Evaluation of the 2018 Sacramento Region Spare The Air Campaign

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2018 Spare The Air Evaluation

RESEARCH METHODOLOGY

Background

The Sacramento region's public outreach program Spare The Air was created in 1995 to engage the general public in voluntarily helping to solve the problem of ground-level ozone air pollution. The Sacramento region is a severe nonattainment area for the federal 1997 and 2008 eight-hour ozone standards. The attainment deadlines are 2019 for the 1997 standard and 2027 for the 2008 standard. However, for the 2008 standard, the Sacramento Regional 2008 NAAQS 8-hour Ozone Attainment and Reasonable Further Progress Plan demonstrated that the region can attain the standard by 2024.

These health-based standards affect the quality of life and health of area residents, particularly during the summer months. The region is on track to attain these health-based standards by the deadlines, provided the district continues to maintain key efforts like the Spare The Air campaign. 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 (Sac Metro Air District) 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 (VOCs) 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 through 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. 2018 Spare The Air outreach efforts included radio, television, digital and outdoor billboard advertising featuring various air quality tips, a website (www.SpareTheAir.com) including "Scooter's World" for children, daily social media posts (Facebook, Twitter, Instagram and Pinterest), the Sacramento Region Air Quality app, as well as Scooter's appearance at community events, distribution of newsletter articles and other materials to almost 3,900 business and community partners.

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 126 (0.078 parts per million) the next day, a Spare The Air alert is issued by the Sac Metro Air District by 12:00 p.m. The Spare The Air alert communication involves notifying the public through a variety of channels, including social media, paid radio, television and digital outdoor billboard advertising, email Air Alerts, news broadcasts, the Spare The Air website, the Sacramento Region Air Quality app 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 the central plain district of Yolo-Solano. To some extent this is due to the fact that ozone precursors emitted by vehicles throughout the region take time to convert into ground-level ozone pollution, and that pollution can be transported into the foothills. The pollutants can also get "trapped" if there are stagnant, stable conditions, which would prevent flow uphill.

It is, therefore, important that the Spare The Air message continue to involve everyone in the basin, although the air pollution readings in individual districts on specific days may not be the same.

Spare The Air 2018 Season

There were **20** Spare The Air days called during the 2018 summer smog season. This increase in Spare The Air days was due in part to substantial wildfire activity in the state affecting the region as well as to the trigger level being lowered in 2016. The region's air pollution control officers lowered the trigger to .078 parts per million (126 on the Air Quality Index) in response to the 2015 federal ozone standard of .070 ppm . In comparison, the 2015 season's Spare The Air trigger level of .086 ppm resulted in five Spare The Air days.

Spare The Air date	*Forecast AQI*	*Actual Maximum AQI*	*Health Level for Actual AQI*	*Reporting Station of Actual Maximum AQI*
June 13	126	105	Unhealthy for Sensitive Groups	Auburn
July 18	126	129	Unhealthy for Sensitive Groups	Folsom
July 27	133	140	Unhealthy for Sensitive Groups	Colfax
July 28	143	179	Unhealthy	Auburn
July 29	136	122	Unhealthy for Sensitive Groups	Colfax
July 30	143	156	Unhealthy	Auburn
July 31	133	203	Very Unhealthy	Colfax
August 1	133	201	Very Unhealthy	Auburn
August 2	140	210	Very Unhealthy	Auburn
August 3	126	115	Unhealthy for Sensitive Groups	Placerville
August 4	151	133	Unhealthy for Sensitive Groups	Auburn
August 5	133	172	Unhealthy	Placerville
August 6	140	112	Unhealthy for Sensitive Groups	Placerville
August 7	151	159	Unhealthy	Colfax
August 8	140	195	Unhealthy	Colfax
August 9	133	182	Unhealthy	Auburn/Cool (seasonal)/ Sloughhouse
August 10	133	177	Unhealthy	Woodland
August 18	133	97	Moderate	Placerville/Sloughhouse

August 19	129	126	Unhealthy for Sensitive Groups	Auburn
September 27	129	119	Unhealthy for Sensitive Groups	Sloughhouse

Media Buy

To educate a broad audience about the campaign and its message to reduce driving on a Spare The Air day, the 2018 Spare The Air campaign's paid advertising for general outreach consisted of radio, TV, outdoor billboards, online banner ads, and paid social media advertising on Facebook and Twitter. For episodic advisories, alerts were issued the day before and the day of each Spare The Air day. The 2018 season used a variety of mediums to communicate the alert, including Spare The Air alert TV and radio commercials, digital outdoor billboard advertising, news broadcasts, social media, the Spare The Air website, The Sacramento Bee, plus online advertising.

General Media Buy

In 2018, a total of $140,641 was spent on the Spare The Air general awareness campaign. It ran from May through September 2018, and used radio commercials in English and Spanish, television commercials, online digital ads, social media ads, and boosted social media posts to reach residents throughout the Sacramento region. The campaign focused around the message, "Clean Air Is Up To Us." The advertising emphasized the various things people can do to reduce their impact on air quality during the season, how everyone can help contribute to reducing air pollution and how to take action on Spare The Air days.

Specific Spare The Air Alert Episodic Media Buy

This year, a total of $57,513 was spent on episodic TV and radio commercials, and digital outdoor billboards for advertising on 13 of the 20 Spare The Air days. The episodic advertising message was "Reduce your driving or don't drive at all. Share a ride, or use public transportation. Help stop air pollution." Advertising was not placed on seven Spare The Air days due to wildfire smoke impacts and the intense media and public awareness about poor air quality on those days.

1.	6/13/2018	$ 4,958.00
2.	7/18/2018	$ 6,569.50
3.	7/27/2018	$ 6,578.25
4.	7/28/2018	$ 4,806.25
5.	7/29/2018	$ 4,806.25
6.	7/30/2018	$ 4,540.00
7.	7/31/2018	$ 2,985.00
8.	8/01/2018	$ 0.00
9.	8/02/2018	$ 0.00
10.	8/03/2018	$ 4,000.00
11.	8/04/2018	$ 2,475.00
12.	8/05/2018	$ 2,475.00
13.	8/06/2018	$ 0.00
14.	8/07/2018	$ 0.00
15.	8/08/2018	$ 0.00
16.	08/09/2018	$ 0.00
17.	08/10/2018	$ 0.00
18.	08/18/2018	$ 4,834.00
19.	08/19/2018	$ 1,650.00
20.	09/27/2018	$ 6,835.75

Research Objectives

Annual evaluations have been conducted since 1995 (with the exception of 1997) 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.[1]

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.[2]
4. Compare awareness of the Spare The Air campaign and driving reduction among the individual air quality districts in the Sacramento Nonattainment Area.
5. Measure the percentage of drivers who habitually drive less during the summer season 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.

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. Although Spare The Air interviewing has always set quotas based on geography, age and gender, it has become more and more difficult to survey young adults in the U.S. aged 18 to 34 years via a landline-only frame. In 2018, a 55% mobile, 45% landline approach was planned. By the second night of surveying the plan was modified to

[1] 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 emission reductions attributable to the program. This is the definition of a purposeful reducer.

[2] 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 Inventory - EMFAC 2017 model, for the summer of 2018 accessed from https://www.arb.ca.gov/emfac/2017/.

75%/25% respectively as landline incidence rates were insufficient to reach target demographics. This in turn increased cost as dialing mobile phones is more expensive than dialing landline phones.

Moreover, increasing regulation of Computer Assisted Telephone Interviewing (CATI) has rapidly inflated the cost of interviewing in the past decade. To maintain this evaluation's accuracy within budget parameters that have not expanded as quickly as costs, it has become necessary to random sample from Listed frames, meaning that a computer draws from known working numbers within set area codes and prefixes. In so doing, costs are reduced by avoiding dialing dead numbers, businesses, fax machines, or something else.

Sampling Design

The next table summarizes the targeted goal of completed interviews in each air district area for both Spare The Air days and Control days.[3] The goal was to conduct up to 1,200 interviews following Spare The Air days and 800 following Control days. The margin of error associated with a sample of 1,200 is +/– 2.7%, at a 95% confidence level.

Air District	Spare The Air interviews	Control day interviews
Sac Metro Air District:	400	200
Yolo-Solano AQMD	300	200
Placer County APCD	300	200
El Dorado County AQMD	200	200
Maximum Total	1,200	800

Within each air district, quotas were set with respect to geographic area, age, and gender.[4] Not all areas of each county are included in the Nonattainment Area. Some residents in Yolo, Solano, Placer and El Dorado counties are excluded from interviews because they do not reside in a zip code contained in the Nonattainment Area boundary. 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. Given the increase in alert days resulting from EPA's lower 2015 ozone health standard, the strategy adopted was to conduct approximately 80-100 interviews throughout the region (proportionally representative of the population in general by county), starting with every occurrence of a Spare The Air alert, and then deciding on an episode-by-episode basis whether

[3] 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.

[4] 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. In survey research, 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 350 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.

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.

Interviewing typically takes place on the day following each Spare The Air day. This season, the Carr Fire in Shasta and Trinity Counties burned 229,651 acres and brought smoke into the Sacramento region impacting air quality from July 23 – August 30. With the August 1 episode, advertising spending was substantially reduced, and surveying was ceased until the August 18 episode. The advertising spending was reduced again for the August 19 episode and so no surveying was conducted. Control day interviewing took place in September and October. Control day interviews were matched in terms of the day of the week of the Spare The Air day interviews, and took place on September 6, 8, 9, 17, 18, 22, 25, 28 and October 5, 7, 10, 11.

Respondents

In Sac Metro Air District, Yolo-Solano AQMD, Placer County APCD, and El Dorado County AQMD, interviews were conducted with a random representative sample of listed landline and cellular telephone numbers.

Respondents included a total of **1,350 drivers**, following both Spare The Air days as well as Control days. Results for the Sacramento Nonattainment Area as a whole were weighted proportionally.[5] The next table lists the number of completed interviews for each group along with their affiliated margins of error (at the most conservative level).

A total of **768** interviews were conducted on days following Spare The Air days. Control day calling completed **582** interviews. When weighted,[6] the total number of completed interviews is 331 following Spare The Air days, and 284 on Control days in the Sacramento Nonattainment Area as a whole.

[5] Based on the 2010 US Census available at: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF. The total population in the entire Sacramento Nonattainment Area [including El Dorado AQMD] is 2,272,658: [Sacramento Metropolitan AQMD (63%) - 1,418,788; Yolo-Solano AQMD (15%) – 330,226 (this includes the total 200,849 from Yolo County and 129,377 from the Dixon, Rio Vista and Vacaville areas of Solano County); Placer County APCD (15%) – 338,613 (this figure represents the 87% of Placer County's 348,432 residents who do not live in zip codes north or east of Auburn), El Dorado AQMD (7%) - 150,515 (this figure represents 67% of El Dorado County's 181,058 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).

[6] 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 63% of the entire population, Yolo-Solano AQMD is 15%, Placer County APCD is 15%, and El Dorado County AQMD is 7%). This is why the weighted total number of completed interviews (i.e. 577) is less than the sum of the total number of interviews conducted in all air districts (i.e. 1,078).

Number of Completed Interviews (unweighted)	*Spare The Air Days*	*Margin of Error*	*Control Days*	*Margin of Error*
Sac Metro Air District:	**210**	+/- 6.8%	**180**	+/- 7.3%
Yolo-Solano AQMD	**208**	+/- 6.8%	**151**	+/- 8.0%
Placer County APCD	**176**	+/- 7.4%	**125**	+/- 8.8%
El Dorado County AQMD	**174**	+/- 7.4%	**126**	+/- 6.8%
Total Regional (Unweighted)	**768**	+/- 3.5%	**582**	+/- 6.8%
Total Regional (Weighted)	**331**	**+/- 5.4%**	**284**	+/- 5.8%

The Questionnaire

The main body of the questionnaire has remained the same to maintain consistency, although slight modifications have sometimes occurred, due to information needs or budget constraints. All surveys were conducted using a Computer Assisted Telephone Interviewing (CATI) system. The questionnaire was translated into Spanish and approximately 1% of all interviews were conducted in that language. The average interview lasted just over four minutes. A copy of the 2018 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 how many trips they avoided and why they avoided those trips.

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.

Statistical Significance

The level of significance for each statistical test is set to a *p* value of less than .05, which equates to at least 95% assurance in the integrity of an identified significant relationship. That is, a significant relationship is one that cannot be accounted for by chance alone. Because the relationship cannot be accounted for by chance alone it is instead 95% likely due to differences in the subpopulations being compared. It is assumed this relationship holds for members of the population who are not part of the sample, but who share the quality being used to compare subpopulations. For example, it may be determined that a significant difference arises in the driving reduction between Yolo-Solano AQMD and El Dorado County AQMD respondents such that Yolo-Solano residents reduced driving to a greater degree than El Dorado residents. This means researchers are 95% sure that a difference in reported driving reduction between residents of these regions is due to their location, and not to chance.

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 (Sac Metro Air District); Yolo-Solano AQMD; Placer County APCD; El Dorado County AQMD; or Prosio Communications 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 2018 SPARE THE AIR CAMPAIGN

Objectives

The specific objectives of the current section are to:

a. Measure awareness of the 2018 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 2010 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 2018 Spare The Air campaign (correcting for Control days).

e. Identify which media and/or outreach mediums most noticeably communicated Spare The Air information.

