California Environmental Protection Agency

Air Resources Board

Staff Report:
Initial Statement of Reasons For
Proposed Rulemaking

Proposed Regulation for Under Inflated Vehicle Tires

Stationary Source Division
Project Assessment Branch

FEBRUARY 2009

State of California
AIR RESOURCES BOARD

STAFF REPORT:
INITIAL STATEMENT OF REASONS
FOR THE PROPOSED RULEMAKING

Public Hearing to Consider

Regulation for Under Inflated Vehicle Tires

To be considered by the Air Resources Board on March 26, 2009

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Regulation for Under Inflated Vehicle Tires

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Acknowledgements

This report was prepared with the assistance and support from the other divisions and offices of the Air Resources Board. In addition, we would like to acknowledge the assistance and cooperation that we have received from many individuals and organizations.

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Climate Change Overview

While the Earth's natural climate is dynamic and constantly changing, the climate change observed over the last one-and one-half centuries seems to differ in both its rate and its magnitude. Many sources of data indicate that the Earth is warming faster than at any time in the last millennium. For example, 11 of the last 12 years from 1995 to 2006 rank among the 12 warmest years in instrumental record of global surface temperatures (IPCC, 2007). As the global mean surface temperature increases, significant adverse effects may be observed: decreased water supply, higher sea levels, changed agricultural patterns, altered ecosystems, and worse air quality.

Global temperatures have been linked to the greenhouse gas (GHG) effect, where certain gases in the lower atmosphere absorb radiation released by the Earth's surface that was heated by solar radiation. While the GHG effect is important in maintaining the temperature of the Earth's lower atmosphere, the addition of more GHG emissions into the atmosphere due to human activities may be causing the increase in the average global ambient temperature. Burning of fossil fuels is the single largest contributor to the release of GHG emissions. The transportation sector is the largest contributor of human GHG emissions in California accounting for 38 percent of total carbon dioxide equivalent (CO_2E) emissions in 2004. The largest contributing category in the transportation sector is from passenger vehicles which account for 74 percent of the total transportation CO_2E emissions.

Regulatory Authority

The California Global Warming Solutions Act of 2006 (AB 32) established requirements for a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, enforceable and cost-effective reductions of GHG emissions. AB 32 gave the Air Resources Board (ARB/Board) authority for monitoring and reducing GHG emissions. It requires ARB and other state agencies to adopt regulations and other requirements that would reduce by 2020, statewide GHG emission levels to the equivalent of 1990 levels. Further, by Executive Order the Governor has directed the GHG emission levels be reduced to 80 percent below 1990 levels by 2050. The 2020 goal establishes an aggressive, but achievable, mid-term target, and the 2050 goal represents the level scientists believe is necessary to reach in order to stabilize the climate.

To swiftly address GHG reductions in the near-term, one requirement of AB 32 directed ARB to identify a list of early action measures that the Board could adopt by January 1, 2012. In 2007, the Board identified 44 such early action measures

including potential regulations affecting motor vehicles, fuels, refrigerants in cars, and many other sources. From these measures, the Board identified nine "discrete" early action measures that would be adopted and enforceable by January 1, 2010 (ARB, 2007). The Proposed Regulation for Under Inflated Vehicle Tires (Proposed Regulation) is one of the discrete early action measures.

Proposed Regulation

According to the National Highway Transportation Safety Administration (NHTSA), as well as independent staff surveys, a significant percentage of vehicles have at least one under inflated tire. The staff proposal would reduce GHG emissions by reducing the consumption of fuel from passenger vehicles operating with under inflated vehicle tires. Proper tire inflation decreases the tire rolling resistance and reduces fuel consumption.

The Proposed Regulation applies to automotive service providers (ASPs) performing or offering to perform automotive maintenance or repair services in California. Staff estimates there are approximately 40,000 ASPs in California that would be subject to the Proposed Regulation. Except for under limited circumstances, it requires ASPs to perform a tire pressure service (check and inflate) on all passenger vehicles that are brought in to the facilities for service or repair. This includes passenger cars, light duty trucks, medium duty vehicles, and light heavy duty trucks with gross vehicle weight ratings (GVWR or GVR) of less than or equal to 10,000 pounds. These requirements would apply to ASPs that perform engine maintenance, smog checks or routine service such as oil changes on any passenger vehicle. Examples of ASPs that would not be affected include automotive car washes, body and paint facilities, and glass repair.

Consumers are expected to benefit from reduced fuel consumption and prolonged tire life when their vehicle tires are inflated to proper inflation levels. Health and environmental benefits are expected from reductions in GHG, particulate matter (PM), and oxides of nitrogen (NOx) emissions. The reductions in PM and NOx emissions would be small but would help contribute towards attainment of the State's air quality standards.

The Proposed Regulation will impact virtually all of the approximately 25 to 29 million passenger vehicles on the road in California during the period 2010 through 2020. Under the Proposed Regulation, these vehicles are expected to have a tire pressure check and inflate service performed an additional two times per year.

Regulation Costs

Many ASPs are expected to incur additional labor costs and minor capital and operating costs associated with the Proposed Regulation. The total cost of the Proposed Regulation to affected California businesses is expected to amount to $1.1 billion for the period 2010 through 2020 (2008 dollars), or average slightly over $100 million (2008 dollars) per year. Of this amount, the average annual labor (total compensation) costs for the period 2010 through 2020 are estimated to be $98 million (2008 dollars) per year. Staff believes that the ASPs are likely to pass these additional costs onto their customers in the form of increased service rates or imposed environmental fees on the invoice. Staff expects the additional cost to be no more than $4 per vehicle per year. The Proposed Regulation would also have a small impact on gasoline and tire retail sales due to consumers using less fuel and tire tread life lasting longer. As a result of tires lasting longer, the number of tires entering the waste stream would be reduced, resulting in less fees being collected and lower revenue for both the California Integrated Waste Management Board and ARB.

In addition to labor costs, the Proposed Regulation will also require ASPs to purchase American National Standard Institute (ANSI) B40.1 Grade B tire pressure gauges, and a tire inflation reference manual. A reference manual recommends tire inflation pressures for most model year vehicles with Original Equipment Manufacturer (OEM) sized wheels/tires as well as list load/inflation tables to help determine proper tire pressures for non-OEM sized wheels/tires. Some ASPs currently have the required pressure gauge and manual; however, most will need to purchase this equipment. In addition, most ASPs are presently equipped with compressors. Test-only smog check centers are expected to make minor engineering modifications to tap into their existing compressed air lines for tire inflation purposes. Total capital and operating costs are estimated to be $5 million per year.

Regulation Benefits

In 2010, California consumers are expected to consume about 15 billion gallons of fuel per year. This amount of fuel use is expected to decline to about 14 billion gallons of fuel by 2020. This is due to the combined effects of the measures identified in the Board's Scoping Plan approved in December 2008. These measures included the Pavley I and II regulations, and the regional transportation measure.

The regulation would result in a cost savings due to fuel savings from properly inflated vehicle tires. Fuel savings are expected to average about 0.6 percent, roughly 75 million gallons per year which results in an overall cost savings averaging $9 per vehicle per year, based on average fuel costs of about $3.40 per gallon. The average annual economic benefit of this reduction in fuel

consumption (savings) is estimated to be about $250 million (2008 dollars). For the period 2010 through 2020, the total economic benefit would equal $2.7 billion (2008 dollars).

The Proposed Regulation is also expected to prolong tire life by reducing tread wear that results from tire under inflation. On average, the Proposed Regulation is expected to prolong tire life by 1,600 to 7,800 miles for most vehicles with tires found to be moderately or severely under inflated, respectively. Staff estimates that prolonging vehicle tire life due to proper tire inflation is equivalent to removing an estimated 700,000 tires Californians generate as waste annually or a total of 7.8 million fewer tires between the periods 2010 through 2020. Staff estimates that the Proposed Regulation will save California's vehicle owners on average $90 million (2008 dollars) per year in tire replacement costs during the period 2010 through 2020, or a total of $980 million dollars (2008 dollars) for the entire period. This benefit translates into a savings to California consumers of about $3 per vehicle.

The total benefits to California consumers are estimated to be about $3.7 billion (2008 dollars), or $340 million (2008 dollars) per year. This translates into total benefits of approximately $12 per vehicle per year.

The GHG emissions reduced are calculated from the estimated fuel savings and tire benefits and are expressed in million metric tons of carbon dioxide equivalents ($MMTCO_2E$). Based on the estimated fuel savings, the statewide emissions reductions are projected to be about 0.9 $MMTCO_2E$ in 2010. In 2020, the benefits are estimated to be about 0.6 $MMTCO_2E$. The emission reductions in 2020 are lower due both to the lower amount of fuel consumed in 2020, and the implementation of tire pressure monitoring systems installed on new vehicles beginning in 2006 and fully implemented in 2008. In addition, staff expects slight reductions for both PM and NOx emissions. The cost-effectiveness of the Proposed Regulation is estimated to be a net savings of about $320 per metric ton carbon dioxide equivalent ($MTCO_2E$).

The emissions reductions obtained from the Proposed Regulation will result in reduced exposure to PM2.5 for all Californians, which contribute to a number of adverse health effects. In addition, properly inflated tires will provide additional safety benefits for California's motorists such as fewer crashes from blowouts, and improved vehicle handling (NHTSA, 2005).

Other Tire Related Measures Under Development

In addition to the Proposed Regulation, staff is investigating the feasibility of an Inflation Pressure Loss Rate (IPLR) standard for vehicle tires. Tires rated at an IPLR performance standard would limit the air pressure loss from the tires to a fixed level every month. The IPLR would not replace the tire pressure check and

inflate service requirement of the Proposed Regulation. ARB staff is working closely with the California Energy Commission (CEC) to include this concept as part of their overall tire improvement measures for the California Fuel Efficient Tire Program pursuant to AB 844.

Alternatives to the Proposed Regulation

ARB staff evaluated the potential alternatives to the Proposed Regulation. First, ARB staff considered a consumer education and outreach program as an alternative to the Proposed Regulation. This alternative would develop an outreach program aimed at improving consumer awareness about the benefits of proper tire inflation. The second alternative considered would require ASPs to purge air from vehicle tires and inflate with pure nitrogen. Since pure nitrogen has a lower permeability than oxygen, the use of pure nitrogen would improve tire inflation pressure retention. The third alternative would require all California registered vehicles to be equipped with or retrofitted with tire pressure monitoring systems that would alert the driver in real-time to an under inflation condition. For this alternative, staff assumed maximum benefits based on the assumption that drivers would take corrective action on their vehicle tires as soon as possible.

After evaluating each of the three alternatives, staff determined that the Proposed Regulation was the most cost effective means of achieving the needed emission benefits. The Proposed Regulation is more cost effective at a net savings of about $320 per $MTCO_2E$ in comparison to the alternatives. Staff concluded that outreach alone would not achieve the needed GHG emission reductions and was not considered for cost-effectiveness. The nitrogen inflation option was not recommended as it would require substantial capital cost investments without the attendant increase in benefits. The third alternative would require substantial retrofits to in-use vehicles, without a significant increase in benefits. Furthermore, both the nitrogen inflation option and retrofit option would be a net cost instead of a net benefit. Therefore, staff concluded that none of the proposed alternatives are more cost-effective, less burdensome, or more expeditiously implemented than the Proposed Regulation.

Recommendation

ARB staff recommends that the Board adopt the regulation as proposed in the Initial Statement of Reasons.

I. Introduction and Overview

A. Introduction

The mission of the California Air Resources Board (ARB/Board) is to protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on the economy of the State (ARB, 2002a). ARB's vision is that all individuals in California, especially children and the elderly, can live in a healthful environment free from harmful exposure and the effects of air pollution. To this end, staff is proposing a regulation to reduce greenhouse gas (GHG) emissions from vehicles operating with under inflated tires (Proposed Regulation). The Proposed Regulation would affect all automotive service providers (ASPs) performing or offering to perform automotive maintenance or repair services in the State of California.

