nonattainment Area.
5. Measure the percentage of drivers who habitually drive less during the summer season in order to improve air quality, and estimate the emission reductions from this group of seasonal reducers.
6. Track awareness and behavioral changes over time.

## Research Methodology

Since 1995, two groups of respondents have been interviewed, one following Spare The Air days, and the other following non-Spare The Air (or Control) days, matched for the same day of the week as the Spare The Air interviews. A further control is that no interviews are conducted on rainy days. This type of experimental design adjusts for any overstatements individuals might make about their reported driving reduction on Spare The Air days (social desirability response bias), by providing a means of calculating a correction or adjustment factor. More accurate estimates about the number of drivers and households impacted by the Spare The Air program and the amount of emissions reduced are therefore obtained by subtracting this correction factor from the results. Including Control day data provides the most conservative estimates of program effectiveness. Control day data also have provided other insights into driving behavior.

## Sampling Frames

In previous years, telephone interviews were conducted with samples of residents throughout the air basin, using Random Digit Dialing (RDD) procedures in which a computer generates phone numbers from known landline area codes and prefixes. Prior to 2011, these samples have only included landline numbers and not cell phone numbers, and, although Spare The Air interviewing has always set quotas based on geography, age, and gender, it is becoming more and more difficult to survey young adults in the U.S. aged 18 to 34 years via a landline-only frame. As cell phone use in the United States grows, the potential for coverage bias in RDD telephone surveys may also increase if they continue to exclude most cell phone numbers.

This potential for coverage error stemming from the growth of the cell phone-only population has led to the development of dual frame, random digit dial (RDD) surveys. In these dual frame designs, a traditional sample from the landline RDD frame is supplemented with an independent sample from the banks of numbers designated for cellular phones.

The 2011 and 2012 surveys adopted this dual-frame design for Sacramento County only to determine what differences may exist between cell-phone and landline interviewees in the Sacramento Metropolitan AQMD. For both survey years, comparisons between the two groups of Spare The Air respondents (landline RDD sample versus cell phone RDD sample) on key questions revealed **no significant differences in responses**. Results from both **groups were**

Inventory - EMFAC 2011 v 2.3 model, for the summer of 2013, provided by Charles Anderson, Program Coordinator, SMAQMD Planning & Emission Inventory in an email dated November 21, 2013..

**therefore combined**, new weights for the entire nonattainment area were calculated and all results reported include the Sacramento cell phone sample responses. Because no differences were found between landline RDD sample and cell phone RDD sample, and the cost of including cell phone samples far outweighs the cost of landline samples, **the 2013 survey year did not include any cell-phone sample interviews**.

## Sampling Design

The next table summarizes the targeted maximum number of completed interviews for both Spare The Air and Control days.[9] The goal was to conduct up to 1,200 interviews following Spare The Air days and 1,200 following Control days. The margin of error associated with a sample of 1,200 is +/– 2.5%, at a 95% confidence level.

| Air District | Spare The Air interviews | Control day interviews |
|---|---|---|
| **Sacramento Metropolitan:** | Up to | |
| **RDD landline** | 400 | 300 |
| **Yolo-Solano AQMD** | 300 | 300 |
| **Placer County APCD** | 300 | 300 |
| **El Dorado County AQMD** | 200 | 300 |
| **Maximum Total** | 1,200 | 1,200 |

Within each air district, quotas were set with respect to geographic area, age, and gender.[10] Additionally, respondents were screened so that only those who had driven within the last week were interviewed.

## Interviewing Strategy

A continuing challenge in terms of methodology is trying to estimate the number of Spare The Air days each season so that interviewing days and the number of completed interviews can be representative of the season and still provide adequate statistical precision. A field house needs advance notification and a target of a certain minimum number of interviews on a given day in order to maximize efficiency and contain costs. The strategy adopted was to conduct

[9] It should be noted that the sampling design is for the maximum number of interviews to be completed. Due to the uncertainty about the number of Spare The Air days in each season, the actual number of completed interviews is often less than the targeted maximum.

[10] Interviewing took place only in the relevant zip codes within certain counties (i.e. in Placer County, zip codes north or east of Auburn were excluded as well as those west of Vacaville in Solano County and those east of Placerville in El Dorado County). In order to avoid potential unbalanced and biased samples quotas were set for gender and age in order to ensure that respondents were representative of the population as a whole. It is well-known in survey research that certain groups (such as elderly females) are more likely to respond to telephone interviews than others (such as young males).: so, for example, no more than 13% of the 400 interviews conducted in Sacramento County were to have been with females aged 65 years and older; and no fewer than 10% were to be conducted with males aged 18 to 24. It has also been the case that residents in Davis are more likely to answer surveys than residents in other areas of the Yolo-Solano Air Quality Management District and so a quota of no more than 20% of interviews were to be conducted with Davis residents.

approximately 150-200 interviews throughout the region (proportionally representative of the population in general by county), starting with every occurrence of a Spare The Air advisory, and then deciding on an episode-by-episode basis whether to conduct interviews, taking into consideration the month within the season, the day of the week, and whether the event was single or multi-day, until the maximum number of budgeted interviews and the best coverage was obtained. Because the first Spare The Air day in the 2013 season did not occur until August 18, and the second on September 9, the target number of completed interviews for each day was increased to 300 to attempt collecting a statistically valid sample size.

Interviewing took place the day following each Spare The Air day. Control day interviewing took place only in September. Control day interviews were matched in terms of the day of the week (Monday and Tuesday) of the Spare The Air day interviews, and took place on September 16, 17, 23, 24, and 30. Because the total number of completed Spare The Air day interviews was lower than usual, the number of completed Control day interviews was increased to reduce the likelihood of sampling error when comparing Spare The Air to Control day responses. Consequently, there were 5 days on which Control group interviews took place.

## Respondents

In Sacramento Metropolitan AQMD, Yolo-Solano AQMD, Placer County APCD, and El Dorado County AQMD interviews were conducted with a random representative sample of landline telephone.

Respondents included a total of **1,223 drivers**, following both Spare The Air as well as Control days. Results for the Sacramento Nonattainment Area as a whole were weighted proportionally.[11] The next table lists the number of completed interviews for each group along with their affiliated margins of error (at the most conservative level).

It can be seen that a total of **549** interviews were conducted on days following Spare The Air episodes. Control day calling completed **674** interviews. When weighted,[12] the total number of completed interviews was 263 following Spare The Air days, and 366 on Control days in the Sacramento Nonattainment Area as a whole. In order to be able to compare current results

[11] Based on 2013 estimates from the 2010 US Census: State of California, Department of Finance, *E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2012 and 2013* available online at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls The total population in the entire Sacramento nonattainment area [including El Dorado AQMD] is 2,211,806: [Sacramento Metropolitan AQMD (66%) - 1,450,121; Yolo-Solano AQMD (15%) - 324,240 (this includes the total 204,118 from Yolo County and 120,122 from the Dixon, Rio Vista and Vacaville areas of Solano County); Placer County APCD (15%) – 314,663 (this figure represents the 87% of Placer County's 361,682 residents who do not live in zip codes north or east of Auburn), El Dorado AQMD (5%) - 122,781 (this figure represents 68% of El Dorado County's 180,561 residents, and 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).

[12] Weighted, includes El Dorado County AQMD. Since the beginning evaluation in 1995, the methodology for weighting has been to set Sacramento Metropolitan AQMD interviews as 1, and down-weight interviews from all other counties appropriately, adjusted proportionally to the population within each air district. (Sacramento Metropolitan AQMD represents 66% of the entire population, Yolo-Solano AQMD is 15%, Placer County APCD is 15%, and El Dorado County AQMD is 5%.) This is why the weighted total number of completed interviews (i.e. 514) is less than the sum of the total number of interviews conducted in all air districts (i.e. 976).

with those from previous years' evaluations, El Dorado County[13] results have been excluded from some of the year-to-year analyses, and the "**Sacramento Core Region**" is the term used for the combined air districts of Sacramento Metropolitan AQMD, Yolo-Solano AQMD, and Placer County APCD. Proportions and weights were appropriately re-calculated for these analyses.[14]

| *Number of Completed Interviews (unweighted)* | *Spare The Air Days* | *Margin of Error* | *Control Days* | *Margin of Error* |
|---|---|---|---|---|
| **Sacramento Metropolitan AQMD:** | **166** | +/- 7.6% | **240** | +/- 6.3% |
| **Yolo-Solano AQMD** | **138** | +/- 8.3% | **159** | +/- 7.9% |
| **Placer County APCD** | **135** | +/- 8.4% | **160** | +/- 7.7% |
| **El Dorado County AQMD** | **110** | +/- 9.3% | **115** | +/- 9.1% |
| **Total Regional (Unweighted)** | **549** | +/- 4.2% | **674** | +/- 3.8 |
| **Total Regional (Weighted)** | **263** | **+/- 6.0%** | **366** | +/- 5.1% |

## The Questionnaire

The main body of the questionnaire has remained the same in order to maintain consistency, although slight modifications have sometimes occurred, due to information needs or budget constraints. In 2002 a question about Spare The Air awareness that was worded by the Air Resources Board (ARB)[15] was added and has been included every year since. All surveys were conducted using a Computer Assisted Telephone Interviewing (CATI) system. In 2010 four questions that dealt with employer encouragement on Spare The Air days were deleted in order to save on costs. Questions about cell phone versus regular/wired phone use were added in 2011 and 2012. This year those questions were removed. The questionnaire was translated

[13] Interviews with residents in El Dorado County AQMD were only conducted in 2004, 2006, 2007, 2008, 2009, 2011, 2012, and 2013.

[14] Excluding El Dorado AQMD, the new proportions for the smaller Sacramento Core Region for 2013 are: 70% in Sacramento Metropolitan AQMD, 15% in Yolo-Solano AQMD, and 15% in Placer County APCD.

[15] ARB memo dated April 26, 2002 by J. Weir, J. Lu, & E. Schreffler sent to J. Lamare, Cleaner Air Partnership.

into Spanish and approximately 2% of all interviews were conducted in that language. The average interview lasted just under 4 minutes. A copy of the 2012 questionnaire is included as Appendix B.

### Questions about Driving Behavior on the Previous Day

The questionnaire begins by asking respondent drivers how many times they entered a vehicle to drive the preceding day, and then whether they had driven the "same", "more" or "less" than usual. Respondents who reported driving "less" were then asked what they did instead of driving and why they reduced driving. Those who drove less for air quality reasons were then asked to describe how many single trips they avoided.

### Questions about Air Quality

After the portion of the interview about driving, respondents were asked questions about air quality. Awareness of the Spare The Air program was asked in two questions, and the order of these two was randomized so as to eliminate any possible order-response bias. The two questions are:

1) 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?" (the ARB-worded question)

2) Specific awareness of the request not to drive: "Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?" (original question)

Respondents were also asked whether they typically tried to reduce driving for air quality reasons in the summer, and if so, what they had done specifically this past summer to avoid adding to air pollution.

## Caveat

The sole purpose of this report is to provide a collection, categorization and summary of public opinion data. Meta Research intends to neither endorse nor criticize the Spare The Air program, the Sacramento Metropolitan Air Quality Management District (SMAQMD), Yolo-Solano AQMD, Placer County APCD or El Dorado County AQMD; Katz and Associates or their policies, products, or staff. The Client (SMAQMD) shall be solely responsible for any modifications, revisions, or further disclosure/distribution of this report.

# RESULTS & CONCLUSIONS
# AWARENESS OF THE 2013 SPARE THE AIR CAMPAIGN

## *Objectives*

The specific objectives of the current section are to:

a. Measure awareness of the 2013 Spare The Air campaign and determine if awareness was similar or different among drivers in four air quality districts in the Sacramento Nonattainment Area (Sacramento Metropolitan AQMD, Yolo-Solano AQMD, Placer County APCD, and El Dorado County AQMD).
b. Determine if awareness during annual summer Spare The Air seasons has increased, decreased, or stayed the same from 2000 to the present.
c. Compare levels of awareness between respondents interviewed following Spare The Air days and those interviewed on Control (non-Spare The Air) days.
d. Extrapolate the results to the population by estimating the number of **drivers** who were aware of the 2013 Spare The Air campaign (correcting for Control days).
e. Identify which media outlets most noticeably disseminated Spare The Air information by using responses from participants regarding where each read/heard/saw notifications about air quality.

## *Results*

### General Awareness

*1* ➢ ***The level of general awareness of Spare The Air in 2013, which only had two (2) Spare The Air days, decreased from previous years – an average of 32% of respondents in the entire Sacramento region had heard, read, or seen the Spare The Air advertisements. Data are consistent with the developing trend of fewer Spare The Air days due to lower air pollution readings resulting in lower awareness. The 32% translates into an estimated 707,777 residents in the Sacramento Nonattainment Area who were aware of the 2013 Spare The Air campaign.***

The Spare The Air season runs from May through October of each year. This year there were two Spare The Air days.[16] Levels of general awareness of Spare The Air have been measured since 2002 with the following question:

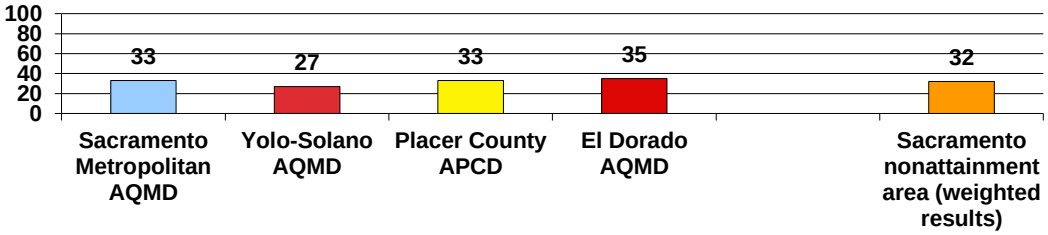
> "In the past two days have you heard, read, or seen any advertisements or news broadcasts about Spare The Air, or poor air quality, or requests to drive less in this area?"

The next chart indicates 2013 levels of general awareness for residents in the individual air districts as well as in the entire Sacramento nonattainment area as a whole (weighted results[17]). It can be seen that on average, 32% of respondents in the entire region were

[16] The two Spare The Air Days were Sunday, August 18 and Monday, September 9. Interviewing took place following each day.

aware of Spare The Air in general, translating to 707,777 residents[18]. In terms of the individual air quality districts, it can be seen that general awareness ranged from 27% in Yolo-Solano AQMD to 35% in El Dorado AQMD. However, the differences among individual air districts were not statistically significant.

**2013 General Awareness of Spare The Air (ARB wording)**




***The 2010 and 2011 reports indicate that a decrease in awareness is not synonymous with a decline in the efficacy of the Spare The Air program. Instead, these reports suggest that a decrease in general awareness may be explained by a relationship between the number of Spare The Air episodes in a season and general awareness of the program. Data from 2013 are consistent with this trend.***

Considering that a major contribution to general awareness is the occurrence of Spare The Air episodes, it follows that general awareness will be lower the fewer Spare The Air episodes occur in a season. To test this notion, a correlation analysis was conducted using number of Spare The Air days in a year and the average general awareness of the Sacramento Core Region[19] for that year. Results indicate a strong correlation,[20] supporting the claim that fewer Spare The Air days results in decreased general awareness. That general awareness in 2013 marks a significant decrease from previous years may be explained at least in part by this phenomenon.

Also in support of the notion that fewer episodes results in decreased awareness are the 2011 and 2012 tests of a relationship between consecutive episodes and media penetration.

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17 See methodology section for a complete description of weighting methods. Interviews were conducted with random digit dialed (RDD) samples of residents with landline phones in all counties, and an additional RDD cell phone sample of residents in Sacramento County (only).

18 Based on 2013 estimates from the 2010 US Census: State of California, Department of Finance, *E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2012 and 2013* available online at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls The total population in the entire Sacramento nonattainment area [including El Dorado AQMD] is 2,211,806: [Sacramento Metropolitan AQMD (66%) - 1,450,121; Yolo-Solano AQMD (15%) - 324,240 (this includes the total 204,118 from Yolo County and 120,122 from the Dixon, Rio Vista and Vacaville areas of Solano County); Placer County APCD (15%) – 314,663 (this figure represents the 87% of Placer County's 361,682 residents who do not live in zip codes north or east of Auburn), El Dorado AQMD (5%) - 122,781 (this figure represents 68% of El Dorado County's 180,561 residents, and 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).

19 Weighted Results

20 ($r = .73$, $p < .005$)

The 2011 report found a significant and positive relationship between multi-day episodes and general awareness. The 2012 report found moderate support for the same claim. Though the 2013 season included no multi-day episodes, the lack of episodes and decrease in general awareness are also consistent with the possible relationship between multi-day episodes and general awareness.

## Specific Awareness: Request Not to Drive

***2 ➢ 11% of respondents in the Sacramento region were aware of the specific request not to drive on Spare The Air days. When extrapolated to the entire population, this means that an estimated 243,298 residents were aware of Spare The Air advisories.***

Since 1995, specific awareness of the request not to drive has been measured every survey year with the following question:

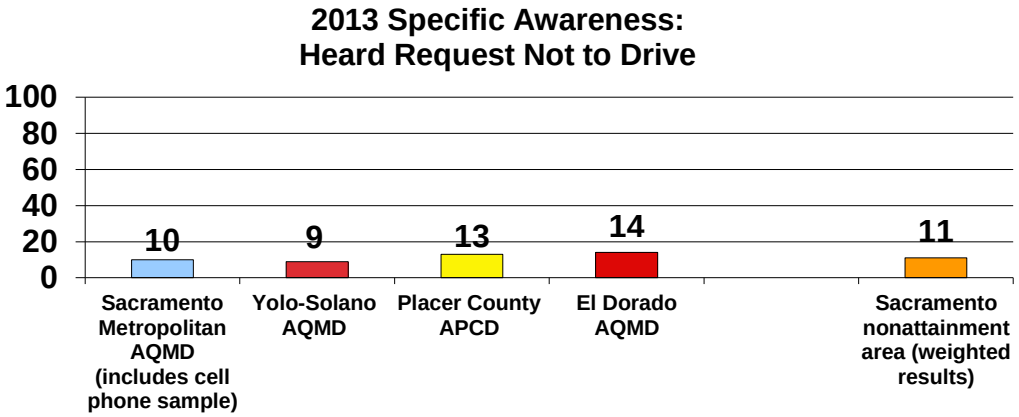
> "Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?"[21]

The specific episodic advisory that is sent to Air Alert subscribers and radio, television and print media says: "Drivers in the Sacramento region are asked to reduce driving or not drive at all during this period of unhealthy air quality. Carpool to sports and recreation activities, bike or walk in the morning hours when pollution levels are low, postpone errands or take the bus and light rail."