RESULTS

General Awareness

1 ➢ ***In 2018, 35% of respondents in the entire Sacramento region had heard, read, or seen the Spare The Air advertisements. The 35% translates into an estimated 795,430 residents in the Sacramento Nonattainment Area who were aware of the 2018 Spare The Air campaign.***

The Spare The Air season runs from May through October of each year. This year there were 20 Spare The Air days.[7] 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 displays 2018 general awareness levels for residents in the individual air districts as well as in the entire Sacramento Nonattainment Area as a whole (weighted results[8]). **On average, 35% of respondents in the entire region were aware of Spare The Air in general, translating to 795,430 residents**[9]. General awareness in the individual air districts varied from 28% in Yolo-Solano AQMD to 38% in Placer County APCD.

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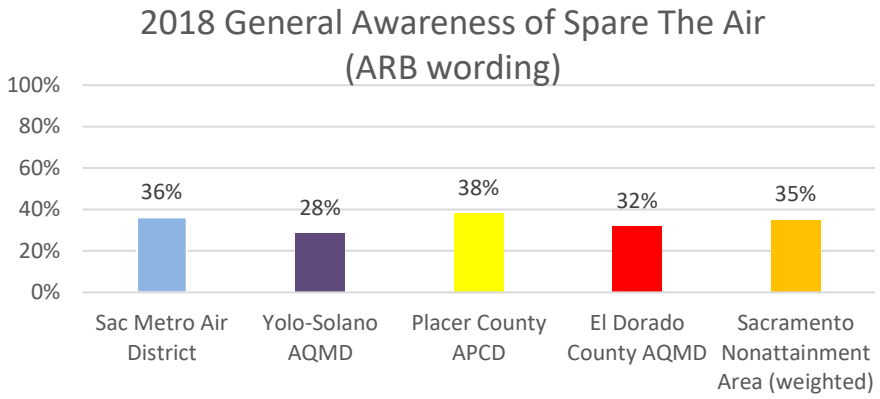
[7] See Methodology section for a complete list of 2018 Spare The Air episodes.

[8] See Methodology section for a complete description of weighting methods.

[9] Based on the 2010 US Census available at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. The total population in the entire Sacramento Nonattainment Area [including El Dorado AQMD] is 2,272,658: [Sac Metro Air District (63%) - 1,418,788; Yolo-Solano AQMD (15%) – 330,226 (this includes the total 200,849 from Yolo County and 129,377 from the Dixon, Rio Vista and Vacaville areas of Solano County); Placer County APCD (15%) – 338,613 (this figure represents the 87% of Placer County's 348,432 residents who do not live in zip codes north or east of Auburn), El Dorado AQMD (7%) - 150,515 (this figure represents 67% of El Dorado County's 181,058 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).



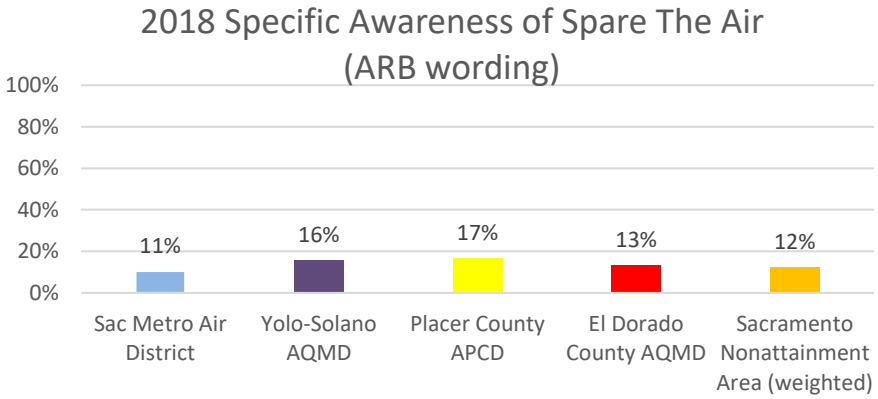
Specific Awareness: Request Not to Drive

2 ➢ ***After weighting, 12% 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 281,102 residents were aware of Spare The Air alerts.***

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?"[10]

In total, 12% of respondents in the region[11], translating into an estimated **281,102** residents, heard the specific request not to drive on Spare The Air days. Specific awareness has always been lower than general awareness as it requires the respondent recall the driving reduction request explicitly. Levels of specific awareness ranged from 11% in Sac Metro Air District to 17% in Placer County APCD.

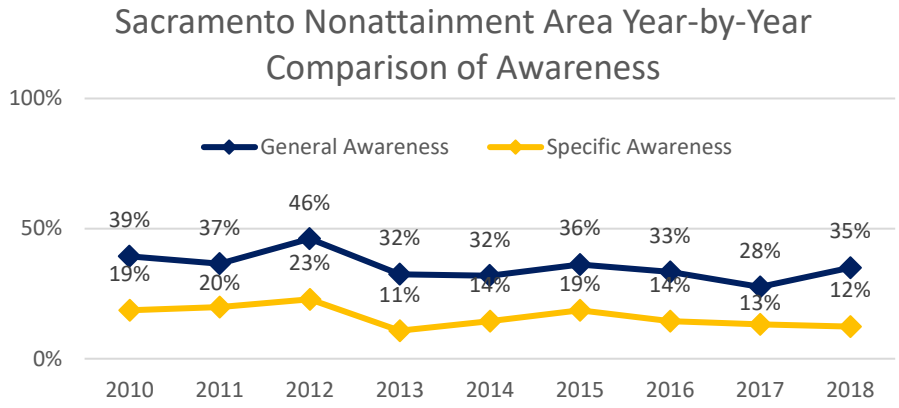


[10] The order of the specific and general awareness questions was randomized to eliminate any possible order-response bias.
[11] See methodology section for review of weighting procedures.

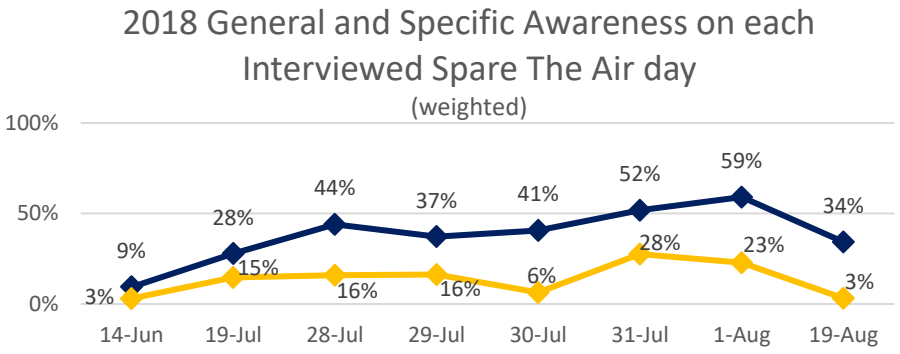
Year-To-Year Comparisons of Awareness: Sacramento Nonattainment Area

3 ➢ ***The level of general awareness for 2018 in the Sacramento Nonattainment Area (35%) matches the nine-year average (35%). Specific awareness remains consistent with previous seasons, at 12% in 2018, which does not differ significantly from the nine-year average of 17%.***

The next chart displays annual percentages of general and specific awareness of Spare The Air in the Sacramento Nonattainment Area for the past nine seasons. General awareness in 2018 matches the 2010-2018 average (35%), returning to the standard historic trend from new lows set in 2017. Specific awareness levels in 2018 do not differ significantly from the average (17%).



The 2018 season offers a unique opportunity to test the hypothesis unconfirmed in other seasonal Spare The Air survey reports that multi-day episodes result in greater general and specific awareness levels. The 2018 season included 20 Spare The Air days, 15 of which were a single consecutive string of episodes from July 27 through August 10 due to the impact of smoke from a surrounding wildfire. The occurrence is so rare that paid advertising and other messaging tactics were substantially reduced since driving reduction wasn't going to make the smoke go away. Surveying was halted by August 2 in response to the smoke impacts so valuable resources would be available for more ground-level ozone episodes later in the season. The chart below shows that excepting the July 29 weekend, both general and specific awareness increase as the multi-day stretch transpires. This evidence tips the balance in favor of a strong relationship between multi-day episodes resulting in greater air quality awareness.



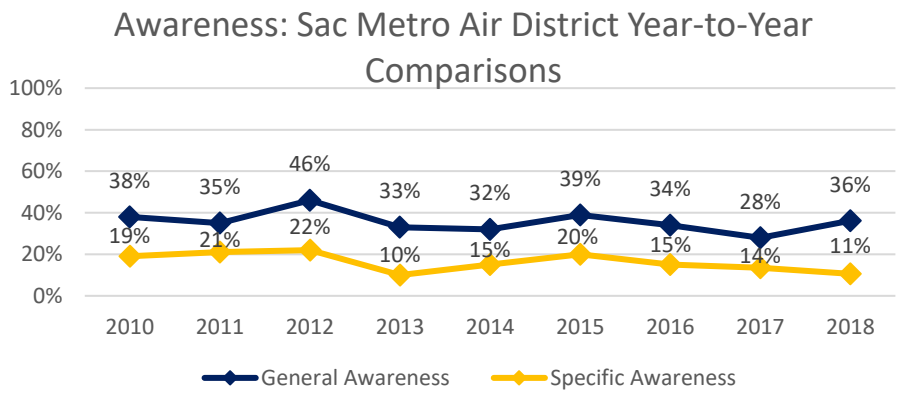
Year-To-Year Comparisons by Air District

4 ➢ ***General awareness improved in every air district during the 2018 season. Specific awareness levels in each area do not differ from the nine-year average except in Sac Metro Air District, where specific awareness is at 11%, down 6% from the nine-year average of 17%.***

Year-to-year comparisons of the annual levels of general and specific awareness for the individual air districts from the most recent eight seasons are presented in the next graphs.

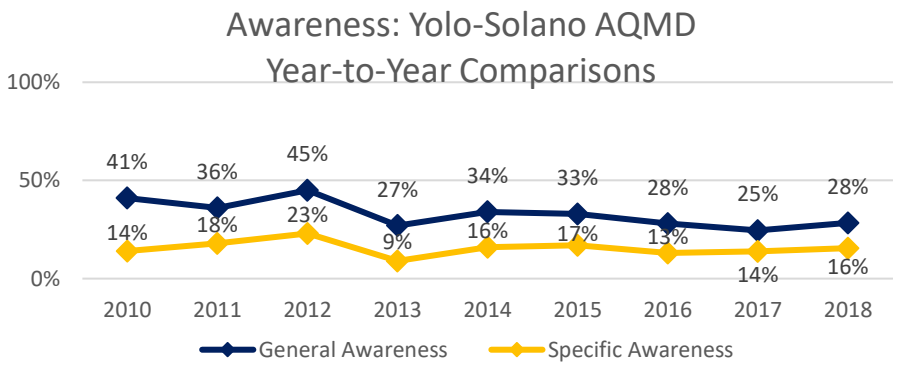
Sac Metro Air District

As can be seen in the next graph, general awareness levels returned to the average (36%), up from the low in 2017 of 28%. The 2012 season remains significantly greater than the average while the 2017 season remains significantly lower. Specific awareness in Sac Metro Air District, at 11% in 2018, is not a new low, but is significantly lower than the nine-year average (17%).



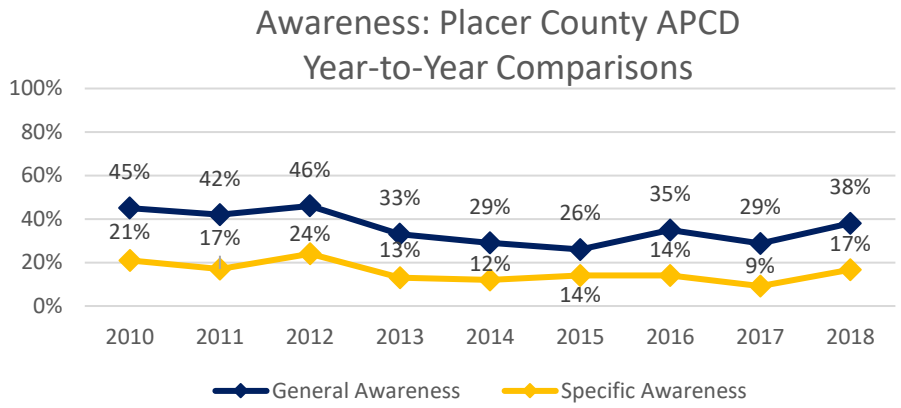
Yolo-Solano AQMD

In Yolo-Solano AQMD, the 2018 level of general awareness (36%) marks a significant improvement from 2017 but is not significantly different from the nine-year average of 33%. This year's level of specific awareness (11%) is also not different from the mean (16%). In Yolo-Solano AQMD, like Sacramento, 2012 shows a significantly high general awareness.



