

# ARB STAFF RESPONSES TO COMMENTS RAISING SIGNIFICANT ENVIRONMENTAL ISSUES REGARDING THE PROPOSED REGULATIONS TO CONTROL GREENHOUSE GAS EMISSIONS FROM MOTOR VEHICLES

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## Background

The Alliance of Automobile Manufacturers and its consultants submitted extensive comments arguing that the proposed regulation will result in a significant increase in criteria pollutant emissions. The purported increase in criteria pollutant emissions is due to the combined effect of three elements for which the commenters reached conclusions that differ substantially from the staff analysis:

1. Fleet Turnover Effect. The commenters argue that increased vehicle prices will decrease sales of new vehicles and thereby slow the introduction of new, cleaner vehicles into the fleet (the “fleet turnover” effect.)
2. Rebound Effect. The commenters argue that the required low greenhouse gas vehicles will be cheaper to operate and as a result vehicle owners will drive more, thus increasing emissions (the “rebound” effect).
3. Fuel Cycle Emissions. The commenters argue that the staff analysis overstates the emission decrease that results from reduced production, storage and distribution of fuel (“fuel cycle” emissions.)

The first two elements above involve an assessment of consumer response to the new low greenhouse gas vehicles required under the regulation. Because ARB regulations typically have a negligible effect on vehicle attributes such as price or performance, consumer response issues are not directly addressed by the standard modeling tools, such as the EMFAC vehicle emission model and the E-DRAM model of the California economy, that are used by staff to project the emission and economic consequences of ARB regulations.

In this rulemaking the staff technical analysis concluded that the regulation would have no effect on vehicle performance (performance was held constant during the vehicle-level simulation modeling), that vehicle prices would increase by an average of about \$1,000 for the 2016 mid-term standards – well within historical price trends – and that the increased vehicle price would be more than offset by reduced operating costs. In reaching these conclusions the technical analysis employed a number of conservative assumptions (for example it based the standard on the greenhouse gas levels that could be reached by the heaviest manufacturer fleet, it ensured that multiple feasible technology packages were available in each vehicle category, it excluded any greenhouse gas reductions due to hybridization, and it assumed a fuel price of \$1.74

per gallon.) Thus staff determined that it was appropriate in this greenhouse gas rulemaking to rely on the standard EMFAC and E-DRAM tools for the main environmental and economic analyses for both criteria and greenhouse gas emissions, and that these modeling results alone would suffice to support conclusions concerning criteria pollutant impacts. As stated in the ISOR, “[t]he economic impact analysis is based on the staff assessment that the lower vehicle operating cost resulting from the regulation will be sufficiently attractive to new car buyers to compensate for the vehicle price increase, and results in vehicle sales that are unchanged from the levels that would have been the case without regulation.” *Staff Report/ISOR* at p. 199.

Using the results of these standard, main analyses, the staff analysis concluded with regard to environmental impacts that “[t]he climate change regulation will have a negligible impact on criteria pollutant emissions. However, to the degree that there are upstream benefits associated with reduced petroleum shipping, storage and distribution, emissions will be reduced.” See *Staff Report/ISOR* at Section 11.3, p. 166.

Staff also understood, however, that theoretical questions can be posed concerning the effect on consumer behavior of increases in vehicle purchase prices and decreases in operating costs potentially attributable to ARB regulations. Recognizing that such issues would be raised in this rulemaking, staff determined that the Board and the public could benefit from additional studies examining the issue. See *Staff Report/ISOR* at p. 171. To provide a context for consideration of such issues, ARB contracted with the Institute of Transportation Studies at the University of California at Davis to update its CARBITS model for use as a tool to model consumer purchase behavior, and contracted with the University of California, Irvine to prepare a California-specific econometric evaluation of the rebound effect. The results of these studies were reported in a separate Section 12 of the ISOR entitled “Other Considerations”.

Cognizant of the experimental though useful nature of the effort to combine all of these factors – fleet turnover, rebound and fuel cycle emissions – staff provided in the Other Considerations section a supplemental analysis reporting its “best estimate” and its “current thinking” regarding the combined effect of those factors on criteria pollutant emissions. This “best estimate” concluded that even taking all such factors into account, the net effect of the regulation would still be a reduction in criteria pollutant emissions. Thus the supplemental analysis reinforced and supported the conclusions of the standard, main analyses. *Staff Report/ISOR* p. 188-189.