The next chart indicates that 11% of respondents in the region as a whole (weighted results) were aware of this specific request not to drive.[22] Specific awareness has always been statistically lower than general awareness. The 11% translates into an estimated **243,298** residents in the Sacramento region who heard the specific request not to drive on Spare The Air days.

There were no statistically significant differences among the individual air quality districts. Levels of specific awareness ranged from 9% among Yolo-Solano AQMD respondents to 14% in El Dorado AQMD.

[21] The order of the specific and general awareness questions was randomized so as to eliminate any possible order-response bias.
[22] See methodology section for review of weighting procedures.

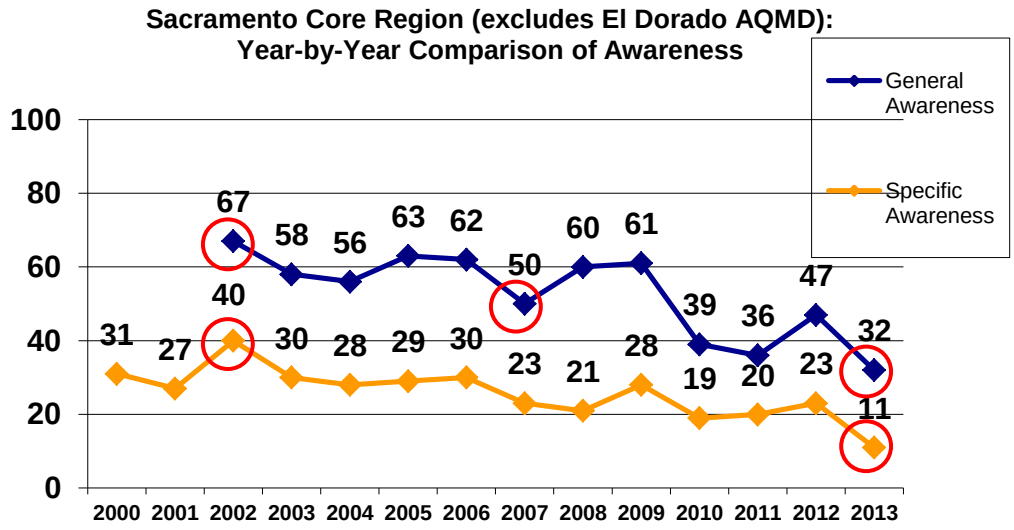



## Year-To-Year Comparisons of Awareness: Sacramento Core Region

***3 ➢ The level of general awareness in the Sacramento Core Region is lower at 32% than in most previous evaluation years.***

The next chart indicates annual percentages of general (since 2002) and specific awareness (since 2000) of Spare The Air in the Sacramento Core Region.[23] It can be seen that general awareness at 32% is a statistically significant decrease from the previous year and years prior to 2010, but similar to the 2010 and 2011 seasons. General awareness was highest in 2002 at 67%, a year when air quality was very poor and there were 22 Spare The Air days, including many multi-day episodes. As has already been discussed, this year's level can likely be attributed to only two Spare The Air days, which is the fewest number in the program's 19-year history. Including results from this year, the average level of general awareness is 50%.

[23] Throughout this report, any references to the Sacramento Core Region exclude El Dorado County AQMD as it was not included in all the evaluation years. Weights were recalculated proportionally after excluding El Dorado responses. Results from the cell phone sample in Sacramento County were again included.




Circled percentages represent significant highs and lows.

The average of specific awareness is 26%. The significantly lower 11% specific awareness in 2013 can likely be accounted for by improved air quality and fewer Spare The Air episodes. As was described in the General Awareness section, there is a strong and significant correlation between general awareness and the number of episodes in a season. A strong and positive correlation is also found between specific awareness and the number of episodes in a season[24].

## Year-To-Year Comparisons by Air District

***4 ➢ Levels of both types of awareness in all individual air districts were highest in 2002, when there were 22 Spare The Air days, and at their lowest in 2013, but not significantly lower than the 2010 or 2011 season.***

Year-to-year comparisons of the annual levels of general and specific awareness for the individual air districts are presented in the next four graphs. (El Dorado County AQMD residents were not interviewed in 2002, 2003, or 2005).

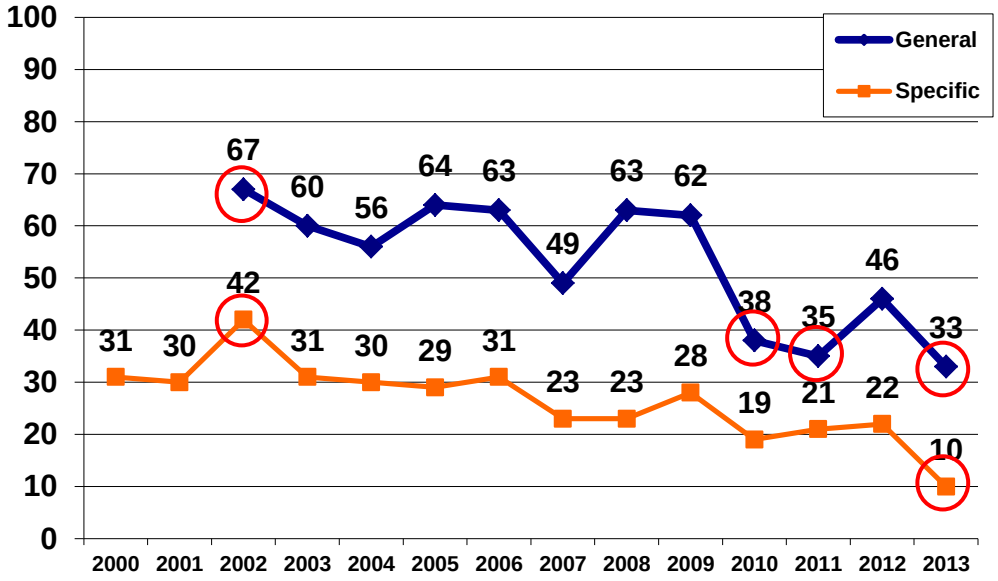
### Sacramento Metropolitan AQMD

As can be seen in the next graph, the highest levels of general as well as specific awareness in Sacramento Metropolitan AQMD occurred in 2002. There was a significant drop in the two types of awareness in 2007, and again during 2010 and 2011. After a slight increase during the 2012 season, awareness levels are at their lowest in 2013. The general

[24] ($r = .84$, $p < .001$)

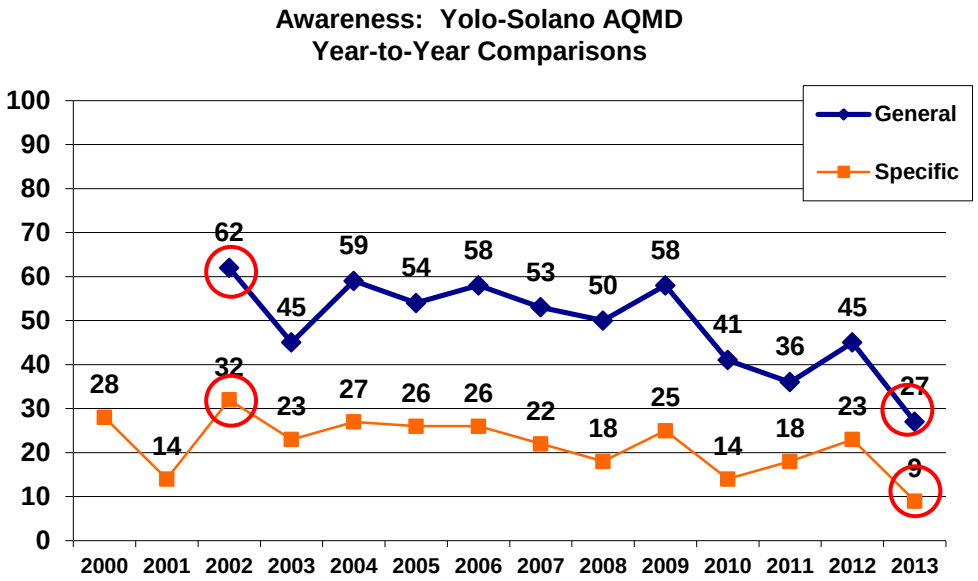
awareness average over time in Sacramento Metropolitan AQMD is 53%; the average for specific awareness is 25%.

**Awareness: Sacramento Metropolitan AQMD**
**Year-to-Year Comparisons**




**Yolo-Solano AQMD**

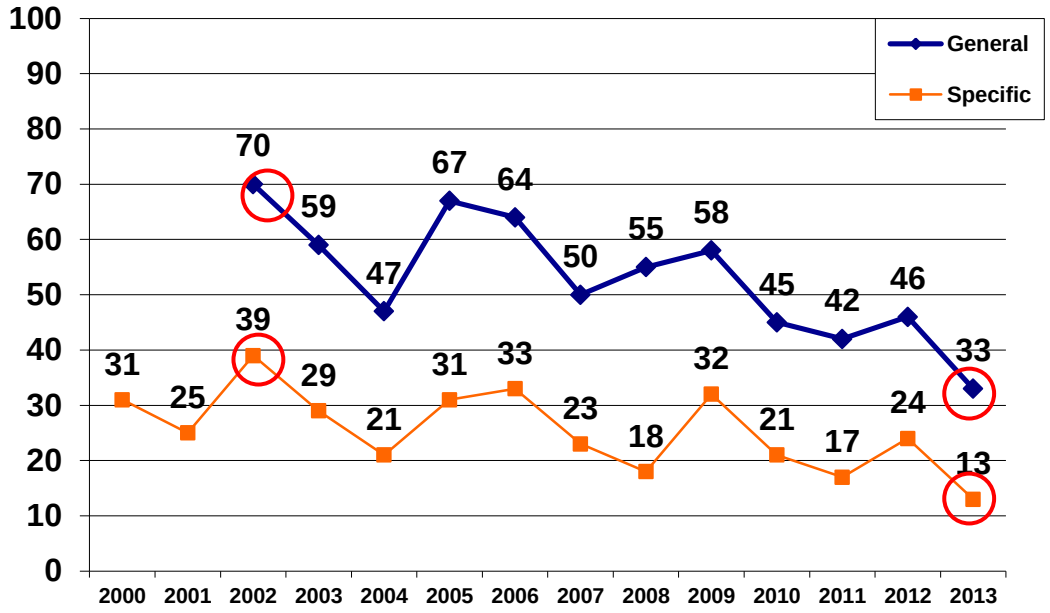
In Yolo-Solano AQMD, this year's level of general awareness decreased from last year and is lower than previous years. The average over time is 49%. In terms of specific awareness, this year's level of 9% is also lower than previous years. The average over time for specific awareness is 22%.




**Placer County APCD**

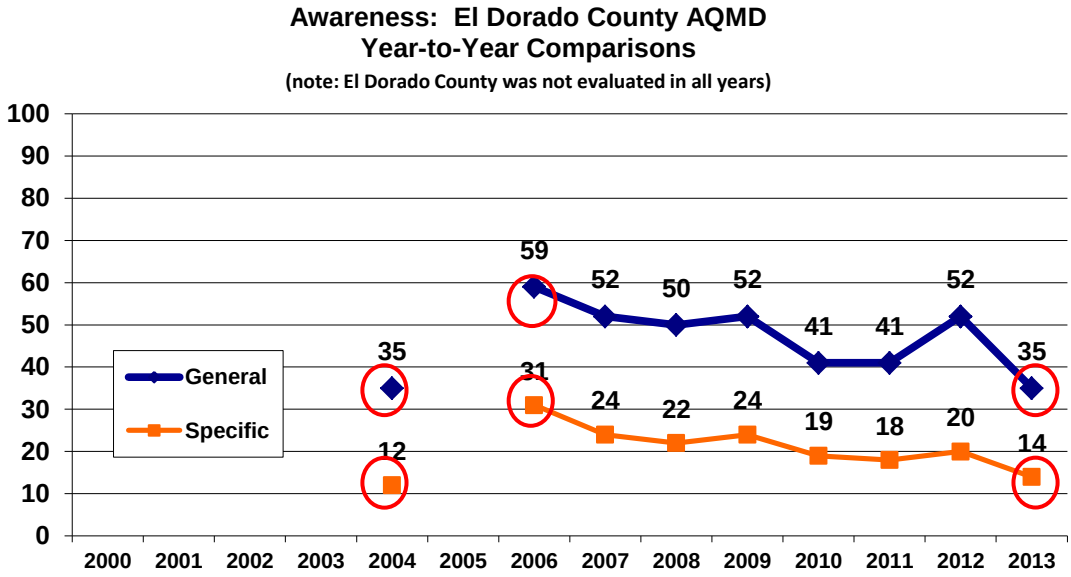
Results have been the most variable in Placer County APCD from one year to the next. General awareness this year decreased to 33%, which is lower than each other year. The average level of general awareness in Placer County APCD is 53%; and that of specific awareness is 26%. In this case, specific awareness at 13% in 2013 is not significantly lower than the 2008 or 2011 season when episodes were also infrequent.

**Awareness: Placer County APCD**
**Year-to-Year Comparisons**




**El Dorado County AQMD**

In El Dorado County AQMD, both types of awareness have decreased but are consistent with the 2004 season during which residents were surveyed following only one out of the six Spare The Air days that season, but still including a valid sample size (n=254). The 2004 season recorded lower awareness in each geography. The average over time for general awareness in El Dorado County AQMD is 48%; and the average for specific awareness is 21%.



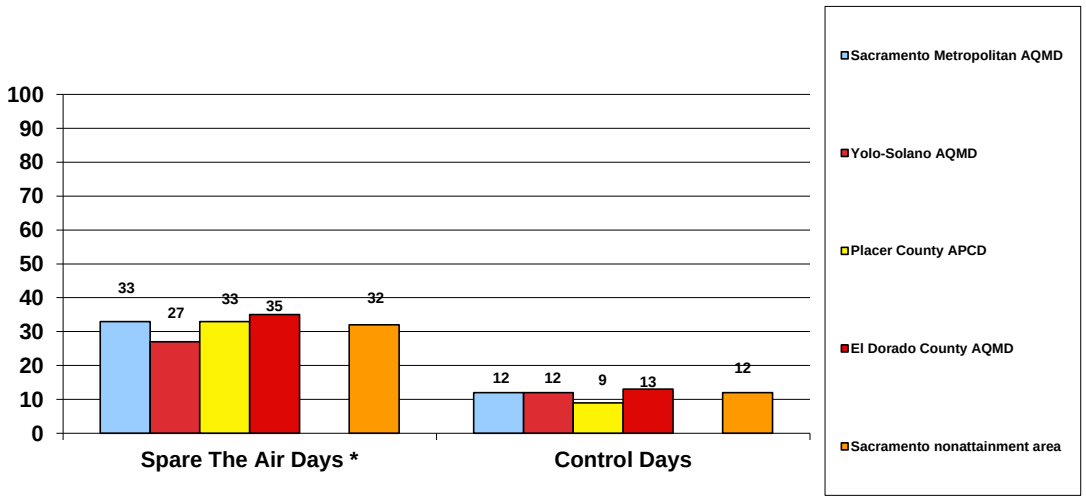

## Spare The Air Versus Control Days

***6 ➢ Levels of both general and specific awareness of Spare The Air were significantly higher when respondents were interviewed following Spare The Air days than on Control days, a further indication that the announcements are in fact being heard.***

Control day interviews were conducted on non-Spare The Air days with random samples of landline residents representative of all air districts in the Nonattainment Area. The same questionnaire as the one used following Spare The Air days was used for Control day calling. The use of a Control group ensures that any positive results attributed to the Spare The Air program are indeed due to the program itself and not to a possible social desirability response bias. Control interviews took place on the same days of the week as the Spare The Air interviews, but on a day that wasn't a Spare The Air day.

Results for general awareness are presented in the next chart and indicate that although 12% of area respondents interviewed on Control days said they had seen or heard Spare The Air announcements, significantly more (32%) of those interviewed after Spare The Air days remembered seeing or hearing them. Thus, the television and radio commercial media buy was effective at reaching Sacramento Area residents throughout the summer, particularly following Spare The Air days, when respondents also had the opportunity to witness an episodic advertisement, which is included in the general awareness measure. Results in each of the individual air districts were similar. The **Spare The Air program is still able to use the media to effectively reach the Sacramento air basin population**.

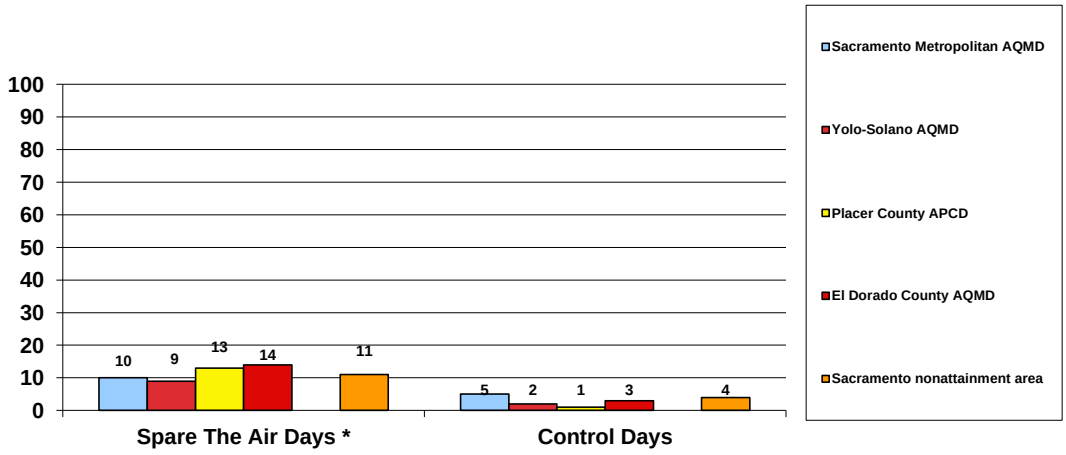
**Spare The Air vs. Control Days: 2013 General Awareness**




* indicates statistically significant differences between Spare The Air and Control percentages in all districts.