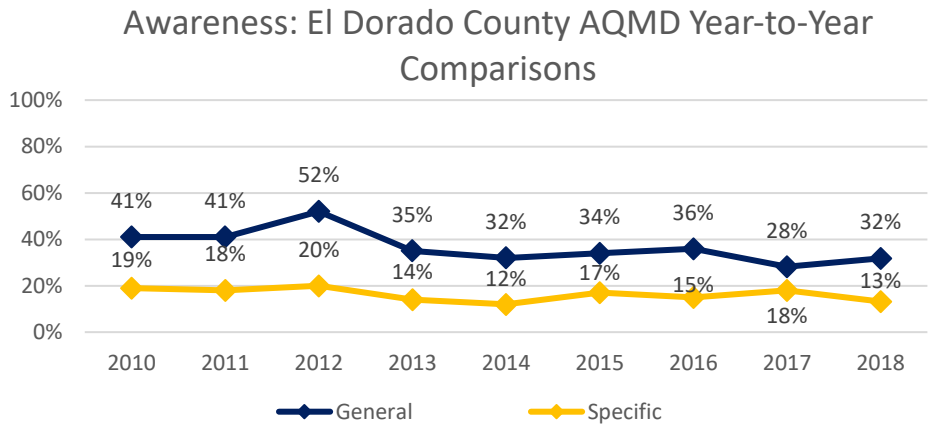
Placer County APCD

General awareness in Placer County APCD increased significantly in 2018 to 38%, though it is not significantly greater than the nine-year average of 36%. Specific awareness at 17% also marks a significant improvement from 2017 but is not significantly greater than the mean (16%). The 2012 season, at 24%, is a significant high for Placer County APCD.



El Dorado County AQMD

In El Dorado County AQMD, the 32% general awareness is not significantly different from the nine-year average of 37%. In contrast, the 52% level in 2012 is still a significant high compared to later seasons. Specific awareness in El Dorado County AQMD has remained relatively constant, with no significant difference between years. The 13% specific awareness in 2018 is comparable to the nine-year average of 16%.

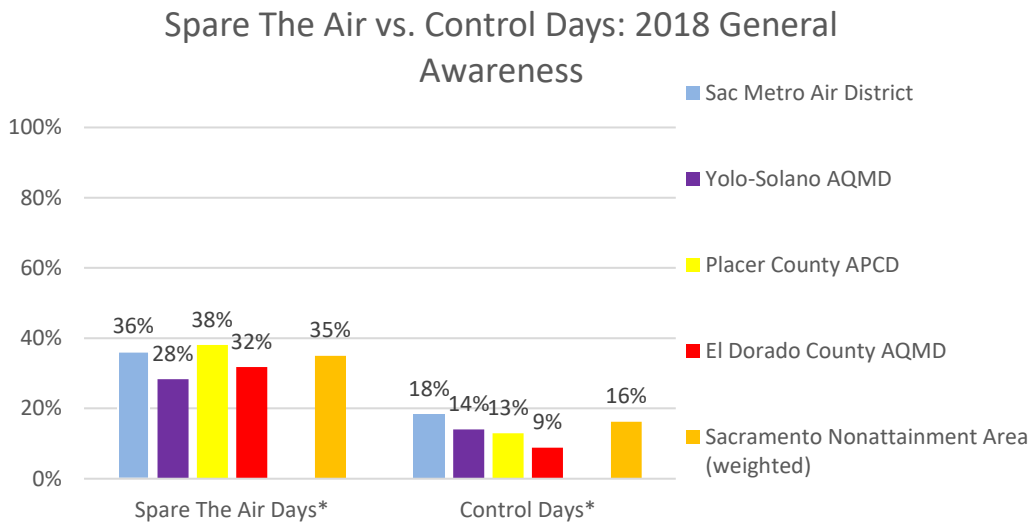


Spare The Air vs Control Days

6 ➢ ***Significantly more (35% vs 16%) of those interviewed after Spare The Air days remembered the messaging. Thus, the paid episodic media buy was effective at reaching the Sacramento region's residents throughout the summer.***

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. 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. 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 due to the program itself and not to a possible social desirability response bias. An alternative approach would be to use a standard correction factor, or by use of strict procedural controls.

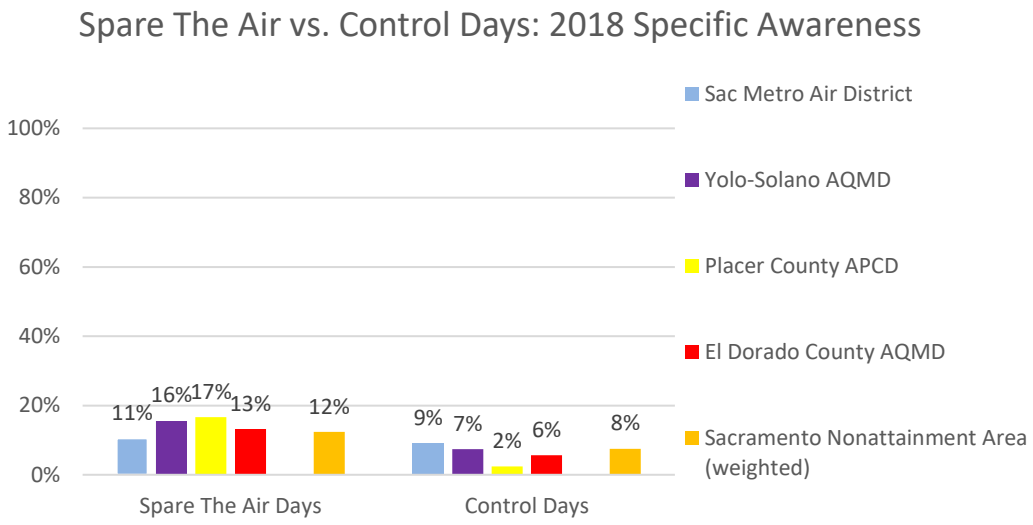
Results for general awareness are presented in the next chart and indicate that 16% of area respondents interviewed on Control days said they had seen or heard Spare The Air announcements. Significantly more (35% vs 16%) of those interviewed after Spare The Air days remembered the messaging. Thus, the paid episodic media buy was effective at reaching the Sacramento region's residents throughout the summer. This was particularly evident 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 and each is supported by significantly greater general awareness on Spare The Air days compared to Control days. These data show that **the Spare The Air program is still effective at reaching the Sacramento region population**.



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

In terms of specific awareness, 8% of Control day respondents in the area incorrectly heard a request not to drive versus the 12% 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 except in Sac Metro Air District, where 11% of Spare The Air day respondents was not significantly greater than the 9% of Control day respondents who said they remember hearing a request not to drive. The long-term trend in Sac Metro Air District is one of success, and these data from 2018 may be indicative of an anomaly. Considering that, these results demonstrate once again that **the Spare The Air program is still effective in reaching area residents with episodic announcements**.



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

Estimating the Number of Spare The Air-Aware Drivers

7 ➢ ***The percentage of respondents who were aware of Spare The Air in general translates into an estimated 564,360 drivers in the Nonattainment Area who were aware of a Spare The Air day during the 2018 season.***

There were an estimated 1,684,369 drivers in the entire Sacramento Nonattainment Area in the summer of 2018.[12] With the level of general awareness of Spare The Air at 35%, this translates into an estimated **564,360 drivers in the Sacramento Nonattainment Area who were aware of the 2018 Spare The Air campaign in general**. The next table displays the calculations and the estimated number of drivers who heard, read, or saw Spare The Air media in each individual air district.

Air District	*Total Estimated Number of Drivers*	*Percent Aware of STA (General Awareness) STA*	*Estimated Number of Drivers Aware of STA in General [13]*
Sac Metro Air District	1,034,580	36%	***372,449***
Yolo-Solano AQMD	230,682	28%	***65,810***
Placer County APCD	235,035	38%	***109,724***
El Dorado County AQMD	123,869	32%	***40,322***
Sacramento Nonattainment Area[14]	1,684,369	35%	***589,529***

[12] The number of drivers in the Sacramento Nonattainment Area for 2018 was estimated using the number of driver licenses by county for 2017, obtained from the California Department of Motor Vehicles database found at https://www.dmv.ca.gov/portal/wcm/connect/90a04dc3-ac0d-4528-a6a3-4797d0842689/DL+By+County+2016.pdf?MOD=AJPERES. The estimated number of licensed drivers for the total Sacramento Nonattainment Area in 2018, therefore, was 1,684,369. Sac Metro Air District: total 1,034,580 + Yolo-Solano: total of 235,035 (139,231 in Yolo County + Solano County: 309,044 * 31% for the proportion located within the air district = 95,804) + Placer County: total of 288,747 (297,678 * 97% for the air district) + El Dorado County: total of 126,007 (151,816 * 83% for the air district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region.

[13] In previous seasons, Control day respondents who said they were generally aware of the campaign were subtracted from the total generally aware Spare The Air day respondents to make these calculations. It was decided in a meeting on April 2, 2014 between Lori Kobza of Sac Metro Air District and Joe Hanson of Meta Research that for general awareness, a correction factor to extrapolate to the resident population is unnecessary because Control day respondents can reasonably be generally aware of the campaign even if they do not recall a specific request not to drive because there are Spare The Air outreach efforts taking place from May through October. Reducing estimates of generally aware residents by subtracting Control day responses greatly underreports total awareness estimates.

[14] The results for the Sacramento Nonattainment Area 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 correcting for Control day responses, 64,498 drivers in the region heard the episodic request not to drive on Spare The Air days in 2018.***

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, the 12% aware, less the 8% erroneously aware Control respondents, translates into an estimated **64,498 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)*
Sac Metro Air District	1,011,962	11% / 9%	***113,804 – 93,112= 20,692***
Yolo-Solano AQMD	230,682	16% / 7%	***37,606 – 16,452= 21,153***
Placer County APCD	281,954	17% / 12%	***49,087 – 5,775= 43,312***
El Dorado County AQMD	123,869	13% / 6%	***16,381 – 7,560= 8,820***
Sacramento Nonattainment Area[15]	1,648,467	12% / 8%	**193,495 – 128,997=** ***64,498***

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

Awareness of General Media Campaign

9 ➢ News or weather broadcasts, television commercials, and radio commercials were the most cited sources of air quality information in the Sacramento Nonattainment Area.

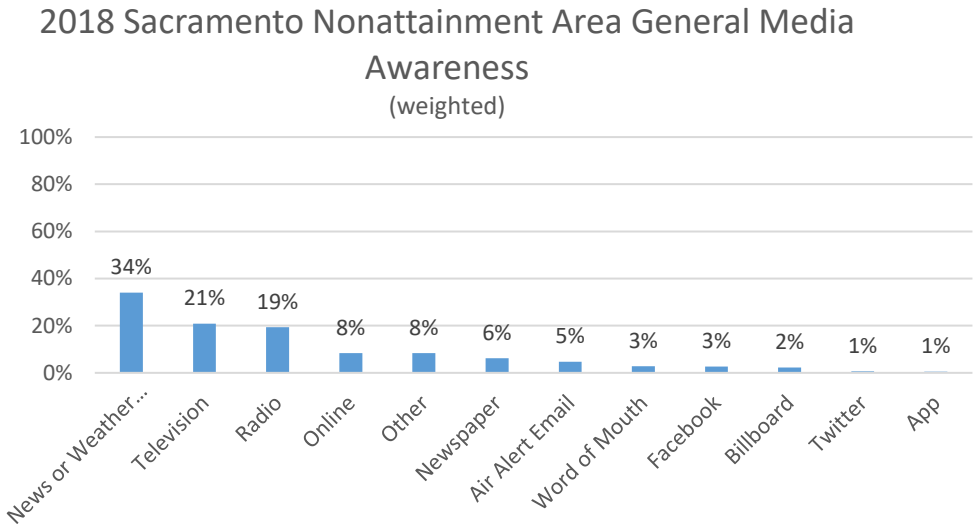
Respondents were asked to identify the medium(s) through which they heard, read, or saw a message about air quality after indicating that they received such a message. That is, after stating yes to the general awareness item, respondents were asked:

"Where do you recall seeing/hearing/reading that information?" [16]

The data resulting from this survey item may help coordinators allocate funds and effort during subsequent seasons to maximize message dissemination. The next table illustrates the percentage of respondents who identified any of 11 mediums through which they received a message about air quality in general for the Sacramento Nonattainment Area.

The most cited sources of Spare The Air information are news or weather broadcasts (34%), television commercials (21%) and radio commercials (19%). The next most cited sources are nearly equally distributed among the other media and are infrequent. Respondents who were aware because of something 'other' than the 11 categorized media mention things like their employer alerting them through their work intranet.

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.