As noted above, the Alliance of Automobile Manufacturers and its consultants presented comments disagreeing with staff conclusions on each of the underlying factors (fleet turnover, rebound, and fuel cycle emissions) and on their combined effect. The following sections discuss each subject in turn.

## Responses to Comments

### The Fleet Turnover Effect

1. Comment: The Alliance of Automobile Manufacturers (Alliance) submitted extensive comments asserting that assumed increases in the prices of new California cars and light trucks resulting from the proposed regulations would depress sales of new vehicles to the extent that emissions would increase due to the greater number of older vehicles on the road emitting higher levels of criteria pollutants longer than would occur under a no regulation scenario. This is known as the “fleet turnover effect.” See also *Declaration of Stephen Douglas*. To support this position, the Alliance submitted an analysis with attachments. The main document, dated September 22, 2004 and prepared by NERA Economic Consulting, was entitled *Reviews of Studies Evaluating the Impacts of Motor Vehicle Greenhouse Gas Emissions Regulations in California (NERA Review)*, which reviewed ARB’s analysis of the consumer response issue. Attachment B-1.1 to the *NERA Review* provides a separate analysis conducted by NERA/Sierra, which included re-running ARB’s analysis using different assumptions. *NERA Economic Consulting and Sierra Research, Environmental and Economic Impacts of the ARB Staff Proposal to Control Greenhouse Gas Emissions from Motor Vehicles, attachment B-1.1*). Portions of the analysis were updated in a document entitled *Analysis of the Impact of CARB’s AB 1493 Regulations on Criteria Pollutant Emissions as a Result of Rebound, Fleet Turnover, and Reduced Fuel Consumption*, Appendix J to the Alliance comments submitted on November 5, 2004 in response to the first 15 Day Notice.

The *NERA Review* raised numerous methodological concerns over ARB’s consumer response analysis. Though these concerns do not directly present significant environmental issues, detailed responses are provided in the Final Statement of Reasons (FSOR).

The main conclusion of the NERA/Sierra analysis is that the estimated number of reduced new vehicle sales in 2020 ranges from about 53,000 to more than 300,000. Their estimated number of increased pre-2009 vehicles in 2020 ranges from about 64,000 vehicles to more than 1 million vehicles. See Table ES-1 below.

**[NERA/Sierra] Table ES-1. Summary of the Changes in Statewide 2020 Vehicle Population Estimates as a Result of the Staff Greenhouse Gas Proposal Scenarios**

	<b>New Vehicle Sales in 2020</b>	<b>Pre-2009 Vehicles in 2020 Stock</b>
NERA/Sierra methodology with NERA/Sierra inputs	-176,176	1,068,444
NERA/Sierra methodology with ARB staff inputs	-50,916	388,634
CARBITS methodology with NERA/Sierra inputs	-309,243	905,371
CARBITS methodology with ARB staff inputs	-72,472	64,244

(NERA Economic Consulting and Sierra Research, Environmental and Economic Impacts of the ARB Staff Proposal to Control Greenhouse Gas Emissions from Motor Vehicles, pages ES – 4-5). Note--The discrepancy between “53,000” in the text and “-50,916” in the table is in the original NERA/Sierra document.

The Alliance and others then claim (see Comment 4. herein) that the emission impact of the projected sales decrease under any of these scenarios will overwhelm the decrease in fuel cycle emissions, such that the net effect of the regulation will be to increase criteria pollutant emissions.

Agency Response: There are two main factors that account for the different conclusions reached by the staff and the NERA/Sierra analyses. First, NERA/Sierra assumes a much higher vehicle price increase and a much smaller operating cost decrease, which in turn increases the estimated impact on vehicle sales. Second, NERA/Sierra criticizes the methodology used by ARB to estimate the effect of a given price increase on sales and substitutes its own methodology.

