CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

REGULATIONS TO CONTROL GREENHOUSE GAS EMISSIONS FROM MOTOR VEHICLES

FINAL STATEMENT OF REASONS

August 4, 2005

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California Environmental Protection Agency
AIR RESOURCES BOARD

Final Statement of Reasons for Rulemaking,
Including Summary of Comments and Agency Responses

ADOPTION OF REGULATIONS TO CONTROL GREENHOUSE GAS EMISSIONS FROM MOTOR VEHICLES

Public Hearing Date: September 23-24, 2004
Agenda Item Number: 04-8-2

I. GENERAL

In this rulemaking, the Air Resources Board (ARB or Board) is adopting regulations to control greenhouse gas emissions from motor vehicles. The Board is taking this action pursuant to Chapter 200, Statutes of 2002 (AB 1493, Pavley) which directed the Board to adopt regulations that achieve the maximum feasible and cost effective reduction in greenhouse gas emissions from motor vehicles. The regulations, which will take effect in 2006 following an opportunity for legislative review, apply to new passenger vehicles and light duty trucks beginning with the 2009 model year.

The rulemaking was formally initiated by the August 6, 2004 publication of a Notice of a September 23, 2004 public hearing to consider adoption of regulations to control greenhouse gas emissions from motor vehicles. A Staff Report: Initial Statement of Reasons (ISOR) was also made available for public review and comment starting August 6, 2004. The ISOR, which is incorporated by reference herein, contained an extensive description of the rationale for the proposed regulations. The text of the proposed regulations – adoption of section 1961.1, title 13, California Code of Regulations (CCR), and amendment of sections 1900, 1961 – was included as Appendix A to the ISOR. These documents were also posted on August 6, 2004 on the ARB's Internet site for this rulemaking at http://www.arb.ca.gov/regact/grnhsgas/grnhsgas.htm, as was the text of the proposed amendments to the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," which is incorporated by reference in section 1961(d).

On September 23 and 24, 2004, the Board conducted the public hearing. The Board received written and oral comments at the hearing. At the conclusion of the hearing the Board adopted Resolution 04-28, which initiated steps towards final adoption of the originally proposed amendments with modifications in several areas. One modification incorporated a suggested modification staff had presented at the hearing ("Staff's Proposed Modifications to the Proposed Regulation Order, presented at the Board's September 23-24 hearing,") shown in Attachment C to the Resolution. Other modifications were initiated by the Board itself ("Additional Modifications Directed by the Board at its September 23-24, 2004 Hearing") also shown in Attachment C to the Resolution. The

Resolution directed the ARB's Executive Officer to incorporate the approved modifications into the proposed regulatory text, with such other conforming modifications as may be appropriate, and to make the modified text available for a supplemental comment period of at least 15 days.

In preparing the modified regulatory language, the staff made various additional revisions in an effort to best reflect the intent of the Board at the hearing. The staff also identified several additional modifications that are appropriate in order to make the amended regulation work as effectively as possible. These supplemental modifications were incorporated into the text of the proposed amendments, along with the modifications specifically identified in the Resolution.

The text of the proposed modifications to the amendments was made available for a supplemental 15-day comment period ending November 5, 2004 by issuance of a Notice of Public Availability of Modified Text (the first 15-day notice). This notice and its two attachments were posted on October 19, 2004 on the ARB's Internet site for the rulemaking. They were also mailed by October 20, 2004 to all parties identified in section 44(a), title 1, CCR, along with various other interested parties.[1]

Attachment I to the first 15-day notice contained the Board-approved modifications to the originally proposed regulatory text for section 1961.1, title 13 of the California Code of Regulations and to the "California Exhaust Emission Standards and Test Procedures for 2001 and subsequent Model Passenger Cars, Light-Duty Trucks and Medium-duty Vehicles," along with commentaries identifying and explaining all of the substantive modifications. Attachment II listed for comment additional documents that the ARB was adding to the rulemaking record in accordance with Government Code section 11347.1. The first 15-day notice indicated that Resolution 04-28 and its attachments are available on the rulemaking's Internet site. Twenty-two written comments were received during the supplemental comment period ending November 5, 2004.