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

PURPOSEFUL DRIVING REDUCTION

Objectives

One measure of the effectiveness of the Spare The Air public 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 2010 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 2010 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 2018;
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

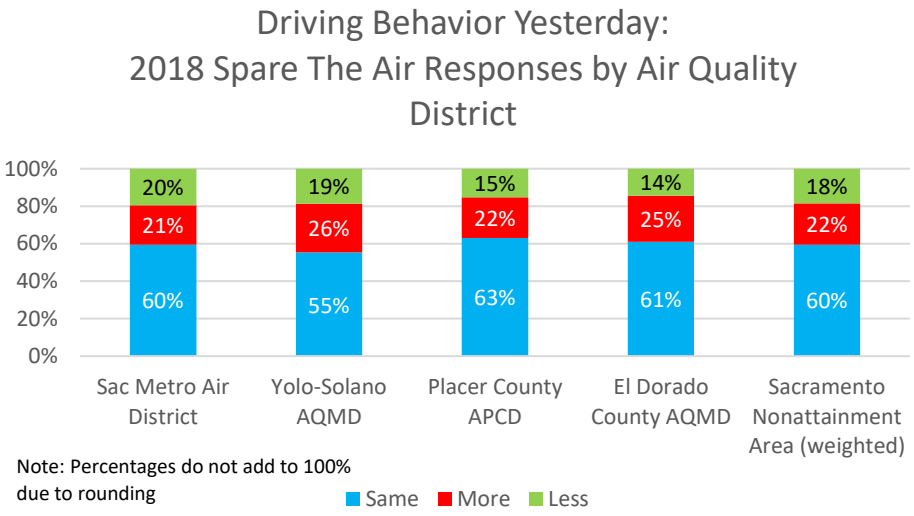
Driving Behavior Yesterday

1 ➢ ***Nearly one in five (18%) of respondents in the Sacramento Nonattainment Area as a whole said they drove less on Spare The Air days. This 18% is not significantly less than the nine-year average (20%).***

At the beginning of the survey, respondents are 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.

Most respondents did not make any changes in their driving behavior – 60% in the Nonattainment Area said they drove the same as usual. Over a fifth (22%) said they drove more, and the remaining **18% said they drove less**. This pattern is seen within each of the individual air quality districts such that the majority of respondents drove the same, the next greatest portion drove more, and the final

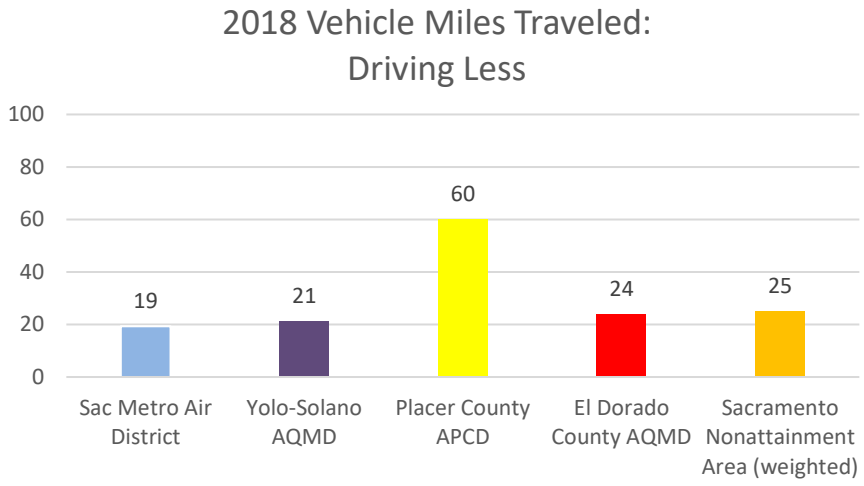
portion drove less. The percentage driving less varied from a low of 14% in El Dorado County AQMD to a high of 20% in Sac Metro Air District.



Note: Percentages do not add to 100% due to rounding

Vehicle Miles Traveled

Respondents who drove less were asked "and approximately how many miles less than normal did you drive?" The data for the 2018 season are displayed in the table below for each air district and for the Sacramento Nonattainment Area[17] 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 19 miles in Sac Metro Air District to 60 miles in Placer County APCD.

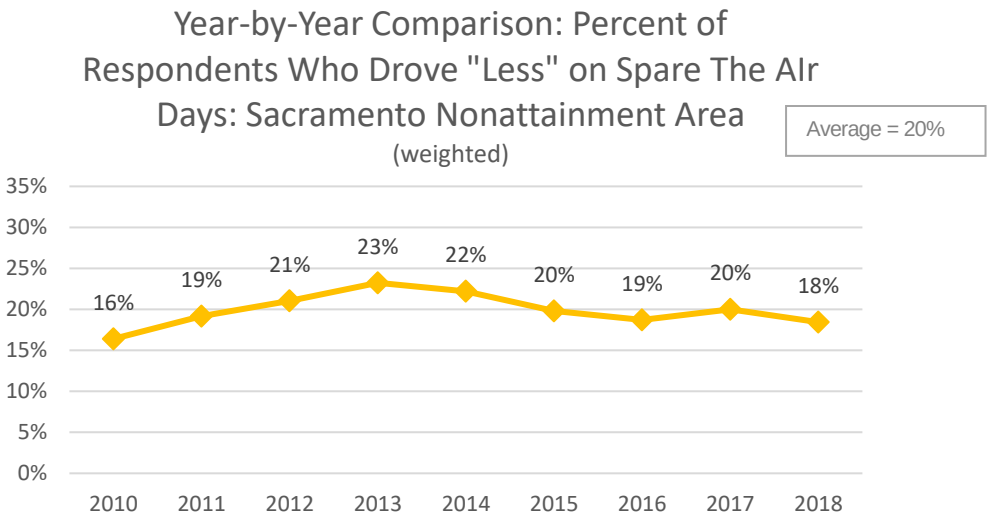


[17] Weighted results

Year-to-Year Comparisons: Percent Who Drove Less

2 ➢ ***This year's 18% of respondents who said they drove less on Spare The Air days is not significantly less than the nine-year average.***

The next graph plots the percentages of drivers from 2010 to the present who said they drove less on Spare The Air days in the Sacramento Nonattainment Area. With only a few 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 nine-year average. Driving reduction was at it's lowest with 2010 at 16% and at it's highest in 2013. The 2018 season, at 18%, is not significantly different from the nine-year average[18].



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

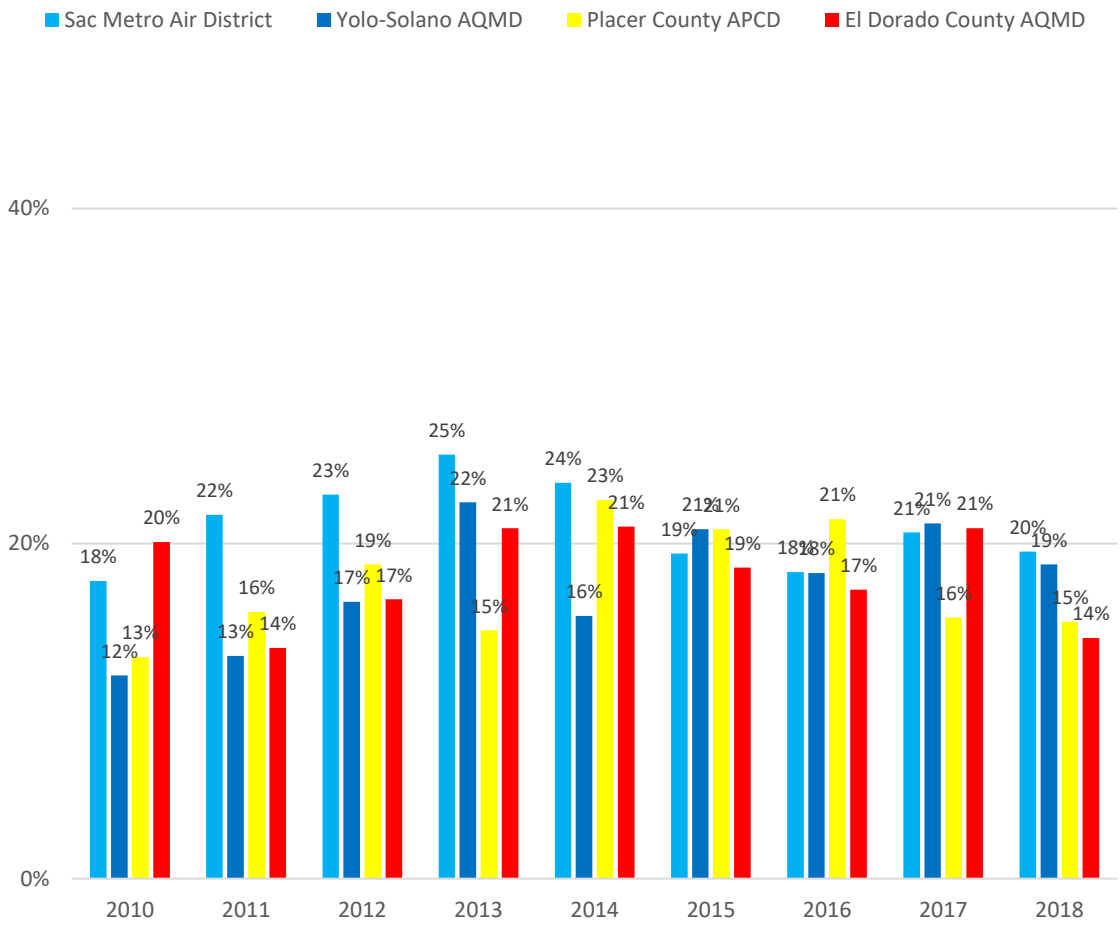
3 ➢ ***In the individual air districts, the percentage of respondents who drove less this year is not significantly different from their averages.***

The annual percentage of respondents who drove less the previous day in the individual air districts from 2010 to the present are presented in the next chart. In Sac Metro Air District the percentage of residents who said they drove less on Spare The Air days ranged from a low of 18% in 2010 and 2016 to a high of 25% in 2013. This year's percentage of 20% is not significantly less than the average of 21%.

Results in **Yolo-Solano AQMD** ranged from a low of 12% in 2010 to high of 22% in 2013. This year's 19% marginally exceeds the nine-year average of 18% in that air district. In **Placer County APCD,** the 15% of respondents this year who said they drove less does not differ from the nine-year average of 18%. In **El Dorado County AQMD,** the 14% of respondents who reported driving less is not significantly different from the nine-year average of 18%.

[18] For reference, the number of estimated drivers in the Sacramento Nonattainment Area in 2010 was 1,447,679. In 2018 the number of drivers has grown to 1,684,369, a 16% increase.

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



Percentage of Purposeful Reducers

5 ➢ ***In 2018, after weighting, 0.28% of respondent drivers were classified "purposeful reducer" -- they drove less on Spare The Air days because they heard the Spare The Air alerts and wanted to improve air quality in the region.***

The definition of a purposeful driving reducer is quite strict with three requirements: 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 heard announcements about Spare The Air (general awareness using the ARB question[19]). Results from each air quality district and for the weighted Sacramento region are presented in the next table.

For the Sacramento Nonattainment Area, 0.28% of Spare The Air respondents met the **strict ARB standard** for purposeful driving reduction. Individually, no respondents in **Sac Metro Air District,** one respondent in Yolo Solano AQMD, two respondents in **Placer County APCD**, and one respondent in **El Dorado County AQMD** can be classified as purposeful reducers.

Sac Metro Air District is used as the baseline during the data weighting procedure[20] and all other air districts are weighted down according to their respective population relative to Sacramento County. Therefore, **after weighting, 1 purposeful reducer is recorded for the Sacramento Nonattainment Area as a whole.**

Spare The Air: Purposeful	*# Respondents Who Reduced Driving For Air Quality Reasons and Were*	*# of Respondents Interviewed on Days Following*	*Sampling Error[21]*	*% of Total Respondents Who Reduced Driving for Air Quality Reasons and Were*

[19] 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.

[20] See Methodology section for full description of weighting procedure.

[21] 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 1,000 individuals from a population of 1,000,000 will likely not be exact

Reducers in 2017	*Aware of STA Alerts*	*Spare The Air*		*Aware of STA Alerts*
Sac Metro Air District	**0**	**210**	**+/- 6.8%**	**0.0%**
Yolo-Solano AQMD	**1**	**208**	**+/- 6.8%**	**0.5%**
Placer County APCD	**2**	**176**	**+/- 7.4%**	**1.1%**
El Dorado County AQMD	**1**	**174**	**+/- 7.4%**	**0.6%**
Sacramento Nonattainment Area[22]	**1**	**331**	**+/- 5.4%**	**0.28%**

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%). See the Methodology section for a thorough description of sampling error.

[22] Since the beginning evaluation in 1995, the methodology for weighting has been to set Sac Metro Air District interviews as 1, and down-weight interviews from all other counties appropriately, adjusted proportionally to the population within each air district. (Sac Metro Air District represents 63% of the entire population, Yolo-Solano AQMD is 15%, Placer County APCD is 15%, and El Dorado County AQMD is 7%.) This is why the weighted total number of completed interviews (i.e. 615) is less than the sum of the total number of interviews conducted in all air districts (i.e. 1,350).

Percentage of Purposeful Reducers: Year-To-Year Comparisons

7 ➢ The percentage of purposeful reducers in each air district for 2018 is not significantly different from their averages.

The next table lists the annual proportions of purposeful reducers from 2010 to the present. In the Sacramento Nonattainment Area, this year's percentage of **0.28% reducers** is less than, but not significantly different from, the nine-year average of 0.7%.