B. Need for Greenhouse Gas Emission Reductions

Human, or anthropogenic, activities have altered the chemical composition of the atmosphere through the buildup of GHG emissions. Over the past century, the Earth's northern hemisphere has warmed at a faster rate than at any other time over the last millennium. The potential impacts of a warming of the planet include: a rise in sea level, spread of certain diseases out of their usual geographic ranges, loss of agricultural production, decreased water supply, altering of ecosystems, increased strength and frequency of storms, extreme heat events, air pollution episodes, and the consequences of these effects on the economy. As a result, there is an urgent need to curtail GHG emissions from all anthropogenic sources where technologically feasible and economically practicable. (IPCC, 2007; ARB, 2008b)

C. Overview

Beginning July 1, 2010, the Proposed Regulation would reduce GHG emissions by requiring all ASPs to perform a tire pressure service (check and inflate) on all passenger cars, light duty trucks, medium duty vehicles, and light heavy duty trucks while performing any vehicle maintenance or repair services. ASPs would indicate on the vehicle service invoice that a tire pressure service was performed and what the tire pressure levels were after the service was completed to provide a record of that service. The Proposed Regulation also requires that ASPs use and maintain an American National Standards Institute (ANSI) B40.1 Grade B tire gauge for checking tire pressures, as well as having a tire inflation reference manual to improve accuracy.

II. Regulatory Authority

California first addressed climate change in 1988 with the passage of Assembly Bill 4420 directing the California Energy Commission, in consultation with ARB and other agencies to study global warming impacts to the state and develop an inventory of GHG emission sources. Since then, many other pieces of legislation have been passed to continue to research global warming impacts, to establish and update GHG emission inventories, and to develop mitigation efforts. One such bill, AB 1493, signed on July 22, 2002, required ARB to develop and adopt regulations that achieve the maximum feasible and cost-effective reduction for GHGs from light-duty vehicles. This resulted in the first regulation in the nation, adopted by the Board in September 2004, to control GHG emissions from motor vehicles.

In 2006, the Legislature passed and Governor Schwarzenegger signed AB 32, the Global Warming Solutions Act of 2006 (Nunez, 2006). It calls for the reduction of GHG emissions to 1990 levels by the year 2020, a reduction of about 25 percent. In addition, the Governor issued an Executive Order calling for the State to reduce GHG emissions to 80 percent below 1990 levels by 2050. The 2020 goal establishes an aggressive, but achievable, mid-term target, while the 2050 goal represents the level scientists believe must be reached in order to stabilize the climate.

To swiftly address GHG reductions in the near-term, one requirement of AB 32 directed ARB to identify a list of early action measures that the Board could adopt by January 1, 2012. In 2007, the Board identified 44 such early action measures including potential regulations affecting motor vehicles, fuels, refrigerants in cars, and many other sources. From these measures, the Board indentified nine "discrete" early action measures that would be adopted and enforceable by January 1, 2010 (ARB, 2007). The Proposed Regulation for Under Inflated Vehicle Tires (Proposed Regulation) is one of the discrete early action measures.

III. Public Outreach and Environmental Justice

A. Public Outreach Efforts

A public process that involves all parties affected by the Proposed Regulation is an important component of all ARB rulemaking activities. During the development of the regulatory proposal, ARB staff conducted numerous outreach efforts to inform affected parties of the proposal and to obtain stakeholder comments. Outreach efforts included public workshops, individual meetings, emails, and telephone contacts.

PUBLIC MEETINGS

ARB has held two public workgroup meetings and one public workshop during the development of the Proposed Regulation (see Table III-1). Staff utilized the Tire Pressure list serve to notify individuals, companies, trade associations and other interested parties of the scheduled public meetings. Staff mailed over 40,000 workshop notices to all ASPs. Staff also made information available via ARB's website (http://www.arb.ca.gov/tirepressure) to further expand public outreach opportunities and reach the widest possible audience. When possible, the workgroup/workshop meetings were broadcast live on the internet or available via teleconference, making them easily accessible to the public.

Table III-1: Public Workgroup/Workshop Meetings

Date	Location	Meeting
March 18, 2008	Sacramento	Workgroup
June 4, 2008	Sacramento	Workgroup
October 8, 2008	Sacramento	Workshop

STAKEHOLDER MEETINGS

Staff met with a variety of stakeholders during the development of the Proposed Regulation. Staff discussed issues regarding the proposed requirements and addressed issues of concern. See Table III-2 for a list of involved stakeholders.

Table III-2: Associations, Companies and Other Organizations Contacted

American Society For Testing And Materials (ASTM)
Automotive Aftermarket Industry Association
Automotive Service Council
Automotive Wholesalers' Association
Bureau of Automotive Repair (BAR)
California Emission Technology Smog Test Only Stations
California Energy Commission (CEC)
California Integrated Waste Management Board (CIWMB)
California Motor Car Dealers Association
Exxon Mobil Chemical
Lehigh Technologies
National Highway Transportation Safety Administration
Parker Hannifin Corporation
Rubber Manufacturing Association

ADDITIONAL OUTREACH EFFORTS

ARB staffed a booth at the California State Fair in August of 2008. For this event, staff developed a monthly email tire pressure check reminder sign-up sheet and handed out over 2,500 tire gauges. Staff discussed the benefits of checking tire pressure monthly and provided literature to educate consumers

about the proper procedures for checking and inflating tires (RMA, 2008). Staff collected over 1,100 email addresses and has sent monthly reminders to encourage consumers to regularly check their tires. In addition, staff plans to develop a tire inflation procedure and will make it available via the website at www.arb.ca.gov/tirepressure to ensure consistent application for the tire pressure service. Staff plans to continue these outreach efforts.

B. Environmental Justice

ARB is committed to integrating environmental justice in all of its activities. In 2001, the Board approved Environmental Justice Policies and Actions (Policies), which formally established a framework for incorporating environmental justice into ARB's programs, consistent with the directives of state law. Environmental justice is defined as the fair treatment of people of all races, cultures and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (ARB, 2001). ARB recognizes its obligation to work closely with all stakeholders (communities, environmental and public health organizations, industry, business owners, other agencies and all other interested parties) to successfully implement these Policies. These Policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

The Proposed Regulation would benefit the people of California by reducing fuel consumption of passenger vehicles throughout the State, and reducing emissions of GHGs and criteria pollutants (PM and NOx) in all communities throughout California, including those with environmental justice concerns.

IV. Proposed Regulation

A. Purpose and Applicability

Beginning July 1, 2010, all ASPs will be required to perform a tire pressure service (check and inflate) on all passenger cars, light duty trucks, medium duty vehicles, and light heavy duty trucks while performing any vehicle maintenance or repair services. The Proposed Regulation will impact the following ASPs: automotive service/repair facilities, chain store instant oil change facilities, tire sales and service facilities, test-only smog check centers, car sales and service dealerships, and truck rental facilities operating in the State of California.

B. Maintenance Requirements

ASPs would indicate on the vehicle service invoice that a tire pressure (check and inflate) service was performed and what the tire pressure levels were after the service was completed. The Proposed Regulation requires that all ASPs use and maintain an ANSI B40.1 Grade B tire gauge for checking tire pressures as well as having a tire inflation reference manual. ASPs are required to keep an updated manual to reference inflation pressures for both original equipment tire and wheels and non-original sized tire and wheels. Manuals are described in Section V.C. These maintenance requirements are subject to verification by enforcement personnel.

C. Exemptions

The Proposed Regulation excludes auto body repair, collision, and paint facilities, glass and windshields repair/replacement facilities, auto parts sales, exclusive stores, wrecking and towing companies, and miscellaneous automotive service facilities such as car wash and detailing shops not engaged in automotive service or repair. Staff is also proposing that ASPs not be required to perform the tire pressure service (check and inflate) if they deem a tire to be unsafe (i.e., lack of tread depth, exposed belts).

D. Enforcement and Fines

ARB personnel would carry out enforcement of the proposed requirements by conducting audits and through consumer complaint investigations. Audits and investigations would entail a review of an ASP's invoices to ensure that the check and inflate service is being performed, as well as verifying that the required equipment is on-site and is being properly maintained. A violation of the proposed requirements may result in civil or criminal penalties. A violation may be issued for failure to comply with the proposed regulatory requirements. The extent of the penalty would depend on the willfulness of the violation, the length of time of the non-compliance, the magnitude of the non-compliance, and other pertinent factors. In addition to standard enforcement efforts, staff will implement an extensive outreach program aimed at both the ASPs and consumers to educate them about the regulatory requirements and the benefits of proper tire inflation.

V. Feasibility of the Proposed Regulation

In this section, staff reviews the equipment necessary for ASPs to conduct a tire pressure service (check and inflate). Two pieces of equipment essential for the tire check and inflate service are an accurate tire gauge and an air compressor. In addition to the equipment, a reference manual will be required to assist personnel in determining proper tire pressures.

A. Tire Gauge

An accurate tire gauge is essential to properly checking tire pressures. Tire inflation pressure cannot be accurately estimated through visual inspections. Figure V-1 contains photographs of two tires, one at the proper inflation pressure while the other is under inflated.

Tire 1 Tire 2

Figure V-1: Visual Tire Pressure Comparison

From the two photographs, it is very difficult to visually determine which tire is under inflated as well as the extent of under inflation. Tire two is properly inflated while tire one is under inflated by 40 percent. The air pressure for tire one should be at 32 pounds per square inch (psi) but is actually at 19 psi. Therefore, an accurate tire gauge is essential for properly checking tire pressures.

The tire gauge would be used to check the air pressure of a tire and compare the measured tire pressure against the vehicle manufacturer's recommended pressure. The Proposed Regulation will require ASPs to use dial-type tire

pressure gauges that meet ANSI B40.1 Grade B specifications. A dial-type tire pressure gauge meeting this specification would have an accuracy of +/- three percent for the first and last quarters of the dial and +/- two percent for the middle half of the dial. For example, a dial-type gauge that has a range of 0 to 60 psi, the accuracy for the ranges 0-15 psi and 45-60 psi is +/- three percent and the accuracy for the range 15-45 psi is +/- two percent. Staff researched the availability of ANSI B40.1 Grade B tire gauges and determined that several models are available. One particular type was a gauge and inflator combination that attaches to an air compressor hose. Another type was a gauge that connects directly to the hose. These options allow ASPs to use existing complying equipment or to replace their existing equipment or purchase a separate ANSI B40.1 Grade B tire gauge. Staff determined that these gauges cost approximately $25 each with an estimated life expectancy of two years. Figure V-2 shows examples of tire gauges meeting the requirement.

Figure V-2: Examples of ANSI B40.1 Grade B Tire Gauges

B. Air Compressor

Staff has determined that all ASPs, including test-only smog check centers, are expected to have air compressors for their routine operations. As a result, compressed air lines can be tapped for tire inflation purposes and no significant additional capital equipment expenditures are expected to be incurred by the ASPs.

However, for those facilities that choose to upgrade their existing compressors or need additional compressors, staff has provided examples of air compressor units suitable for automotive/garage shop applications including tire inflation. A 5 hp reciprocating air compressor with an 80 gallon tank as shown in Figure V-3 is expected to retail for $2,500[1]. Larger configurations

[1]Staff conversation with Mr. Todd Barrett, Applications Engineer, Cisco Air Systems, Sacramento, California on January 8, 2009.

(10 hp/120 gallon) and (15 hp/120 gallon) are expected to retail for $3,800 and $4,900, respectively. An optional air filter and dryer can also be purchased with the unit to prevent tool corrosion and contamination. The cost of this option is expected to be approximately $1,800. Alternatively, an integrated unit (Figure V-4) can be purchased for $6,600 to $9,000.