In Resolution 04-28 the Board also found that it was appropriate to reexamine the estimated number of lifetime vehicle miles traveled, used by staff in their analyses, to ascertain whether this number should be revised in response to testimony presented at the hearing. The first 15 day notice indicated that staff had revisited this issue and determined that there was no need to revise the lifetime VMT used in the analysis, and that additional explanation was available online at the ARB's Internet site for this rulemaking.

Additional supporting documents and information were made available for a second supplemental 15-day comment period ending May 26, 2005 by issuance of a Second Notice of Public Availability of Supporting Documents and Information (the second 15-day notice). This notice and its attachment were posted on May 11, 2005 on the ARB's

[1] Persons who had commented by email were transmitted by email links to the first 15-day notice and its attachments on the Internet for the rulemaking; they were not separately sent the notice by postal mail.

Internet site for the rulemaking. They were also mailed by May 11, 2005 to all parties identified in section 44(a), title 1, CCR, along with various other interested parties.[2]

Attachment I to the second 15-day notice listed for comment additional documents that the ARB was adding to the rulemaking record in accordance with Government Code section 11347.1. The additional supporting documents and information included additional staff analysis and calculation regarding EMFAC mileage accrual for pre-2008 vehicles and the calculation of consumer monthly savings, 122 additional references, and 77 emails and other correspondence. The second 15-day notice did not propose any modifications to the regulatory text. Four written comments were received during the supplemental comment period ending May 26, 2005.

After considering all of the comments received, the Executive Officer issued Executive Order G-05-061, adopting the amendments to title 13, CCR, and the incorporated Exhaust Emission Standards and Test Procedures reflecting the modifications that had been made available for supplemental comment.

Incorporated Documents

The Exhaust Emission Standards and Test Procedures are incorporated by reference in section 1961(d) and section 1961.1, title 13, CCR. The Exhaust Emission Standards and Test Procedures in turn incorporate certification test procedures adopted by the U.S. Environmental Protection Agency (U.S. EPA) and contained in title 40, Code of Federal Regulations (CFR) Part 86.

Section 1961(d), title 13, CCR identifies the incorporated Exhaust Emission Standards and Test Procedures by title and date. The ARB document is readily available from the ARB upon request and was made available in the context of this rulemaking in the manner specified in Government Code section 11346.5(b). The CFR is published by the Office of the Federal Registrar, National Archives and Records Administration, and is therefore reasonably available to the affected public from a commonly known source.

The Exhaust Emission Standards and Test Procedures are incorporated by reference because it would be impractical to print them in the CCR. Existing ARB administrative practice has been to have the motor vehicle emissions test procedures incorporated by reference rather than printed in the CCR as these procedures are highly technical and complex. They include the “nuts and bolts” engineering protocols required for certification of motor vehicles and have a very limited audience. Because the ARB has never printed complete test procedures in the CCR, the affected public is accustomed to the incorporation format. The ARB’s test procedures as a whole are extensive and it would be both cumbersome and expensive to print these lengthy, technically complex procedures with a limited audience in the CCR. Printing portions of the ARB’s test procedures that are incorporated by reference would be unnecessarily confusing to the affected public.

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[2] Persons who had commented by email were transmitted by email links to the second 15-day notice and its attachments on the Internet for the rulemaking; they were not separately sent the notice by postal mail.

The Exhaust Emission Standards and Test Procedures incorporate portions of the CFR because some of the ARB requirements are substantially based on the federal emission regulations. Manufacturers typically certify vehicles and engines to a version of the federal emission standards and test procedures that have been modified by state requirements. Incorporation of the federal regulations by reference makes it easier for manufacturers to know when the two sets of requirements are identical and when they differ. Each of the incorporated CFR provisions is identified by date in the ARB test procedure documents.