The NERA/Sierra analysis provided analytical results from four scenarios, which lay out the four possible combinations of NERA/Sierra vs. ARB assumptions and NERA/Sierra vs. ARB methodology. The scenarios, and an explanation of their differences, are as follows:

- *NERA/Sierra methodology with NERA/Sierra inputs.* In this scenario, the new vehicle sales estimate is much lower than ARB’s estimate and the pre-2009 vehicle stock is much higher than ARB’s estimate (i.e. there is a significant fleet turnover effect). These differences are due mainly to NERA/Sierra’s overestimate of cost increases and underestimate of operating cost savings. A substantial portion of the FSOR is devoted to examining the automaker’s cost estimates and their calculations of operating cost savings, concluding that the values provided simply are not credible. In general, this is because the automaker methodology relies on costly, unnecessary technologies such as widespread use of aluminum body structures and

advanced hybrids that are not necessary or even cost-effective for meeting the standards. Meanwhile, other commenters have produced evidence based on past rulemakings that suggests that ARB's cost estimates are likely conservative (i.e. higher than will turn out to be the case).

NERA/Sierra also employ a different methodology to estimate the impact on sales of a given vehicle price increase. Again, the FSOR reviews the NERA/Sierra methodology and NERA/Sierra's critique of the ARB methodology in detail and provides full and complete responses to the issues raised. In general staff concludes that the staff methodology provides a more accurate assessment for the purpose at hand. For example the NERA model focuses solely on new vehicle sales and thus excludes consideration of used vehicle purchases, and NERA also excludes dynamic variables such as household purchase decisions and demographic changes. Finally, NERA/Sierra did not indicate whether the NERA/Sierra model had been peer reviewed or whether its outputs agreed with those of other models, further undermining its credibility.

- *NERA/Sierra methodology with ARB staff inputs.* In this scenario the NERA/Sierra pre-2009 vehicle stock still is much higher than ARB's estimate (i.e. there is a significant rebound effect.) The differences in outputs are due to differences between the NERA/Sierra model and CARBITS, as discussed above.
- *CARBITS methodology with NERA/Sierra inputs.* In this scenario, the NERA/Sierra new vehicle sales estimate is much lower than ARB's estimate and the NERA/Sierra pre-2009 vehicle stock is much higher than ARB's estimate (again, a significant fleet turnover effect). Here, the NERA/Sierra document describes how NERA/Sierra prepared their input, but does not provide the specific values used. The ARB staff could not find, on the CD-ROMs provided by NERA/Sierra, any files that contained vehicle attributes for use in CARBITS. ARB staff therefore did not have the information needed to fully evaluate this scenario.
- *CARBITS methodology with ARB staff inputs.* In this scenario, which is intended to replicate the ARB staff analysis, the NERA/Sierra results agree with the ARB results within the uncertainty of the CARBITS output. This validates the calculations provided by ARB staff.

As shown in Table ES-1 above, the largest estimated effects on new vehicle sales and the pre-2009 vehicle stock come from the two scenarios that employ the NERA/Sierra inputs. This suggests that the underlying technology cost estimates, rather than differences in methodology, account for the majority of the difference between the NERA/Sierra and the staff conclusions. Because ARB staff have thoroughly reviewed the manufacturers' comments regarding vehicle cost, and do not find them to be credible, staff concludes that the purported emission impact due to fleet turnover likewise is illusory.

Finally, staff notes that there are a number of factors that serve to reduce the cost of the regulation that are not taken into account in the modeling results. As required by AB 1493, the proposed regulations provide flexibility to manufacturers. As described in the *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles*, August 6, 2004 (*Staff Report/ISOR*) at pp. 129-136, the proposed greenhouse gas emission regulations do so by allowing the averaging of fleet emissions between the PC/LDT1 and LDT2 classes, by allowing trading between manufacturers, and by allowing banking of credits for later use or trading with others. The regulations also allow alternative fuel vehicle projects to create additional credits. In addition, manufacturers have until the end of each Tier of the standards (2012 and 2016) to demonstrate compliance with the standard. Together, staff expects that during program implementation these flexibility provisions will reduce the real world cost impact of the greenhouse gas emission reduction program and its impact on sales.