Figure V-3: Examples of Air Compressors
(5 hp reciprocating unit with an 80 gal tank) ~ Cost = $2,500

Figure V-4: Example of Air Compressor with an Air Filter and Dryer
(10 hp rotary with a 120 gal tank) ~ Cost = $8,300

C. Tire Inflation Reference Manual

ASPs would also be required to obtain a Tire Inflation Reference Manual, if they do not already have one available. There are several types of Manuals. Examples include: the 2008 Year Book which is distributed by The Tire and Rim Association, and the 2008 Tire Guide which is distributed by Goodyear (see Figure V-5). These manuals would be used during the check and inflate service. They contain critical vehicle and tire information to help determine proper tire pressure for non-OEM sized wheels and/or tires. The cost of these types of manuals is estimated to be $50 and would need to be replaced and/or updated every 3 years. Manuals are available through most tire manufacturers and can be purchased on-line, or from local tire dealers.

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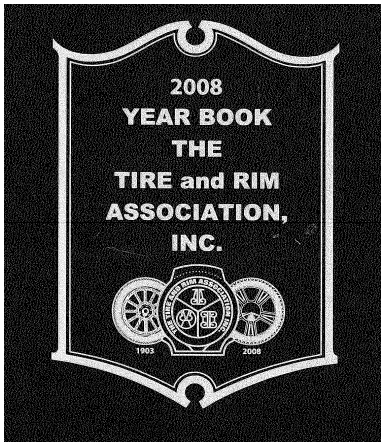


Figure V-5: Examples of Tire Inflation Reference Manual

ARB staff believes that all ASPs can easily comply with the proposed regulatory requirements. Upgraded tire pressure gauges and the required Manual are readily available and inexpensive. The checking of tire pressure and inflating to the vehicle manufacturer's recommended pressure is expected to be an easy addition to ASPs existing vehicle repair and/or maintenance procedures.

VI. Estimates of Emission Benefits

This section provides information about the baseline emissions inventory used to estimate benefits resulting from the implementation of the Proposed Regulation.

A. GHG Emissions and Fuel Consumption Estimates

The primary GHG responsible for global warming is carbon dioxide (CO_2). The transportation sector is the largest contributor to the State's carbon dioxide equivalent (CO_2E)[2] emissions inventory. CO_2E emissions from vehicles correlate with a vehicle's fuel consumption. The Proposed Regulation reduces CO_2E emissions by significantly decreasing the amount and length of time that vehicle tires are under inflated. Figure VI-1 shows the 2002 to 2004 average GHG emissions inventory broken down by sector (ARB, 2008a). As shown in the figure, the transportation sector, which includes on-road vehicles, aviation, rail, and ships, is the largest contributor to the total statewide GHG emissions, producing approximately 38 percent of the State's total GHGs, or 179 $MMTCO_2E$. Furthermore, as shown in Figure VI-2, on-road vehicle emissions account for more than 90 percent of the transportation emissions, with 75 percent from light-duty vehicles. The Proposed Regulation would contribute towards AB 32 goals of reducing GHG emissions from the transportation sector.

[2]Carbon dioxide equivalent (CO_2E) is a metric measure used to compare the emissions from various GHGs based upon their global warming potential. Global warming potential (GWP) is the index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a GHG to that from emission of one kilogram of CO_2 over a period of time (usually 100 years). For example, the GWP of CO_2, methane, and nitrous oxide is 1, 21, and 310, respectively. CO_2 equivalents are commonly expressed as "million metric tons of carbon dioxide equivalent ($MMTCO_2E$)".

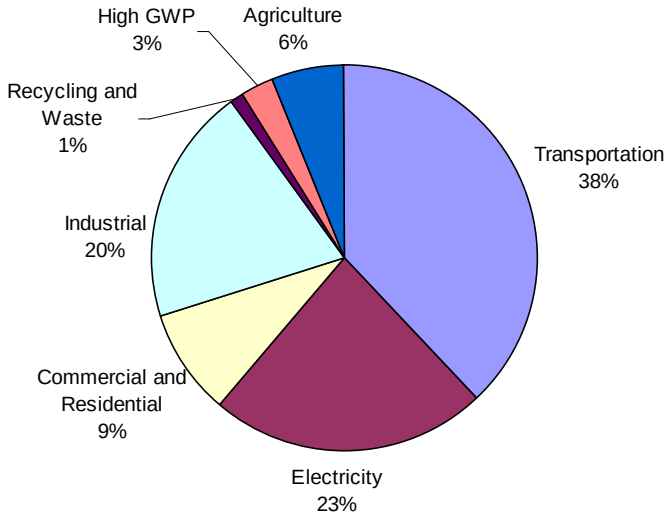


Figure VI-1: California GHG Emissions by Sector – 2002 - 2004 Average (ARB, 2008a)

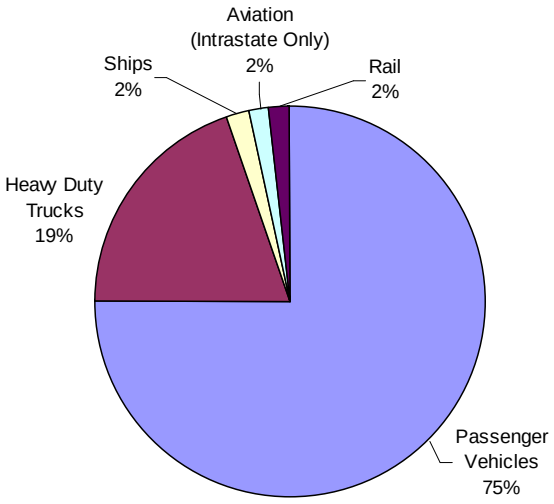


Figure VI-2: Transportation Sector GHG Emissions – 2002 - 2004 Average (179 MMTCO$_2$E) (ARB, 2008a)

Using the information above, staff determined the emission inventory for all passenger vehicles. Staff then projected the emission inventory for 2020 if no actions were taken to reduce emissions from vehicles operating with under inflated tires. Knowing that carbon dioxide emissions from vehicles are directly proportional to gasoline consumption, with one gallon of fuel consumed producing 8.94 kg CO_2E (ARB, 2008a), staff calculated the average fuel consumption estimates for the years 2002 to 2004 and 2020.
Table VI-1 below shows the baseline inventory estimates.

Table VI-1: GHG and Fuel Consumption Projections

2002 to 2004 Average GHG Emissions Inventory ($MMTCO_2E$)	2002 to 2004 Average Fuel Consumption (Gallons (Billions))	2020 Average GHG Emissions Inventory ($MMTCO_2E$)	2020 Average Fuel Consumption (Gallons (Billions))
133.9	15.0	160.8	18.0

The Proposed Regulation will help to ensure that a vehicle's tires are inflated to the vehicle manufacturer's recommended specifications. The goal is to reduce GHG emissions by reducing the amount of fuel that is consumed due to under inflated tires.

B. Vehicle Population

The Proposed Regulation will affect passenger cars and light-duty, medium-duty, and light-heavy-duty vehicles with a Gross Vehicle Weight Rating (GVWR or GVR) of 10,000 pounds or less. Examples of typical vehicles are shown in Table VI-2.

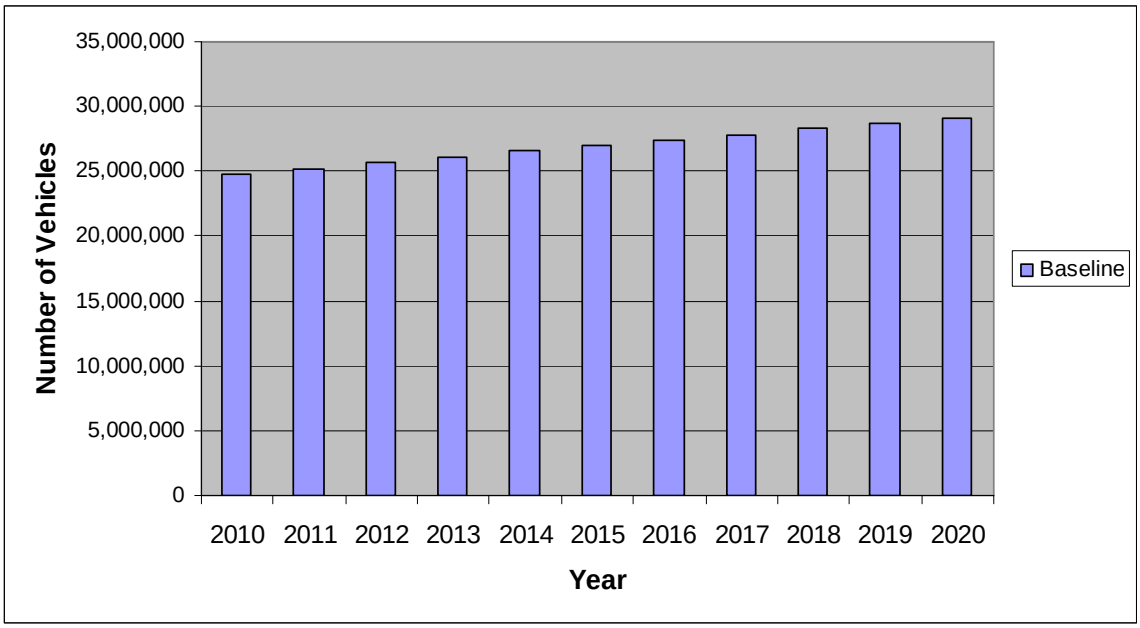
Table VI-2: Example Passenger Vehicles

Vehicle Categories	Example Vehicles
Passenger Cars (All)	Toyota Camry, Ford Focus, Chevrolet Cavalier, Volkswagen Beetle
Light-Duty Trucks 1 (0 – 3,750 LVW[3])	Ford Ranger, Toyota Tacoma, Chevrolet Colorado
Light-Duty Trucks 2 (3,751 LVW[3] – 5,750 LVW[3])	Ford F150, Chrysler Town and Country Van, Nissan Murano
Medium-Duty Vehicles (5,751 LVW[3] – 8,500 GVR)	GMC Yukon, Dodge Ram 1500, Ford Expedition
Light-Heavy-Duty Trucks 1 (8,501 GVR – 10,000 GVR)	Ford F-350 Crew Cab, Chevrolet Silverado 3500, Dodge Ram 2500 Mega Cab

To estimate the baseline number of California registered passenger vehicles impacted by the Proposed Regulation, staff utilized the annual vehicle population projections for the years 2010 through 2020 in ARB's Emission Factors modeling software (EMFAC2007 version 2.3). EMFAC projections estimate that 25 to 29 million vehicles will be impacted by the Proposed Regulation. Figures VI-3 shows the estimated baseline vehicle populations for gasoline fueled vehicles for 2010 through 2020. Of the vehicles affected by this regulation, virtually all are gasoline fueled. Therefore, the regulatory impacts are based on an assessment of gasoline vehicles only.

[3] Loaded vehicle weight is determined to be the curb weight of the vehicle plus 300 pounds. Alternatively, vehicles are rated by their gross weights (GVR or GVWR).

Figure VI-3: California Baseline Gasoline Vehicle Population



C. Adjustments to Emissions and Fuel Consumption Inventory Estimates

To reflect the emissions reductions achieved by the Proposed Regulation, staff adjusted the baseline inventory projections to account for the implementation of AB1493 (Pavley, 2002) and SB375 (Steinberg, 2008). As identified in the AB32 Scoping Plan (ARB, 2008b), implementation of AB1493 is projected to reduce GHG emissions by an estimated 31.7 $MMTCO_2E$ by the year 2020. The Pavley bill directed ARB to adopt vehicle standards that lowered greenhouse gas emissions to the maximum extent technologically feasible, beginning with the 2009 model year. ARB plans to adopt a second, more stringent phase to obtain additional reductions. Implementation of SB375 is expected to result in a reduction of 5 $MMTCO_2E$ by the year 2020. This represents an estimate of what may be achieved from local transportation and land use changes. Table VI-3 lists the 2002 to 2004 baseline emission and fuel consumption inventories as well as the 2020 adjusted baseline emission and fuel consumption inventories.