Fiscal Impacts

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed regulations are presented below.

Pursuant to Government Code sections 11346.5(a)(5) and 11346.5(a)(6), the Executive Officer has determined that the proposed regulatory action will create costs or savings to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to part 7 (commencing with section 17500), division 4, title 2 of the Government Code, or other nondiscretionary savings to state or local agencies.

In general, the steps that manufacturers will need to take to comply with the regulatory standards are expected to lead to price increases for new light duty passenger vehicles. Many of the technological options that manufacturers will choose to comply with the regulation are also expected to reduce operating costs. The staff analysis concludes that over the lifecycle of the vehicle the reduction in operating costs will more than offset the increased initial cost, resulting in a net savings to vehicle owners.

There are about 420,000 State and local agency-owned vehicles in California. A typical agency-owned vehicle is driven an average of 12,500 miles each year. This usage rate is very similar to that of private consumers. The staff analysis indicates that for individual consumers, the increased initial cost is more than offset by operating cost savings over the life of the vehicle. Staff expects that the same would hold true for public agencies. Thus beginning in the 2009 model year state and local agencies would need to budget for increased initial vehicle costs, but savings from the lowered operating costs of the proposed regulation would outweigh the higher price over the lifecycle of the vehicles.

Vehicles built to comply with the regulation are likely to be more efficient, which, as a consequence, means that new vehicles sold in 2009 and beyond will use less fuel. This will result in the future in reduced state and local government revenue from the excise tax and sales tax on motor vehicle fuel. This reduction will be partially offset by increased sales tax due to the increased cost of new vehicles.

In developing this regulatory proposal, the ARB staff evaluated the potential economic impacts on representative private persons or businesses. The regulation directly affects automakers worldwide that manufacture California-certified light duty vehicles. Staff

estimates that for large manufacturers the regulation would result in average compliance costs in model year 2009 of about $20 per vehicle for PC and LDT1 and about $40 per vehicle for LDT2. Compliance costs would increase over time as the standards are phased in, rising to about $1,060 per vehicle for PC and LDT1 and $1,030 per vehicle for LDT2 in 2016. Compliance costs for intermediate and small manufacturers would vary depending on their specific circumstances.

The climate change regulation affects only light duty vehicles whose primary use is noncommercial personal transportation. Therefore, many vehicles that businesses use would not be covered under the proposed regulation. However, if the businesses purchase the same vehicles as consumers, they would be expected to pay higher prices for the vehicles but save on operating costs. As noted above, staff expects that reduced operating costs will more than outweigh the effect of the increase in price over the life cycle of the vehicle.

Due to higher initial vehicle costs and reduced demand for fuel, the proposed regulation may adversely affect some sectors of the economy. It is very likely, however, that savings from reduced vehicle operating costs would end up as expenditures for other goods and services. These expenditures would flow through the economy, causing expansion or creation of new businesses in several sectors. Staff's economic analysis shows that on balance the proposed regulation will have a positive impact on jobs and personal income in California.

Consideration of Alternatives

The regulations proposed in this rulemaking were the result of extensive discussions and meetings involving ARB staff and motor vehicle manufacturers, environmental groups, and others. The ISOR, released and made available to the public on August 6, 2004, identified and rejected three potential alternatives to the staff proposal: (1) adopt less stringent or no new vehicle standards, (2) adopt more stringent new vehicle standards, and (3) adopt standards that only regulate mobile air conditioner refrigerant emissions.

Staff rejected the first alternative because Chapter 200, Statutes of 2002 (AB 1493) requires the Board to adopt regulations that achieve the maximum feasible and cost effective reduction of greenhouse gas emissions from new motor vehicles. The staff analysis has demonstrated that the reductions achieved under the staff proposal are both feasible and cost effective. Therefore the alternative of no or less stringent standards was rejected because it would not achieve the maximum reductions and therefore would fail to meet the statutory requirement.