In terms of specific awareness, 4% of Control day respondents in the area as a whole incorrectly heard a request not to drive versus the 11% of respondents who correctly remembered the request following Spare The Air days. As can be seen in the following chart, the difference between Spare The Air and Control day interviewing in each individual air district was likewise significant. These results indicate once again that the **Spare The Air program is still effective in reaching area residents**.

**Spare The Air vs. Control Days: 2013 Specific Awareness**




* indicates statistically significant differences between Spare The Air and Control percentages in all districts.

## Estimating the Number of STA-Aware Drivers

7 ➢ ***Adjusting for Control day responses, the percentage of respondents who were aware of Spare The Air in general translates into an estimate of 295,923 drivers in the Nonattainment Area who were aware of a Spare The Air day during the 2013 season.***

There were an estimated 1,479,618 drivers in the entire Sacramento Nonattainment Area in the summer of 2013.[25] With the level of general awareness of Spare The Air at 32%, this translates into an estimated 473,477 **drivers** in the region who were aware of Spare The Air. However, there were also 12% of Control day respondents (or 177,554 drivers) who thought they heard about Spare The Air when in fact no advertisement had been issued. Correcting then for Control day responses through subtraction means that **295,923 drivers in the Sacramento nonattainment area as a whole were aware of the 2013 Spare The Air campaign in general**. The next table indicates the calculations and the estimated number of drivers who heard the advisories in each individual air district.

| *Air District* | *Total Estimated Number of Drivers* | *Percent Aware of STA (General Awareness) STA / Control* | *Estimated Number of Drivers Aware of STA in General (STA – Control)* |
|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | 941,693 | 33% / 12% | ***310,758 – 113,003= 197,755*** |
| ***Yolo-Solano AQMD*** | 206,996 | 27% / 12% | ***55,889 - 24,839= 31,050*** |
| ***Placer County APCD*** | 234,433 | 33% / 9% | ***77,363 – 21,099= 56,264*** |
| ***El Dorado County AQMD*** | 96,495 | 35% / 13% | ***33.773 – 12,544= 21,229*** |
| ***Sacramento Nonattainment Area[26]*** | 1,479,618 | 32% / 12% | **473,477 – 177,554= *295,923*** |

[25] The number of drivers in the Sacramento nonattainment area for 2013 was estimated, using the number of driver licenses by county for 2012, obtained from the California Department of Motor Vehicles database http://www.dmv.ca.gov/about/profile/dl_outs_by_county.pdf , and calculating the percentage increase, based on county population figure increases from 2012 to 2013 listed at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls. The estimated number of licensed drivers for the total Sacramento nonattainment area in 2012, therefore, was 1,479,618: Sacramento Metropolitan AQMD: total 941,693 + Yolo-Solano: total of 206,996 (126,712 in Yolo County + Solano County: 276,839 * 29% for the proportion located within the Air Quality district = 80,283) + Placer County: total of 234,433 (269,464 * 87% for Air Quality district) + El Dorado County: total of 96,495 (141,904 * 68% for Air Quality district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region as a whole.

[26] The results for the Sacramento nonattainment area as a whole are not the simple sum of the individual air districts, but rather, are weighted results that reflect the relative proportional distribution of residents in the area.

**8** ➢ ***In terms of specific awareness, and again correcting for Control day responses, 103,573 drivers in the region heard the episodic request not to drive on Spare The Air days in 2013.***

The estimated numbers of drivers who were aware of the specific request not to drive are presented in the next table. For the entire Sacramento Nonattainment Area, and correcting for Control day responses, this translates into an estimated 103,573 drivers who were specifically aware of the requests not to drive on Spare The Air days.

| *Air District* | *Total Estimated Number of Drivers* | *Percent Aware of STA (Specific Awareness) STA / Control* | *Estimated Number of Drivers Aware of STA Specific Request Not to Drive (STA - Control)* |
|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | 941,693 | 10% / 5% | ***94,169 – 47,084= 47,085*** |
| ***Yolo-Solano AQMD*** | 206,996 | 9% / 2% | ***18,629 - 4,139= 14,490*** |
| ***Placer County APCD*** | 234,433 | 13% / 1% | ***30,476 – 2,344= 28,132*** |
| ***El Dorado County AQMD*** | 96,495 | 14% / 3% | ***13,509 - 2,895= 10,614*** |
| ***Sacramento Nonattainment Area***[27] | 1,479,618 | 11% / 4% | **162,757 – 59,184= *103,573*** |

## Awareness of General Media Campaign

**9** ➢ ***News or weather broadcasts were the most cited sources of air quality information in the Sacramento Nonattainment Area. Television and radio commercials followed far behind while online mediums and newspapers were rarely noted as sources of information.***

Continuing from the evaluation in 2012, respondents in 2013 were asked to identify the medium(s) through which they heard, read, or saw a message about air quality after indicating that they received such a message. That is, after stating yes to the general awareness item, respondents were asked:

[27] The results for the Sacramento nonattainment area as a whole are not the simple sum of the individual air districts, but rather, are weighted results which reflect the relative proportional distribution of residents in the area.

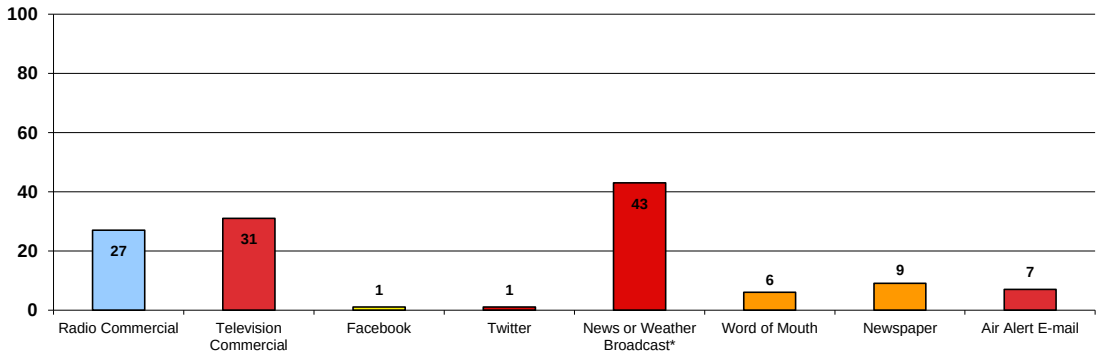
"Where do you recall seeing/hearing/reading that information?" [28]

The data resulting from this survey item may help coordinators better allocate funds and effort during subsequent seasons and maximize message dissemination. The next table illustrates the percentage of respondents who identified any of eight mediums through which they received a message about air quality in general for the Sacramento Nonattainment Area.

It can be seen in the table below that the most cited source of Spare The Air information is news or weather broadcasts selected by 43% of respondents who were aware of the campaign in general. The next most cited source was television, followed closely by radio. Facebook and other online media were recent additions to campaign efforts, and a small percentage of respondents cited information from those sources indicating that those mediums are possible avenues for dissemination in the future.

No significant differences arose between geographic locations and, therefore, no data is presented for the individual air districts. The most accurate representation of media sources is accounted for by the Nonattainment Area as a whole.

**2013 Sacramento Nonattainment Area (weighted)**
**General Media Awareness**




# PURPOSEFUL DRIVING REDUCTION

## *Objectives*

[28] Seeing/hearing/reading syntax dependent upon answer to general awareness item.

One measure of the effectiveness of the Spare The Airpublic education program in the Sacramento Nonattainment Area is to examine actual changes in driving behavior. Since 2002, following discussions with the Air Resources Board (ARB), the following standard for measuring behavioral driving reductions was implemented – it requires that drivers be aware of Spare The Air, make fewer vehicle trips on Spare The Air days, and further, that they do so purposefully to help reduce air pollution on Spare The Air days. These drivers are called "purposeful reducers."

The broad objectives of the current section are to calculate purposeful driving reduction within the Sacramento Nonattainment Area using the strict ARB standard, and to see whether driving reduction will be lower this year compared with previous years. Specifically, the objectives are to:

a. report the percentage of respondents who reported driving "less" the previous day and statistically compare with annual results from 2000 to the present
b. 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 advisories (general awareness)

    and determine if the percentage of reducers is similar or different among four air quality districts in the Sacramento nonattainment area (Sacramento Metropolitan AQMD, Yolo-Solano AQMD, Placer County APCD, and El Dorado County AQMD)
c. determine if the percentage of purposeful reducers in the Sacramento Core Region (excluding El Dorado County AQMD) has increased, decreased, or stayed the same from 2000 to the present
d. extrapolate to the population by estimating the number of **drivers** in the Sacramento nonattainment area who purposefully reduced the number of trips they made on Spare The Air days in 2011
e. estimate the number of **single trips** avoided by purposeful reducers on Spare The Air days, and
f. compare the percentage of reducers found in the group of respondents interviewed about Spare The Air days with that of the group interviewed on Control (non-Spare The Air) days.

# RESULTS

## Driving Behavior Yesterday

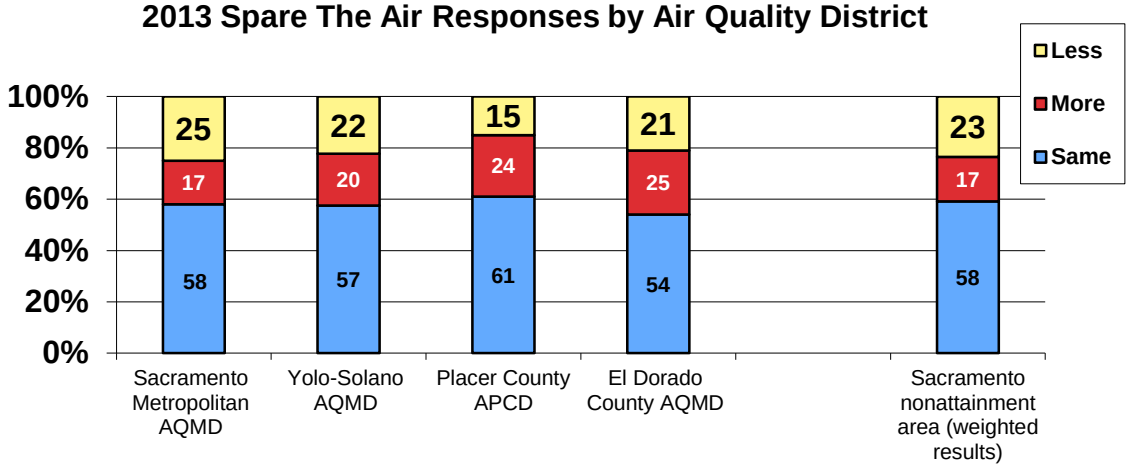
***1 ➢ Nearly one in four (23%) respondents in the Sacramento Nonattainment Area as a whole said they drove less on Spare The Air days. The percentage was highest among Sacramento Metropolitan residents (25%), and lowest among Placer County AQMD residents (15%).***

At the beginning of the survey, respondents interviewed following Spare The Air days were asked to think about their driving behavior the previous day and say whether they drove the "same, more, or less frequently" than they normally did on that particular day of the week. Results from each of the four individual air quality districts and the entire Sacramento Nonattainment Area (weighted results) are presented in the next chart.

It can be seen that the majority of respondents did not make any changes in their driving behavior – 58% in the area as a whole said they drove the same as usual the previous day. Slightly over a sixth of respondents (17%) said they drove more, and the remaining 23% said they drove less. This pattern was seen within each of the individual air quality districts, where only slight differences arose between areas. Most notably, Placer County APCD respondents were the most likely to have not changed their driving behavior.

The highest percentage of those who said they drove less on Spare The Air days occurred in Sacramento Metropolitan AQMD (25%). In Yolo-Solano APCD, 22% drove less. In El Dorado County AQMD 21% of respondents drove less on Spare The Air days. Placer County APCD residents exhibited the lowest percentage of residents driving less (15%).

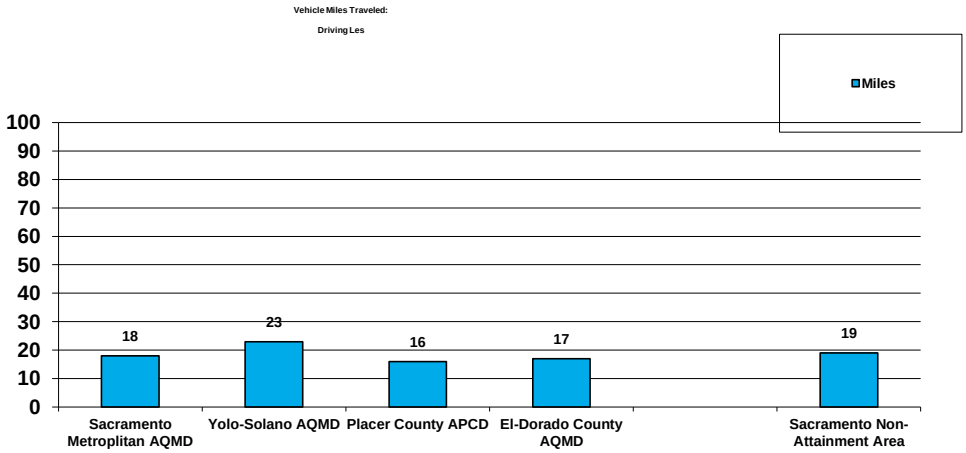
**Driving Behavior Yesterday:**
**2013 Spare The Air Responses by Air Quality District**




## Vehicle Miles Traveled

The 2013 survey extended the standard inquiry into driving behavior by asking specifically how many miles less each participant drove on a Spare The Air day. Those who drove less were asked "and approximately how many miles less than normal did you drive?" These data are displayed in the table below for each air district and for the Sacramento Non-Attainment Area[29] as a whole. The average number of fewer miles driven by those who said they drove less on a Spare The Air day ranged from 16 miles in Placer County APCD to 23 miles in Yolo-Solano AQMD. There are no significant differences between air districts for fewer miles driven. This may be due in part to the small sample size as well as the great variability between individual responses.

[29] Weighted results



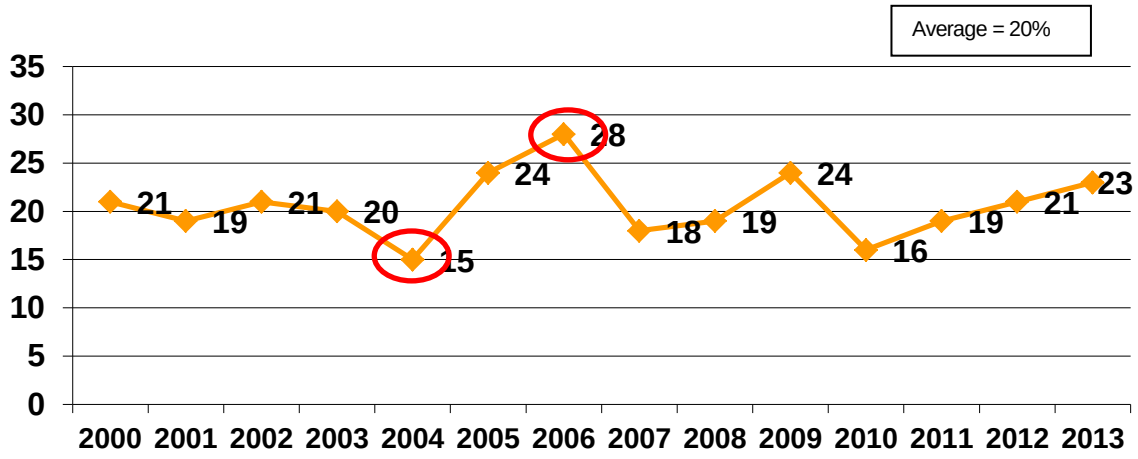

## Year-to-Year Comparisons: Percent Who Drove Less

2 ➢ ***Over the last 14 years, the highest percentage of those who drove less on Spare The Air days in the Sacramento Core Region occurred in 2006 (28%), and the lowest percentage occurred in 2004 (15%). This year's 23% of respondents said they drove less on Spare The Air days is not significantly greater than the 14-year average of 20%, but it is the highest percentage since 2009.***

The next graph plots the percentages of drivers from 2000 to the present who said they drove less on Spare The Air days in the Sacramento Core Region (which excludes El Dorado County AQMD).[30] It can be seen that, with only a couple of exceptions, the percentage of respondents who said they drove less on Spare The Air days has remained relatively stable at about 20%, which is the 14-year average. In 2004 the level declined significantly to 15%, a summer with relatively good air quality and six Spare The Air days. Rising significantly from 2004 levels, 2006 registered the highest percentage of all years, at 28%: 2006 was a poor air quality summer, with 15 Spare The Air days. Current results at 23% are not significantly different from the 14-year average.

[30] Results are for the Sacramento Core Region (weighted) and exclude El Dorado County AQMD because interviews were not conducted with El Dorado respondents in all survey years.