Table VI-3: Adjusted Baseline Inventory Projections

2002 to 2004 Average GHG Emissions Inventory ($MMTCO_2E$)	2002 to 2004 Average Fuel Consumption (Gallons (Billions))	2020 Average GHG Emissions Inventory ($MMTCO_2E$)	2020 Average Fuel Consumption (Gallons (Billions))
133.9	15.0	124.1	13.9

Note: Staff assumed that the 2002-2004 average fuel consumption was equivalent to 2010 fuel consumption.

D. Adjustments Due to Tire Pressure Monitoring Systems

To reflect the benefits from the implementation of the Proposed Regulation, staff needed to know what percentage of vehicles in the California registered fleet has tires that are severely or moderately under inflated. Of the 25 to 29 million vehicles that will be affected by the Proposed Regulation, staff determined that the benefits of the regulation would not apply to the fuel consumed by vehicles whose tire pressure monitoring system (TPMS) devices encouraged the vehicle owner to take corrective action. In 2006, manufacturers began installing TPMS systems that are designed to alert the vehicle owner when a vehicle's tire is 25 percent below the manufacturers recommended pressure. Since the vehicle population with TPMS devices will continue to grow through 2020, the benefits of the Proposed Regulation will decrease over time.

Staff assumed that 50 percent of the vehicle owners would respond to the TPMS notification and immediately take corrective action. These adjustments affected both the percentage of vehicles in the moderately and severely underinflated category and the average tire pressure under inflated values. Those vehicle owners taking corrective action were not included in the benefits calculation. Table VI-4 shows the adjusted fuel use data for 2010 and 2020.

Table VI-4: Adjusted Fuel Use

Year	2010	2020
Baseline Fuel Use (Billions of Gallons)	15.0	13.9
Fuel Used by Pre-2006 Vehicles (Billions of Gallons)	9.3	3.0
Fuel Used by 2006 and Newer Vehicles (Billions of Gallons)	5.7	10.9
Fuel Used by Vehicles with Under Inflated Tires that Cause the TPMS Light to Go On (Reduced by 50% to Reflect Consumer Response) (Billions of Gallons)	0.7	1.9
Net Fuel Subject to the Regulation for 2006 and Newer Vehicles (Billions of Gallons)	5.0	9.0

E. Fuel Savings and GHG Emission Reduction Benefits

PROFILING LEVELS OF UNDER INFLATION

Staff utilized the NHTSA On-road Tire Pressure Survey (U.S. EPA, 2006) (NHTSA, 2005) data to profile the under inflation levels. An estimated 20 percent of the light duty vehicles surveyed by NHTSA were found to have at least one tire that was severely under inflated. Another 34 percent of the light duty vehicles surveyed was found to have tires that were moderately under inflated. Severely under inflated tires are defined as tires with pressures to be greater than 6 psi below the vehicle manufacturer's recommended pressure. Moderately under inflated tires are defined as tires with pressures to be between 1 and 6 psi below the vehicle manufacturer's recommended pressure.

The original NHTSA Study was conducted in 2001. To check if the NHTSA data was still current, or if the impact of higher gasoline prices changed consumer behavior, staff conducted two tire pressure surveys at retail fuel dispensing facilities where vehicles were randomly selected for sampling. Tire pressures of the sample vehicles were recorded and compared to the vehicle manufacturer's recommended tire inflation pressures. Approximately 90 vehicles were sampled in each survey. The results of the surveys indicated that vehicle tire under inflation conditions similar to those estimated by the NHTSA study continue to exist.

In addition, staff utilized the U.S. Environmental Protection Agency (U.S. EPA, 2006) estimate that for every decrease in tire inflation pressure of 2.96 pounds per square inch (psi), the fuel consumption of the vehicle can be expected to increase by 1 percent.

Table VI-5 shows the results of the two staff surveys as well as the NHTSA Study. The sample data of each survey and the sampling methodology employed is presented and discussed in Appendix B.

Table VI-5: Results of Staff Tire Pressure Surveys and the NHTSA Study

	Passenger Cars and Light-Duty Trucks 1 (0 to 3750 lb LVW)			Light-Duty Trucks 2, Medium-Duty Vehicles, and Light-Heavy Duty Trucks (3751 lb LVW to 10,000 lb GVR)		
	NHTSA Study	**ARB Staff Survey 1**	**ARB Staff Survey 2**	**NHTSA Study**	**ARB Staff Survey 1**	**ARB Staff Survey 2**
Percentage of Vehicles with Severely Under Inflated Tires (Average of all 4 tires)	20%	38%	18%	26%	24%	17%
Average Tire Pressure Under Inflated (psi)	8.65	8.27	7.98	8.49	9.08	7.75
Percentage of Vehicles with Moderately Under Inflated Tires (Average of all 4 tires)	34%	31%	25%	37%	37%	28%
Average Tire Pressure Under Inflated (psi)	2.88	3.32	3.19	3.03	3.9	3.35

Note: LVW = Loaded Vehicle Weight; GVR = Gross Vehicle Weight

Staff then applied a correction to the NHTSA study results based on the ARB survey results and the adjusted vehicle population data to compensate for vehicles equipped with TPMS. Table VI-6 shows the adjusted NHTSA study data.

Table VI-6: Adjusted NHTSA Study Results

	Passenger Cars and Light-Duty Trucks 1 (0 to 3750 lb LVW)	Light-Duty Trucks 2, Medium-Duty Vehicles, and Light-Heavy Duty Trucks (3751 lb LVW to 10,000 lb GVR)
Percentage of Vehicles with Severely Under Inflated Tires (Average of all 4 tires)	13%	14%
Average Tire Pressure Under Inflated (psi)	7.86	7.69
Percentage of Vehicles with Moderately Under Inflated Tires (Average of all 4 tires)	30%	31%
Average Tire Pressure Under Inflated (psi)	2.88	2.83

Note: LVW = Loaded Vehicle Weight; GVR = Gross Vehicle Weight

DETERMINATION OF FUEL SAVINGS DUE TO PROPERLY INFLATED TIRES

Using both the original and adjusted NHTSA Study results and the expected corresponding decrease in fuel economy (1 percent reduction in fuel economy for every 2.96 psi drop in average tire pressure), staff was able to calculate the fuel savings factors for vehicles having severely and moderately under inflated tires. When calculating the fuel savings factor, staff also considered the average pressure drop from vehicle tires over a 3-month period (1.37 psi for passenger cars and 1.53 psi for light duty trucks). The average pressure drops were calculated using a weighted average for each vehicle category and was based upon an average permeation loss rate of approximately 1 psi per month. For example, for pre-2006 model year passenger cars with severely under inflated tires that are inflated to proper pressure, the fuel savings would be calculated as follows:

((Average Under Inflation for Passenger Cars with Severely Under Inflated Tires – Natural Pressure Drop for Passenger Cars) / (Fuel Efficiency Factor for a 1 Percent Improvement in Fuel Consumption)/100) x (Fuel Consumption for Pre-2006 Vehicles with Severely Under Inflated Tires) = Fuel Savings.

Where:

- Average Under Inflation for Passenger Cars with Severely Under Inflated Tires = 8.65 psi
- Average Pressure Drop for a Passenger Car = 1.37 psi
- Fuel Efficiency Factor for a 1 Percent Improvement in Fuel Consumption = 2.96 psi
- Fuel Consumption for Pre-2006 Passenger Car with Severely Under Inflated Tires = Total Fuel Consumed x Percentage of Vehicles with Severely Under Inflated Tires
  Cars = 5.2 billion x 20 percent = 1.0 billion

((8.65 psi – 1.37 psi) / 2.96 psi)/100 x 1.0 billion gallons = 25 million gallons

Similarly, staff calculated the fuel savings for pre-2006 model year passenger cars with moderately under inflated tires.

((2.88 psi – 1.37 psi) / 2.96 psi)/100 x 1.9 billion gallons = 10 million gallons

Total fuel savings for all pre-2006 vehicles with under inflated tires = 35 million gallons.

Tables VI-7 summarizes the fuel consumption for all pre-2006 passenger cars. Table VI-8 summarizes the fuel savings for pre-2006 vehicles with under inflated tires that are corrected to proper inflation as a result of the Proposed Regulation.

Table VI-7: Total Fuel Consumption for Pre-2006 Passenger Cars (Gallons)

	Passenger Car (billion)	Light Duty Truck (billion)	TOTAL (billion)
2010	5.2	4.1	9.3
2020	1.7	1.3	3.0

Table VI-8: Total Fuel Savings for Pre- 2006 Vehicles with Under Inflated Tires (Gallons)

	Passenger Car (million)	Light Duty Truck (million)	TOTAL (million)
2010	35	32	67
2020	11	10	21

Using the same methodology, staff calculated the fuel savings for model year 2006 and newer vehicles (includes half of the fuel used by vehicles for which no corrective action was taken). Table VI-9 shows the fuel consumption for 2006

and newer model year vehicles. Table VI-10 shows the fuel savings for these vehicles. Table VI-11 shows the total fuel savings from all model year vehicles.

Table VI-9: Total Fuel Consumption for 2006 and Newer Passenger Cars (Gallons)

	Passenger Car (billion)	Light Duty Truck (billion)	TOTAL (billion)
2010	3.0	2.0	5.0
2020	5.0	4.0	9.0

Table VI-10: Total Fuel Savings for 2006 Model Year and Newer Vehicles (Gallons)

	Passenger Car (million)	Light Duty Truck (million)	TOTAL (million)
2010	13	9	22
2020	23	16	39

Table VI-11: Total Fuel Savings (Gallons)

	Passenger Car (million)	Light Duty Truck (million)	TOTAL (million)
2010	48	41	89
2020	34	26	60

EMISSION REDUCTIONS FROM PROPERLY INFLATED TIRES

Using the fuel savings shown above, staff determined the corresponding CO_2 emission reduction benefits. Table VI-12 shows the total CO_2 emission reduction in 2010 and 2020.

Table VI-12: Total CO2 Reductions ($MMTCO_2E$)

	Passenger Car ($MMTCO_2E$)	Light Duty Truck ($MMTCO_2E$)	TOTAL ($MMTCO_2E$)
2010	0.42	0.37	0.79
2020	0.30	0.24	0.54

VII. Environmental Impacts

The Proposed Regulation is driven by the need to reduce GHG emissions from the transportation sector and specifically from on-road vehicles. The reductions are expected to be achieved through a tire pressure service (check and inflate) program.

Staff expects the implementation of the regulation to result in GHG emission reductions and does not anticipate any significant adverse public health or environmental impacts associated with the Proposed Regulation. The following sections discuss the environmental impacts associated with the Proposed Regulation.

A. Legal Requirements

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to identify the potential environmental impacts of proposed regulations and to mitigate significant effects whenever it is feasible to do so. Since ARB's program involving adoption of regulations has been certified by the Secretary of Resources as meeting certain environmental standards set forth in CEQA, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons (ISOR or Staff Report) for this rulemaking in lieu of following the CEQA format of an Initial Study and Negative Declaration, and Environmental Impact Report (see Public Resources Code, section 21080.5). In addition, ARB staff will respond, in the Final Statement of Reasons for the regulation, to all significant environmental issues raised by the public during the public review period or at the Board public hearing.

Public Resources Code section 21159 requires that the ARB's environmental impact analysis include the following:

- An analysis of the reasonably foreseeable environmental impacts of the methods of compliance;
- An analysis of reasonable foreseeable mitigation measures; and
- An analysis of reasonably foreseeable alternative means of compliance with the regulation.

Compliance with the Proposed Regulation is expected to directly affect air quality and potentially affect other environmental media as well. Our analysis of the reasonable foreseeable environmental impacts of the methods of compliance is presented below.

Regarding mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

The Proposed Regulation is designed to reduce GHG emissions from vehicles operating with under inflated tires. The reductions are needed to reduce global warming which poses a threat to the public health, natural resources, economic well being, and the environment of California as required by AB 32.

Alternatives to the Proposed Regulation are discussed in Section X of this report. ARB staff has concluded that there are no alternative means of compliance that would achieve similar GHG emission reductions at a lower cost.