Staff also considered proposing more stringent vehicle standards. This could be accomplished by shortening the phase-in period, or by building into the standard some degree of early penetration of technologies that the staff technical analysis determined would not be available for widespread application in the near and/or mid term periods. Staff concluded that in either case, manufacturers would have a very difficult time incorporating the needed technologies across their fleet as rapidly as would be necessary.

Comments received from manufacturers and their consultants on the June 14, 2004 draft staff proposal, which used a three-year phase in schedule rather than the four-year phase in schedule recommended now, served to reinforce this point. Staff therefore rejected this alternative on the grounds that more stringent standards would not be technically feasible.

Finally, staff also considered proposing standards that only regulate mobile air conditioner refrigerant emissions. While the staff analysis has shown that regulation of mobile air conditioner refrigerant emissions can achieve significant greenhouse gas reductions, staff rejected this approach for two reasons. First, this would amount to a mandate to use specific technologies or equipment, rather than a performance standard. In general staff favors performance standards, which provide manufacturers flexibility to meet any given remission reduction target in the most cost-effective manner. Second, as noted above the staff analysis has identified a variety of other vehicle technology improvements that are feasible and cost effective, and would result in greater greenhouse gas emission reductions. Therefore the alternative of mobile air conditioner refrigerant regulation also failed to meet the statutory requirement to achieve the maximum feasible and cost effective reductions.

Staff has performed a thorough analysis of possible ways to reduce greenhouse gas emissions from motor vehicles, quantifying the emission reductions achieved and their cost. No alternatives or combination of alternatives considered by the Board or otherwise identified and brought to the Board's attention have been identified that would be equally effective in achieving the emission reductions projected under, and less burdensome to affected private persons than, the adopted regulation. This Final Statement of Reasons provides supporting information for this conclusion.

II. MODIFICATIONS TO THE ORIGINAL PROPOSAL

A. AN OVERVIEW OF THE ORIGINAL PROPOSAL

1. Background

Over the 20th century, we have observed a rapid change in climate that is attributable to human activities. The global mean temperature is warming at a rate that cannot be explained by natural causes alone. Human activities are directly altering the chemical composition of the atmosphere through the buildup of greenhouse gases. The past century has already seen changes in climate-related conditions in California such as average temperature (up 0.7°F), sea level (up 3 to 8 inches), spring run-off (decreased by 12 percent), and the timing of snowmelt and spring bloom (advanced by 1 to 3 weeks).

Projected future climate change may affect California in a variety of ways. Public health can suffer due to greater temperature extremes and more frequent extreme weather events, increases in transmission of infectious disease, and increases in air pollution. California's agriculture industry is especially vulnerable to altered temperature and rainfall patterns, and new pest problems. Climate change can adversely affect California's forest ecosystems and the Sierra snowpack that functions as the state's largest reservoir. Sea

level rise and storm surges could lead to flooding of low-lying property, loss of coastal wetlands, erosion of cliffs and beaches, saltwater contamination of drinking water, and damage to roads, causeways, and bridges.

In response to these threats, in 2002 the Legislature adopted and the Governor approved Chapter 200, Statutes of 2002 (AB 1493, Pavley), which directed the Air Resources Board to adopt the maximum feasible and cost-effective reduction of greenhouse gas emissions from motor vehicles.

In setting greenhouse gas emission standards, the staff performed a detailed evaluation of the technologies and fuels available to reduce vehicular greenhouse gas emissions, the reductions that could be achieved, and their cost. The evaluation of vehicle technology that formed the basis of the staff assessment was derived primarily from a comprehensive vehicle simulation modeling effort and a thorough cost analysis performed for the Northeast States Center for a Clean Air Future (NESCCAF) by consultants frequently used by the auto industry. ARB staff believes the NESCCAF study is the most advanced and accurate evaluation of vehicle greenhouse gas emission reduction technologies that has been conducted to date.