**Year-by-Year Comparison: Percent of Respondents Who Drove "Less" on Spare The Air Days: Sacramento Core Region**
**(excludes El Dorado County AQMD)**

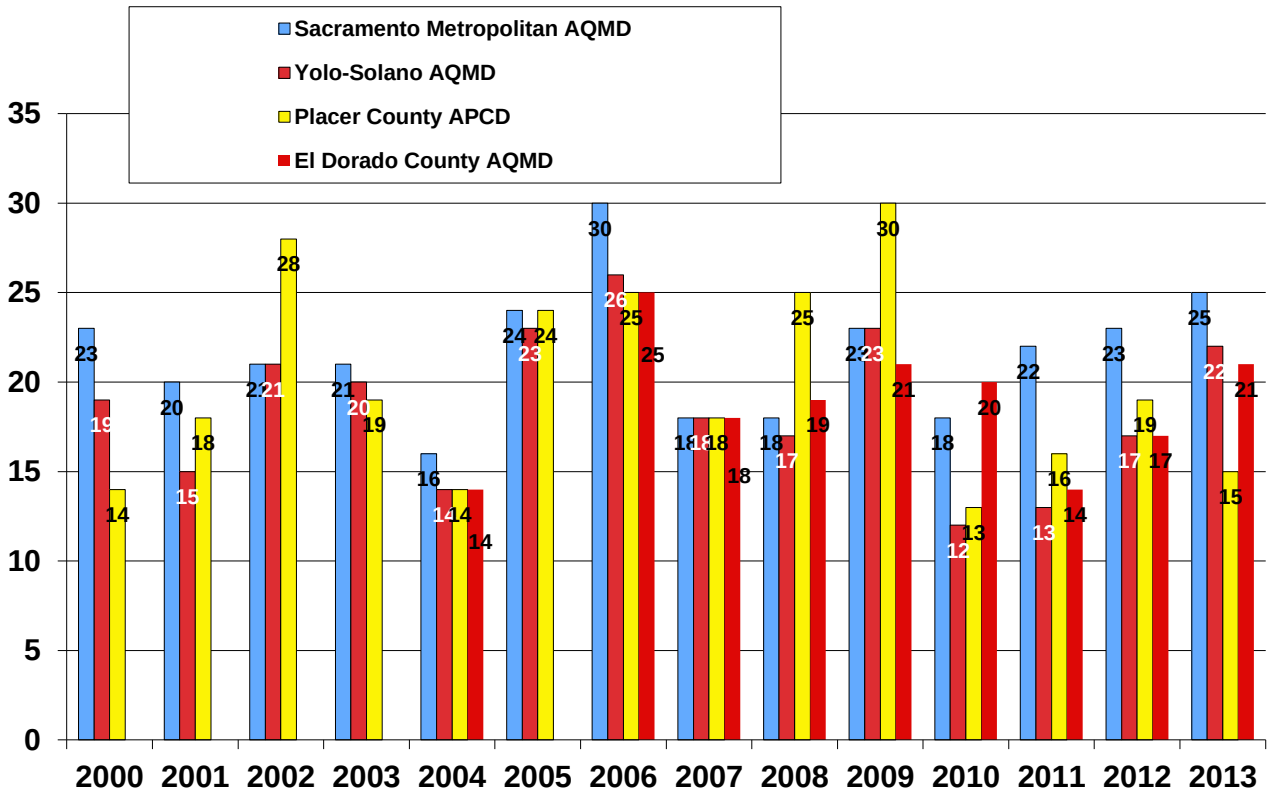



* circles indicate the highest and lowest percentages over time.

3 ➢ ***In the individual air districts, the percentage of respondents who drove less this year was not significantly different from each air district's average over time.***

The annual percentage of respondents who drove less the previous day in the individual air districts from 2000 to the present are presented in the next chart. In **Sacramento Metropolitan AQMD** the percentage of residents who said they drove less on Spare The Air days ranged from a low of 16% in 2004 to a high of 30% in 2006. This year's percentage of 25% is greater than 12 of the other years, but is not statistically different from the 14-year average of 21% in the SMAQMD. Results in **Yolo-Solano AQMD** ranged from a low of 12% in 2010 to a high of 26% in 2006. This year's 22% is not significantly different from the 14-year average of 18% in that air district. In **Placer County APCD** results tended to fluctuate more from one year to the next and this year is no different. The 17% of residents this year who said they drove less was not significantly lower than the14 year average of 20%. Respondents in **El Dorado County AQMD** were interviewed in nine of the 14 years, and this year's 21% of respondents who reported driving less is consistent with the 9-year average of 19%.

**Year-to-Year Comparison of Percent of STA Respondents Who Drove Less on Spare The Air Days: Individual Air Districts**




## Spare The Air Days vs. Control Days

***4 ➢ This year, there were no differences in driving less between Spare The Air and Control day respondents.***

Control day interviewing is an integral part of the evaluation methodology of Spare The Air. Samples of respondents were interviewed on the same days of the week as the Spare The Air interviews, but on cooler, non-Spare The Air days in August and September.[31] The use of Control day interviewing provides a means of calculating a correction or adjustment factor to account for any tendency that some individuals might have to overstate their driving reduction on Spare The Air days (social desirability response bias), and, therefore, provides the most conservative estimates of program effectiveness.

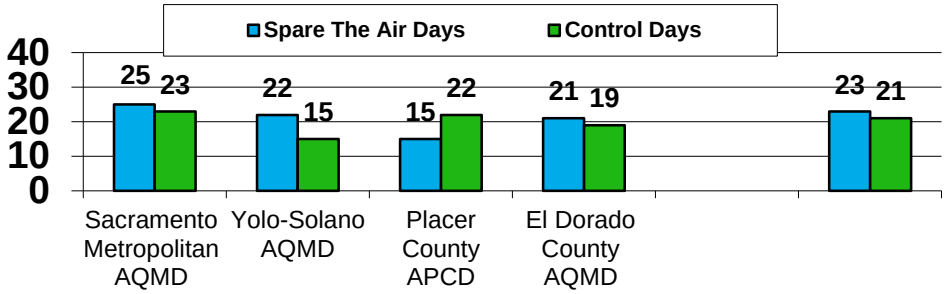
The next chart shows the results of Spare The Air and Control day interviewing for each individual air district and for the weighted Sacramento Core Region.[32] It can be seen that the percentage of respondents who said they drove less on Spare The Air days in the

[31] In order to know which days of the week to match, Control day interviews have to be conducted after Spare The Air days. See methodology section for a complete description of the sampling design.

[32] The Sacramento Core Region excludes El Dorado County AQMD in order to be able to make comparisons with previous years.

Sacramento Core Region was not significantly greater at 23% than the 21% of respondents interviewed on Control days. This was also true in **Sacramento Metropolitan AQMD**, where the 25% of respondents interviewed following Spare The Air days was not significantly higher than the 23% interviewed on Control days. The percentage of respondents (22%) in **Yolo-Solano AQMD** who drove less on Spare The Air days is marginally but not significantly larger than the percentage (15%) who drove less on Control days. In **Placer County APCD** the difference was reversed, but still not significant (15% vs. 22%). In **El Dorado County AQMD**, more respondents on Spare The Air days (21%) drove less than on Control days (19%), although this difference was not significant.

**2013 Spare The Air vs. Control Days: Percent of Respondents Who Drove Less The Previous Day**




Over the past 14 years, significant differences between the percentage of respondents who said they drove less on Spare The Air versus Control days have been found in all but five years – 2003, 2007, 2008, 2010 and 2013. (Within the individual air quality districts, however, there have been fewer years when the differences were significant.[33]) Results for the Sacramento Core Region are presented in the next table.

[33] In terms of the individual air districts within the Sacramento Core Region, Sacramento Metropolitan AQMD showed significant differences in 2000, 2001, 2002, 2004, 2005, 2006 and 2012. Placer County APCD showed differences in only four of the 14 years (2002, 2005, 2006, and 2009); and in Yolo-Solano AQMD there has been only one year in which the difference was significant (2002). Yolo-Solano AQMD generally experiences better air quality than any of the other air districts in the nonattainment area.

| Year | Percentage of Respondents Who Drove Less Yesterday: Sacramento Core Region (excludes El Dorado County AQMD) | | Difference (or "Spread") | Statistically Significant Difference? |
|---|---|---|---|---|
| | Spare The Air Day Respondents | Control Day Respondents | | |
| 2000 | 21% | 13% | 8% | Yes |
| 2001 | 19% | 14% | 5% | Yes |
| 2002 | 21% | 17% | 4% | Yes |
| 2003 | 21% | 18% | 3% | No |
| 2004 | 15% | 11% | 4% | Yes |
| 2005 | 23% | 17% | 6% | Yes |
| 2006 | 28% | 18% | 10% | Yes |
| 2007 | 18% | 15% | 3% | No |
| 2008 | 19% | 16% | 3% | No |
| 2009 | 24% | 19% | 5% | Yes |
| 2010 | 16% | 17% | -1% | No |
| 2011 | 19% | 14% | 5% | Yes |
| 2012 | 21% | 15% | 6% | Yes |
| 2013 | 23% | 21% | 2% | No |

As this season marks another year in which no significant differences are found between Spare The Air and Control day drivers, it is reiterated again here that perhaps the time has come to drop this as a prerequisite to the calculation of emission reductions.[34] Particularly important to this year is the impact of sample size on the final results. As sample size decreases, the likelihood of detecting a true but small difference between Spare The Air and Control day responses decreases as well. Historically, significant differences have been small but were easier to detect because of the larger sample size. This year sample size was especially low due to having only two Spare The Air days, making it difficult to determine if a difference between driving less on Spare The Air and Controls days is true.

## Percentage of Purposeful Reducers

***5*** ➢ ***During the summer of 2013, a small portion (0.4%) of respondent drivers were classified "purposeful reducer" -- they drove less on Spare The Air days because they heard the Spare The Air advisories and wanted to improve air quality in the***

[34] This requirement was introduced into the methodology in 2000 by Jude Lamare, Ph.D.; formerly with the Cleaner Air Partnership; and prior to discussions in 2002 with the Air Resources Board as to what would constitute a purposeful driving reducer. The definition of a purposeful reducer changed after these discussions, but the previous methodology requiring a significant difference between Spare The Air and Control drivers saying they drove less the previous day did not. The air districts might therefore want to reconsider whether this prerequisite is still necessary, given the fact that Control day interviewing already acts as a correction factor; that the sampling design change in 2008 of fewer completed interviews means that the margins of error in each air district are increased, that many drivers are seasonal reducers and have already reduced the amount of driving they do during the summer, and that other explanations are plausible.

***region. While these data are consistent with the recent trend toward a decline in purposeful reducers, they offer evidence that the program is still effective during a changing economic, air quality and media landscape.***

The definition of a purposeful driving reducer is quite strict: it includes only those interviewed following a Spare The Air day who said they drove less the previous day, specifically for air quality reasons, and who had heard announcements about Spare The Air (general awareness using the ARB question.[35]) Results from each air quality district and for the weighted Sacramento region (Sacramento Core Region plus the Nonattainment Area) are presented in the next table. It can be seen that for the Sacramento Nonattainment Area, one of the Spare The Air respondent drivers (1 out of 263) met the **strict ARB standard** for purposeful driving reduction. Individually, it can be seen that one respondent in **Sacramento Metropolitan AQMD** qualified as a purposeful reducer; no respondents in **Yolo-Solano AQMD**; one respondent in **Placer County APCD**; and one respondent in **El Dorado County AQMD** can be classified as a purposeful reducer. Because Sacramento Metropolitan AQMD is used as the baseline during the data weighting procedure[36] and all other air districts are weighted down according to each respective population relative to Sacramento County, after weighting, the one recorded purposeful reducer in Placer County APCD is measured as only 15% of one full reducer, and the one recorded reducer in El Dorado County AQMD is measured as only 6% of one full reducer. Therefore, and in the tables that follow, only one purposeful reducer is recorded (after rounding down) for the Sacramento Nonattainment Area as a whole.

Similar results were obtained during the previous four seasons. Possible explanations, revised here, were explicated in the 2012 report. First, the steady improvement in the Sacramento region's air quality over the past six years may influence the number of recorded purposeful reducers. Data show that the number of ground-level ozone exceedances have gradually declined since 1999.[37] In fact, the Sacramento region attained the federal one-hour ozone standard. Air quality in the summers of 2012 and 2013 were especially good. 2013 in particular had only two Spare The Air days. In contrast, the 2002 season had 22 Spare The Air days and recorded 10 red Unhealthy days and one purple Very Unhealthy day. That year's evaluation yielded the greatest number of purposeful reducers of all evaluation years. The table below displays the recorded number of Spare The Air days along with the calculated percentage of purposeful reducers in the Sacramento Core Region for each season. A correlation analysis[38] determined that the number of Spare The Air days is strongly and positively related to the calculated percentage of purposeful reducers.

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35 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 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 from 1999 to the present. Typically, more respondents indicate general awareness of Spare The Air than specific awareness of the request not to drive the previous day.

36 See Methodology section for full description of weighting procedure.

37 Data from http://www.sparetheair.com/Exceedances.cfm.

38 $r = 0.77$, $p < .01$

| | ***Percentage of Respondents Who Drove Less Yesterday: Sacramento Core Region (excludes El Dorado County AQMD)*** | |
|---|---|---|
| ***Year*** | ***Number of Spare The Air days*** | ***Percentage of Purposeful Reducers*** |
| ***2000*** | **-** | **-** |
| ***2001*** | **15** | **1.7%** |
| ***2002*** | **22** | **2.7%** |
| ***2003*** | **14** | **1.4%** |
| ***2004*** | **6** | **1.5%** |
| ***2005*** | **14** | **1.4%** |
| ***2006*** | **15** | **2.2%** |
| ***2007*** | **5** | **1.2%** |
| ***2008*** | **8** | **0.7%** |
| ***2009*** | **5** | **1.7%** |
| ***2010*** | **6** | **0.36%** |
| ***2011*** | **5** | **0.5%** |
| ***2012*** | **6** | **0.0%** |
| ***2013*** | **2** | **0.4%** |

These data support the reasoning that improving air quality, resulting in less perceived immediacy, may be one reason for the slight decline in purposeful reducers in recent seasons. In addition, residents are able to view air pollution levels at www.SpareTheAir.com, and also view the latest hourly conditions at the region's monitoring sites on the website under Current Conditions. It is possible that Sacramento Area residents do not "see" high pollution readings or "feel" the need to modify their driving behavior for air quality reasons alone. This reasoning from the 2012 report informed the addition of questions pertaining to experienced health effects from poor air quality that were included in seasons prior. Described in detail in the Summer 2013 Health Issues section of this report, it can be seen that 17% and 13% of respondents following Spare The Air days in the Sacramento nonattainment area reported experiencing difficulty breathing during the Spare The Air day or the day following, respectively, and are significantly greater in number than Control day respondents. However, both Spare The Air days occurred during a period of extreme wildfire smoke in the area[39] which likely contributed to the experience of negative health effects on and around the Spare The Air days. The majority of Control day interviews occurred at the end of September, when the fires were nearly contained and residents may have experienced fewer health effects due to wildfire smoke. This is especially true in Placer and El Dorado counties, which were more impacted by wildfire smoke, and where experienced health effects were the greatest, and showed the most discrepancy between Spare The Air and Control days. **Consequently, that residents went unaffected by poor air quality attributable to emissions, excluding wildfire smoke, is still a possible**

[39] From Sonoma Technology in an email to Lori Kobza, Sacramento Metropolitan AQMD, dated January 13, 2014

**explanation for the decline of purposeful reducers,** as indicated by the 2010, 2011 seasons.

Another probable explanation of the reduction in purposeful reducers is that drivers are reducing their trips for reasons other than air quality or increasing their trips for unavoidable reasons. The 2013 survey probed further into respondents who drove either less or more on a Spare The Air day. So as not to prime responses, the survey asks participants why they drove less on the particular day of the week prior to asking for awareness of an episodic advisory. Analysis of the data shows that 75% of respondents who drove less on a Spare The Air day cite reasons other than air quality, such as gas prices, and/or weather for reducing, indicating that respondents are experiencing some alternative motivation for driving less on Spare The Air days other than air quality or common incentives. As these data do not offer an alternative, and because there was no difference found between Spare The Air and Control days regarding driving frequency, driving less on Spare The Air days during the 2013 season is possibly a function of chance.

**Though a trend toward reduction is evident from the previous three years, that the 2013 season includes 0.4% of respondents meeting the strict ARB standard for a purposeful reducer in the Sacramento Nonattainment Area[40] is an indication that the program is still effective and reaching drivers.**

**Considering the comparatively small sample size obtained in 2013, a consequence of the mild season, reaching 0.4% of the population is noteworthy.** Additionally, these results support the explanation for no purposeful reducers delineated in the 2012 report: the trend of long term success is a better indicator of the program's effectiveness in the 2013 season than what could possibly have been sampling error.

[40] Weighted Results

| *Spare The Air: Purposeful Reducers in 2013* | *Number of Respondents Who Reduced Driving For Air Quality Reasons and Were Aware of STA Advisories* | *Total Number of Respondents Interviewed on Days Following Spare The Air* | *Sampling Error*[41] | *% of Total Respondents Who Reduced Driving for Air Quality Reasons and Were Aware of STA Advisories* |
|---|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | **1** | **166** | **+/- 7.6%** | **0.6%** |
| ***Yolo-Solano AQMD*** | **0** | **138** | **+/- 8.3%** | **0.0%** |
| ***Placer County APCD*** | **1** | **135** | **+/- 8.4%** | **0.7%** |
| ***Sacramento Core Region***[42] | **1** | **243** | **+/- 6.3%** | **0.4%** |
| ***El Dorado County AQMD*** | **1** | **110** | **+/- 9.3%** | **0.9%** |
| ***Sacramento Nonattainment Area***[43] | **1** | **263** | **+/- 6.0%** | **0.4%** |

## Extraneous Influence on Driving Behavior

There are many diverse reasons for error in statistical sampling, and they are most often explained by extraneous factors. One such factor affecting the most recent seasons may be a pervasive disinterest in driving behavior modification in the general Sacramento nonattainment area population. Difficulty is being experienced within other driving reduction programs such as the Sacramento Area Council of Governments' (SACOG) [44] public transit efforts to reduce congestion and residents' carbon footprints. The Council reports that three out of four drivers are getting to work the same way that they did in 2000 despite extensive efforts to provide alternative options.

41 Sampling error is a measure of the range of possible difference between the characteristics of the sample and the population from which the sample was drawn. For example, the average weight of a sample of 1000 individuals from a population of 1,000,000 will likely not be exact to the average weight of the entire population. Though the precise difference cannot be determined it is estimated to be within a range of values extending from the sample value (e.g. +/- 10%).