B. Effects on Climate Change

The primary GHG associated with the combustion of fossil fuels is CO_2. Since CO_2 is emitted in direct proportion to the fuel combusted, any reductions in fuel combustion also result in a reduction of CO_2 being emitted. The Proposed Regulation reduces CO_2 emissions by reducing fuel consumption of passenger vehicles by significantly reducing the degree to which vehicle tires are under inflated. In addition, there are CO_2 lifecycle emissions reductions associated with the reduction in tire waste from proper inflation practices over time.

Staff estimated additional GHG emission reductions from the decrease in annual tire replacements. A study conducted by the California Energy Commission (CEC) in 2005 reported an average tire produces 98 kilograms of CO_2E during the manufacturing and disposal processes (CEC, 2005). Staff then calculated the average emission reductions associated with removing over 700,000 tires from being produced and disposed of annually. Staff estimated an additional 0.07 $MMTCO_2E$ would be reduced annually as a result. The additional emission savings were added to the check and inflate program to provide the total emission savings of the Proposed Regulation. Table VII-1 represents staff estimates of the CO_2 emissions reduced as a result of the Proposed Regulation for the years 2010 and 2020.

Table VII-1: Projected Statewide CO_2 Emissions Reductions

Year	Properly Inflated Tires ($MMTCO_2E$)	Tire Lifecycle GHG Emission Reductions ($MMTCO_2E$)	Total CO_2 Emission Reductions ($MMTCO_2E$)
2010	0.79	.07	0.86
2020	0.54	.07	0.61

C. Effects on Air Quality

1. Particulate Matter

In addition to GHG benefits, the reduction in fuel consumption will reduce particulate matter (PM) emissions. The Proposed Regulation is expected to provide a slight reduction in PM emissions as a result of the reduction in fuel consumption. This would contribute towards attainment of the State's air quality standards.

2. Hydrocarbons and Oxides of Nitrogen

The Proposed Regulation is also expected to result in slight reductions in both hydrocarbons (HC) and oxides of nitrogen (NOx) emissions. Since less fuel is required to move a vehicle with properly inflated tires, fewer exhaust emissions are produced. Internal dynamometer tests on passenger vehicles have shown slight reductions in emissions as the vehicle's tires were adjusted to proper inflation levels. However, the quantitative results were statistically inconclusive due to the small sample size of the test and the sensitivity of the instrumentation.

D. Reasonably Foreseeable Environmental Impacts

The Proposed Regulation is also expected to prolong tire life by reducing tread wear that results from tire under inflation. With the Proposed Regulation, staff expects to prolong tire life by 1,600 to 7,800 miles for most vehicles found to be moderately and severely under inflated, respectively. Staff also determined that prolonging vehicle tire life by reducing tread wear due to proper tire inflation is equivalent to removing an estimated 700,000 tires as waste annually, or a total of 7.8 million fewer tires between the period 2010 through 2020.

E. Reasonably Foreseeable Mitigation Measures

ARB staff has concluded that no significant adverse environmental impacts are expected to occur from adoption of and compliance with the Proposed Regulation. Therefore, no mitigation measures are necessary.

F. Alternative Means of Compliance with the Proposed Regulation

Alternatives to the Proposed Regulation are discussed in Section X of this report. ARB staff has concluded that the Proposed Regulation provides the most effective, least burdensome, and cost effective approach to reducing GHGs from under inflated vehicle tires.

VIII. Health Impact Assessment

A public health analysis conducted for the AB32 Scoping Plan indicates that reducing greenhouse gases will also provide a wide range of additional health benefits. The expected reductions in GHGs and criteria pollutants (PM and NOx) from the Proposed Regulation will result in an overall public health benefit.

A substantial number of epidemiologic studies have found a strong association between exposure of PM size 2.5 microns (PM2.5) and a number of other adverse health effects (ARB, 2002b). These adverse impacts include premature deaths, reduced hospital admissions due to respiratory and cardiovascular causes, reduced cases of asthma-related and lower respiratory symptoms, reduced cases of bronchitis, fewer loss work days, and fewer minor restricted activity days.

IX. Economic Impacts

In this section, staff has assessed the economic impacts on ASPs and California consumers from the Proposed Regulation. The ASPs are expected to incur additional labor costs and minor capital and operating costs associated with the Proposed Regulation. Consumers are expected to benefit from the reduced fuel consumption and prolonged tire life because their vehicle tires are inflated to proper inflation levels. A summary of all economic impacts is discussed in Section IX. A.

A. Summary of Economic Impacts

Staff has determined that for 2010, the Proposed Regulation will save California consumers on average about 90 million gallons of gasoline. In 2020, the savings will be about 60 million gallons of gasoline per year. Based on this data, the average annual economic benefit of this reduction in fuel consumption (savings) has been estimated to be about $250 million (2008 dollars) which results in an overall cost savings averaging $9 per vehicle per year. The total fuel savings for 2010 through 2020 is expected to be $2.7 billion (2008 dollars).

The Proposed Regulation is also expected to prolong tire life by reducing tread wear that results from tire under inflation. Overall, 700,000 tires would be diverted from the waste stream annually. Staff estimated an annual average savings of about $90 million (2008 dollars) and a total savings of $980 million for the period 2010 through 2020. Tire savings to California consumers is expected to amount to $3 per vehicle per year.

The total benefits to California consumers are estimated to be $3.7 billion (2008 dollars), or $340 million (2008 dollars) per year. This translates into total benefits of approximately $12 per vehicle per year.

The Proposed Regulation is expected to affect an estimated 40,000 ASPs in California. These facilities are expected to primarily incur additional labor costs associated with the check and inflate procedure. Average annual labor (total compensation) costs for the period 2010 through 2020 are estimated to be $98 million (2008 dollars) per year. The total labor cost incurred by the ASPs is estimated to be $1.1 billion (2008 dollars) during the entire period.

In addition to labor costs, the Proposed Regulation will require ASPs to purchase tire pressure gauges and a tire inflation reference manual. Since most ASPs are presently equipped with compressors, no additional capital costs are expected to be incurred by these facilities. However, test-only smog check centers are expected to make minor engineering modifications to tap into compressed air lines for tire-inflation purposes. These facilities could incur an initial cost of approximately $150. In addition, all ASPs are expected to incur one-time programming and record keeping costs of as much as $460. ASPs are required to note on the service invoice that the check and inflate service was performed and what pressure the tires were filled to. Some ASPs may choose to enhance their electronic systems to include this information. The service invoice records help enforcement personnel ensure that ASPs are adhering to the regulatory requirements. Total annualized capital and operating costs during the period 2010 through 2020 are expected to average about $5.3 million (2008 dollars) per year, or a total of about $58 million (2008 dollars) for the entire period.

The total cost to affected California businesses is expected to amount to $1.1 billion for the period 2010 through 2020 (2008 dollars), or average $103 million (2008 dollars) per year. Staff believes that ASPs are likely to pass these costs onto their customers. The cost to consumers is expected to be no more than $4 per vehicle per year.

Overall, the statewide average annual GHG emission reduction benefits are projected to be about 0.7 $MMTCO_2E$. Therefore, the cost effectiveness of the Proposed Regulation is estimated to result in a net savings of $320 per $MTCO_2E$.

B. Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall consider the impact of the Proposed Regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states. Also, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance (DOF). The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

In addition, Health and Safety Code section 57005 requires ARB to perform an economic impact analysis of submitted alternatives to a proposed measure before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars. Since the estimated costs of the Proposed Regulation to California businesses does exceed $10 million, staff has conducted an economic analysis of the cost effectiveness of submitted alternatives to the Proposed Regulation. The costs and benefits of the alternatives are discussed in further detail in Section X.

In the following sections, staff discusses the methodology used to estimate costs to businesses, benefits or savings to consumers, net benefits of the Proposed Regulation, as well as the costs and benefits for Alternatives to the Proposed Regulation.

C. Costs of the Proposed Regulation

In this section, staff discusses the basis and methodology for estimating the total present value costs of the Proposed Regulation. Total costs to ASPs were primarily estimated by determining additional labor costs and minor capital, overhead and maintenance, and one-time programming costs that would be incurred.

To estimate total labor costs, staff must make a determination of how many times an individual is likely to visit an ASP during the course of the year. Staff must then determine if the tire pressure service (check and inflate) is part of the routine service visit, or determine the net costs likely to be incurred by the ASP as a result of the requirements of the Proposed Regulation. A derivation of the frequency of visits to an ASP so that labor costs may be computed is presented below.

FREQUENCY OF VISITS TO CALIFORNIA AUTOMOTIVE SERVICE PROVIDERS

To estimate the total labor costs associated with the Proposed Regulation, staff estimated the frequency of visits that California consumers make to ASPs. Table IX-1 lists the information for manufacturer recommended service visits. Staff expects the recommended service visits to vary between vehicle brands. Staff also recognizes that many consumers are likely to have service performed less frequently due to personalized levels and driving habits, and service their vehicles based on mileage accrued. Staff believes that the actual service level based on accrued mileage should also be a plausible service level.

Staff also considered survey results and external reports. For example, staff learned that the recommended oil change frequency by most express oil change facilities is 3,000 to 5,000 miles. In California, oil changes are performed at an average interval of 4,200 miles for most passenger vehicles (CIWMB, 2007). In other cases, staff relied on input from local businesses on the frequency of visits to ASPs. Staff further recognized that some consumers service their own vehicles, and made adjustments to the annualized frequency of visits to ASPs. For example, it is estimated that about 18 percent of individuals perform their own oil changes. The annualized frequency of visits for oil changes was adjusted to reflect this information.

Staff also believes that a tire pressure check and inflate service is not always included with every service. For example, a brake shop presently is not likely to check and inflate the tire pressures when the vehicle is brought in for service. In other cases, it is expected that the vehicle tire pressure check will be performed. For example, all tires are inflated to the recommended inflation level when new tires are purchased. The annualized frequency of visits is a number calculated to determine how many times a year consumers are likely to visit an ASP. The number is adjusted to reflect a net annualized frequency of visits if it is determined that the tire pressure check and inflate procedure is built into the automotive service level. For example, if a consumer routinely obtains an express oil change for his or her vehicle, then the visits to the express oil change facility would count in the annualized frequency of visits. However, if the express oil change facilities offers a tire pressure check and inflate service with the oil change, then the visit is not counted as a visit to an ASP. The annualized frequency of visits is then adjusted to obtain a net annualized frequency of visits. Staff is required to make a determination of only the net labor costs to businesses. In the examples cited above, the visit to the brake shop would count as a visit, but the visits to the tire store for new replacement tires and the visit to the express oil change facility would not count as visits since the tire pressure check and inflate procedure is part of the service.

Staff also recognized that many consumers obtain more than one service during a visit to an ASP. For example, consumers are likely to have tires rotated with

the oil change service or obtain oil changes at recommended dealership service levels. To reflect this service, the annualized frequency of visits was adjusted. This avoids overestimating the actual number of visits to an ASP. Table IX-1 lists the net annualized frequency of visits to an ASP for which additional labor costs associated with the Proposed Regulation would be incurred.

Lastly, staff recognized that individuals with newer cars are likely to visit ASPs less often than those who keep their vehicles for longer periods. Staff therefore removed 60,000 mile or greater level visits for these individuals, assuming that the vehicle is sold, traded, or returned to the lessor after 5 years. Table IX-2 lists the net annualized frequency of visits to an ASP for which additional labor costs associated with the Proposed Regulation would be incurred. Staff notes that in determining the net annualized frequency of visits, a weighted average frequency of visits based on those individuals who trade their vehicles after 5 years was utilized. Overall, staff estimated that ASPs in California would perform the tire pressure check and inflate service an additional 2 times per year for California registered vehicles during their normal visits to such facilities.