### The Rebound Effect

2. Comment: The Alliance claimed that criteria pollutant emissions would also increase due to consumer response to reduced operating costs. They claimed that because consumers would spend less money on fuel to operate their vehicles, they would respond in part by driving more miles – and emitting more criteria and greenhouse gas pollutants – than would occur under the no regulation scenario. These arguments are detailed in the testimony of Tom Austin, Sierra Research, in *the Review of the August 2004 Proposed CARB Regulations to Control Greenhouse Gas Emissions from Motor Vehicles: Cost Effectiveness for the Vehicle Owner or Operator*, page C1-26), and in the *NERA Review*. Portions of the analysis were updated in a document entitled *Analysis of the Impact of CARB's AB 1493 Regulations on Criteria Pollutant Emissions as a Result of Rebound, Fleet Turnover, and Reduced Fuel Consumption*, Appendix J to the Alliance comments submitted on November 5, 2004 in response to the first 15 Day Notice.

The *NERA Review* critiqued the rebound effect estimate by the University of California, Irvine that the ARB staff used in their analysis, and provided a separate estimate. The *NERA Review* estimated a rebound effect of 17 percent. (That is, for a given decrease in the cost of driving, the number of miles driven would increase by 17 percent of the change. For example, a 10 percent decrease in the cost of driving would increase driving by 17 percent of that change, or 1.7 percent overall). They argued that this in turn would reduce consumers' operating cost savings, and increase the net cost of technologies needed from \$3,129 to \$3,357. This would thereby increase criteria pollutant emissions by direct emissions from the increased vehicle miles traveled and to a lesser extent by exacerbating the fleet turnover effect. In its critique of the UC Irvine study the *NERA Review* raised several methodological concerns. Again, though these concerns do not directly present significant environmental issues, detailed responses are provided in the Final Statement of Reasons (FSOR).

Sierra Research presented an additional analysis purporting to show that the rebound effect in California is approximately 16%, which Sierra termed consistent with the literature for the nationwide rebound effect and with the *NERA Review*. (*Sierra Research, Review of the August 2004 Proposed CARB Regulations to Control Greenhouse Gas Emissions from Motor Vehicles: Cost Effectiveness for the Vehicle Owner or Operator*.) This too would manifest itself in increased criteria pollutant and greenhouse gas emissions due to increase vehicle miles traveled.

Agency Response: Staff has carefully reviewed the Sierra and the NERA rebound analyses and finds that they both suffer from methodological problems. Staff believes that the UC Irvine estimate, which is a peer reviewed California-specific econometric evaluation based on a well founded theoretical framework, provides the best available assessment of the possible rebound implications of greenhouse gas reduction measures.

The Sierra analysis provides a rough estimate of the rebound effect for 2003 based on Smog Check data. In its analysis, Sierra associates the entire change in 2003 vehicle miles traveled (VMT) to three changes in fuel price in that year. In other words, Sierra only uses three data points in 2003 to estimate the rebound effect while the UC Irvine study on which ARB relies uses over 1,800 data points (i.e., a data set for 1966 to 2001 on a cross-section of U.S. states and District of Columbia). In addition, it is well understood that changes in fuel price cannot solely explain the entire change in VMT. In addition to fuel price changes, VMT changes due to changes in time cost, travel congestion, income, income level, and other factors. It was due to this complexity that the ARB in 2003 commissioned the study by UC Irvine on the rebound effect. ARB staff believes that the rebound effect estimation approach developed by the UC Irvine is more credible and realistic than the simplistic approach used by Sierra Research. This is because the UC Irvine study uses a significantly more complex approach and data points to estimate the rebound effect. In addition, it was extensively peer-reviewed.

The *NERA Review* rebound analysis also is considerably less robust than the approach presented in the *Staff Report/ISOR*. In its approach, NERA assumes that the entire change in VMT is caused by changes in travel cost-per-mile. However, similar to the issue with respect to fuel price noted above, it is well understood that changes in cost-per-mile cannot solely explain the entire change in VMT. Changes in VMT are caused by changes in time cost, travel congestion, income, income level, and other factors. To ignore the other explanatory factors in explaining changes in VMT would bias the projection of the rebound effect. In addition, NERA's use of a linear demand curve to explain the relationship between VMT and cost-per-mile is hard to justify because it implies that VMT could decline to zero, even at some finite cost, in regions of high cost-per-mile. This reveals another flaw – the failure to consider the effects of income and urbanization in California.