42 Weighted, excludes El Dorado County AQMD.

43 Weighted, includes El Dorado County AQMD. Since the beginning evaluation in 1995, the methodology for weighting has been to set Sacramento Metropolitan AQMD interviews as 1, and down-weight interviews from all other counties appropriately, adjusted proportionally to the population within each air district. (Sacramento Metropolitan AQMD represents 66% of the entire population, Yolo-Solano AQMD is 15%, Placer County APCD is 14%, and El Dorado County AQMD is 5%.) This is why the weighted total number of completed interviews (i.e. 514) is less than the sum of the total number of interviews conducted in all air districts (i.e. 976).

44 Bizjak, T. (2013, November 17). Solo drivers still dominate Sacramento commute hour. *The Sacramento Bee.* Retrieved from: http://www.sacbee.com/2013/11/17/5918970/solo-drivers-still-dominate-sacramento.html

## Percentage of Purposeful Reducers: Year-To-Year Comparisons

7 ➢ ***The percentage of purposeful reducers in the Sacramento Core Region is low, but not significantly lower than the 14-year average of 1.3% of drivers who reduced driving on Spare The Air days in order to help improve air quality. Given that the sample size obtained in the 2013 season causes concern over the reliability of the results, it is possible that the consistency in years prior is a better estimation of the percentage of purposeful reducers present in the total population during 2013 than the sample data from 2013 suggest.***

The next table lists the annual proportions of purposeful reducers from 2000 to the present. Tests of proportion were used to compare year-to-year results. In the Sacramento Core, this year's results were significantly lower at **0.4%** than in some previous years, but not significantly different from the 14-year average of **1.3%** of all drivers who purposefully reduced driving on Spare The Air days, specifically in order to help improve air quality.

In terms of the **Sacramento Metropolitan AQMD**, although annual results have varied slightly, the percentage of reducers has not changed significantly from one year to the next, including 2013. In **Yolo-Solano AQMD** the percentage of reducers was significantly higher in 2002 than in most other years. The percentage of reducers in **Sacramento Metropolitan AQMD** was also higher in 2002 than in other years; however, this peak is not significantly different from the average. In **Placer County APCD**, the percentages of reducers were significantly higher in 2002 and 2006 than in most other years.

**The Spare The Air program has consistently seen success.** Given that the sample size obtained in the 2013 season causes concern over the reliability of the results, it is possible that the consistency in years prior is a better estimation of the percentage of purposeful reducers present in the total population during 2013 than the sample data from 2013 suggest. That is, it may be that respondents in the 2013 survey year are not generalizable to the population and the consistency in percentages from years prior better predict the number of purposeful reducers present in the total population of 2013. This season appears to be anomalous in that it included only two Spare The Air days, the smallest sample in the 19-year history of the program. Yet, the data indicate the program was successful under those constraints which is evidence for consistency opposed to selectivity. The 2014 season may offer more conclusive evidence of this possibility.

| *Spare The Air: Purposeful Reducers* | *2000* | *2001* | *2002* | *2003* | *2004* | *2005* | *2006* | *2007* | *2008* | *2009* | *2010* | *2011* | *2012* | *2013* | *Significant Difference Among Years? (see footnotes)* | *14-year Average* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | **2.0%** | **2.1%** | **2.3%** | **1.2%** | **1.6%** | **1.5%** | **1.9%** | **1.3%** | **0.5%** | **1.2%** | **0.5%** | **0.8%** | **0.0%** | **0.6%** | **No** | **1.2%** |
| ***Yolo-Solano AQMD*** | **1.3%** | **0.2%** | **3.5%** | **1.2%** | **1.1%** | **1.3%** | **1.9%** | **1.6%** | **0.5%** | **2.7%** | **0.0%** | **0.0%** | **0.0%** | **0.0%** | **Yes[45]** | **1.1%** |
| ***Placer County APCD*** | **1.0%** | **0.9%** | **3.9%** | **2.3%** | **1.4%** | **1.5%** | **4.3%** | **0.4%** | **1.6%** | **2.6%** | **0.3%** | **0.4%** | **0.0%** | **0.7%** | **Yes[46]** | **1.5%** |
| ***Sacramento Core Region*** | **1.8%** | **1.7%** | **2.7%** | **1.4%** | **1.5%** | **1.4%** | **2.2%** | **1.2%** | **0.7%** | **1.7%** | **0.36%** | **0.5%** | **0.0%** | **0.4%** | **Yes[47]** | **1.3%** |

[45] In Yolo-Solano AQMD, 2002 was significantly higher than 2001, 2003, 2004, 2005, 2007, 2008, 2010, 2011, 2012, and 2013; 2009 was higher than 2001, 2010, 2011, 2012 and 2013; 2006 and 2007 were higher than 2010, 2011, 2012, and 2013.

[46] In Placer County APCD, 2002 and 2006 results were significantly higher than 2000, 2001, 2004, 2005, 2007, 2010, 2011, 2012, and 2013; and 2003 and 2009 were higher than 2007, 2010, 2011, 2012, and 2013.

[47] In the Sacramento Core Region, results in 2002 and 2006 were significantly higher than 2008, 2010, 2011, 2012, and 2013; and 2000, 2001 and 2009 were higher than 2010, 2012, and 2013.

## Estimated Number of Purposeful Reducers

**8** ➢ ***After weighting, an estimated 5,919 drivers in the entire Sacramento Nonattainment Area purposefully made fewer trips each Spare The Air day in 2013, in order to reduce air pollution.***

There were an estimated 1,479,618 drivers[48] in the entire Sacramento nonattainment area in 2013. Estimates of the number of purposeful reducers for the individual air districts as well as for the region (both excluding and including El Dorado County AQMD) are presented in the next table.

| *Air District* | *Total Number of Drivers* | *Percent of Purposeful Reducers* | *Estimated Number of Purposeful Reducers in 2013* |
|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | 941,693 | **0.6%** | ***5,650*** |
| ***Yolo-Solano AQMD*** | 206,996 | **0.0%** | ***0*** |
| ***Placer County APCD*** | 234,433 | **0.7%** | ***1,641*** |
| ***Sacramento Core Region***[49] | **1,383,123** | **0.4%** | ***5,533*** |
| ***El Dorado County AQMD*** | 96,495 | **0.9%** | ***869*** |
| ***Sacramento Nonattainment Area***[50] | 1,479,618 | **0.4%** | ***5,919***[51] ***purposeful reducers*** |

## Estimated Number of Single Trips Avoided by Purposeful Reducers

**9** ➢ ***In the Sacramento Nonattainment Area, 5,919 trips were avoided by purposeful reducers.***

Purposeful driving reducers were asked how many single vehicle trips they had avoided on the Spare The Air day. The mean number of single trips avoided in the entire **Sacramento Nonattainment Area** was **1** resulting in a total of **5,919 trips avoided directly attributed to**

[48] The number of drivers in the Sacramento nonattainment area for 2013 was estimated, using the number of driver licenses by county for 2012, obtained from the California Department of Motor Vehicles database http://www.dmv.ca.gov/about/profile/dl_outs_by_county.pdf , and calculating the percentage increase, based on county population figure increases from 2012 to 2013 listed at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls. The estimated number of licensed drivers for the total Sacramento nonattainment area in 2013, therefore, was 1,479,618: Sacramento Metropolitan AQMD: total 941,693 + Yolo-Solano: total of 206,996 (126,712 in Yolo County + Solano County: 276,839 * 29% for the proportion located within the Air Quality district = 80,283) + Placer County: total of 234,433 (269,464 * 87% for Air Quality district) + El Dorado County: total of 96,495 (141,904 * 68% for Air Quality district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region as a whole.

[49] Excludes El Dorado County AQMD.

[50] Includes El Dorado County AQMD.

[51] The results for the Sacramento Nonattainment Area as a whole are not the simple sum of the individual air districts, but rather, are weighted results that reflect the relative proportional distribution of residents in the area.

**the Spare The Air program**. Results for the individual air districts as well as for the weighted regions are presented in the next table.

| *Air District* | *Estimated Number of Purposeful Reducers* | *Mean # of Trips Avoided for Air Quality Reasons* | *Estimated Number of Single Trips Reduced* |
|---|---|---|---|
| ***Sacramento Metropolitan AQMD*** | ***5,650*** | **1** | **5,650** |
| ***Yolo-Solano AQMD*** | ***0*** | | **0** |
| ***Placer County APCD*** | ***1,641*** | **1** | **1,641** |
| ***Sacramento Core Region***[52] | ***5,533*** | **1** | **5,533** |
| ***El Dorado County AQMD*** | ***869*** | **1** | **869** |
| ***Sacramento Nonattainment Area***[53] | ***5,919***[54] | **1** | **5,919 trips** |

## Percentage of Purposeful Reducers: Spare The Air Days vs. Control Days

10 ➢ ***Control day interview results indicated that there were no respondents who specifically avoided making trips for air quality reasons on non Spare The Air days. However, because of the few purposeful reducers on Spare The Air days, there is no significant difference between Spare The Air and Control percentages this year.***

Control day respondents were also asked if they had reduced the number of trips the day before, and if so, why. If the same percentage of drivers claimed to have reduced their driving on Control days for air quality reasons as on Spare The Air days, it is harder to credit the Spare The Air program as the cause of driving reduction.[55]

The next table indicates the results from Control interviews in all the air districts. It can be seen that in the entire Nonattainment Area, no respondents reduced the number of trips for air quality reasons on Control days.

52 Excludes El Dorado County AQMD.

53 Includes El Dorado County AQMD.

54 The results for the Sacramento Nonattainment Area as a whole are not the simple sum of the individual air districts, but rather, are weighted results that reflect the relative proportional distribution of residents in the area.

55 This year the same methodology as was adopted last year was used for Control day interviews: namely, reducers were classified as those respondents who said they drove less the previous day for air quality reasons, and who were not seasonal driving reducers (see 2010 Seasonal Driving Reduction Report for a complete description.)

| *Air District* | *% of Respondents Who Reduced for Air Quality Reasons* | | *Significant Difference?* |
|---|---|---|---|
| | *Who Were Aware On STA Days* | *On Control Days* | |
| *Sacramento Metropolitan AQMD* | 0.6% | 0.0% | No |
| *Yolo-Solano AQMD* | 0.0% | 0.0% | No |
| *Placer AQMD* | 0.7% | 0.0% | No |
| *Sacramento Core Region* | 0.4% | 0.0% | No |
| *El Dorado County AQMD* | 0.9% | 0.0% | No |
| *Sacramento Nonattainment Area* | 0.4% | 0.0% | No |

# ESTIMATED EMISSION REDUCTIONS

## *Objective*

The main objective of the current section is to estimate how many tons of ozone precursor emissions [Reactive Organic Gas (ROG) and Nitrogen Oxides (NOx)] were reduced during the 2012 season that could be attributed directly to the Spare The Air program. In order not to overestimate possible reductions, a correction factor based on Control day interviewing has been applied. Results, therefore, are conservative.

## RESULTS

### Calculation of Estimated Emission Reductions

1 ➢ ***The 2013 Spare The Air voluntary driving reduction program was successful in reducing air pollution in the entire Sacramento Nonattainment Area by an estimated 0.02 tons of ozone precursors per Spare The Air day. This is due specifically to drivers purposefully reducing the number of trips they took on Spare The Air days for air quality reasons.***

The methodology used to estimate emission reductions due specifically to the Spare The Air program is very conservative. First, it includes only those drivers who said they drove less the previous day for air quality reasons (we interview respondents the day after a Spare The Air day is called). Thus, seasonal reducers who normally make fewer trips during the summer to help improve air quality are not (necessarily) included[56]. Further, any purposeful driving reduction for air quality reasons on non-Spare The Air days (i.e. Control day interviews) is subtracted from the emission reduction estimate. In addition, emission reductions were to be calculated only in those air districts where significantly more respondents said they drove less on Spare The Air days than on Control days. It has previously been recommended that the

[56] These respondents are examined in another report on Seasonal Driving Reduction.

necessity of requiring this last step be dropped.[57] The prerequisite was introduced at a time when air quality in the nonattainment area was much worse.[58]

Results from the Sacramento Nonattainment Area as a whole (including El Dorado County AQMD results) are used to illustrate the procedure for estimating emission reductions according to the following steps:

1. Calculate the percentage of purposeful reducers, that is, drivers who said they were aware of the Spare The Air advisories,[59] and who also said they drove less than usual on Spare The Air days, specifically for air quality reasons. For the Nonattainment Area as a whole, this was **0.4%**[60] (1 / 263[61]) of all respondents interviewed following Spare The Air days.

2. Record the mean (average) number of single trips they avoided for air quality reasons on Spare The Air days. These purposeful reducers were asked to estimate the number of single trips they avoided making on the Spare The Air day. For the Nonattainment Area, the mean was **1** single trip avoided.

3. Extrapolate to the total number of drivers in the region[62] this year: the percentage of Spare The Air reducers therefore represents **5,919** drivers in the Sacramento Nonattainment Area, and the number of single trips avoided was **5,919** (5,919drivers x 1 trips avoided on average).

4. Multiply the number of trips avoided by a per trip emission reduction average of **3.29 grams of ozone precursors.**[63] [This includes a total of Reactive Organic Gas (ROG)

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57 See also Purposeful Driving Reduction reports in 2009, 2010, 2011, 2012 and 2013.

58 This requirement, considered a prerequisite for the calculation of emission reductions in each air district, was introduced into the methodology in 2000 by Jude Lamare, Ph.D.; formerly with the Cleaner Air Partnership; and prior to discussions in 2002 with the Air Resources Board as to what would constitute a purposeful driving reducer. The definition of a purposeful reducer changed after these discussions, but the previous methodology requiring a significant difference between Spare The Air and Control drivers saying they drove less the previous day did not. The air districts might therefore want to reconsider whether this prerequisite is still necessary, given the fact that Control day interviewing already acts as a correction factor; that the sampling design change in 2008 of fewer completed interviews means that the margins of error in each air district are increased, and that other explanations are plausible. In fact, in 2009 a significant difference was found in the weighted Sacramento nonattainment area as a whole as well as in Placer County APCD, but not in Sacramento Metropolitan AQMD, or Yolo-Solano AQMD, or El Dorado County AQMD. Emission reductions were still calculated for Sacramento Metropolitan AQMD as it is the largest air district within the nonattainment area. This year there were no significant differences in any of the air districts.

59 Using the ARB-worded question for measuring general awareness of Spare The Air: Q.12b "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?"

60 See the Purposeful Driving Reduction section of the 2013 report for a full explanation of these results.

61 The total number of completed interviews was weighted. Since the beginning evaluation in 1995, the methodology for weighting has been to set Sacramento County interviews as 1, and down-weight interviews from all other counties appropriately, depending on the size of their populations. (Sacramento Metropolitan AQMD: 65%, Yolo-Solano AQMD: 15%, Placer County APCD: 15%, and El Dorado County AQMD: 5%.) This is why the weighted total of completed interviews (263) is less than the sum of the total number of interviews in all air districts (549). Consequently, the one recorded purposeful reducer in Yolo/Solano AQMD, and the one in El Dorado County AQMD are weighted out of the Nonattainment region as a whole.

62 The number of drivers in the Sacramento nonattainment area for 2013 was estimated, using the number of driver licenses by county for 2012, obtained from the California Department of Motor Vehicles database http://www.dmv.ca.gov/about/profile/dl_outs_by_county.pdf , and calculating the percentage increase, based on county population figure increases from 2012 to 2013 listed at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls. The estimated number of licensed drivers for the total Sacramento nonattainment area in 2012, therefore, was 1,479,618: Sacramento Metropolitan AQMD: total 941,693 + Yolo-Solano: total of 206,996 (126,712 in Yolo County + Solano County: 276,839 * 29% for the proportion located within the Air Quality district = 80,283) + Placer County: total of 234,433 (269,464 * 87% for Air Quality district) + El Dorado County: total of 96,495 (141,904 * 68% for Air Quality district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region as a whole.

63 Estimates were based on the Summer On-Road Inventory - EMFAC 2011 v 2.3 model, for the summer of 2013, provided by Charles Anderson, Program Coordinator, SMAQMD Planning & Emission Inventory in an email dated October 21, 2013. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (5.55 + 1.79 + 2.35) were converted to pounds (multiplied by 2,000) and then to grams (multiplied by 454) before dividing by the combined total number of trips (i.e. 3,077,211 for light duty passenger cars + 424,733 for light duty trucks1 + 1,058,015 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (3.57 +1.02 + 2.25) x 2000 x

emissions (1.93 grams per trip for light duty passenger cars plus two categories of light duty trucks) plus Oxides of Nitrogen (NOx) emissions (1.36 grams per trip for light duty passenger cars and light duty trucks) emissions, based on 2013 models of EMFAC2011 V2.3.] EMFAC2011 V2.3 is the latest update to the EMFAC model. It is used by California state and local governments to meet Clean Air Act (CAA) requirements. EMFAC2011 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 Sacramento Nonattainment Area, this amounts to **19,474 grams** of ozone precursors (5,919 single trips avoided x 3.29 grams per trip).

5. Convert to tons.[64] For the Sacramento Nonattainment Area as a whole, this translates to an estimated total of **0.02 tons of pollutants reduced** per Spare The Air day.

6. Repeat the process for Control day interviews: record the mean number of trips avoided by the respondents who drove less for air quality reasons on Control days. As there were no recorded purposeful reducers on control days, this step was skipped.