The staff technology assessment reviewed baseline vehicle attributes and their contribution to atmospheric climate change emissions, and evaluated technologies that have the potential to decrease these emissions. The technologies explored are currently used on some vehicle models, or have been demonstrated by auto companies and/or vehicle component suppliers in at least prototype form. Promising near-term technologies include cylinder deactivation, improved transmissions, variable valve timing and lift, turbocharging, gasoline direct injection, and more efficient, low-leak air conditioning.

2. The Originally-Proposed Greenhouse Gas Regulations

a. Climate Change Emission Reduction Standard

Based on the technology evaluation, the regulation approved by the Board imposes climate change emission standards that are incorporated into the current Low-Emission Vehicle (LEV) program, along with the other light and medium-duty automotive emission standards. This approach was taken to ensure that manufacturers can meet the standards while continuing to provide the full range of vehicles available today. The standards phase in during the 2009 through 2016 model years, allowing changes to be made as part of the normal product improvement cycle. When fully phased in, the near term (2009-2012) standards will result in about a 22 percent reduction in greenhouse gas emissions as compared to the 2002 fleet, and the mid-term (2013-2016) standards will result in about a 30 percent reduction.

Vehicle climate change emissions comprise four main elements: (1) CO_2, CH_4 and N_2O emissions resulting directly from operation of the vehicle, (2) CO_2 emissions resulting from operating the air conditioning system (indirect AC emissions), (3) refrigerant emissions from the air conditioning system due to either leakage, losses during recharging, sudden

releases due to accidents, or release from scrappage of the vehicle at end of life (direct AC emissions, and (4) upstream emissions associated with the production of the fuel used by the vehicle. The climate change emission standard incorporates all of these elements.

The regulation establishes one standard for passenger cars and the lightest trucks (PC and LDT1), and a separate standard for heavier trucks (LDT2). Staff proposed setting near-term standards, phased in from 2009 through 2012, and mid-term standards, phased in from 2013 through 2016. The proposed standards, expressed in terms of CO_2 equivalent grams per mile, are shown in Table II-1 below:

Table II-1. CO_2 Equivalent Emission Standards for Model Years 2009 through 2016

Tier	Year	CO2-equivalent emission standard (g/mi)	
		PC/LDT1 (Passenger cars and small trucks/SUVs)	LDT2 (Large trucks/SUVs)
Near-term	2009	323	439
	2010	301	420
	2011	267	390
	2012	233	361
Mid-term	2013	227	355
	2014	222	350
	2015	213	341
	2016	205	332

To maintain simplicity, staff proposed to use the upstream emissions for vehicles that use conventional fuels as a "baseline" against which to compare the relative merits of alternative fuel vehicles. Therefore, the emissions standards as shown above do not directly reflect upstream emissions. Rather, when certifying gasoline or diesel-fuel vehicles, manufacturers would report only the "direct" or, "on vehicle" emissions. For alternative fuel vehicles, exhaust CO_2 emissions values will be adjusted in order to compensate for the differences in upstream emissions. This approach simplifies the regulatory treatment of gasoline vehicles, while at the same time allowing for appropriate treatment of alternative fuel vehicles.

Small Volume, Independent Low Volume, and Intermediate Volume manufacturers would not be required to comply with the climate change requirements until the final year of the phase-in (2016). Beginning in 2016, these smaller manufacturers would be required to meet the average CO_2 equivalent emissions of all 2012 comparable vehicles produced by the major vehicle manufacturers. A specialty low volume vehicle that utilizes a powertrain from a major manufacturer from the same model year would be considered compliant with the greenhouse gas emission standards if it adopted the package without modifications. Should a comparable vehicle not be available from a large manufacturer, the small volume manufacturer would be required to meet the 2012 emission standard for large volume manufacturers in 2016 and beyond.

b. Early Credits

AB 1493 directs that emission reduction credits be granted for any reductions in greenhouse gas emissions achieved prior to the operative date of the regulations. ARB staff proposed that (1) credit for early emission reductions should be available for model years 2000 through 2008, with manufacturers allowed to opt in to the program during any model year during this timeframe, and (2) the baseline against which manufacturer emissions are measured should be the fully phased in near term standard.