The net annualized frequency of visits to an ASP during which time the tire pressure service is expected to be performed is determined by calculating a weighted average frequency of visits based on the net number of visits determined in Tables IX-1 and IX-2. These values were determined to be 2.3 visits per year for individuals who keep their vehicles for an extended period of time and 1.2 visits for individuals who trade their vehicles before reaching 60,000 miles / 5 years of ownership. Staff then determined from the EMFAC database what proportion of vehicles are late model year vehicles, and applied the ratio to determine the weighted average frequency of visits to an ASP. For the five vehicle categories impacted by Proposed Regulation, staff determined that in the year 2010, approximately 30 percent of the vehicle population is assumed to be 5 years old or less. The sample calculation is presented below:

Net Annualized Frequency of Visits = (30.1% x 1.2 visits) + (69.9% x 2.3 visits)
Net Annualized Frequency of Visits = 1.97 visits per year
Net Annualized Frequency of Visits ~ 2.0 visits per year.

Table IX-1: Determination of Net Annualized Frequency of Visits to Automotive Service Providers

Purpose of Visit	Recommended Service Level at Mileage	Actual Service Level at Mileage	Annual Visits[4]	Tire Pressure Check in Procedure	Annualized Frequency of Visit Due to Proposed Regulation
Oil & Filter Changes	3,000 – 5,000	4,200	2.36	50%	1.18
Manufacturer Recommended Periodic Service	10,000 – 15,000	20,000	0.60	100%	0.00
Tire Rotation	6,000	10,000	1.21	75%	0.30
Tire Replacement	30,000 – 60,000	45,000	0.27	100%	0.00
Smog Check[5]	Once Every 2 Years for Older Vehicles	N/A	0.40	0%	0.40
Brake and Exhaust	40,000	40,000	0.30	0%	0.30
Battery Replacement	60,000	60,000	0.20	0%	0.20
Unscheduled Repairs, Recalls, & Warranty					
Shocks and Struts	75,000	75,000	0.16	0%	0.16
Alternator	100,000	100,000	0.12	0%	0.12
AC Service	100,000	100,000	0.12	0%	0.12
Transmission (Automatic)	100,000	100,000	0.12	0%	0.12
Misc. Repair, Recalls, & Warranty	30,000	30,000	0.40	0%	0.40
Total Number of Annual Visits			6.30		3.30
Redundancy of Visits			-1.00		-1.00
Net Annualized Frequency of Visits			**5.3**		**2.30**

[4] Staff determined that the projected weighted average annual vehicle miles traveled (VMT) for all affected vehicles impacted by the Proposed Regulation in the EMFAC2007 database are 12,086 miles per year for the period 2010 through 2020.

[5] Smog Check Service Level is based on 2007 Actual Number of Smog Checks Performed for Passenger Cars, Light Duty Vehicles, and Medium Duty Vehicles (up to 8,500 lb). The California Smog Check Program requires a smog check for 6 year old or older vehicles once every two years.

Table IX-2: Determination of Net Annualized Frequency of Visits to Automotive Service Providers (Vehicles Traded at 5 Years / 60,000 miles)

Purpose of Visit	Recommended Service Level at Mileage	Actual Service Level at Mileage	Annual Visits[6]	Tire Pressure Check in Procedure	Annualized Frequency of Visit Due to Proposed Regulation
Oil & Filter Changes	3,000 – 5,000	4,200	2.36	50%	1.18
Manufacturer Recommended Periodic Service	10,000 – 15,000	20,000	0.60	100%	0.00
Tire Rotation	6,000	10,000	1.21	75%	0.30
Tire Replacement	30,000 – 60,000	45,000	0.27	100%	0.00
Brake and Exhaust	40,000	40,000	0.30	0%	0.30
Unscheduled Repairs, Recalls, & Warranty					
Misc. Repair, Recalls, & Warranty	30,000	30,000	0.40	0%	0.40
Total Number of Annual Visits			4.90		2.20
Redundancy of Visits			-1.00		-1.00
Net Annualized Frequency of Visits			**3.9**		**1.2**

POPULATION OF VEHICLES IMPACTED BY PROPOSED REGULATION

As discussed in Section VI.C the total number of vehicles impacted by the Proposed Regulation was determined by compiling the number of vehicles in each vehicle category which includes Passenger Cars (LVW[7] 0 – 3,750 lbs), Light Duty Trucks 1 (LVW 0 – 3,750 lbs), Light Duty Trucks 2 (LVW 3,751 – 5,750 lbs), Medium Duty Vehicles (LVW 5,751 – GVR 8,500 lbs), and Light Heavy Duty Vehicles (GVR 8,501 – 10,000 lbs). These vehicle categories are consistent with the EMFAC2007 vehicle categories for all vehicles up to 10,000 pounds. Staff notes that as vehicle categories get heavier, vehicles are specified by their GVR and not their LVW ratings. Staff then utilized the vehicle

[6] Staff determined that the projected weighted average annual vehicle miles traveled (VMT) for all affected vehicles impacted by the Proposed Regulation in the EMFAC2007 database are 12,086 miles per year for the period 2010 through 2020.

[7] The Loaded Vehicle Weight (LVW) is determined to be the curb weight of the vehicle plus 300 pounds. Alternatively, vehicles are rated by their gross vehicle weight ratings, commonly known as GVWR or GVR.

population projections from 2010 through 2020 to estimate the number of vehicles impacted by the Proposed Regulation.

LABOR COSTS

To estimate the overall labor costs, staff determined that it would take no more than five additional minutes per vehicle for a tire service specialist or an auto mechanic to perform the tire pressure check and inflate service. Staff based this determination on observations of vehicles being serviced, easy access to compressed air lines, and the assumption that vehicles would not need to be repositioned or re-parked for tire inflation purposes. Staff assumed that 50 percent of the time, the automotive service provider facility manager would designate a tire service specialist to perform the task of vehicle tire pressure check and inflation. For the remainder of the time, staff assumed that the vehicle tire pressure check and inflation procedure would be fulfilled by the auto service mechanic designated to service the vehicle for the purpose it was brought into the shop. As a result, wages and total compensation rates were adjusted to reflect the level of service personnel attending to the vehicle. Based on the California wage rates for tire service specialists and auto mechanics, the mean total compensation rate for performing the tire pressure check and inflation task was determined and found to be $21.94 per hour[8].

The total labor compensation costs were determined to be $1.83 (2008 dollars) per vehicle per visit. Average annual labor compensation costs to California ASPs for the period 2010 through 2020 for all affected California registered vehicles was estimated to be $98 million (2008 dollars) per year. Total labor costs for the entire period were estimated to be approximately $1.1 billion (2008 dollars). See Appendix C.4 for a detailed description.

[8] The mean total compensation rate is based on the average of the wage rates of a tire service specialist ($12.35 per hour) and an automotive service mechanic or technician ($19.63 per hour) (U.S. BLS Standard Occupation Codes 493093 and 493023, respectively). This average wage rate was determined to be $15.99 per hour in 2007 (which equals $16.48 per hour in 2008 dollars (adjusted for one year of inflation)). The cost of total benefits as a percentage of total compensation was estimated to be 24.9% for the period 2007/2008 (U.S. BLS). The mean total compensation rate is therefore computed to be $21.94 per hour (2008 dollars).

CAPITAL AND OPERATING EXPENDITURES

Staff estimates that to comply with the requirements of the Proposed Regulation, all ASPs will incur minor capital and operating expenditures. Specifically, the facilities are required to perform the tire pressure measure function using ANSI B40.1 Grade B specified tire pressure gauges. A staff survey determined that these gauges cost approximately $25 each with an estimated life expectancy of two years. Staff assumed that most ASPs would purchase one tire gauge per service bay and therefore larger ASPs would incur slightly higher capital costs.

The facilities are also required to have updated annual tire inflation reference manuals. These reference manuals list the recommended tire pressures for most model year vehicles, as well as load/inflation tables to help determine proper pressure for non-OEM sized wheels/tires. Staff estimates that the reference manual could be purchased at a cost of $50 per book and would need to be replaced once every three years.

In addition, test-only smog check centers are likely to incur engineering costs to initially tap into compressed air lines for tire inflation purposes. Staff estimated this cost to be $100 per compressor per facility[9] or $150 for an average 1.5 compressors per facility. All facilities are expected to own compressors, so no additional capital expenditures related to compressor purchase are anticipated as a result of the requirements of the Proposed Regulation. The differential compressor operating costs are also expected to be minor[10]. Staff estimated that the annualized costs to all facilities for initial and replacement tire gauges, tire inflation reference manual purchases, and minor engineering to be approximately $60 - $70 per facility per year.

The total annualized capital and operating (O&M) costs are estimated to be $2.8 million (2008 dollars) per year for an estimated 38,000 to 41,000 ASPs (not including test-only smog check centers) impacted by the Proposed Regulation during the period 2010 through 2020. The total costs to the ASPs were estimated to be $31 million (2008 dollars) for the entire period. See Appendix C.6 for a detailed description.

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[9] Staff determined that on average there are approximately 1.5 compressors per automotive service facility. Compressor use is also expected to vary widely with shop tool use and tire service (replacement and repair).

[10] Staff estimated compressor differential operating (electrical) costs based on cold and hot tire makeup volume required for 25-29 million vehicles with severely and moderately under inflated tires as well as properly inflated tires being serviced during the period 2010 through 2020. Staff determined the total air makeup volume requirements in the year 2010 to be approximately 50 million cubic feet at 68 degrees F and normal atmospheric pressure (14.7 psia). Staff concluded that the annual differential compressor operating costs based on this air makeup volume requirement were negligible. The Statewide air makeup volume requirements and compressor operating costs determination is further discussed in Appendix C.

The total annualized capital and operating (O&M) costs are estimated to be $128,000 (2008 dollars) per year for an estimated 2,000 to 2,200 test-only smog check centers impacted by the Proposed Regulation during the period 2010 through 2020. The total capital and operating costs were estimated to be $1.4 million (2008 dollars) for the entire period. See Appendix C.6 for a detailed description.

SUMMARY OF TOTAL COSTS

The total labor, capital, and operating costs to all ASPs for the period 2010 through 2020 was estimated to be $1.1 billion (2008 dollars). This cost also includes the cost of programming and record keeping applicable to all facilities as a result of the requirements of the Proposed Regulation (see Appendix C.7). On an annualized basis, the total cost is approximately $103 million (2008 dollars). The total labor, capital, and operating costs are summarized in Table IX-3.

Table IX-3: Summary of Total Costs for Proposed Regulation

Period	Labor Costs for All Facilities (2008 dollars)	Smog Check Centers Costs (2008 dollars)	Auto Service Providers Costs (2008 dollars)	Programming & Record keeping Costs (2008 dollars)	Total Cost of Regulation (2008 dollars)
2010-2020	~$1.1 billion	~$1.4 million	~$31 million	~$25 million	~$1.1 billion
Average Annual Costs	**~$98 million**	**~$128,000**	**~$2.8 million**	**~$2.3 million**	**~$103 million**

Note: Summary totals are rounded values

D. Economic Benefits of the Proposed Regulation

Staff estimated that the total benefits associated with the Proposed Regulation primarily include benefits from reduced fuel consumption and prolonged tire life due to reduced tread wear. These benefits were estimated to be $3.7 billion (2008 dollars) for the period 2010 through 2020. Average annual benefits for the same period were estimated to be about $340 million (2008 dollars) per year. A discussion of the methodologies employed to estimate the total benefits of the Proposed Regulation is presented below.

ESTIMATING FUEL SAVINGS FROM PROPER TIRE INFLATION

The fuel savings estimation methodology is presented is Section VI. Staff determined what the drop in fuel economy would be in between quarterly visits to ASPs as a result of the natural pressure loss. Most passenger vehicle tires are expected to lose approximately 1 psi per month, resulting in an average pressure drop of 1.5 psi over a three month period. Staff accounted for this loss and computed net fuel savings to California consumers. A summary of annual fuel

savings for all vehicle categories from pre-regulation levels for the period 2010 and 2020 is presented in Table IX-4.