7. Apply the correction factor. To ensure that only purposeful driving reduction due to the Spare The Air program is counted in the estimate of emission reduction, we subtract the Control day air quality emission reduction from the Spare The Air day reduction. Because Control day emissions reductions equal zero, no correction factor is necessary :

8. Result: **0.02 tons of ozone precursors reduced per Spare The Air day in 2013.**

| Sacramento Nonattainment Area | Percent of Respondent Drivers Who Drove Less for Air Quality Reasons[65] | X Number of Licensed Drivers in Sacramento Nonattain-ment Area (1,479,618 Total) | X Mean Number of Single Trips Reduced Per Day | X 3.29 Grams of Ozone Precursors Per Trip (EMFAC 2011 V2.3) 2013 summer | = Estimated Tons per Day of Ozone Precursors Reduced |
|---|---|---|---|---|---|
| Spare The Air Days | 0.4% (1 / 263) | 5,919 | 5,919 | 19,474 grams | 0.02 tons |
| Control Days | 0.0% (0 /366) | 0 | 0 | 0 grams | 0.00 tons |
| **Estimated Tons of Ozone Precursors Reduced Per Day: (STA Day Reductions minus Control Day Reductions)** | | | | | ***0.02 tons*** |

454 / (3,077,211+ 424,733 + 1,058,015). ROG grams and NOx grams were then combined (1.93 + 1.36) to obtain 3.29 grams per trip of emission precursors in the region as a whole. These are the figures considered most accurate at the time this report was written.

64 There are 907,200 grams in a ton.

65 In addition, in the case of Spare The Air respondents, these drivers had to say they had heard the Spare The Air advisory (the ARB general awareness question - Q12b).

## 2013 Emissions Reduction Estimate: Sacramento Metropolitan AQMD

*2 ➢ There was a 0.02 ton reduction in ozone precursors in Sacramento Metropolitan AQMD per Spare The Air day. See pages 30-33 for explanation.*

| Sacramento Metropolitan AQMD | Percent of Respondent Drivers Who Drove Less for Air Quality Reasons | X Number of Licensed Drivers in Sacramento Metropolitan AQMD (941,693 Total) | X Mean Number of Single Trips Reduced Per Day | X 3.29 Grams of Ozone Precursors Per Trip (EMFAC 2011 V2.3) 2013 summer | = Estimated Tons Per Day of Ozone Precursors Reduced |
|---|---|---|---|---|---|
| Spare The Air Days | 0.6% (1 /166) | 5,650 | 5,650 | 18,588 grams | 0.02 tons |
| Control Days | 0.0% (0 / 240) | 0 | 0 | 0 grams | 0tons |
| Estimated Tons of Ozone Precursors Reduced Per Day: (STA Day Reductions minus Control Day Reductions) | | | | | *0.02 tons* |

## Comparison with Previous Years: Sacramento Metropolitan AQMD (only)

A comparison of estimated emission reductions[66] due to the Spare The Air program from 2001 to 2013 present in the Sacramento Metropolitan Air Quality Management District[67] are presented in the next table. It is important to point out that the factors that contribute to the estimates (i.e. differences in yearly estimated ROG and NOx emission factors per trip,[68] changes in the number of drivers, the percentage of purposeful reducers, the average number of trips reduced, the severity of air quality conditions and the number of Spare The Air days experienced during each summer season) vary from one year to the next.

It can be seen that the estimated emission reductions per Spare The Air day ranged from a low of .00 tons in the 2012 season to a high of 1.32 tons in 2001. **The Spare The Air program has been successful in reducing the amount of ozone precursors in the air each year except for 2012.** Following questionable conclusions from the 2012 season, data from 2013 are evidence of the continued success of the program. Though the this season included a record low two Spare The Air days, the program was successful in reducing ozone precursors in the Sacramento Nonattainment Area on those days.

[66] The estimated emissions reductions shown in the current table were based on accepted EMFAC models for each year. This year, estimates were based on the EMFAC 2011 v 2.3 model, 2013 summer, Charles Anderson, Program Coordinator, SMAQMD Planning & Emission Inventory & Hao Quinn, SMAQMD Associate Air Quality Engineer in an email dated October 21, 2013.

[67] Over the years, reductions could often not be calculated for Placer County APCD, Yolo-Solano AQMD, and El Dorado County AQMD as there were often no significant differences between Spare The Air and Control day drivers who said they drove less. (See footnote 3.) Once again, the air quality districts might want to consider dropping this prerequisite. Also, as El Dorado County AQMD respondents were not interviewed in every survey year, it is not feasible to compare the tons reduced from the entire nonattainment area over the years. Emission reductions for just the Sacramento Core Region (excluding El Dorado County AQMD) were not included in previous years' evaluations.

[68] It should be noted that over the years the motor vehicle emissions have lowered, because cleaner burning vehicles produce fewer emissions.

| *Year* | *2001* | *2002* | *2003* | *2004* | *2005* | *2006* | *2007* | *2008* | *2009* | *2010* | *2011* | *2012* | *2013* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Sacramento Metropolitan AQMD:***<br>***Average emission reductions attributed to Spare The Air (tons)*** | **1.32** | **0.99** | **0.26** | **0.42** | **0.25** | **0.26** | **0.06** | **0.03** | **0.19** | **0.07** | **0.08** | **0.00** | **0.02** |

# 2013 SUMMERTIME SEASONAL TRIP REDUCTIONS

## *Objectives*

There is a group of residents who usually drive less to help improve air quality in the region during the summer months who are not necessarily included in emission reduction estimates as they may have not driven less on a Spare The Air day because they have already reduced their driving behavior. Specific objectives of the current report are to:

a. 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,
b. compare the percentage of seasonal trip reducers and the mean number of trips they have avoided over the past 13 years, and
c. estimate emission reductions from these voluntary driving reducers.

## RESULTS

### Seasonal Driving Reducers

1 ➢ ***One third (32%) of all respondents in the Sacramento Nonattainment Area are seasonal reducers – that is, they usually reduce the amount of driving they do during the summer to avoid adding to air pollution.***

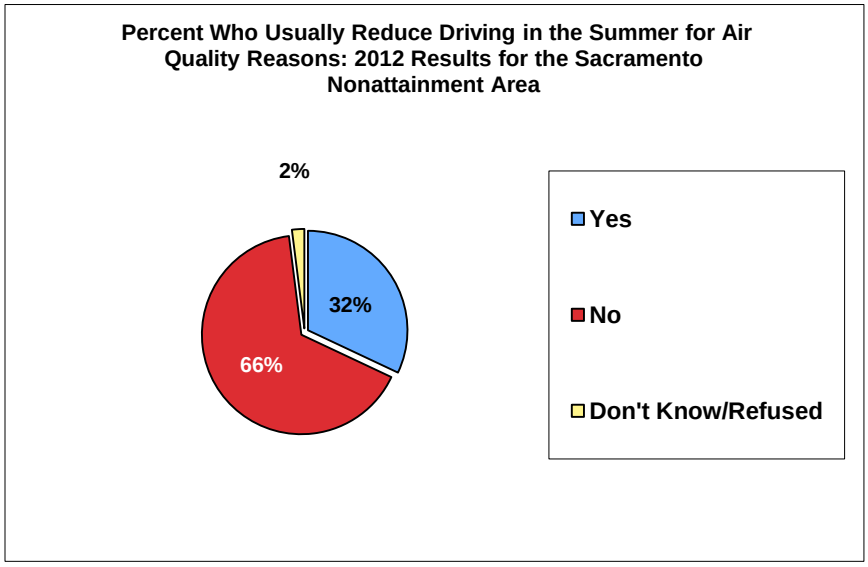
Seasonal driving reducers are defined as those who say they usually reduce the amount of driving they do during the summer months to avoid adding to air pollution. **In large part, they can be considered as Spare The Air "success" stories** – they understand that driving is a significant contributor to air pollution particularly through the summer months, and have incorporated it into their actual driving behavior by reducing the number of vehicle trips they make during the summer. It can be seen in the next pie chart that for the entire Sacramento Nonattainment Area as a whole, 32% of all[69] respondents in 2013 can be considered seasonal driving reducers. That 32% translates into an estimated 473,773[70]

[69] For the purpose of this report, results from respondents interviewed following Spare The Air days have been combined with those interviewed on Control days as the issue under discussion applies equally to both groups of respondents.

[70] The number of drivers in the Sacramento nonattainment area for 2013 was estimated, using the number of driver licenses by county for 2012, obtained from the California Department of Motor Vehicles database http://www.dmv.ca.gov/about/profile/dl_outs_by_county.pdf , and calculating the percentage increase, based on county population figure increases from 2012 to 2013 listed at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/documents/E-1_2013_Internet_Version.xls. The estimated number of licensed drivers for the total Sacramento nonattainment area in 2013, therefore, was 1,479,618:

drivers in the Sacramento Nonattainment Area who regularly reduce their driving during the summer months to avoid adding to air pollution.

.




## Number of Reduced Trips

**2** ➢ ***Summertime driving reducers made fewer trips than those who did not change their driving habits during the summer: on average, they made .32 fewer trips per day.***

This percentage of seasonal reducers reported that they entered their cars the previous day an average of 2.39 times. The 66% who said they did not usually reduce the amount of driving they do during the summer self-reported entering their cars more frequently, an average of 2.71 times. **On average, seasonal driving reducers made 0.32 fewer trips per day** than did non-reducers (2.71 – 2.39 = 0.32 trips). An analysis of variance indicated that these means are significantly different from each other.[71]

| | *Seasonal Driving Reducers: Mean # Times Entered Vehicle* | *Non-Reducers: Mean # Times Entered Vehicle* | *Statistically Significant Difference?* |
|---|---|---|---|
| *Sacramento Nonattainment Area (weighted results)* | **2.39** | **2.71** | **Yes** |

Sacramento Metropolitan AQMD: total 941,693 + Yolo-Solano: total of 206,996 (126,712 in Yolo County + Solano County: 276,839 * 29% for the proportion located within the Air Quality district = 80,283) + Placer County: total of 234,433 (269,464 * 87% for Air Quality district) + El Dorado County: total of 96,495 (141,904 * 68% for Air Quality district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region as a whole.

[71] $F(1, 1178) = 4.47$, $p < .05$.

## Seasonal Trip Reduction: Estimated Emission Reductions

***3 ➢ In 2013, nearly half a million (473,477) drivers were seasonal reducers. The number of trips they avoided translated into a reduction of 0.55 tons per day of ozone precursors during the summer of 2013.***

Respondents who habitually drive less in the summer represent a substantial proportion of the general population of drivers who are helping to improve air quality in the region by reducing emissions. The 32% of 2013 seasonal reducers translates into nearly half a million drivers (473,477) in the entire nonattainment area. It is possible to estimate the amount of ozone precursors that have been reduced due to respondents habitually driving less during the summer for air quality reasons. The methodology is the same as that used to estimate emission reductions on Spare The Air days[72] and is summarized in the next table. **It can be seen that the average of 0.32 of a trip per day that seasonal reducers avoided translates into an estimated 0.55 tons of ozone precursors reduced per summer day in 2013.**

| Sacramento Nonattainment Area | Percent of Respondent Drivers Who Usually Drive Less During the Summer for Air Quality Reasons | x Number of Licensed Drivers in Sacramento Nonattain-ment Area (1,479,618 Total) | x Mean Number of Trips Reduced Per Day Compared to Non-Reducers | x 3.29 Grams of Ozone Precursors Per Trip (EMFAC 2011 V2.3) 2013 Summer Model[73] | = Estimated Tons[74] Per Day of Ozone Precursors Reduced |
|---|---|---|---|---|---|
| Spare The Air and Control Day Interviews Combined | 32% | 473,477 | x 0.32 = 152,513 | 498,476 grams | 0.55 tons |

[72] For a full explanation of the methodology, see report titled "Estimated Emission Reductions during the 2013 Spare The Air Season", Joseph Hanson, November 2013.

[73] Estimates were based on the Summer On-Road Inventory - EMFAC 2011 v 2.3 model, for the summer of 2013, provided by Charles Anderson, Program Coordinator, SMAQMD Planning & Emission Inventory in an email dated October 21, 2013. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (5.55 + 1.79 + 2.35) were converted to pounds (multiplied by 2,000) and then to grams (multiplied by 454) before dividing by the combined total number of trips (i.e. 3,077,211 for light duty passenger cars + 424,733 for light duty trucks1 + 1,058,015 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (3.57 +1.02 + 2.25) x 2000 x 454 / (3,077,211+ 424,733 + 1,058,015). ROG grams and NOx grams were then combined (1.93 + 1.36) to obtain 3.29 grams per trip of emission precursors in the region as a whole. These are the figures considered most accurate at the time this report was written.

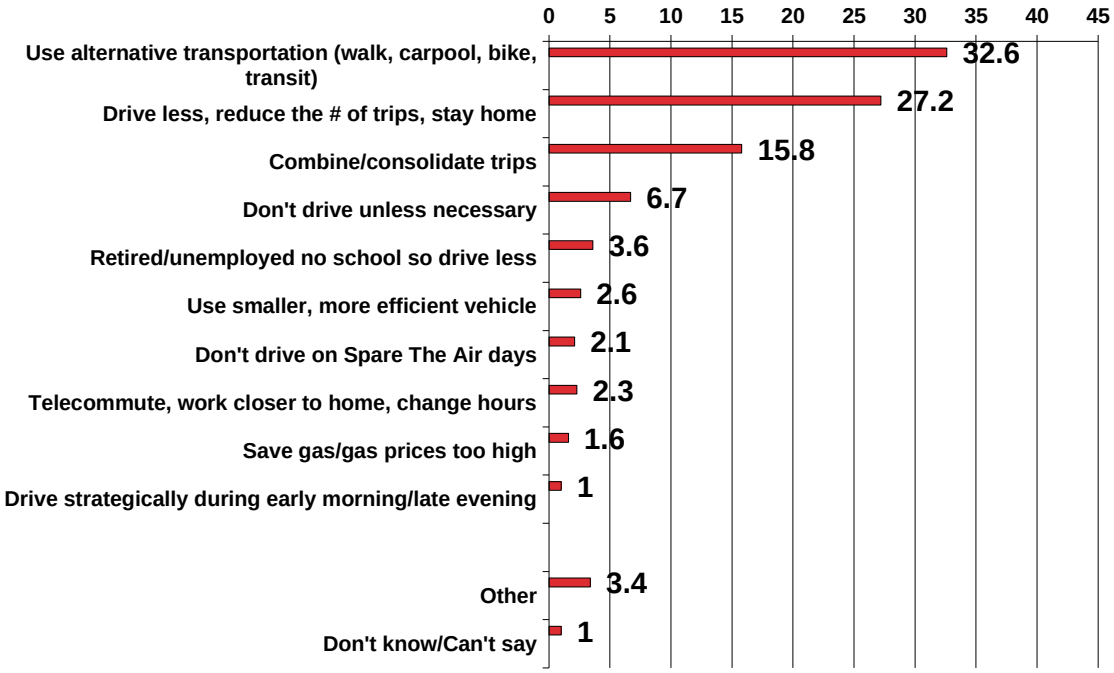
[74] There are 907,200 grams in a ton.

## How They Reduce Driving

***4 ➢ Seasonal reducers used alternative transportation, made fewer trips, stayed home, or planned and consolidated errands in order to reduce the amount of driving they did during the summer months.***

Those who said they usually reduce the amount of driving during the summer months were then asked to elaborate. Verbatim comments were captured and later categorized, and the results are presented in the next graph. It can be seen that a third (32%) of seasonal reducers said they used alternative transportation, which included biking, walking, carpooling, or using public transit. One quarter (24%) said they made fewer trips or just stayed home. A further 19% said they regularly combined or consolidated their trips so as to go out less. Another portion (7.2%) said they do not drive unless necessary. Close to five percent (4.5%) were either retired, unemployed, or as parents or teachers, they didn't have to drive to school during the summer. Some respondents (3.2%) use a smaller more efficient vehicle. Two percent (1.9%) specifically mentioned that they avoided driving on Spare The Air days. "Other" reasons were offered by two percent of respondents (2.1%).

**How Have You Reduced Driving This Summer?**




A few representative comments[75] from those who used alternative transportation are listed below.

- Take the bus and sometimes I walk.
- Walking. If I don't have to drive my car then I don't. Gas is expensive.

[75] The complete transcripts of all responses are available in the statistical file.

- I ride a bike when I can.
- I ride a bike where I need to go.
- Walking.
- Walk to town.
- Ride bikes.
- I use my bicycle or by walking.
- Walking and riding a bike.
- Sometimes I ride my bike.
- I walk more than I drive.
- I car pool and plan my trips out so I don't have to double back.
- Rode my bicycle more and car pooled with my husband.
- Ride the bike more and walk.
- I walk to work.
- Car pool.
- Ride my bike.
- Ride my bike 4-5 days a week.
- Car pool and walking.
- I will walk sometimes or carpool when I can.
- We carpool.
- I take the light rail.
- We have bikes.
- We try to carpool
- I ride a bike.
- Take public transit.
- Just sharing rides.
- I have a scooter and I also walk.

A few representative comments from those who said <u>they drove less, reduced the number of trips, or stayed home</u> are listed below.

- I stay at home.
- Not to go anywhere.
- It is too hot to drive.
- I haven't driven that much and taking fewer trips.
- I don't really go anywhere.
- Just don't go anywhere.
- Just drive less.
- Stay home.
- I just don't go out that much. Have not been going many places.
- Reduce my daily runs.
- I do not go out.
- No weekend driving.
- I just don't drive as much and I just don't go as many places if I don't have to. Plus, because of the price of gas.
- Stayed home.
- Don’t go out.
- Not going out as much. I try not to travel to places unless they’re close to my route.
- Stayed home more.
- Just don’t drive very much.
- Didn’t drive as often, and combined different shopping tasks.