As noted in Table II-1 above, staff proposed that the fully phased in near term standard for passenger cars and T1 trucks should be 233 grams per mile CO_2 equivalent, and for T2 trucks should be 361 grams per mile. Thus under the staff early credit proposal a manufacturer's fleet average emissions, for model years beginning with their first year of participation through 2008, would be compared to these standards. If a manufacturer has fleet average emissions in a specific model year lower than these standards, the manufacturer would earn early compliance credits. Any emission reduction early credits earned could be used during model years 2009 through 2014, or traded to another manufacturer. To ensure that the regulation ultimately achieves the greatest possible climate change reductions, staff proposed that the credits generated by early compliance retain full value through the 2013 model year. These credits will then be worth 50 percent of their initial value in MY 2014, 25 percent of their initial value in MY 2015 and have no value thereafter.

c. Alternative Compliance

AB 1493 requires that the regulations "provide flexibility, to the maximum extent feasible consistent with this section, in the means by which a person subject to the regulations ... may comply with the regulations. That flexibility shall include, but is not limited to, authorization for a person to use alternative methods of compliance with the regulations." Thus the use of alternative compliance strategies must not undercut the primary purpose of the regulation, which is to achieve greenhouse gas reductions from motor vehicles. Accordingly, the ARB's alternative compliance program will be limited to the vehicles that are regulated through AB 1493, and their fuels. This is to ensure that the program does not dilute the technology-forcing nature of the regulation, since the goal is to improve the vehicles themselves. The major features of the staff proposal are:

- Projects must be located in California to be eligible as alternative methods of compliance.
- Only companies regulated by AB 1493 (automakers) will be permitted to apply for alternative compliance credits.
- Only those vehicles regulated under AB 1493 are eligible for alternative compliance credits. This includes model year 2009 and later passenger vehicles and light-duty trucks and other vehicles used for noncommercial personal transportation in California.
- Staff proposed that eligible projects be limited to those that achieve greenhouse gas reductions through documented increased use of alternative fuels in eligible vehicles.

B. MODIFICATIONS TO THE ORIGINAL PROPOSAL

At the conclusion of the September 2004 hearing, the Board adopted Resolution 04-28, in which it approved the original staff proposal described above, with modifications in four areas. The first modification, which specifies that the regulation may not take effect before January 1, 2006, was suggested by staff before the hearing to address the requirements of Health and Safety Code section 43018.5(b)(1). The text of this modification was contained in a document titled "Staff's Proposed Modifications to the Proposed Regulation Order, presented at the Board's September 23-24, 2004 hearing," which was distributed at the hearing and was Attachment C to the Resolution. Three additional modifications were suggested by staff at the hearing in response to public comments made to staff after issuance of the original proposal. The Resolution directed the Executive Officer to incorporate the approved modifications into the proposed regulatory text, with such other conforming modifications as may be appropriate, and to make the modified text available for a supplemental comment period.

The approved modifications include specifying that the regulation may not take effect before January 1, 2006; allowing the Executive Officer to approve the use of lower upstream adjustment factors for hydrogen vehicles and electric vehicles, based on the increased use of cleaner sources of hydrogen or electricity production; and providing credit for plug-in hybrid electric vehicles in the first year of production.

In addition, in response to comments, staff proposed additional modifications to extend the life of credits earned to five years and increase the number of years manufacturers are given to make up emission debits also to five years. These additional modifications will provide additional compliance flexibility to manufacturers while maintaining the overall stringency of the Board-approved proposal.