In terms of **Sac Metro Air District**, the 0% of reducers is significantly lower than the 2015 season, which was high at 4.0%, but no different from the other seasons. In **Yolo-Solano AQMD** the percentage of reducers (0.2%) matches the average of 0.2%. In **Placer County APCD**, the 1.1% of purposeful reducers is not significantly different from the average at 0.6%. Likewise, at 0.5% in 2018, **El Dorado County AQMD** shows no difference from the nine-year average of 0.5%.

Spare The Air: Purposeful Reducers	*2010*	*2011*	*2012*	*2013*	*2014*	2015	*2016*	*2017*	*2018*	*Significant Difference Among Years? (see footnotes)*[23]	*Nine-year Average*
Sac Metro Air District	0.5%	0.8%	0.0%	0.6%	0.8%	4.0%	0.8%	0.0%	0.0%	Yes	0.8%
Yolo-Solano AQMD	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%	0.0%	0.4%	0.5%	No	0.2%
Placer County APCD	0.3%	0.4%	0.0%	0.7%	1.4%	0.8%	1.1%	0.0%	1.1%	No	0.6%
El Dorado County AQMD	0.5%	0.0%	0.5%	0.9%	0.0%	0.6%	1.1%	0.0%	0.6%	No	0.5%
Sacramento Nonattainment Area	0.36%	0.5%	0.0%	0.4%	0.8%	2.8%	0.8%	0.1%	0.28%	Yes	0.7%

One possible explanation for a relatively lower rate of recorded purposeful reduction is explained in the 2016 report and remains true now. Employment in the Sacramento Nonattainment Area continues to improve and is nearly at a 20-year low.[24] Driving reduction may not have been an option for many Sacramento Nonattainment Area residents as demonstrated by a slowly declining percentage of respondents driving less on Spare The Air days.

Fewer reducers may also be explained in part by the intense and especially attention competitive media market emerging from the 2018 election cycle. Political rhetoric was intensely covered by popular media outlets. It may have detracted attention away from the Spare The Air message[25],

23 In Sac Metro Air District the percentage of purposeful reducers in the 2015 season is significantly greater than 2010, 2011, 2012, 2013, 2014, 2016, 2017, and 2018. In the Sacramento Nonattainment Area (weighted) the percentage of purposeful reducers in the 2015 season is significantly greater than 2010, 2011, 2012, 2013, 2014, 2016, 2017, and 2018.

24 Data retrieved from the Bureau of Labor and Statistics 11/22/2017 at http://beta.bls.gov/dataViewer/view/timeseries/LAUCN060670000000003.

25 Qiu, X.; Oliveira, D.; Shirazi, S.; Flammini, A.; & Menczer, F.: "Limited individual attention and online virality of low-quality information", Nature Human Behaviour 1, Article number: 0132 (2017) doi:10.1038/s41562-017-0132.

deterred residents from the media sources that spread the message, or influenced the willingness of residents to respond to the survey due to survey fatigue[26].

The predicament of an especially competitive media market also means there's a competitive market for attitudes and behavior. The ARB standard for purposeful reducers requires that a respondent state that air quality is the reason they drove less, unprimed and willingly. **It could be that for some respondents to this survey, air quality *is* a reason for driving less, but not the primary or most accessible reason when the respondent is answering the question**. They are trying to hurry through a phone survey and return to their busy life, so they offer the first thought that comes to mind for why they drove less, but it's not air quality, even though air quality may influence their driving behavior overall. Because of that, **purposeful reduction in the Spare The Air survey reports should be considered conservative estimates.**

[26] See Methodology section for a description of sampling error and its importance in results interpretation.

Estimated Number of Purposeful Reducers

8 ➢ ***After weighting, an estimated 4,716 drivers in the entire Sacramento Nonattainment Area purposefully made fewer trips each Spare The Air day in 2018 in order to reduce air pollution.***

There were an estimated 1,684,369 drivers[27] in the entire Sacramento Nonattainment Area in 2018. Estimates of the number of purposeful reducers for the individual air districts as well as for the region are presented in the next table. After weighting results, **in the Sacramento Nonattainment Area, 4,716 purposeful reducers per Spare The Air episode are estimated for the 2018 season**. Among the individual districts, Placer County APCD recorded the most purposeful reduction, with 3,176 estimated reducers in that area.

Air District	*Total Number of Drivers*	*Percent of Purposeful Reducers*	*Percent of Control 'Reducers'*[28]	*Estimated Number of Purposeful Reducers in 2018 [(Reducers - Control)*Drivers]*
Sac Metro Air District	1,034,580	0.0%	0.0%	0
Yolo-Solano AQMD	235,035	0.5%	0.0%	1,175
Placer County APCD	288,747	1.1%	0.0%	3,176
El Dorado County AQMD	126,007	0.6%	0.0%	756
Sacramento Nonattainment Area	1,684,369	0.28%	0.0%	***4,716***[29] ***purposeful reducers***

[27] The number of drivers in the Sacramento Nonattainment Area for 2018 was estimated using the number of driver licenses by county for 2017, obtained from the California Department of Motor Vehicles database found at https://www.dmv.ca.gov/portal/wcm/connect/90a04dc3-ac0d-4528-a6a3-4797d0842689/DL+By+County+2017.pdf?MOD=AJPERES. The estimated number of licensed drivers for the total Sacramento Nonattainment Area in 2018, therefore, was 1,684,369. Sac Metro Air District: total 1,034,580 + Yolo-Solano: total of 235,035 (139,231 in Yolo County + Solano County: 309,044 * 31% for the proportion located within the air district = 95,804) + Placer County: total of 288,747 (297,678 * 97% for the air district) + El Dorado County: total of 126,007 (151,816 * 83% for the air district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region.

[28] This year the same methodology as was adopted in 2010 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).

[29] The results for the Sacramento Nonattainment Area 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.

Estimated Number of Single Trips Avoided by Purposeful Reducers

9 ➢ ***In the Sacramento Nonattainment Area, 18,864 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. After weighting and rounding, the mean number of single trips avoided in the entire **Sacramento Nonattainment Area** was **four** resulting in a total of **18,864 trips avoided directly attributed to the Spare The Air program**. Results for the individual air districts as well as for the weighted region 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*
Sac Metro Air District	0	0	0
Yolo-Solano AQMD	1,175	4	4,700
Placer County APCD	3,176	2	6,352
El Dorado County AQMD	756	2	1,512
Sacramento Nonattainment Area	*4,716*[30]	4	**18,864** trips

[30] The results for the Sacramento Nonattainment Area 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.

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

10 ➢ ***The 0.28% purposeful reducers on Spare The Air days is not significantly greater than the 0.0% on Control days, but still represents transportation reduction.***

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.[31]

The next table indicates the results from Control interviews in all the air districts. For the entire Nonattainment Area, no respondents erroneously claimed to have reduced their driving because of a specific request not to drive the previous day. Still, the low percentages of true purposeful reducers are not enough to be distinguished from 0%, meaning no significant differences arose in any of the air districts between Control day and episodic purposeful reducers. No differences arising in these calculations has been common place since 2010.

Air District	*% of Respondents Who Reduced for Air Quality Reasons*		*Significant Difference?*
	Who Were Aware On STA Days	*On Control Days*	
Sac Metro Air District	0.0%	0.0%	No
Yolo-Solano AQMD	0.5%	0.0%	No
Placer County APCD	1.1%	0.0%	No
El Dorado County AQMD	0.6%	0.0%	No
Sacramento Nonattainment Area	0.28%	0.0%	No

[31] This year the same methodology as was adopted in 2010 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).

ESTIMATED EMISSION REDUCTIONS

Objective

The main objective of the current section is to estimate how many tons of ozone precursor emissions [Reactive Organic Gases (ROG) and Nitrogen Oxides (NOx)] were reduced during the 2018 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 2018 Spare The Air voluntary driving reduction program was successful in reducing air pollution in the Sacramento Nonattainment Area by an estimated 0.058 tons of ozone precursors per Spare The Air day. There were 20 Spare The Air days in 2018. The reduction of ozone precursors 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, purposeful reduction necessitates that air quality is a top of mind accessible reason for driving less at the time a respondent answers the question. Seasonal reducers who normally make fewer trips during the summer to help improve air quality are not (necessarily) included[32]. 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.

Results from the Sacramento Nonattainment Area 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 alerts,[33] and who also said they drove <u>less</u> than usual on Spare The Air days, specifically for air quality reasons. For the Nonattainment Area, this was **0.28%**[34] (1 / 331[35]) 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. Drivers were asked to estimate the number of <u>single</u> trips they avoided making on the Spare The Air day. For the Nonattainment Area, the mean was **four** single trips avoided.

3) Extrapolate to the total number of drivers in the region[36] this year: the percentage of Spare The Air

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

[33] 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?"

[34] See the Purposeful Driving Reduction section of the 2018 report for a full explanation of these results.

[35] Weighted results. See Methodology section for description of weighting procedures.

[36] The number of drivers in the Sacramento Nonattainment Area for 2018 was estimated using the number of driver licenses by county for 2017, obtained from the California Department of Motor Vehicles database found at https://www.dmv.ca.gov/portal/wcm/connect/90a04dc3-ac0d-4528-a6a3-4797d0842689/DL+By+County+2017.pdf?MOD=AJPERES. The estimated number of licensed drivers for the total Sacramento Nonattainment Area in 2018, therefore, was 1,684,369. Sac Metro Air District: total 1,034,580 + Yolo-Solano: total of 235,035 (139,231 in Yolo County + Solano County: 309,044 * 31% for the proportion located

reducers therefore represents **4,716** drivers in the Sacramento Nonattainment Area, and the number of single trips avoided was **18,864** (4,716 drivers x 4 trips avoided on average).

4) Multiply the number of trips avoided by a per trip emission reduction average of **2.77 grams of ozone precursors.**[37] [This includes a total of Reactive Organic Gases (ROG) emissions (7.10 grams per trip for light duty passenger cars plus two categories of light duty trucks) plus Oxides of Nitrogen (NOx) emissions (4.24 grams per trip for light duty passenger cars and light duty trucks) emissions, based on 2018 models of EMFAC 2017]. EMFAC 2017 is the latest update to the EMFAC model. It is used by California state and local governments to meet Clean Air Act (CAA) requirements. EMFAC 2017 defines trips as vehicle starts and calculates them separately as a function of vehicle population (derived from vehicle registration data), based on ARB and U.S. EPA instrumented vehicle studies. For the Sacramento Nonattainment Area, this amounts to **52,253 grams** of ozone precursors (18,864 single trips avoided x 2.77 grams per trip).

5) Convert to tons.[38] For the Sacramento Nonattainment Area as a whole, this translates to an estimated total of **0.058 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 control day 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 in 2018 equal zero, no correction factor is necessary.

8) Result: **0.058 tons of ozone precursors reduced per Spare The Air day directly attributable to the Spare The Air program**. There were 20 Spare The Air days in 2018. Thus the amount of ozone precursors reduced during the summer due to the Spare The Air program is 1.16 tons.

within the air district = 95,804) + Placer County: total of 288,747 (297,678 * 97% for the air district) + El Dorado County: total of 126,007 (151,816 * 83% for the air district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region.

[37] Estimates were based on the Summer On-Road Inventory - EMFAC 2017 model, for the summer of 2018, accessed from https://www.arb.ca.gov/emfac/2017/. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (4.16 + 1.02 + 1.92) 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. 2,534,080 for light duty passenger cars + 276,664 for light duty trucks1 + 904,356 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (2.32 + 0.48 + 1.43) x 2000 x 454 / (2,534,080 + 276,664 + 904,356). ROG grams and NOx grams were then combined (1.73 + 1.03) to obtain 2.77 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.

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

Sacramento Nonattainment Area	Percent of Respondent Drivers Who Drove Less for Air Quality Reasons[39]	X Number of Licensed Drivers in Sacramento Nonattainment Area (1,684,369 Total)	X Mean Number of Single Trips Reduced Per Day (4)	X 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 summer	= Estimated Tons per Day of Ozone Precursors Reduced
Spare The Air Days	**0.28% (1/331)**	**4,716**	**18,864**	**52,253 grams**	**0.058 tons**
Control Days	**0.0% (0/284)**	**0**	**0**	**0 grams**	**0.00 tons**
Per Episode Estimated Tons of Ozone Precursors Reduced: ***(STA Day Reductions minus Control Day Reductions)***					**0.058 tons**

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

2018 Emissions Reduction Estimate by Air District:

2 ➢ ***El Dorado County AQMD, Placer County APCD and Yolo-Solano AQMD claim emission reductions in 2018.***

Using the established methodology, emission reductions are found in each of the air districts except Sac Metro Air District. There were no purposeful reducers recorded in that district. Claiming no emission reduction is not unusual for any of the air districts in a given season. The impact of the many factors contributing to emission reductions are variable from year to year. Each district has seen seasons where no purposeful reducers are recorded. Since emission reduction is a function of qualifying purposeful reducers, some possible reasons for lower estimated purposeful reduction are described in the Purposeful Reducers section of this report.