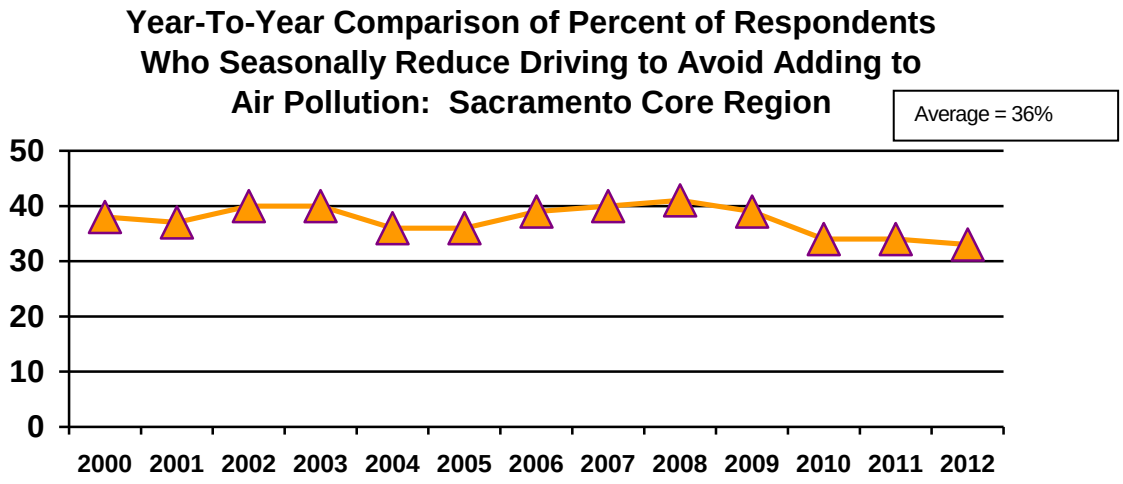
A few representative comments by those who <u>combined trips</u> include:

- I minimize my trips and make them as short as possible.
- I drive during non-commute hours, I combine errands, and stay home some days.
- I try to limit trips to one time. I combine what I have to do into one trip.
- I have been doing all my errands at once.
- Combining trips.
- Well I figure out all I have to do and take care of it at once instead of going in a circle and going back and forth.
- We try to do everything in one trip.
- I'm careful about the trips I take, when it comes to driving. I try to combine them or not go out if I really don't need to.
- I combine trips.
- I try to combine trips together. Like shopping, etc.
- We make any trip we have count by only going when we need to and combining errands.

## Year-To-Year Comparisons

***5 ➢ This year's percentage of seasonal reducers in the Sacramento Core Region is not significantly different from the 14-year average of 36%.***

The year-to-year analysis excludes respondents from El Dorado County AQMD as they were not interviewed in evaluations prior to 2004. As can be seen in the next graph, the percentage of respondents who said they usually reduce their driving during the summer to avoid adding to air pollution has remained relatively stable, with a 14-year average of 36%. In the context of the 2013 season, which exhibited lower readings of ozone air pollution and only two Spare The Air days, consistency with the average over 14 years is evidence of the Spare The Air program's success. The high of 41% reached in 2008 was significantly greater than the 32% of this year, 2011 and 2012.



**6** ➢ ***The 14-year average number of trips avoided on a summer day by seasonal reducers is 0.7. This varied from a high of 1.1 trips avoided in 2001 and 2003 to a low of 0.3 trips in 2013.***

The next table shows the average number of self-reported trips made by seasonal reducers versus non-reducers[76] from 2000 to the present. It can be seen that the average number of additional trips avoided by seasonal reducers (that is, the difference between reducers and non-reducers) ranged from 0.3 of a trip per day to just over 1 trip per day. **In other words, a substantial subset of the population of respondents in the Spare The Air evaluations habitually reduce the amount of driving they do during the summer months.** Some of these individuals may not qualify as episodic reducers on specific Spare The Air days for methodological reasons (i.e. they may not have driven less on a specific Spare The Air day because they already had reduced their driving as much as they could) but they nonetheless contribute to voluntary emissions reductions during the summer months.

| *Year* | *Seasonal Driving Reducers: Mean # Times Entered Vehicle* | *Non-Reducers: Mean # Times Entered Vehicle* | *Difference (Mean Number of Daily Single Trips Avoided by Seasonal Reducers)* | *Statistically Significant Difference?* |
|---|---|---|---|---|
| *2000* | 3.6 | 4.1 | 0.5 | Yes |
| *2001* | 3.1 | 4.2 | 1.1 | Yes |
| *2002* | 3.1 | 4.1 | 1.0 | Yes |
| *2003* | 3.1 | 4.2 | 1.1 | Yes |
| *2004* | 3.4 | 3.9 | 0.5 | Yes |
| *2005* | 3.0 | 3.5 | 0.5 | Yes |
| *2006* | 2.9 | 3.6 | 0.7 | Yes |
| *2007* | 3.2 | 3.8 | 0.6 | Yes |
| *2008* | 2.9 | 3.3 | 0.4 | Yes |
| *2009* | 2.6 | 3.4 | 0.8 | Yes |
| *2010* | 2.9 | 3.8 | 0.9 | Yes |
| *2011* | 2.9 | 3.3 | 0.4 | No |
| *2012* | 2.5 | 3.4 | .85 | Yes |
| *2013* | 2.4 | 2.7 | .3 | Yes |

[76] Excludes El Dorado County AQMD results.

# SUMMER 2013 HEALTH ISSUES

## *Objectives*

The main objective of the current section is to document the relationship between air quality and the health effects experienced by households in the Sacramento nonattainment area during the summer of 2011. More specific objectives are to:

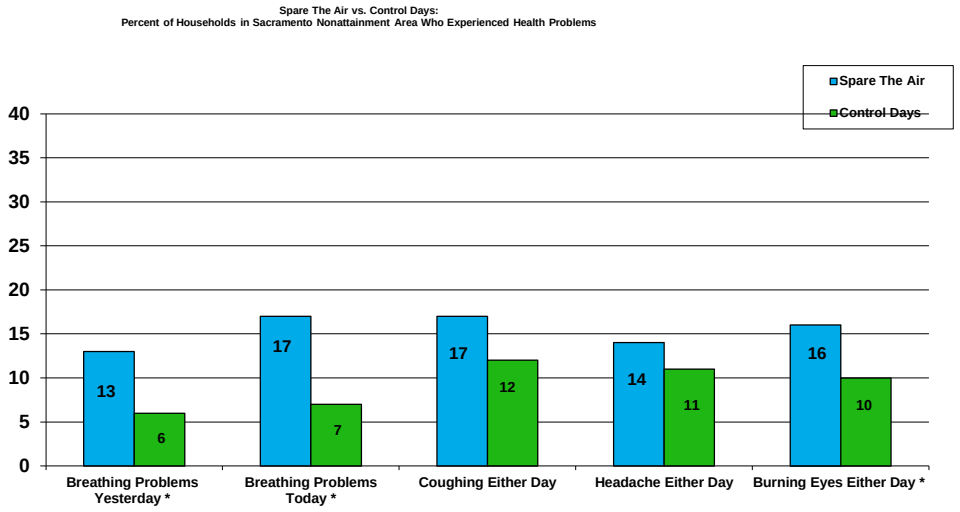
a. compare levels of perceived health effects due to poor air quality between respondents interviewed following Spare The Air days and those interviewed on Control (non Spare The Air) days,
b. estimate the number of households in the Sacramento nonattainment area whose health was affected by poor air quality specifically due to ozone air pollution on Spare The Air days in 2011,
c. determine if levels of reported health problems during summer Spare The Air seasons have increased, decreased, or stayed the same from 2000 to the present in the Sacramento Core Region (excluding El Dorado County AQMD), and
d. compare the incidence of reported health problems among the four air quality districts in the Sacramento nonattainment area (Sacramento Metropolitan AQMD, Yolo-Solano AQMD, Placer County APCD, and El Dorado County AQMD).

## RESULTS

### Perceived Health Problems: Spare The Air Days vs. Control Days

1 ➢ ***Thirteen percent (13%) of households in the entire Sacramento nonattainment area reported breathing problems on Spare The Air days in 2013. Correcting for control day responses, this translates into 60,971 additional households that were affected specifically by pollution on Spare The Air days during the summer of 2013.***

For both Spare The Air and Control day respondents, respiratory health of individuals within the household was measured using two items at the end of the survey, each with a follow-up item to gather more specific information. First, respondents were asked if they or anyone else in their household experienced any health effects, such as burning eyes, headaches, coughing, or difficulty breathing the day before the interview due to unhealthy air. If yes, a secondary question solicited open ended responses as to what, specifically, they experienced (burning eyes, headaches, coughing, difficulty breathing, or other). Next, respondents were asked a similar question that was specific to the day of the interview. If yes, open ended responses were solicited regarding what, specifically, they experienced. Results from the weighted Sacramento nonattainment area as a whole are presented in the next chart. For breathing problems yesterday and today, Spare The Air day respondents experienced significantly more breathing problems than Control day respondents. Thirteen percent (13%) of Spare The Air day respondents said they experienced breathing problems on the previous day, compared with 6% of Control day respondents. However, on the day of the interview 17% of Spare The Air day respondents said they experienced breathing problems that day compared to only 7% of Control day respondents. Coughing, headaches, and burning eyes were experienced by both groups of households but only burning eyes were experienced significantly more frequently by Spare The Air day respondents than Control day respondents.




**indicates a significant difference between groups*

With an estimated 876,566 households in the Sacramento nonattainment area[77], the 13% of respondents who claimed that someone in their household experienced breathing problems on a Spare The Air day translates into 113,564 households. The 6% of respondents who reported breathing problems on Control days translates into 52,593 households. Correcting for Control days through subtraction, this means that **60,971 households experienced breathing problems due to air pollution on Spare The Air days in 2013**.

## Year-To-Year Comparisons

2 ➢ ***There are more health problems now than two years ago: the percentage of households experiencing breathing difficulties in the Sacramento Core Region on Spare The Air days has increased to 13% from a low of 8% in 2011. Because air pollution is decreasing in general, it is possible that the increase in breathing difficulties is due to significant wildfire smoke experienced near each of the two Spare The Air days this summer.***

Because respondents in El Dorado County AQMD were not interviewed in all evaluation years, their responses were excluded and results for just the Sacramento Core Region were reweighted and recalculated. The percentages of respondents who said someone in their household had trouble breathing the previous day[78] on Spare The Air and Control days from

[77] The measure used for households was the "total housing units" column, in order to be consistent with previous years' evaluations. This year the dataset includes a new column for "total households", not previously present. Reference: State of California, Department of Finance, E-5 Population and Housing Estimates for Cities, Counties, and the State, 2010-2011, with 2010 Benchmark. Sacramento, California, May 2011. Online source http://www.dof.ca.gov/research/demographic/reports/estimates/e-5/2011-20/view.php . The estimated number of households for the entire Sacramento nonattainment area is **873,566** ((Sacramento Metropolitan AQMD: 559,806) + (Placer County APCD: 155,782* 87% = 135,530) + (Yolo-Solano AQMD: 118,053 (Yolo: 74,589; Solano (Dixon, Rio Vista & Vacaville: 43,464)) + (El Dorado County AQMD: 88,495* 68% = 60,177)).

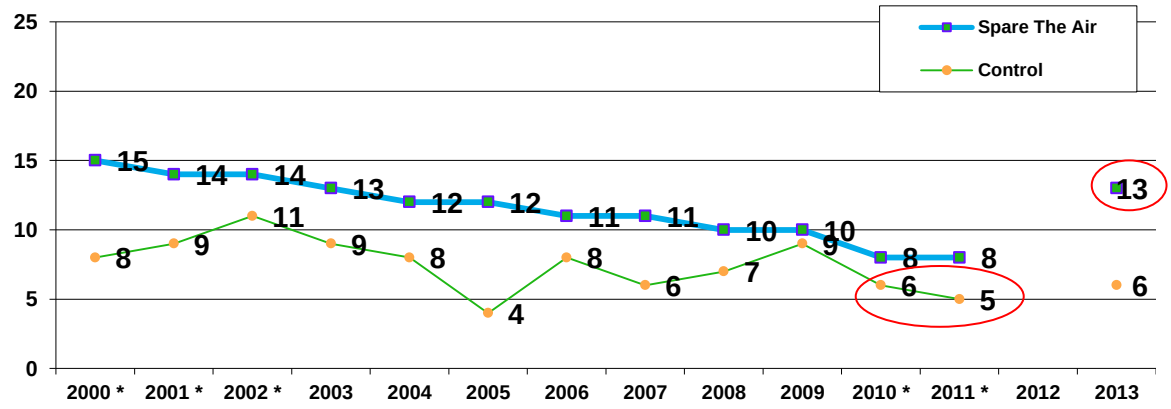
[78] The additional health-related questions of breathing today, coughing, headache, and burning eyes have only been asked since 2004 but not at all in 2012.

2000 to the present, excluding 2012 when health effects were not surveyed, are plotted in the next graph. It can be seen that positive responses to breathing difficulties have increased from the low 2010 and 2011 levels (8%) to the present (13%). This year's levels are also significantly higher than the 13-year average of 12%. In terms of Control day interviewing, the percentage of households who reported breathing difficulties has remained relatively stable and consistently lower, with annual results not differing from the 13-year average of 7%. Considering that the 2013 season recorded lower readings of ozone air pollution than other seasons, and only included two Spare The Air days, the fact that there was an increase in the number of households who experienced breathing difficulties may be explained, at least in part, by the influence of wildfire smoke.

On August 18, a Spare The Air day, smoke from the American Fire in Placer County, and to a lesser degree the Swedes Fire in Butte County, contributed to high ozone concentrations throughout the Sacramento region and unhealthy particle concentrations near Auburn and Colfax. Light east-northeasterly winds during the overnight and early morning hours gradually transported smoke from both fires into Auburn and Colfax and, to a lesser extent, Sacramento County[79]. Ozone levels in the Unhealthy for Sensitive Groups category were recorded in Placer and El Dorado Counties.

On September 9, the region's second Spare The Air day, smoke from the American Fire continued to contribute to higher ozone and particle levels in the region. Similar to the event on August 18, light easterly winds during the early morning hours transported smoke down the valley, into Auburn and Colfax and eventually into Sacramento County. Light winds throughout the day limited smoke dispersion, increasing impacts in affected areas. Also, lingering smoke from the Rim Fire to the south that began on August 17 may have contributed to elevated particle concentrations on September 9. The Rim Fire was California's third largest wildfire in history and the biggest wildfire on record in the Sierra Nevada. It burned 257,314 acres and wasn't fully contained until October.

**Year-to-Year Comparison of Percent of Respondents Whose Households Experienced Breathing Difficulties Yesterday: Sacramento Core Region (excludes El Dorado AQMD)**



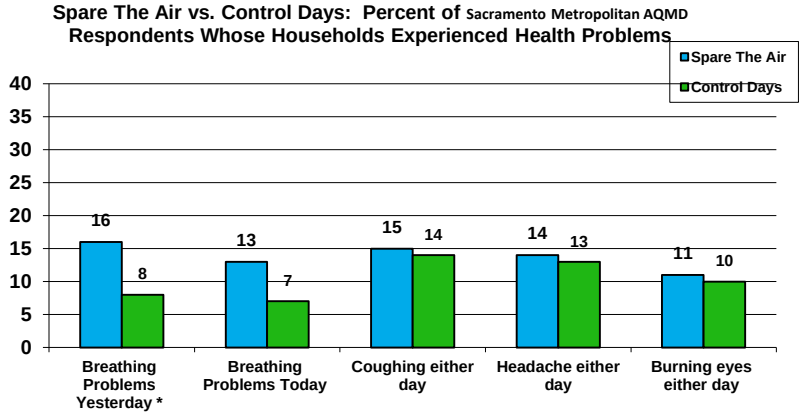

* Circles indicate a significant increase in the percentage of Spare The Air day households from 2010 and 2011 compared to 2013. In addition, 2010 and 2011 percentages were significantly lower than in 2000 - 2002.

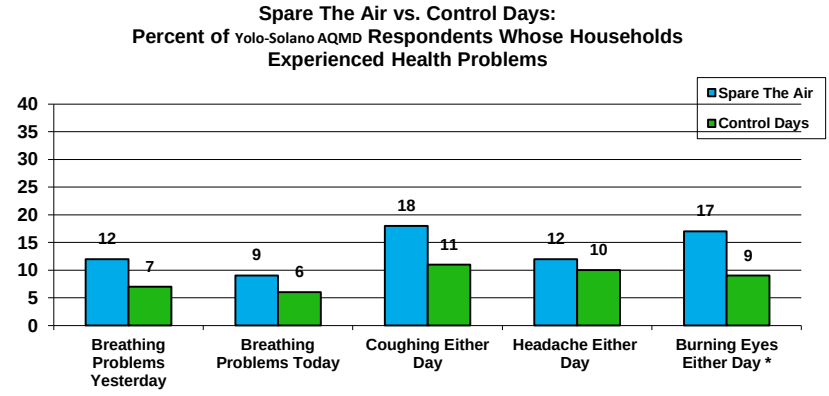
[79] From Sonoma Technology in an email to Lori Kobza, Sacramento Metropolitan AQMD, dated January 13, 2014.

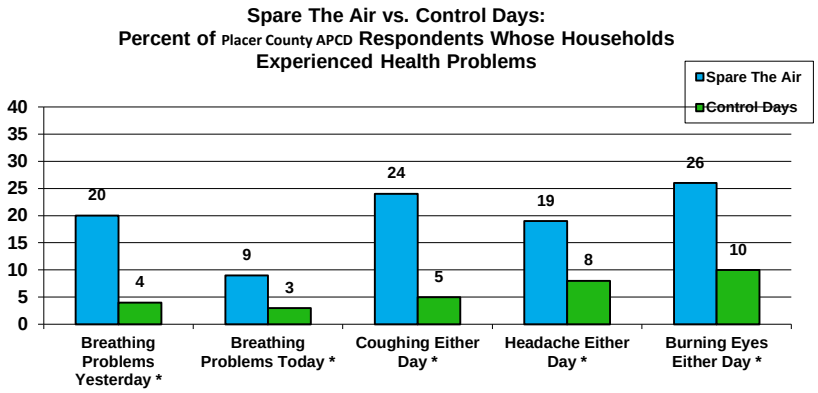
## Individual Air Quality Districts

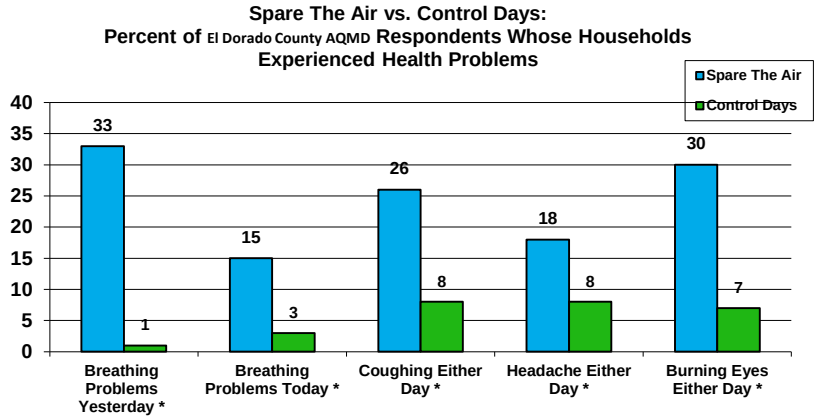
3 ➢ ***Respondents from Placer County APCD and El Dorado County AQMD experienced the most difficulty breathing on either day. It's important to note that smoke from two large wildfires, the American Fire and the Rim Fire, impacted those two counties during both declared Spare The Air days. Additionally, these respondents exhibit the greatest difference between Spare The Air and Control days. This may be due at least in part to wildfire smoke as well.***

The next four graphs indicate the percentages of household health issues experienced by Spare The Air and Control day respondents in each of the individual air quality districts. Significant differences between these groups are indicated with an asterisk (*).