Table IX-4: Total Annual Fuel Savings from Proposed Regulation (All Vehicle Categories)

Year	Annual Fuel Savings for Vehicles with Severely Under Inflated Tires (millions of gallons)	Annual Fuel Savings for Vehicles with Moderately Under Inflated Tires (millions of gallons)	Total Annual Fuel Savings (millions of gallons)
2010	64	25	89
2020	42	18	60

Note: Summary totals are rounded values

A monetary value of the total annual fuel savings as a result of the Proposed Regulation was then determined. To estimate the annual benefit, staff relied on fuel price forecasts made by the California Energy Commissions (CEC, 2007) for the period 2010 through 2020. The fuel price forecasts were projected in 2007 dollars. Due to the decline in energy prices in late 2008, staff determined that an adjustment of the price forecast to account for one year of inflation was not necessary. Staff expects the Proposed Regulation to yield average annual fuel savings of about $250 million (2008 dollars), and a total fuel savings of $2.7 billion (2008 dollars) for the entire period from 2010 through 2020. The estimated annual and total fuel savings from the Proposed Regulation are presented in Table IX-5.

Table IX-5: Estimated Value of Annual Fuel Savings from Proposed Regulation

Year	Total Annual Gasoline Savings (millions of) gallons)	Forecasted Gasoline Real Price (2008 cents/gal)	Annual Savings from Reduced Fuel Consumption (millions) (2008 dollars)
2010	89	307	$270
2020	60	367	$220
Average Annual	**75**	**337**	**$250**
Total (2010 through 2020)			**$2.7 billion**

Note: Summary totals are rounded values

PROLONGED TIRE LIFE BENEFITS

As a result of the Proposed Regulation, staff also expects that proper tire inflation will result in prolonged tire life by reducing premature tread wear. National Highway Traffic Safety Administration (NHTSA) reports (NHTSA, 2005) that every pound of tire pressure (psi) under inflation costs consumers 1.78 percent of the expected tire tread life. Therefore, a tire with a 60,000 mile warranty whose tire pressure is continually maintained one psi below the vehicle manufacturer's

recommended tire pressure can expect a life expectancy of 1,068 fewer miles or 58,932 miles. This premature tire life expectancy as a result of under inflation is a real cost to consumers.

Staff notes that tire under inflation is one of several factors that reduces tire life expectancy. However, these other factors were not considered when evaluating the effects of tire under inflation. To understand the impact of tire under inflation on reduced tread life alone and the real cost to consumers and the environment, staff conducted two tire market price and tread warranty surveys of the most commonly used and specified tires for each vehicle category subject to the Proposed Regulation. The average tire tread warranty determined for each vehicle category was rounded to the nearest 5,000 miles. Table IX-6 lists the results of the mean tire price and warranty market surveys. The tire price and warranty survey data, along with the sampling methodology is discussed in Appendix C.

Table IX-6: Mean Tire Price and Warranty Survey for All Vehicle Categories

Category	Vehicle Class Weight	Average Installed Cost of Tire[11]	Average Tread Warranty (miles)
Passenger Cars	0 - 3,750 LVW	$112.00	60,000
Light Duty Trucks 1	0 - 3,750 LVW	$96.17	60,000
Light Duty Trucks 2	3,751 - 5,750 LVW	$150.23	60,000
Medium Duty Vehicles	5,751 LVW - 8,500 GVR	$154.14	60,000
Light Heavy Duty Vehicles	8,501 - 10,000 GVR	$195.83	50,000

Staff notes that the prices listed above were mean selling prices. To determine the total value of a tire on a vehicle, sales taxes and installation charges were added to the cost of the tire. As can be seen from the table above, tires can reasonably be expected to last for 60,000 miles for most vehicle categories, and 50,000 miles for light heavy duty vehicles. Knowing the approximate value of each tire, staff then determined the loss in value that results from tire under inflation. This loss in tire value can be assumed to be an opportunity cost and a direct benefit of the Proposed Regulation.

Table IX-7 determines the projected annual cost to consumers with severely under inflated tires in gasoline-fueled pre-2006 model year passenger cars for the period 2010 through 2020. The expected tire life is the number of years that one can reasonably expect the tire of a properly inflated vehicle to last based on the average tire tread life warranty and the EMFAC estimated annual vehicles

[11] Staff assumed a sales tax rate of 7.75%. Installation charges are expected to vary between retailers. Staff determined that $15 per tire was a good approximation of tire installation charges.

miles traveled. For gasoline-fueled passenger cars, the expected tire life in the year 2010 is determined to be 60,000 miles / 11,811 miles per year or ~5.1 years. The realized tire life for vehicles with severely under inflated tires is obtained by reducing the expected tire life by ((8.65 – 1.37) psi x 1.78% x 60,000 miles) or approximately 7,800 miles, and then dividing by its estimated annual vehicle miles traveled. Therefore, the realized tire life for vehicles with severely under inflated tires (passenger cars) is (60,000 – 7,800 miles) / 11,811 miles per year or ~4.4 years in the year 2010.

Table IX-7: Cost of Tire Premature Wear Due to Severely Under Inflated Passenger Car Tires (Pre-2006 Vehicles)

Year	Estimated Number of Gasoline Fueled Vehicles	EMFAC2007 (VMT)	Mean Tire Value (2008 dollars)	Expected Tire Life (Years)	Realized Tire Life for Vehicles with Severely Under Inflated Tires (Years)	Tire Value Loss per Vehicle Due to Change in Life Expectancy (2008 dollars)	Number of Vehicles with Severely Under Inflated Tires	Total Loss Tire Value for Vehicles with Severely Under Inflated Tires (2008 dollars)
2010	10,205,476	11,811	$112.00	5.08	4.42	$13.13	2,041,095	$26,791,787
2011	9,596,883	11,784	$112.00	5.09	4.43	$13.10	1,919,377	$25,136,800
2012	8,986,319	11,764	$112.00	5.10	4.44	$13.07	1,797,264	$23,498,112
2013	8,371,836	11,751	$112.00	5.11	4.44	$13.06	1,674,367	$21,867,108
2014	7,756,174	11,736	$112.00	5.11	4.45	$13.04	1,551,235	$20,231,810
2015	7,150,297	11,724	$112.00	5.12	4.45	$13.03	1,430,059	$18,633,612
2016	6,557,049	11,697	$112.00	5.13	4.46	$13.00	1,311,410	$17,048,130
2017	5,976,868	11,681	$112.00	5.14	4.47	$12.98	1,195,374	$15,518,561
2018	5,419,057	11,671	$112.00	5.14	4.47	$12.97	1,083,811	$14,057,894
2019	4,887,218	11,663	$112.00	5.14	4.48	$12.96	977,444	$12,669,294
2020	4,387,393	11,655	$112.00	5.15	4.48	$12.95	877,479	$11,365,792

The annual tire value loss due to a lower tire life expectancy is the cost of under inflation based on an annualized frequency of tire replacements. For vehicles with properly inflated tires, the frequency of annual tire replacements or number of tires replaced annually is determined to be 4 tires/life expectancy (years) or 4/5.1. For vehicles with severely under inflated tires, the frequency of annual tire replacements is 4 tires/life expectancy (Years) or 4/4.4. The cost of under inflation is therefore the difference in the annual frequency of replacements for vehicles with severely under inflated tires and properly inflated tires times the value of a new replacement tire.

Therefore,

Loss of Tire Value Due to Premature Wear of Severely Under Inflated Tires

= (4 / 4.4 – 4 / 5.1) x $112.00 per Passenger Car Tire
= $13.13 per Passenger Car Vehicle in the Year 2010

The total cost of vehicles with severely under inflated tires is then determined to be the loss of tire value per vehicle times the estimated number of vehicles with severely under inflated tires. Therefore, the total cost of vehicles with severely under inflated tires in the year 2010 is determined to be $13.13 per vehicle x ~2.1 million severely under inflated vehicles or about $27 million. The projected annual cost of premature tire wear for gasoline fueled passenger cars that are severely under inflated for the period 2010 through 2020 is presented in Table IX-10.

Similarly, staff determined the annual cost for passenger cars with moderately under inflated tires during the period 2010 through 2020. These results are tabulated in Table IX-8 below.

Table IX-8: Cost of Tire Premature Wear
Due to Moderately Under Inflated Passenger Car Tires

Year	Estimated Number of Vehicles	EMFAC2007 (VMT)	Mean Price Per Tire (2008 dollars)	Expected Tire Life (Years)	Realized Tire Life for Vehicles with Moderately Under Inflated Tires (Years)	Annual Tire Value Loss Due to Change in Life Expectancy (2008 dollars)	Number of Vehicles with Moderately Under Inflated Tires	Total Loss Tire Value for Vehicles with Moderately Under Inflated Tires (2008 dollars))
2010	10,205,476	11,811	$112.00	5.08	4.94	$2.44	3,469,862	$8,457,474
2011	9,596,883	11,784	$112.00	5.09	4.95	$2.43	3,262,940	$7,935,038
2012	8,986,319	11,764	$112.00	5.10	4.96	$2.43	3,055,349	$7,417,746
2013	8,371,836	11,751	$112.00	5.11	4.97	$2.43	2,846,424	$6,902,881
2014	7,756,174	11,736	$112.00	5.11	4.98	$2.42	2,637,099	$6,386,659
2015	7,150,297	11,724	$112.00	5.12	4.98	$2.42	2,431,101	$5,882,149
2016	6,557,049	11,697	$112.00	5.13	4.99	$2.41	2,229,397	$5,381,654
2017	5,976,868	11,681	$112.00	5.14	5.00	$2.41	2,032,135	$4,898,808
2018	5,419,057	11,671	$112.00	5.14	5.00	$2.41	1,842,479	$4,437,714
2019	4,887,218	11,663	$112.00	5.14	5.01	$2.41	1,661,654	$3,999,368
2020	4,387,393	11,655	$112.00	5.15	5.01	$2.41	1,491,714	$3,587,887

Staff then determined the total costs for gasoline-fueled passenger car vehicle tires that are severely and moderately under inflated. These costs are presented in Table IX-9.

Table IX-9: Total Cost of Tire Premature Wear Due to Under Inflation for Pre-2006 Model Year Passenger Cars

Year	Total Loss in Tire Value for Vehicles with Severely Under Inflated Tires (2008 dollars)	Total Loss in tire Value for Vehicles with Moderately Under Inflated Tires (2008 dollars)	Total Loss in Tire Value (2008 dollars)	Estimated Annual Reduction in Tire Waste Generation
2010	$26,791,787	$8,457,474	$35,249,262	314,729
2011	$25,136,800	$7,935,038	$33,071,838	295,287
2012	$23,498,112	$7,417,746	$30,915,858	276,037
2013	$21,867,108	$6,902,881	$28,769,989	256,877
2014	$20,231,810	$6,386,659	$26,618,470	237,667
2015	$18,633,612	$5,882,149	$24,515,761	218,893
2016	$17,048,130	$5,381,654	$22,429,784	200,268
2017	$15,518,561	$4,898,808	$20,417,369	182,300
2018	$14,057,894	$4,437,714	$18,495,608	165,141
2019	$12,669,294	$3,999,368	$16,668,662	148,829
2020	$11,365,792	$3,587,887	$14,953,679	133,516
Average (2010 to 2020)			**~$25 million**	**~221,000**

Note: Summary totals are rounded values

With the Proposed Regulation, owners of gasoline-fueled passenger cars can expect to save approximately $35 million dollars (2008 dollars) in the year 2010. Staff further determined that annual tire waste generation would be reduced by an estimated 221,000 tires ($53 million / $112 per tire).

Similarly, staff determined the total cost of premature wear due to under inflation for gasoline-fueled pre-2006 model year Light Duty Trucks 1, Light Duty Trucks 2, Medium Duty Vehicles, and Light Heavy Duty Vehicle categories, and correspondingly derived the estimated annual reduction in tire waste as a result of the Proposed Regulation. Staff then repeated the procedure for model year 2006 or newer vehicles impacted by the Proposed Regulation.