Sac Metro Air District	Percent of Respondent Drivers Who Drove Less for Air Quality Reasons	X Number of Licensed Drivers in Sac Metro Air District (1,034,580 Total)	X Mean Number of Single Trips Reduced Per Day (5)	X 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 summer	= Estimated Tons Per Day of Ozone Precursors Reduced
Spare The Air Days	0.0% (0/363)	0	0	0 grams	0.00 tons
Control Days	0.0% (0/240)	0	0	0 grams	0.00 tons
Per Episode Estimated Tons of Ozone Precursors Reduced: (STA Day Reductions minus Control Day Reductions)					***0.00 tons***

Yolo-Solano AQMD	Percent of Respondent Drivers Who Drove Less for Air Quality Reasons	X Number of Licensed Drivers in Yolo-Solano AQMD (235,035 Total)	X Mean Number of Single Trips Reduced Per Day (5)	X 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 summer	= Estimated Tons Per Day of Ozone Precursors Reduced
Spare The Air Days	0.96% (2/208)	2,256	11,280	31,246 grams	0.00 tons
Control Days	0.0% (0/151)	0	0	0 grams	0.00 tons
Per Episode Estimated Tons of Ozone Precursors Reduced: (STA Day Reductions minus Control Day Reductions)					***0.03 tons***

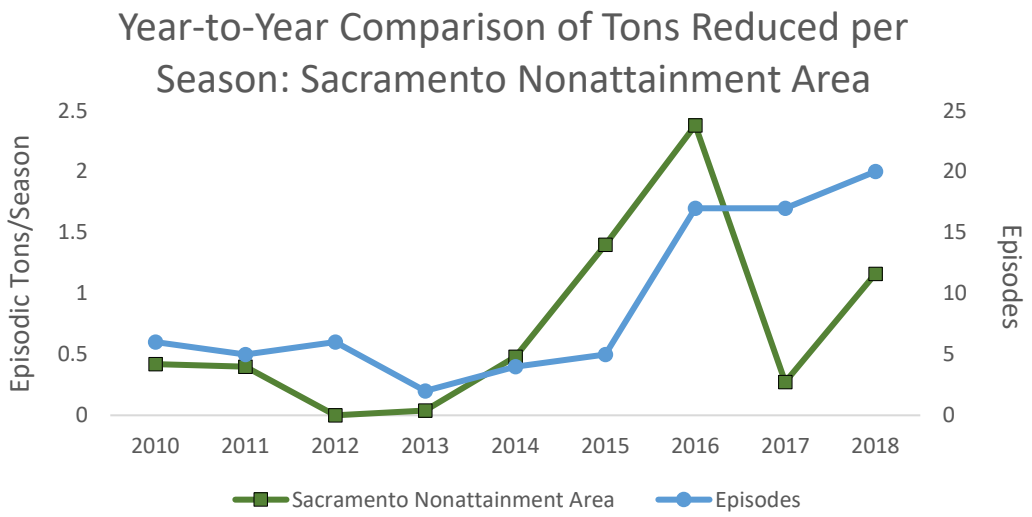
Placer County APCD	Percent of Respondent Drivers Who Drove Less for Air Quality Reasons	X Number of Licensed Drivers in Placer County APCD (288,747 Total)	X Mean Number of Single Trips Reduced Per Day (1.5)	X 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 summer	= Estimated Tons Per Day of Ozone Precursors Reduced
Spare The Air Days	1.1% (2/174)	3,176	4,764	13,196 grams	0.02 tons
Control Days	0.0% (0/123)	0	0	0 grams	0.00 tons
Per Episode Estimated Tons of Ozone Precursors Reduced: (STA Day Reductions minus Control Day Reductions)					***0.02 tons***

El Dorado County AQMD	Percent of Respondent Drivers Who Drove Less for Air Quality Reasons	X Number of Licensed Drivers in El Dorado County AQMD (126,007 Total)	X Mean Number of Single Trips Reduced Per Day (2)	X 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 summer	= Estimated Tons Per Day of Ozone Precursors Reduced
Spare The Air Days	1.2% (2/170)	1,512	3,024	8,377 grams	0.01 tons
Control Days	0.0% (0/126)	0	0	0 grams	0.00 tons
Per Episode Estimated Tons of Ozone Precursors Reduced: (STA Day Reductions minus Control Day Reductions)					***0.01 tons***

Emission Reductions: Year x Year in the Sacramento Nonattainment Area

3 ➢ The 2018 season doubles the 2017 reductions per episode and returns to a trend of greater emission reductions started in 2014.

From 2010 to present the yearly episodic emission reduction total has been variable. The 2018 season doubles the 2017 reductions per episode and returns to a trend of greater emission reductions started in 2014. The per season reductions attributable to the campaign can be calculated by multiplying the number of episodes per season by the per episode emission reductions. In 2018 that value is 1.16 tons per season reduced attributable to the campaign.



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; and
c. estimate emission reductions from these voluntary driving reducers.

RESULTS

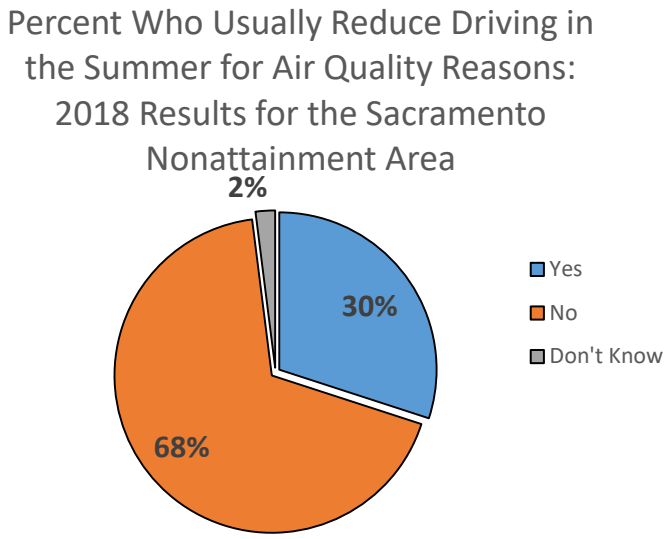
Seasonal Driving Reducers

1 ➢ *In the Sacramento Nonattainment Area, 30% of the 2018 season respondents 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 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. For the entire Sacramento Nonattainment Area, 30% of all[40] respondents in 2018 can be considered seasonal driving reducers. **That 30% translates into an estimated 505,311[41] drivers in the Sacramento Nonattainment Area who regularly reduce their driving during the summer months to avoid adding to air pollution**.

[40] 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.

[41] The number of drivers in the Sacramento Nonattainment Area for 2018 was estimated using the number of driver licenses by county for 2017, obtained from the California Department of Motor Vehicles database found at https://www.dmv.ca.gov/portal/wcm/connect/90a04dc3-ac0d-4528-a6a3-4797d0842689/DL+By+County+2017.pdf?MOD=AJPERES.
The estimated number of licensed drivers for the total Sacramento Nonattainment Area in 2018, therefore, was 1,684,369. Sac Metro Air District: total 1,034,580 + Yolo-Solano: total of 235,035 (139,231 in Yolo County + Solano County: 309,044 * 31% for the proportion located within the air district = 95,804) + Placer County: total of 288,747 (297,678 * 97% for the air district) + El Dorado County: total of 126,007 (151,816 * 83% for the air district). The proportion of drivers in each district also corresponds to the residential population proportions used in the calculation of weights for the region.



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 0.6 fewer trips per day.*

This percentage of seasonal reducers reported that they entered their cars the previous day an average of 2.94 times. The 78% 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 3.54 times. **On average, seasonal driving reducers made 0.6 fewer trips per day** than did non-reducers (3.54 – 32.94 = 0.6 trips). An analysis of variance indicated that these means are not significantly different from each other at the 95% confidence level, but the difference does approach significance (p = .08) and when tested without weights, the difference is significant (p < .01).

The pattern of self-reported seasonal reducers entering their vehicle fewer times than non-reducers is persistent in all the Spare The Air survey reports, a major indicator of the success of the program.

	Seasonal Driving Reducers: *Mean # Times Entered Vehicle*	*Non-Reducers:* *Mean # Times Entered Vehicle*	*Statistically Significant Difference?*
Sacramento Nonattainment Area (weighted results)	2.94	3.54	No

Seasonal Trip Reduction: Estimated Emission Reductions

3 ➢ *In 2018, half a million (505,311) drivers were seasonal reducers. The number of trips they avoided translated into a reduction of 0.93 tons per day of ozone precursors during the summer of 2018.*

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 30% of 2018 seasonal reducers translates into over half a million drivers (505,311) in the entire Sacramento 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[42] and is summarized in the next table. T**he average of 0.6 of a trip per day that seasonal reducers avoided translates into an estimated 0.93 tons of ozone precursors reduced per summer day in 2018.**

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 (1,684,369 Total)	x Mean Number of Trips Reduced Per Day Compared to Non-Reducers	x 2.77 Grams of Ozone Precursors Per Trip (EMFAC 2017) 2018 Summer Model[43]	= Estimated Tons[44] Per Day of Ozone Precursors Reduced
Spare The Air and Control Day Interviews Combined	30%	505,311	x 0.6 = 303,187	839,825 grams	0.93 tons

[42] For a full explanation of the methodology, see report titled "Estimated Emission Reductions during the 2018 Spare The Air Season."

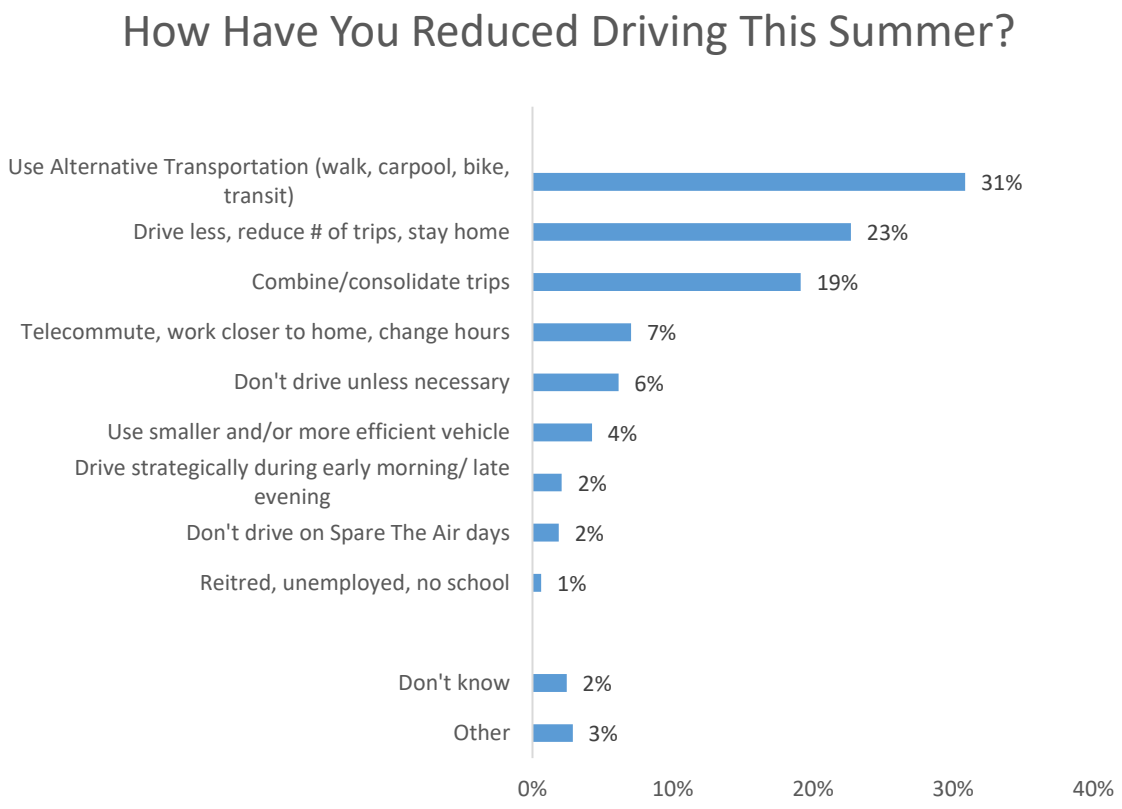
[43] Estimates were based on the Summer On-Road Inventory - EMFAC 2017 model, for the summer of 2018, accessed from https://www.arb.ca.gov/emfac/2017/. The total ROG tons for a combined total of light duty passenger cars and two categories of light duty trucks (4.16 + 1.02 + 1.92) were converted to pounds (multiplied by 2,000) and then to grams (multiplied by 454) before dividing by the combined total number of trips (i.e. 2,534,080 for light duty passenger cars + 276,664 for light duty trucks1 + 904,356 for light duty trucks2) in order to obtain the average grams per trip. The same process was used to calculate NOx grams per trip (2.32 + 0.48 + 1.43) x 2000 x 454 / (2,534,080 + 276,664 + 904,356). ROG grams and NOx grams were then combined (1.73 + 1.03) to obtain 2.77 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.