Also in response to comments, staff proposed two modifications to the calculation of indirect emissions allowances for air conditioning systems. First, an adjustment factor is proposed that will apply to systems equipped with CO_2 as the refrigerant. The adjustment factor offsets an inadvertent penalty that would have resulted when significant compressor downsizing occurs, which is only expected for CO_2-based air conditioning systems. Second, the inclusion of an adjustment factor magnifies the incentive to use a larger than necessary compressor in order to obtain a larger allowance. To minimize the incentive, an upper limit on the indirect emission allowances was proposed.

A minor correction is also proposed to an indirect emissions factor that is used for calculating the upstream greenhouse gas emission adjustment for alternative fuel vehicles. In reviewing the emissions factor, it was noted that an adjustment in the modeling exercise was not carried through. The proposed revision corrects this oversight.

Finally, a comment was made at the hearing that the lifetime vehicle miles traveled (VMT) used in staff's analysis was too high, thus overstating operating cost savings. Staff revisited this issue and determined that there is no need to revise the lifetime VMT used in

the analysis. Additional explanation was made available online at the ARB's Internet site for this rulemaking –http://www.arb.ca.gov/regact/grnhsgas/grnhsgas.htm.

C. MANUFACTURER COSTS AND SAVINGS RESULTING FROM THE ADOPTED REGULATION

As part of its technology evaluation, staff estimated the average fleetwide incremental cost of control to meet the greenhouse gas emission standards. Table II-2 below shows the average cost of control by model year for each standard.

Table II-2: Average Cost of Control

Tier	Year	Average cost of control	
		PC/LDT1 (Passenger cars and small trucks/SUVs)	LDT2 (Large trucks/SUVs)
Near-term	2009	$17	$36
	2010	$58	$85
	2011	$230	$176
	2012	$367	$277
Mid-term	2013	$504	$434
	2014	$609	$581
	2015	$836	$804
	2016	$1,064	$1,029

As is shown in the table, when fully phased in the near-term standards will result in an estimated average cost increase of $367 for passenger cars and small trucks/SUVs, and $277 for large trucks/SUVs as compared to the 2009 baseline vehicle. The fully phased in mid-term standards will result in an estimated average cost increase of $1,064 for passenger cars and small trucks/SUVs, and $1,029 for large trucks/SUVs. The staff analysis concludes, however, that these increased costs will be more than offset by operating cost savings over the lifetime of the vehicle. Using the average increase in vehicle prices associated with the fully phased-in regulation (2016), and an assumed fuel price of $1.74 per gallon, staff calculated that the increased vehicle payment minus the reduction in operating cost would result in a monthly savings of about $3.50 to $7.00. At higher fuel prices, the monthly savings increase.

D. COST-EFFECTIVENESS OF THE ADOPTED REGULATION

Typically, emission control regulations impose a cost. Cost effectiveness is a measure of the cost imposed per ton of reduction achieved, and thus is a useful tool to compare various possible approaches. In this instance, however, AB 1493 requires that the regulations be economical to the consumer over the life cycle of the vehicle. Consistent with this direction, the technology packages that provide the basis for the standard result in operating cost savings that exceed the capital cost, resulting in a net savings to the consumer over the lifecycle of the vehicle. This translates to a "negative" cost effectiveness value (there is a cost savings per ton reduced).

ARB staff estimated the net costs of this proposed regulation primarily by using cost data from the 2004 study "Reducing Greenhouse Gas Emissions from Light-Duty Motor Vehicles" done for the Northeast States Center for a Clean Air Future (NESCCAF). The initial costs are based on the expected increases in vehicle cost resulting from the technology improvements needed to meet the standards in the proposed regulation. The proposed regulation includes a phase-in schedule whereby earlier model year vehicles will meet a less stringent standard and, on average, will require less new technology than later model vehicles. ARB staff has estimated the average cost increases by model year, using data from the NESCCAF study and other sources. Staff has used these cost data, along with the assumption that average vehicle life is 16 years, to calculate the total annualized costs by calendar year. The total annualized costs are estimated to be roughly $1,236 million for calendar year 2020 and $2,595 million for 2030.