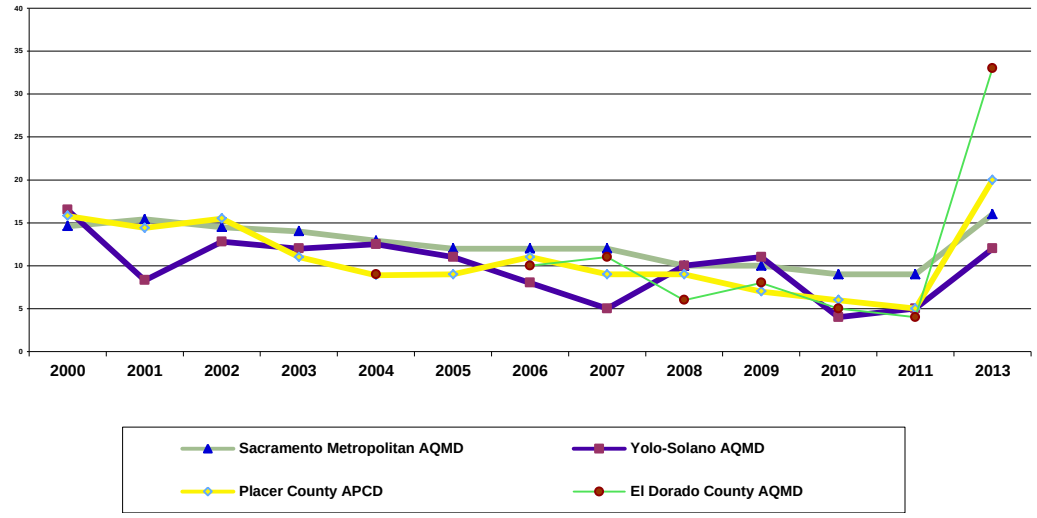




## Air Quality Districts: Year-To-Year Comparisons

*4* ➢ ***Except in Yolo-Solano AQMD, difficulty breathing increased this year in the individual air districts to levels greater than any other year. Considering the relative decrease in ozone air pollution this year, it is another indication of the impact of wildfire smoke.***

The percentages of households who reported breathing problems on Spare The Air days from 2000 to the present in the individual air districts are presented in the next graph. El Dorado County AQMD results are only available for seven years. Results indicate an overall decline in the percentage of households experiencing breathing difficulties from 2000 to 2011 followed by a great increase in 2013. This increase is most likely due to wildfire smoke. The general trend toward improving air quality in the region appears a better indication of daily experiences of Sacramento area residents.

**Year-to-Year Comparison of Percent of Respondents Whose Households Experienced Breathing Problems on Spare The Air days**



# APPENDIX A

## 2013 BEHAVIOR & ATTITUDE TELEPHONE TRACKING SURVEY
## FINAL QUESTIONNAIRE ~ APRIL 1, 2013

| | Methods: |
|---|---|
| Field Dates: | • STA episodes days: May – September, 2013<br>Control days: September, 2013 |
| Sample Size: | • up to 2,400 completed interviews<br>- up to 1,200 completes on STA episodes days<br>- 300 Sacramento Co. residents + up to 100 local cell phone<br>- 300 Yolo/Solano Co. residents<br>- 300 Placer Co. residents<br>- 300 El Dorado Co. residents<br>- 1,200 completes on Control days<br>- 300 Sacramento Co. residents<br>- 300 Yolo/Solano Co. residents<br>- 300 Placer Co. residents<br>- 300 El Dorado Co. residents |
| Unit of Analysis: | • Household |
| Sampling Frame: | • RDD landline |
| Budgeted Length of Interview: | • 4 minutes (Average) |

### • SURVEY INTRODUCTION & REQUEST •

Hello, my name is _____ with Meta Research, a regional public opinion research firm. We are conducting a 4-minute survey regarding your transportation activities yesterday. If someone is available and has the time, I would like to interview the youngest male driver aged 18 or older who is home now.

[If none available: I would like to interview the youngest female driver aged 18 or older who is home now.] Would that be you? [IF NOT, ASK FOR PERSON WHO IS, REPEAT INTRODUCTION]

Do you have 4 minutes for a confidential interview? Your opinions are very important.

[IF NECESSARY, CONTINUE WITH: This is research, NOT SALES. Your telephone number WILL NOT BE associated with your answers. Your answers will be summarized with other peoples' answers; results will not be reported individually.]

[IF RESPONDENT ASKS FOR NAME OF SURVEY SPONSOR, SAY] In order not to bias your responses, we will be glad to tell you the name of the sponsoring agency at the conclusion of the survey.

### • DATA FROM SAMPLE •

DB1. Zip Code

DB2. Geographic Population

1) Sacramento County
2) Yolo/Solano County
3) Placer County
4) El Dorado County

DB3A. Geo/Location Population **QUOTAS for landline sample**
[NOTE TO PROGRAMMER: The data files are divided by the category names and should be coded appropriately. Interviews should be completed proportionally. In other words, categories 20, 21, 22, and 23 should be called simultaneously as well as 30 and 31; similarly for 41 to 46.]

10) Sacramento – Sacramento
**(STA QUOTA: 400 completes)**
**(CONTROL QUOTA: 300 completes)**

20) Yolo/Solano – Davis (95616) (20%)
**(STA QUOTA: 61 completes)**
**(CONTROL QUOTA: 61 completes)**

21) Yolo/Solano – Woodland (95695, 95776), West Sacramento (95605, 95691), Others 95606, 95607, 95612, 95618, 95627, 95653, 95679, 95694, 95698, 95937) (41%)
**(STA QUOTA: 125 completes)**
**(CONTROL QUOTA: 125 completes)**

22) Yolo/Solano – Vacaville (30%)
(95687, 95688)
**(STA QUOTA: STA 90 completes)**
**(CONTROL QUOTA: 90 completes)**

23) Yolo/Solano – Dixon/Rio Vista (8%)
(95620, 945741)
**(STA QUOTA: 24 completes)**
**(CONTROL QUOTA: 24 completes)**

30) Placer – Auburn and vicinity (22%)
(95602, 95603, 95658, 95663)
**(STA QUOTA: 66 completes)**
**(CONTROL QUOTA: 66 completes)**

31) Placer – Roseville (95661, 95678, 95747), Lincoln (95648), Rocklin, Loomis, Other South Placer (95650, 95677, 95765, 95746, 95681) (78%)
**(STA QUOTA: 234 completes)**
**(CONTROL QUOTA: 234 completes)**

41) El Dorado – El Dorado Hills (95762) (23%)
**(STA QUOTA: 46 completes)**
**(CONTROL QUOTA: 69 completes)**

42) El Dorado – Placerville (95667) (31%)
**(STA QUOTA: 63 completes)**
**(CONTROL QUOTA: 95 completes)**

43) El Dorado – Shingle Springs (95682) (24%)
**(STA QUOTA: 49 completes)**
**(CONTROL QUOTA: 73 completes)**

44) El Dorado – Georgetown (95634) (2%)
**(STA QUOTA: 4 completes)**
**(CONTROL QUOTA: 6 completes)**

45) El Dorado – Cool (95614) (3%)
**(STA QUOTA: 6 completes)**
**(CONTROL QUOTA: 9 completes)**

46) El Dorado – Other (95613, 95619, 95623, 95633, 95635, 95651, 95664) (16%)
**(STA QUOTA: 32 completes)**
**(CONTROL QUOTA: 48 completes)**

## • CATI GENERATED •

DB4. STA / Control Date

DB5. Day of Week (for STA or Control Day)

1) Sunday
2) Monday
3) Tuesday
4) Wednesday
5) Thursday
6) Friday
7) Saturday

DB6. Type

1) Spare The Air
2) Control

## • SURVEY BEGINS •

I want to inform you that this call may be monitored for quality purposes.

## • SCREENING QUESTIONS •

ASK ALL RESPONDENTS

Q1. First, did you drive a car, truck, motorcycle or van within the last week?
[If no, thank and seek interview with another driver within the household]

1) Yes
2) No

Q2. To assist in our analysis, please tell me which of the following categories contains your age:

1) 18 to 24

5) 25-64
6) 65 or over
8) Refused

03. Gender [BY OBSERVATION]

1) Male
2) Female

Data for quotas taken from the American Community Survey.[80]

**1200** COMPLETES FOLLOWING A **SPARE THE AIR EPISODES** DAYS

**400** COMPLETES **SACRAMENTO COUNTY** RESIDENTS
**204 FEMALES (51%) / 196 MALES (49%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **9%** | **18** | Completes |
| **MALE 18 - 24** NO LESS THAN **10%** | **20** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **13%** | **27** | Completes |
| **MALE 65 PLUS** NO MORE THAN **9%** | **18** | Completes |

**300** COMPLETES **YOLO/SOLANO COUNTY** RESIDENTS
**150 FEMALES (50%) / 150 MALES (50%) , OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **MALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **12%** | **17** | Completes |
| **MALE 65 PLUS** NO MORE THAN **9%** | **12** | Completes |

**300** COMPLETES **PLACER COUNTY** RESIDENTS
**153 FEMALES (51%) / 147 MALES (49%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **MALE 18 - 24** NO LESS THAN **8%** | **12** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **16%** | **24** | Completes |
| **MALE 65 PLUS** NO MORE THAN **14%** | **21** | Completes |

**200** COMPLETES **EL DORADO COUNTY** RESIDENTS

[80] http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

**100 FEMALES (50%) / 100 MALES (50%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **7%** | **7** | Completes |
| **MALE 18 - 24** NO LESS THAN **8%** | **8** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **15%** | **15** | Completes |
| **MALE 65 PLUS** NO MORE THAN **14%** | **14** | Completes |

**1200** COMPLETES ON **CONTROL** DAYS

**300** COMPLETES **SACRAMENTO COUNTY** RESIDENTS

**153 FEMALES (51%) / 147 MALES (49%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **9%** | **14** | Completes |
| **MALE 18 - 24** NO LESS THAN **10%** | **15** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **13%** | **20** | Completes |
| **MALE 65 PLUS** NO MORE THAN **9%** | **13** | Completes |

**300** COMPLETES **YOLO/SOLANO COUNTY** RESIDENTS

**150 FEMALES (50%) / 150 MALES (50%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **MALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **12%** | **17** | Completes |
| **MALE 65 PLUS** NO MORE THAN **9%** | **12** | Completes |

**300** COMPLETES PLACER COUNTY RESIDENTS

**153 FEMALES (51%) / 147 MALES (49%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **13%** | **20** | Completes |
| **MALE 18 - 24** NO LESS THAN **8%** | **12** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **16%** | **24** | Completes |
| **MALE 65 PLUS** NO MORE THAN **14%** | **21** | Completes |

**300** COMPLETES **EL DORADO COUNTY** RESIDENTS

**150 FEMALES (50%) / 150 MALES (50%), OF THESE WE NEED**

| | | |
|---|---|---|
| **FEMALE 18 - 24** NO LESS THAN **7%** | **11** | Completes |
| **MALE 18 - 24** NO LESS THAN **8%** | **12** | Completes |
| **FEMALE 65 PLUS** NO MORE THAN **15%** | **23** | Completes |
| **MALE 65 PLUS** NO MORE THAN **14%** | **21** | Completes |

Q15. Language of interview [BY OBSERVATION]

1) English
2) Spanish

## • DRIVING BEHAVIOR •

[ALL RESPONDENTS]

Q4a. Thinking just about yesterday, how many different TIMES did you get into a car, truck, motorcycle 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.]

_____ Specific number
999) Don't know/Refused

[Q4A > 0]
Q4b. And approximately how many miles did you drive yesterday during those trips? [PROBE: "Give me a reasonable approximation --a round number."]

_____ Specific number
999) Don't know/Refused

[ALL RESPONDENTS]
Q5a. Yesterday, did you drive your car, truck, motorcycle or van the same, more, or less frequently than you normally do on a [day of the week yesterday]?

1) Same
2) Less
3) More
8) Don't know/Refused [Thank and TERMINATE]

**[PROGRAMMER: For each q5=8, we will need a replacement survey]:** Note that any surveys answered to this point do not count as a completed interview. If participants have not met the quota criteria then a replacement interview must be completed with another participant who does.

[Q5A = 2: THOSE WHO DROVE LESS]
Q5b. And approximately how many miles less than normal did you drive?

_____ Specific number
999) Don't know/Refused

[Q5A = 3: THOSE WHO DROVE MORE]
Q5c. And approximately how many miles more than normal did you drive?

_____ Specific number
999) Don't know/Refused

[Q5A=3: THOSE WHO DROVE MORE]
Q6a. Why did you make that change or those changes? [OPEN ENDED]
50) Record response
99) Non-response (Don't know / Refused)

[Q5=2: THOSE WHO DROVE LESS]
Q7a. Why did you make that change or those changes? [OPEN ENDED-do not read; use for coding only]

1) Air quality/ reduce pollution / concerned about smog/ Spare The Air campaign

2) Weather related reason [NOTE TO INTERVIEWER: If respondent is not specific, and only says "weather," ask them to elaborate. Some may say "weather" when they are thinking about air quality; if an actual weather related reason, skip to Q9]
3) Some other reason [skip to Q9]
4) Multiple INCLUDING air quality related
5) Multiple NOT including air quality related [skip to Q9]
6) High gas prices [skip to Q9]
9) Don't know/Refused [PROMPT AGAIN; skip to Q9]

[Q5=2: AND Q7A= 1 OR 4: THOSE WHO DROVE LESS FOR AIR QUALITY REASONS]

Q7b. About how many SINGLE TRIPS in your vehicle did you avoid driving yesterday to reduce air pollution? And by a SINGLE trip, I mean getting in your vehicle, 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 coming back home is another trip. [PROBE: "Give me a reasonable approximation --a round number." ]

[NOTE TO INTERVIEWER: VALIDATE RESPONSES OVER 12 TIMES]

_____ Specific number
999) Don't know/Refused

[ALL RESPONDENTS]

Q9. Do you usually reduce the amount of driving you do during the summer to avoid adding to air pollution?

1) Yes
2) No
8) Refused/Don't Know/ "depends"

[ASK RESPONDENTS WHO USUALLY REDUCE Q9=1]

Q9b. And how have you reduced driving this summer to decrease air pollution?
50) Record response
99) Non-response (Don't know / Refused)

[ASK RESPONDENTS WHO USUALLY REDUCE Q9=1]

Q10. And on an average day during the summer, by approximately how many miles do you reduce your driving? [PROBE: "Give me a reasonable approximation --a round number." ]

_____ Specific number
999) Don't know/Refused

[ALL RESPONDENTS]

[NOTE TO PROGRAMMER: Please rotate the order of q12a and q12b for every other interview, asking both questions of everyone]

q12. CATI-CALC: Q12 question order

1) Q12a asked first
2) Q12b asked first

[ALL RESPONDENTS]
Q12a. Do you recall being asked not to drive yesterday because our area was experiencing a period of unhealthy air?

1) Yes
2) No, do not recall that
8) Don't know/Refused

[ALL RESPONDENTS]
Q12b. In the past two days have you heard, read, or seen any commercials, news broadcasts or information online about Spare The Air, poor air quality, or requests to drive less in this area?

1) Yes
2) No, do not recall that [Skip Q12c]
8) Don't know/Refused

[Ask if Q12b = 1 (yes)]
Q12c. Where do you recall [Q12b: seeing, hearing, or reading] that information?

CATEGORIES FOR CODING:
1) Mentioned
2) Not mentioned
8) Refused

a. Radio Commercial
b. Television Commercial
c. Facebook
d. Twitter
e. News or Weather Broadcast
f. Word of Mouth
g. Newspaper
h. Air Alert email
i. Outdoor Billboard

[READ TO ALL]
Finally, I just have a couple of questions about your health

[ALL RESPONDENTS]
Q13a. Thinking just about yesterday, did you or anyone else in your household experience any effects on your health, such as burning eyes, headaches, coughing, or difficulty breathing, due to unhealthy air?

1) Yes

2) No
8) Don't know/Don't recall/Refused

[Ask if Q13a = 1]
Q13b What was it that you experienced?

1. Burning eyes
2. Headaches
3. Coughing
4. Difficulty breathing
5. Other [ record response]

Q14a. And what about today, did you or did anyone else in your household experience any effects on your health, such as burning eyes, headaches, coughing or difficulty breathing, due to unhealthy air?

[Ask if Q14a = 1]
Q14b. What was it that you experienced?

1. Burning eyes
2. Headaches
3. Coughing
4. Difficulty breathing
5. Other [ record response]

*THIS HAS BEEN A CONFIDENTIAL INTERVIEW CONDUCTED BY _____ AT META RESEARCH ON BEHALF OF THE SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT. YOU MAY BE CALLED BY SOMEONE FROM META RESEARCH TO VERIFY THAT THIS INTERVIEW WAS CONDUCTED. May I have just your first name for verification purposes? THANK YOU VERY MUCH FOR YOUR TIME.*

IF ASKED, AT END OF SURVEY EXPLAIN THAT THIS SURVEY IS BEING CONDUCTED FOR:
Sacramento Metropolitan Air Quality Management District