NERA's model oversimplifies the relationship between miles traveled and the complex and dynamic series of costs that affect it. Staff disagrees with the assertion that the cost of gasoline dominates out-of-pocket costs, and that travel decisions are primarily

controlled by out-of-pocket costs. NERA's model ignores additional critical costs, both out-of-pocket (e.g., changes in the housing market and personal income that affect location choices) and outside the pocket (e.g., changes in time costs due to altered traffic conditions during economic recession). NERA acknowledges that fuel cost impacts on VMT can be quantified when other things are equal, but its analysis fails to equalize the full series of other important impacts on miles traveled.

Accounting for the above factors, the UC Irvine study estimates a short-run rebound effect of 2 percent. (That is, in the short run a given decrease in the cost of driving would increase the number of miles driven by 2 percent of the change. For example, a 10 percent decrease in the cost of driving would increase the number of miles driven by 2 percent of the 10 percent, or 0.2 percent overall). The study also estimates a long-run rebound effect of 9.3 percent. The results of this study are the basis for the estimates used in the *Staff Report/ISOR*. Staff accordingly concludes that the purported emission increase due to higher estimates of the rebound effect cannot be supported.

### Fuel Cycle Emissions

3. Comment: The Alliance claimed that the staff estimate of reduced fuel cycle emissions (emission reductions that will occur due to a reduction in the amount of fuel reaching, stored in, and transferred in or near California) was overstated. The most recent Alliance analysis is contained in a document entitled *Analysis of the Impact of CARB's AB 1493 Regulations on Criteria Pollutant Emissions as a Result of Rebound, Fleet Turnover, and Reduced Fuel Consumption*, Appendix J to the Alliance comments submitted on November 5, 2004 in response to the first 15 Day Notice. In that analysis the Alliance critiqued the staff estimate, and argued that the reduction in fuel cycle emissions due to the regulation will be 1.5 to 1.7 tons per day of ROG, 0.1 to 0.3 tons per day of NO<sub>x</sub>, and 0.003 to 0.008 tons per day of PM<sub>10</sub>.

Agency Response: Staff's most recent estimate of the reduction in fuel cycle emissions is contained in a document entitled *Upstream Criteria Pollutant Emissions Reductions – 2020*, dated October 6, 2004 and released for public comment as part of the first 15 Day Notice. In that document, which updated previous estimates that were reported in the ISOR and the Addendum, staff estimated that the reduction in fuel cycle emissions will be 4.6 tons per day ROG, 1.0 tons per day NO<sub>x</sub>, and 0.05 tons per day PM<sub>10</sub>. These are somewhat larger reductions than the Alliance estimates noted above.

Staff's analysis relied on a contracted report from TIAX, LLC to develop the emission factors to determine fuel cycle emissions. TIAX is the preeminent firm in this field, and regularly consults for public and private clients in the energy and environmental sectors. While there is inherent uncertainty in developing long-term emission estimates, staff is confident that TIAX possesses the most current knowledge of the factors needed to make such estimates and the ability to apply them.

A wide range of factors can affect the fuel cycle emissions associated with gasoline transport and delivery. ARB staff has reviewed the analysis referred to as "Appendix J"



to determine the differences in the overall estimates for criteria pollutants. Regarding fuel cycle emissions, the analysis in Appendix J disagrees with many of the assumptions contained in two studies used by ARB staff to develop these estimates. The analysis contained in Appendix J represents possible outcomes for fuel delivery infrastructure, but the assumptions used represent lower bound estimates. TIAX also received input and considered other assumptions that would result in estimates higher than those projected by staff. The values used by ARB in this analysis represent sound engineering judgment and would certainly fall within the range of reasonable estimates.

Overall Criteria Pollutant Impacts

4. Comment: Taking into account the combined effect of the previously noted Alliance arguments concerning the fleet turnover and rebound effects, and fuel cycle emissions, the Alliance claimed that the overall impact of the proposed greenhouse gas regulations would be an increase in criteria pollutant emissions. Alliance, *NERA Review*, Testimony of Tom Austin, Sierra Research, and written comment from DaimlerChrysler.