Staff also estimated annual savings in operating cost, again based on information provided in NESCCAF as well as other sources. The annual savings are estimated to be $5,278 million in 2020 and $9,394 million in 2030, well in excess of the annualized cost. This results in net annual savings of $4,042 million in 2020 and $6,799 million in 2030.

The cost effectiveness in dollars per ton for a given calendar year is calculated by dividing the total annualized costs for that year by the total CO_2 equivalent emission reductions for that year. The CO_2 equivalent emissions benefits of the proposed regulation are 87,700 tons per day in 2020 and 155,200 tons per day in 2030. Converting these figures to annual totals yields 32 million tons per year in 2020 and 56.7 million tons per year in 2030.

Table D-1 below provides the cost effectiveness in calendar years 2020 and 2030 based on the annualized vehicle costs and the estimated benefits.

Table D-1. Cost Effectiveness of Proposed Regulation

	2020	**2030**
Net Annualized Costs (Savings)	*$4,042 million*	*$6,799 million*
Emissions Reduction (tons/year)	*32.0 million*	*56.7 million*
Cost effectiveness ($/ton)	***-126***	***-120***

E. ENVIRONMENTAL AND ECONOMIC IMPACTS

The climate change regulation may impact several sectors of the economy. The steps that manufacturers will need to take to comply with the regulatory standards are expected to lead to price increases for new vehicles. Many of the technological options that manufacturers choose to comply with the regulation are also expected to reduce operating costs. These two responses to the regulation have combined positive and negative impacts on California businesses and consumers.

Based on the staff analysis, the net effect of the regulation on the economy is expected to be small but positive. It is very likely that savings from reduced vehicle operating costs will end up as expenditures for other goods and services. These expenditures would flow through the economy, causing expansion or creation of new businesses in several sectors.

Staff's economic analysis shows that as these expenditures occur, jobs and personal income increase. Jobs increase by 3,000 in 2010, by 53,000 in 2020, and by 77,000 in 2030 as compared to the baseline economy without the proposed regulation. Similarly, income grows by $170 million in 2010, by $4.7 billion in 2020, and by $7.3 billion 2030. There is no impact on the ability of California business to compete with businesses in other states. State and local agencies will not be adversely affected and are likely to realize a net reduction in their cost of fleet operations.

Staff estimates that the regulation will reduce climate change emissions from the light duty passenger vehicle fleet by an estimated 87,700 CO_2-equivalent tons per day statewide in 2020 and by 155,200 CO_2-equivalent tons per day in 2030. This equates to an 18 percent reduction in climate changes emissions from the light-duty fleet in 2020 and a 27 percent reduction in 2030. The regulation will also reduce emissions that occur during the fuel cycle (the marketing and distribution of gasoline). Such activities produce both climate change and criteria pollutant (smog-forming) emissions.

Analysis of fleet turnover effects using longstanding and accepted types of analyses indicated that there will be no significant adverse environmental impact associated with any potential delay in purchase of new vehicles.

To provide additional insight into the impact of the regulation, staff used newer exploratory tools to explore what would happen if consumers postpone the purchase of new vehicles due to their higher cost, or increase their driving due to the reduced cost of operating the vehicle. In both cases staff found that the effect on emissions is relatively small.

Staff has not identified any mechanisms by which the climate change regulation would result in a disproportionate negative environmental or economic impact on low income or minority communities. In fact, the reduced emissions from likely changes to the distribution and marketing of gasoline are likely to provide benefits to these communities. Staff also evaluated the broader impacts of the regulation on job and business creation in representative San Diego communities with environmental justice concerns. The evaluation concluded that the regulation would likely result in an increase in jobs and business creation.

III. SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

The ARB received numerous written and oral comments, in connection with the September 23-24, 2004 hearing and during the two subsequent 15-day comment periods. Set forth below are either the full text or a summary of each objection or recommendation specifically directed at the proposed regulation or to the procedures followed by the ARB in proposing or adopting the regulation, together with an agency response. The comments