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

How They Reduce Driving

4 ➢ *Seasonal reducers used alternative transportation, made fewer trips or stayed home, and planned and consolidated errands 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. Nearly one third (31%) of seasonal reducers said they used alternative transportation, such as walking, carpooling, biking, or public transit to avoid driving during the summer. Almost a quarter (23%) of said they "just drove less," often by staying home or by avoiding joy rides and extra trips. Nearly one fifth (19%) said they made combined or consolidated trips. Less frequently, respondents said they were able to telecommute, work closer to home or change their hours (7%). Some said they don't drive unless absolutely necessary (6%) and other said they switch to a hybrid, electric, or smaller vehicle (4%). An equal percent said they drive strategically during the morning or evening when air quality is better (2%) or don't drive at all on Spare The Air days (2%). The final bit said they are retired, unemployed, teachers or parents, and so have no school (1%). Some reduce their driving in a way that doesn't fall into one of these categories (4%) saying they have items delivered if possible, or do their shopping online instead of going to a store.



A few representative comments[45] from those who used alternative transportation include:

- By not getting in my car. Walking, riding my bike, and skiing.
- By taking the train.
- Carpooled a couple times.
- I take my bicycle.
- I take others with me to school.
- I walk to take the kids to school.
- Now I try biking or walking most times.
- Sometimes I take the bus instead.
- Ride my bike most of the time.
- Biking more to places I want to go to.
- Carpooling, less driving.

A few representative comments by those who drove less include:

- By staying at home.
- Don't go out as often.
- Don't do as much shopping during the weekdays.
- I don't take long trips.
- I just choose to drive less.
- I stay home a lot more.
- Just don't go anywhere.
- Just trying to cut down on driving.
- Not going places as much.
- Stay at home more.
- Stay home and swim in the pool.
- We tried to reduce air pollution. We drive less, stay home, limit our trips to the store and that type of thing. It's important. I believe we have to do our part limiting air pollution, Trump is trying to increase it.

A few representative comments from those who said they combined or consolidated trips include:

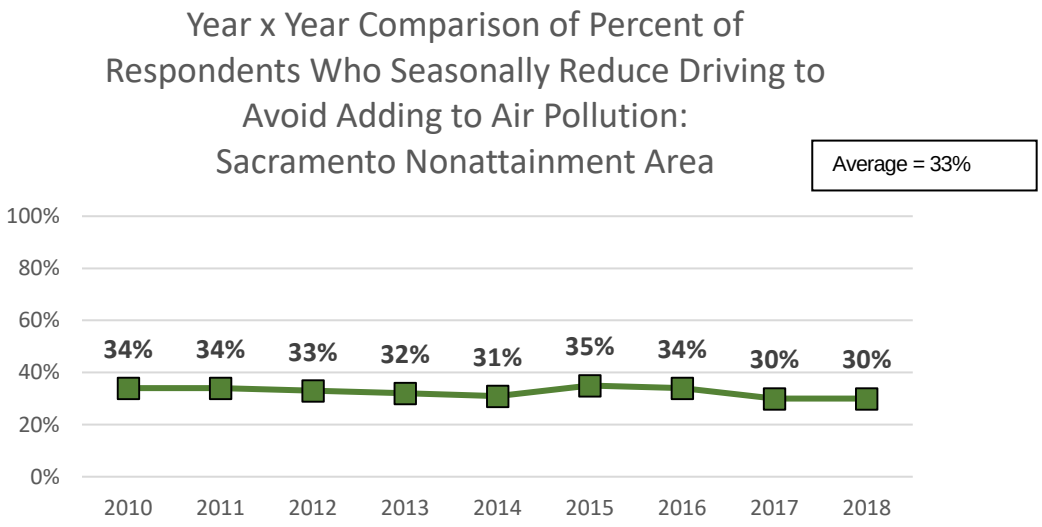
- Combine trips, pick up things from store on way home, public transit.
- Combining trips and if it's a Spare The Air day I will avoid driving that day.
- Consolidate errands to prevent more mileage.
- Do more errands in one trip.
- Get everything done one day of the week.
- I don't make multiple trips, I'm doing everything all at once.
- I try to combine my trips to cut down on using a vehicle.
- Make all my errands in one day.
- Making one continuous trip, rather than making multiple trips.
- Try and plan out my trips.
- We try to combine trips, plan out our day so that we're not making numerous trips.
- When I go somewhere I do it all in one

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

Year-To-Year Comparisons

5 ➢ *This year's percentage of seasonal reducers in the Sacramento Nonattainment Area is not significantly different from the nine-year average of 33%. That the program continues to inspire seasonal reduction is testament to the efforts spent keeping Spare The Air effective.*

The year-to-year analysis shows 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 nine-year average of 33%. The 2018 season finding 30% seasonal reducers is welcome consistency. The evaluation program reaches a similar percentage of residents in the Sacramento Nonattainment Area each year who are self-reported seasonal reducers. The program continues to inspire seasonal reduction, testament to the efforts spent keeping Spare The Air effective.



6 ➢ *The nine-year average number of trips avoided on a summer day by seasonal reducers is 0.7. This varied from a high of 1.12 trips avoided in 2012 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 from 2010 to the present. 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 (1.12 trips). **In other words, a substantial subset of the population of respondents to the Spare The Air phone survey habitually reduce the amount of driving they do during the summer months in order to reduce air pollution.** Some of these individuals may not qualify as purposeful (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?*
2010	2.94	3.84	0.9	Yes
2011	2.88	3.26	0.4	No
2012	2.55	3.67	1.12	Yes
2013	2.40	2.70	.3	Yes
2014	2.92	3.43	.51	No
2015	2.8	3.37	.57	Yes
2016	2.75	3.38	.63	Yes
2017	3.00	3.85	.85	Yes
2018	2.94	3.54	0.6	No

SUMMER 2018 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 2018. 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 2016;
c. determine if levels of reported health problems during summer Spare The Air seasons have increased, decreased, or stayed the same from 2010 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

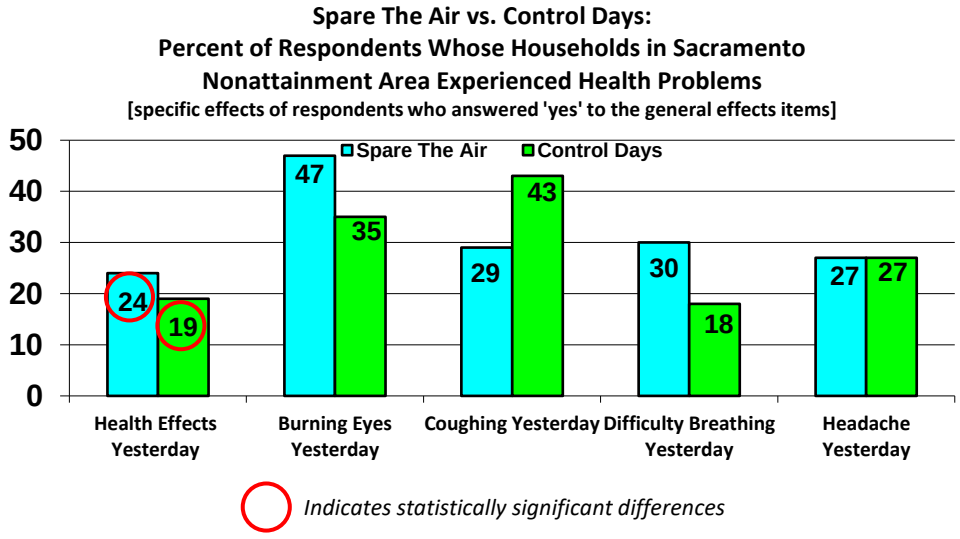
Perceived Health Problems: Spare The Air Days vs. Control Days

1 ➢ ***Twenty-four percent (24%) of households in the entire Sacramento Nonattainment Area reported having difficulties with their health due to poor air quality on Spare The Air days in 2018.***

For both Spare The Air and Control day respondents, respiratory health of individuals within the household is measured using one item at the end of the survey[46], with a follow-up item to gather more specific information. Respondents are 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, which was the actual Spare The Air day. If yes, a secondary question solicited open ended responses as to what, specifically, they experienced (burning eyes, headaches, coughing, difficulty breathing, or other).

Percentages of specific health effects are reported only for respondents who experienced any effects at all. For health effects yesterday, Spare The Air day respondents (24%) experienced significantly more discomfort than Control day respondents (19%). Coughing, headaches, and burning eyes were experienced by both groups of households. No significant differences distinguish the specific health effects experienced by Spare The Air day and Control day respondents.

[46] This year the decision was made to measure health effects only for the episode. In the past, the survey asked about health effects both for the Spare The Air day and for the following day. To save time and combat rising costs, the question about the following day was dropped.



An estimated[47] 215,824 households experienced health effects due to poor air quality on the days of Spare The Air Interviews. After subtracting for Control days (170,861), **a total of 44,963 households in the Sacramento Nonattainment Area experienced health discomfort due to poor air quality on the Spare The Air days.** That being the most conservative estimate, it is entirely likely that Control day respondents experience difficulty due to air quality, be it the moderate level of ozone precursors[48] or because of the continuous torrent of wildfire smoke across the state throughout much of the 2018 season, or a combination thereof. It follows that there need not be a correction applied to the number of households claiming health difficulties on Spare The Air days, and the 215,824 households estimated is indeed the number experiencing discomfort due to poor air quality during episodes.

[47] The measure used for households was the "total housing units" column, to be consistent with previous years' evaluations. Starting 2016 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, 2010-2018, with 2010 Benchmark. Online source http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/. The estimated number of households for the entire Sacramento Nonattainment Area is **899,267** ((Sac Metro Air District: 570,305) + (Placer County APCD: 164,820* 87% = 143,393) + (Yolo-Solano AQMD: 123,182 (Yolo: 77,138; Solano (Dixon, Rio Vista & Vacaville: 46,044)) + (El Dorado County AQMD: 91,745 * 68% = 62,387)).

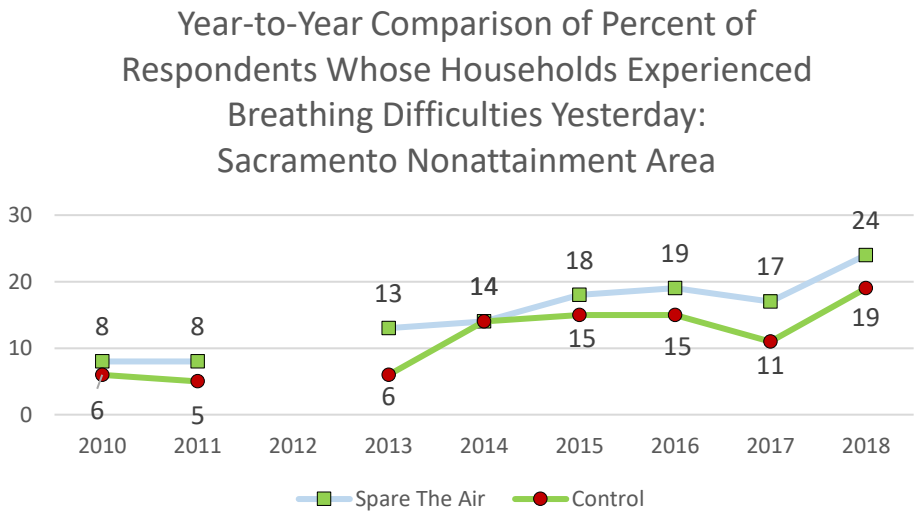
[48] Control day interviews occur on days of the week matching Spare the Air interviews, but when air quality is rated as moderate on the AQI.

Year-To-Year Comparisons

2 ➢ The percentage of reported health effects in 2018 suggests the impact of air quality on health is becoming more pronounced over time.

Reported health effects have increased from the low 2010 and 2011 levels (8%) to the present 24%. In terms of Control day interviewing, the percentage of households who reported breathing difficulties remained relatively stable and consistently lower, until 2014 when it reached 14%. This year it is higher yet, at 19%.

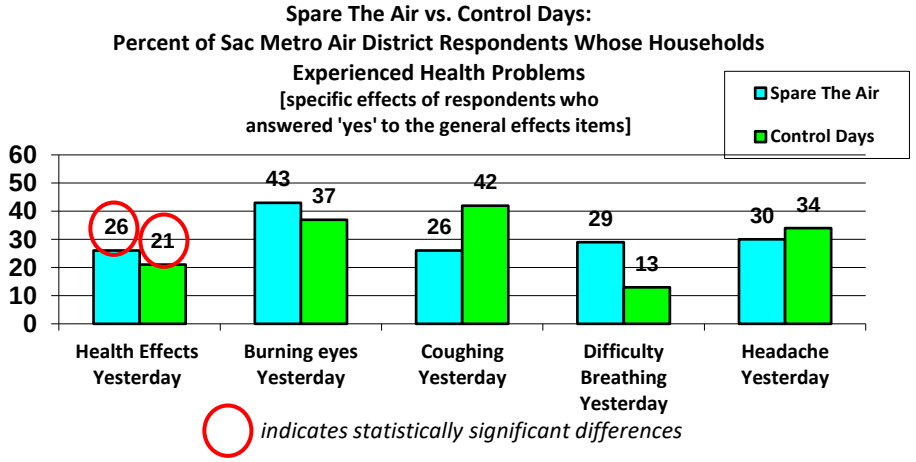
While the new data points suggest the impact of air quality on health is becoming more pronounced with time it is important to consider the impact of wildfire smoke on both Spare The Air and Control day reported health effects in 2018. For both groups it was difficult to avoid conducting interviews during periods of the season without wildfires impacting air quality in the Nonattainment Area. This does not mean the reported levels are necessarily inflated. Wildfire smoke has impacted the previous three season's interviews. The 2018 season is no different in that wildfire smoke no doubt played a role in respondents experiencing health difficulties on both Spare The Air and Control days in 2018.