The most recent Alliance analysis is contained in a document entitled *Analysis of the Impact of CARB’s AB 1493 Regulations on Criteria Pollutant Emissions as a Result of Rebound, Fleet Turnover, and Reduced Fuel Consumption*, Appendix J to the Alliance comments submitted on November 5, 2004 in response to the first 15 Day Notice. In that document, the Alliance updated the fuel cycle emission portion of its earlier analysis that purported to correct errors in CARB’s staff’s analysis of the rebound and fleet turnover effects and the impact of fuel cycle emissions, without challenging any of the underlying assumptions associated with CARB staff’s analysis. That analysis yielded the following estimates of criteria pollutant impacts:

<b>Table 2</b>			
<b>Corrected Estimates of the Impact of the AB 1493 Regulations on 2020 Statewide Emissions of Criteria Pollutants</b>			
Effect	ROG	NO <sub>x</sub>	PM <sub>10</sub>
Corrected Rebound and Fleet Turnover	3.0/3.1 <sup>a</sup>	2.2/2.3	0.4/0.4
Corrected Fuel Cycle	-1.5 to -1.7	-0.1 to -0.3	-0.003 to -0.008
<b>TOTAL</b>	<b>1.3 to 1.6</b>	<b>1.9 to 2.2</b>	<b>0.4 to 0.4</b>

<sup>a</sup> First value is additive impact of rebound and fleet turnover, second value is combined impact. *Analysis of the Impact of CARB’s AB 1493 Regulations on Criteria Pollutant Emissions as a Result of Rebound, Fleet Turnover, and Reduced Fuel Consumption*, page3. (Alliance Appendix J)

The Alliance claimed that this analysis demonstrates that even using the ARB staff methodology and assumptions, as corrected, the estimated increase in 2020 statewide emissions of ROG, NO<sub>x</sub>, and PM emissions due to the rebound and fleet turnover

effects approximately doubles to about 5 tons per day of ROG + NOx and 0.4 tons per day of PM. They further claimed that this demonstrates that using the ARB methodology and assumptions, as corrected, the total impact of the AB 1493 regulations on 2020 statewide criteria pollutant emissions is a decrease of 0.2 to 0.4 tons per day of ROG+NOx emissions (as compared to ARB's claim of 5 tons per day in the September 24 press release) and an increase of 0.35 tons per day in PM emissions.

The Alliance also submitted during the 45 day comment period an additional analysis that calculated the emission impact of the regulation under four scenarios. The four scenarios used various combinations of the ARB staff methodology and assumptions, and the NERA/Sierra methodology and assumptions. That analysis, which was not updated during the 15 Day comment period, reached the following results:

**Summary of the Statewide 2020 Emissions Impacts  
of the Staff Greenhouse Gas Proposal**

Criteria Pollutant Increases,  
Accounting for Turnover and Rebound  
(tons per day)

<b>Scenarios</b>	<b>ROG</b>	<b>NOx</b>	<b>CO</b>	<b>PM<sub>10</sub></b>
NERA/Sierra methodology With NERA/Sierra inputs	17.16	13.23	146.95	1.58
NERA/Sierra methodology With ARB staff inputs	5.56	4.36	46.55	0.50
CARBITS methodology With NERA/Sierra inputs	25.23	19.44	202.25	1.95
CARBITS methodology With ARB staff inputs	3.56	2.77	29.45	0.41

*NERA Review, page ES -6. A related comment is also found on page 25 therein.*

The Alliance stated that each of the scenarios would lead to increases in criteria pollutants in 2020. For the ozone precursor emissions, the increases range from about 6.3 tons per day to about 44.7 tons per day.

Agency Response: As noted in the Background discussion above, staff determined that it was appropriate in this greenhouse gas rulemaking to rely on the standard EMFAC and E-DRAM tools for the main environmental and economic analyses for both criteria and greenhouse gas emissions, and that these modeling results alone would suffice to support conclusions concerning criteria pollutant impacts. Using the results of these standard, main analyses, with regard to environmental impacts the staff analysis concluded that “[t]he climate change regulation will have a negligible impact on criteria pollutant emissions. However, to the degree that there are upstream benefits associated with reduced petroleum shipping, storage and distribution, emissions will be reduced.” See *Staff Report/ISOR* at Section 11.3, p. 166.

Staff understood, however, that theoretical questions can be posed concerning the effect on consumer behavior of increases in vehicle purchase prices and decreases in operating costs potentially attributable to ARB regulations. Recognizing that such issues would be raised in this rulemaking, ARB contracted with the Institute of Transportation Studies at the University of California, Davis to update their CARBITS model for use as a tool to model consumer purchase behavior, and contracted with the University of California, Irvine to prepare a California-specific econometric evaluation of the rebound effect. The results of these studies were reported in a separate Section 12 of the ISOR entitled "Other Considerations". Staff provided in the Other Considerations section a supplemental analysis which concluded that even taking all such factors into account, the net effect of the regulation would still be a reduction in criteria pollutant emissions. Thus the supplemental analysis reinforced and supported the conclusions of the standard, main analyses.

Subsequent to the release of the staff report and the Addendum, staff released updated estimates of the fuel cycle emission reductions that would result from the regulation. These estimates were released for public comment as part of the first 15 Day Notice, and were taken into account in the Alliance comments noted in Comment 3 above.

Using the updated fuel cycle emission reduction estimates, plus the existing staff fleet turnover and rebound estimates, the updated supplemental approach concludes that the regulation will result in a net decrease of about 2.8 tons per day statewide in ROG + NO<sub>x</sub>, and a de minimis increase of about 0.18 tons per day statewide in PM<sub>10</sub>. Because light duty vehicles account for only a small portion of total PM<sub>10</sub> emissions, this estimated PM<sub>10</sub> increase of 0.18 tons per day represents about 0.007 percent of the total statewide PM<sub>10</sub> inventory for 2020, which is 2560 tons per day.

Even if the supplemental analysis was used as the sole basis of the environmental analysis for criteria pollutants, however, the emission increases reported by the Alliance and its consultants are overstated. Their analysis of each factor – fleet turnover, rebound, and fuel cycle emissions – is unreliable, as described in the responses to comments 1 through 3. Therefore their overall argument fails. Even if that were not the case – i.e., if one or more portions of the automaker analysis could be considered reliable – the weaknesses in their analysis noted below and described in detail in the Final Statement of Reasons would render the overall results unreliable and not credible.

The NERA/Sierra independent analysis provides results from four scenarios, each of which differs from the analysis performed by ARB staff:

- *NERA/Sierra methodology with NERA/Sierra inputs.* Here, the difference in results is due mainly to NERA/Sierra overestimates of cost increases and underestimates of operating cost savings. As discussed above ARB staff has carefully reviewed the basis of the automaker cost estimates and does not find the estimates to be supportable.

- *NERA/Sierra methodology with ARB staff inputs.* Here, the difference in results is due to differences between the NERA/Sierra model and CARBITS. These issues also are thoroughly discussed in the FSOR.
- *CARBITS methodology with NERA/Sierra inputs.* The NERA/Sierra document describes how NERA/Sierra prepared their input, but does not provide any numbers. Nor could ARB staff find any files that contained vehicle attributes for use in CARBITS. ARB staff therefore does not have a sufficient basis for evaluating this scenario.
- *CARBITS methodology with ARB staff inputs.* NERA/Sierra modified CARBITS methodology to correct for “lost VMT”. NERA/Sierra overcorrect the resulting emissions increase, so the numbers presented in their table overestimate the emissions impact.

By contrast, application of the results of the CARBITS consumer response analysis and the UC Irvine rebound study to staff’s fundamental conclusion from the main analysis – that there will be a slight criteria pollutant emissions benefit due primarily to upstream fuel cycle emission reductions – remains far from tipping the scales towards finding an adverse impact on criteria pollutant emissions. Despite the tendency of the proposed regulations to slightly increase sales in the initial years of the regulation (2009 through 2013) and slightly decrease sales in subsequent years (2014 and beyond), and a modest rebound effect, the combined effect of all these factors in the supplemental analysis is a slight but demonstrable reduction in ROG and NO<sub>x</sub>, and a de minimis increase in PM<sub>10</sub>. Again, even if this supplemental analysis was used as the sole basis for estimating criteria pollutant impacts, staff does not consider the de minimis PM<sub>10</sub> impact identified significant alone or cumulatively, given its minute proportion of the statewide inventory.

To summarize, staff concludes – based primarily on its substantial experience in projecting cost increases from potential technologies – that there is minimal risk that the proposed greenhouse gas regulations will increase criteria pollutant emissions in California.