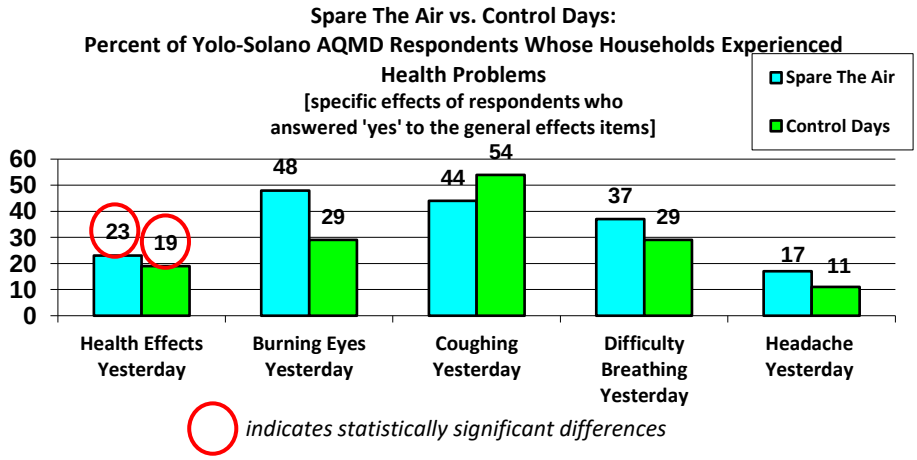


Individual Air Quality Districts

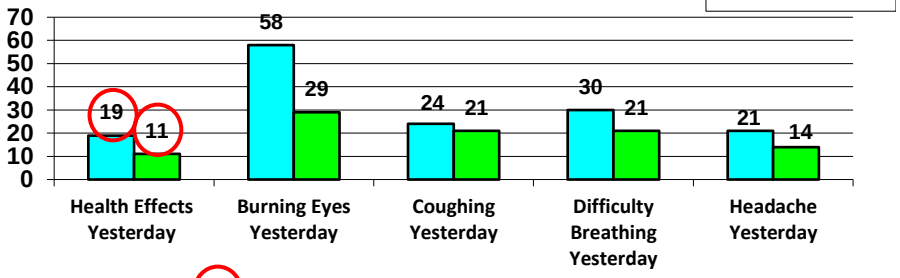
3 ➢ ***Discomfort on a Spare The Air day is significantly greater than discomfort on Control days in each of the districts.***

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. In each district, discomfort is significantly greater on Spare The Air days than on Control days. Yet among those who report discomfort, the specific impacts on health vary wildly from one district to the next and between Spare The Air and Control Day respondents.



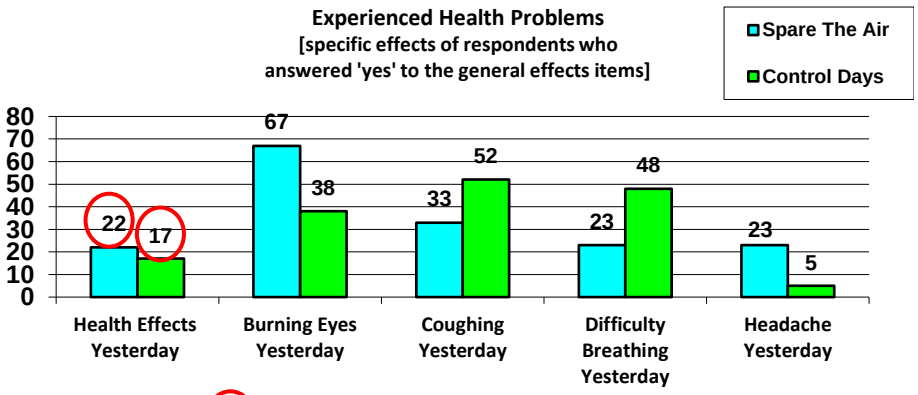


Spare The Air vs. Control Days:
Percent of Placer County APCD Respondents Whose Households Experienced Health Problems
[specific effects of respondents who answered 'yes' to the general effects items]



indicates statistically significant differences

Spare The Air vs. Control Days:
Percent of El Dorado County AQMD Respondents Whose Households Experienced Health Problems
[specific effects of respondents who answered 'yes' to the general effects items]

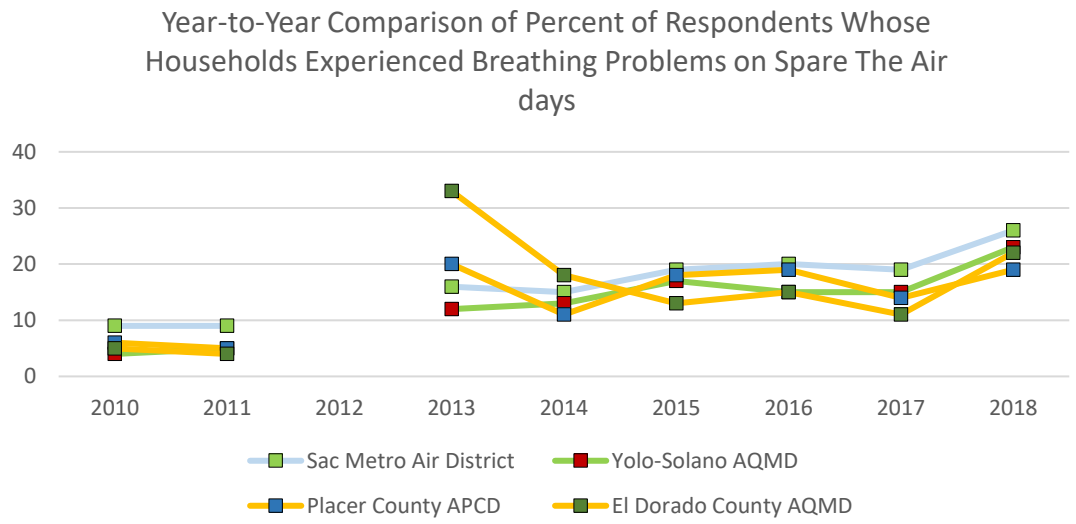


indicates statistically significant differences

Air Quality Districts: Year-To-Year Comparisons

4 ➢ ***Reports of health concerns in each of the individual air districts show the same trend as the Nonattainment Area as a whole: Difficulties were more common than previous years.***

Aside from El Dorado County AQMD in 2013, reports of health concerns were consistent from 2013 through 2017. Yet as with the aggregate Nonattainment Area results, in the 2018 season each district shows a marked increase in the percentage of respondents reporting sensitivity to the air quality on Spare The Air days. This may be indicating a trend toward heightened sensitivity or more identifiable symptoms, though the impact of wildfire smoke should not be ignored.



APPENDIX A

2016 SPARE THE AIR
BEHAVIOR & ATTITUDE TELEPHONE TRACKING SURVEY
DRAFT QUESTIONNAIRE ~ 04/11/2016

	Methods:
Field Dates:	• STA episodes days: May – September, 2018 Control days: June - September, 2018
Sample Size:	• up to 2,000 completed interviews - up to 1,200 completes on STA episodes days - 400 Sacramento Co. residents - 300 Yolo/Solano Co. residents - 300 Placer Co. residents - 200 El Dorado Co. residents - 800 completes on Control days - 200 Sacramento Co. residents - 200 Yolo/Solano Co. residents - 200 Placer Co. residents - 200 El Dorado Co. residents
Unit of Analysis:	• Household
Sampling Frame:	• Listed landline (55%) and mobile (45%)
Budgeted Length of Interview:	• 4 minutes (Average)

• SURVEY INTRODUCTION & REQUEST •

Hello, my name is _____ with Meta Research, a regional public opinion research firm. We're conducting a survey regarding transportation activities in the area and need your input.
Would you mind if I asked a few questions about your transportation yesterday? This is a brief and anonymous survey.

[IF RESPONDENT SAYS "I didn't drive yesterday" THEN INTERVIEWER]:

"That's ok, we still want to hear from you. So…" [BEGIN SURVEY].

[IF RESPONDENT SAYS, "I don't want to buy anything" THEN INTERVIEWER]:

"This is research, not sales. Your telephone number will not be associated with your answers or used for any purpose other than this call. May we begin?

[IF RESPONDENT ASKS FOR NAME OF SURVEY SPONSOR THEN INTERVIEWER]:

"To avoid biased responses, we will be glad to tell you the name of the sponsoring agency at the end of the survey, which shouldn't take long. May we begin?"

[IF RESPONDENT STILL RESISTENT BECAUSE OF SURVEY SPONSER TRY]: "This is not a political survey, it's about transportation. May we begin?"

• 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: 200 completes)

20) Yolo/Solano – Davis (95616) (20%)
(STA QUOTA: 60 completes)
(CONTROL QUOTA: 40 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: 123 completes)
(CONTROL QUOTA: 82 completes)

22) Yolo/Solano – Vacaville (30%)
(95687, 95688)
(STA QUOTA: STA 90 completes)
(CONTROL QUOTA: 60 completes)

23) Yolo/Solano – Dixon/Rio Vista (8%)
(95620, 945741)
(STA QUOTA: 24 completes)
(CONTROL QUOTA: 16 completes)

30) Placer – Auburn and vicinity (22%)
(95602, 95603, 95658, 95663)
(STA QUOTA: 66 completes)
(CONTROL QUOTA: 44 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: 156 completes)

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

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

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

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

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

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

1) Yes
2) No [If no, thank and seek interview with another driver within the household. If no others available, THANK AND TERMINATE]

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

1) 18 to 24
5) 25 to 64
6) 65 or over
8) Refused [terminate]

Q3. Gender [BY OBSERVATION]

1) Male
2) Female

Data for quotas taken from the American Community Survey.[49]

	Spare The Air Day Interviews	Control Day Interviews
Sacramento County Residents	**400**	**200**
Male	196	98
18-24	*>20*	*>10*
65+	*<18*	*<8*
Female	204	102
18-24	*>18*	*>10*
65+	*<27*	*<13*
Yolo/Solano County	**300**	**200**
Male	150	100
18-24	*>20*	*>13*
65+	*<12*	*<9*
Female	150	100
18-24	*>20*	*>13*
65+	*<17*	*<12*
Placer County	**300**	**200**

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

Male	147	98
18-24	*>12*	*>8*
65+	*<21*	*<14*
Female	153	102
18-24	*>20*	*>14*
65+	*<24*	*<16*
El Dorado County	**200**	**200**
Male	100	100
18-24	*>8*	*>8*
65+	*<14*	*<14*
Female	100	100
18-24	*>7*	*>7*
65+	*<15*	*<15*

DB7. 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 been in a car as the passenger.]

[NOTE TO INTERVIEWER: VALIDATE RESPONSES OVER 50 TIMES]

_____ 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."]

[NOTE TO INTERVIEWER: VALIDATE RESPONSES OVER 500 MILES]

_____ 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?

[NOTE TO INTERVIEWER: VALIDATE RESPONSES OVER 100 MILES]

_____ Specific number
999) 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; Record response if not (1) or (2)]

1) Air quality; OR reduce pollution; OR concerned about smog; OR Spare The Air campaign
2) Multiple INCLUDING air quality related
3) RECORD RESPONSE
9) Don't know/Refused [PROMPT AGAIN; skip to Q9]

[Q5=2: AND Q7A= 1 OR 2: 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."]

[NOTE TO INTERVIEWER: VALIDATE RESPONSES OVER 100 MILES]

_____ 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 or smoggy 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) Online/digital Ad
e) Outdoor Billboard
f) News or weather story
g) Community event
h) Air Alert email
i) Spare The Air website
j) Sacramento Region Air Quality App
k) Other (Specify)

[READ TO ALL]
Almost finished, I just have a few questions about your health and activity.

[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?

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

[Ask if Q13a = 1]
Q13b What was it that you experienced? [OPEN ENDED-do not read options; use for coding only]

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

Q15. Finally, thinking of your media use, with which of the following would you say you spend the most time? [Randomize 1-4 & read list]

1) Broadcast Television
2) Cable Television
3) Subscription streaming services such as Netflix, Amazon Prime, or Hulu
4) Social Media platforms such as Facebook, Twitter, Instagram, or Snapchat
5) Broadcast Radio
6) Satellite radio or other subscription streaming service such as Spotify, Google Music, Apple Music, or Pandora
7) Printed Newspapers or magazine
8) Online newspapers or magazines

9) Something else [RECORD RESPONSE]
10) Don't know/Don't recall/Refused

Q16. Finally, and for statistical purposes only, please stop me when I reach the category that best describes your household income before taxes in 2015.

1) Less than $15,000
2) $15,000 to less than $25,000
3) $25,000 to less than $50,000
4) $50,000 to less than $100,000
5) $100,000 or more
6) Don't Know/Refused

THIS HAS BEEN A CONFIDENTIAL INTERVIEW CONDUCTED BY _____ AT META RESEARCH ON BEHALF OF THE SAC METRO AIR 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.