A summary of the total cost of tire premature wear due to under inflation for all vehicle categories is presented in Table IX-10. As can be seen from the table, under inflation of vehicle tires is expected to cost California consumers on average $90 million (2008 dollars) a year during the period 2010 through 2020, or a total of $980 million for the entire period.

Table IX-10: Total Cost of Tire Premature Wear Due to Under Inflation for All Vehicle Categories

Year	Loss of Tire Value for Vehicles with Severely Under Inflated Tires (2008 dollars)	Loss of Tire Value for Vehicles with Moderately Under Inflated Tires (2008 dollars)	Total Loss of Tire Value Due to Under Inflation (2008 dollars)	Estimated Total Annual Reduction in Tire Waste Generation
2010	$72,802,856	$22,867,319	$95,670,176	756,996
2011	$71,349,489	$22,787,024	$94,136,512	745,456
2012	$70,005,361	$22,739,017	$92,744,377	734,933
2013	$68,745,005	$22,720,656	$91,465,660	725,224
2014	$67,446,291	$22,682,395	$90,128,686	715,001
2015	$66,229,610	$22,669,409	$88,899,020	705,582
2016	$64,849,056	$22,586,351	$87,435,407	694,331
2017	$63,579,221	$22,536,649	$86,115,870	684,200
2018	$62,405,020	$22,511,531	$84,916,551	675,011
2019	$61,319,679	$22,505,721	$83,825,400	666,659
2020	$60,976,640	$22,833,773	$83,810,413	667,783
Average Annual	**~$66 million**	**~$23 million**	**~$90 million**	**~700,000**
Total Cost (2010 through 2020)	**~$730 million**	**~$250 million**	**~$980 million**	**~7.7 million**

Note: Summary totals are rounded values

Staff correspondingly determined that as a result of the Proposed Regulation, approximately 700,000 fewer waste tires per year would be generated in California, or a total of 7.8 million fewer tires between the periods 2010 through 2020. A summary of annual tire reduction by each vehicle category is presented in Table IX-11 below.

Table IX-11: Reduction in Annual Tire Waste Generation Due to the Proposed Regulation

Year	Passenger Car Tires	Light Duty Truck 1 Tires	Light Duty Truck 2 Tires	Medium Duty Vehicle Tires	Light Heavy Duty Vehicle Tires	Annual Tire Waste Reduction
2010	372,938	86,115	198,555	88,074	11,315	756,996
2011	367,894	85,547	194,812	86,250	10,953	745,456
2012	363,135	85,039	191,444	84,679	10,636	734,933
2013	358,616	84,572	188,374	83,307	10,354	725,224
2014	353,769	84,029	185,161	81,913	10,129	715,001
2015	349,268	83,534	182,176	80,667	9,937	705,582
2016	343,891	82,841	178,692	79,203	9,704	694,331
2017	339,086	82,229	175,505	77,875	9,504	684,200
2018	334,805	81,670	172,551	76,660	9,326	675,011
2019	330,988	81,134	169,821	75,544	9,173	666,659
2020	336,181	80,677	167,358	74,524	9,042	667,783
2010 through 2020	**3.8 million**	**920,000**	**2 million**	**890,000**	**110,000**	**7.7 million**
Average Annual	**350,000**	**83,000**	**182,000**	**80,000**	**10,000**	**700,000**

Note: Summary totals are rounded values

A summary of the total benefits of the Proposed Regulation is presented in Table IX-12 below.

Table IX-12: Summary of Total Benefits of the Proposed Regulation

Year	Total Annual Fuel Savings (gallons)	Annual Savings from Reduced Fuel Consumption (2008 dollars)	Reduction in Annual Tire Waste Generation Due to Proposed Regulation	Estimated Savings Due to Reduction in Premature Tread Wear (2008 dollars)	Total Annual Savings from Proposed Regulation (2008 dollars)
2010	89,366,609	$272,713,886	756,996	$95,670,176	$368,384,061
2020	60,315,404	$222,004,673	667,783	$83,810,413	$305,815,086
Average Annual Savings	**~75 million**	**~250 million**	**~700,000**	**$90 million**	**$340 million**

Note: Summary totals are rounded values

COST-EFFECTIVENESS OF THE PROPOSED REGULATION

Staff estimated the net benefits of the Proposed Regulation from the difference of the total costs estimated in Section IX.C and the total benefits estimated in Section IX.D. Average total net benefits from the Proposed Regulation for 2010 and 2020 were estimated to be $230 million (2008 dollars).

Staff notes that in addition to these net benefits, staff estimated that there will be health benefits associated with a reduction in PM emissions achieved by the Proposed Regulation.

The cost effectiveness for a measure is determined by calculating the ratio of annualized costs less benefits to the estimated annual reductions in emissions. For the Proposed Regulation costs and benefits (cost savings) determined above, the cost effectiveness is determined to be $103 million (average annual costs) less $337 million (average annual benefits or costs savings) divided by an estimated 0.73 $MMTCO_2E$ reduced per year for the period 2010 through 2020.

Therefore,

Cost Effectiveness = (103 million - 337 million) / (0.73 $MMTCO_2E$)
Cost Effectiveness ~ - 320 / $MTCO_2E$

Staff notes that a negative cost effectiveness implies zero net costs or net benefits for the Proposed Regulation.

E. Potential Impact on Employment, Business Creation, Elimination or Expansion

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the Proposed Regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states. Also, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance (DOF). The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

Staff determined that the Proposed Regulation is expected to have no adverse economic impact on California business enterprises. Since automotive repair and maintenance is a localized service, staff expects the Proposed Regulation to have no impact on the ability of California businesses to compete with businesses in other States. ASPs are expected to incur minor capital and operating expenditures to comply with provisions of the Proposed Regulation. In addition, all ASPs are expected to incur higher labor costs associated with the tire pressure check and inflate service. These costs were discussed in Section IX.C. Staff expects ASPs to recover their costs by passing on their costs to their customers (individual) either by increasing their labor service rates or by imposing an environmental fee on the invoice. Staff further determined that the

monetary impact of the Proposed Regulation on the individual (vehicle owner) is on average $4 per vehicle per year. This impact would cover the actual costs incurred by the ASPs.

Staff expects the Proposed Regulation to have a marginal positive impact on job creation by creating a demand for tire service specialists. Staff believes that by requiring ASPs to perform mandatory tire pressure checks and corrective action on all vehicles that come in for service, there would be an additional labor demand for tire service specialists. Staff based this assumption on an additional two tire pressure inspections per vehicle per year being performed on an initially estimated 25 million vehicles being serviced at California's 40,000 ASPs every year. Staff believes that for most ASPs, the additional labor demand will be met with productivity increases of existing auto mechanics and tire service specialists. However, staff expects some ASPs and car dealerships located in busy metropolitan / downtown areas to recruit additional entry-level auto mechanics or tire service specialists to perform the tire pressure check and inflate service.

Staff believes that there is likely to be a minor impact on retail fuel dispensing merchants and petroleum refiners. The fuel savings from the Proposed Regulation is expected to reduce fuel sales at retail fuel dispensing facilities (gas stations). Staff estimates that there are approximately 9,700 retail fuel dispensing facilities in California that would be affected by the Proposed Regulation. The value of this impact is a loss in sales of approximately 22 gallons per day per facility. Assuming retail margins to be 8.5 percent of the retail fuel price, the impact on retail fuel dispensing merchants is expected to be (22 gallons x $3.37 per gallon) x 8.5 percent x 347.6 days per year or ~$2,200 per year.

Similarly, refiners could see a reduction in fuel sales valued on average at $250 million per year. Assuming refining margins to be 6 percent, the potential loss to refiners could be $250 million x 6 percent or ~$15 million per year.

Staff also expects that prolonging tire life will result in fewer tire sales to tire sale merchants. While it is not known how many ASPs are engaged in tire sales or what proportion of tire sales come exclusively from tire specialty stores, the average impact would be approximately 700,000 fewer tires sold annually.

Staff believes that the Proposed Regulation is a proactive measure which will result in savings to the California consumer, provide additional health benefits, and reduce emissions and the generation of solid waste (tires). As a result, staff expects no impact of the Proposed Regulation on business expansion, elimination or creation.

State agencies such as the ARB are expected to incur enforcement costs associated with the Proposed Regulation. Staff has estimated that one personnel year (1 PY) at a cost of $167,000 per year would be dedicated to

enforcing the provisions of the Proposed Regulation, conducting outreach, and resolving conflicts and complaints. In addition, ARB expects to collaboratively work with local districts and other State agencies to enforce the provisions of the Proposed Regulation.

Staff also expects that reducing tire waste by an average 700,000 tires annually will result in lower revenues for both the California Integrated Waste Management Board (CIWMB) and ARB. Pursuant to Assembly Bill 923 (Firebaugh, 2004) which amends the California Tire Fee Act, a fee of $1.50 per new tire would be collected commencing January 1, 2007. Of the amount collected per new tire sold in California, $0.50 would be deposited in the Air Pollution Control fund for use by ARB and local districts to fund programs and projects that mitigate or remediate air pollution caused by tires. The bill requires the remaining revenues to be deposited to the California Tire Recycling Management Fund to fund existing waste tire programs. Staff estimates the potential loss of revenues to ARB and CIWMB from reduced sales of replacement tires as a result of the Proposed Regulation to be approximately $350,000 and $700,000 per year, respectively. For CIWMB, staff notes that the loss in revenue is in accordance with their mandate to reduce waste through source reduction[12]. Staff believes that the Proposed Regulation is one such measure.

X. Alternatives to the Proposed Regulation

Staff evaluated the costs and benefits associated with three alternatives. The first alternative would develop an outreach program administered by ARB (Alternative 1). The second alternative (Alternative 2) would require ASPs to purge air from vehicle tires and re-inflate with pure nitrogen (using a source such as compressed nitrogen from a cylinder or an off-the-shelf nitrogen generation/inflation system). Based on the data that staff evaluated, a determination was made that since tire pressure retention with pure nitrogen is better than that of air alone, differential benefits would be realized in between quarterly consumer visits to ASPs. The third alternative (Alternative 3) would require all affected vehicles to be equipped or retrofitted with a tire pressure monitoring system (TPMS) that displays the air pressure of the tires of the vehicles in real time and alerts the driver when the tire pressure falls to an under inflated level or condition. Since TPMS may be offered in newer model year vehicles, staff assumed that Alternative 3 would only impact the 2010 passenger vehicle inventory. Staff assumes that with Alternative 3, all individuals would take corrective action when notified and would derive equal or higher benefits than the Proposed Regulation.

[12] Per Public Resources Code section 40196, "source reduction" means any action which causes a net reduction in the generation of solid waste.

A. Outreach

ARB staff considered a consumer education and outreach program as an alternative to the Proposed Regulation. This alternative would develop an extensive outreach program aimed at improving consumer awareness about the benefits of proper tire inflation. In addition, there is currently multiple tire inflation outreach campaigns being conducted by the Integrated Waste Management Board, Bureau of Automotive Repair and the Rubber Manufacturers Association among many others that are aimed at improving consumer awareness of the benefits associated with proper tire inflation. Furthermore, ARB staff has already implemented a tire inflation education and outreach program to compliment the Proposed Regulation, but does not recommend outreach as a single alternative. Staff believes that current or additional outreach efforts alone will not achieve the needed GHG emission reductions. Staff plans to continue to incorporate ongoing outreach efforts in addition to the Proposed Regulatory requirements by participating in public events, sending monthly email reminders, and providing literature about the benefits of proper tire inflation.

B. Nitrogen Tire Inflation

The second alternative (Alternative 2) to the Proposed Regulation is nitrogen tire inflation. Those consumers who replace their vehicle tire air with pure nitrogen would benefit from higher gas retention in their tires. Staff notes that nitrogen inflation requires the tires to be serviced by an ASP; therefore, all affected vehicles would be initially serviced by an ASP. Staff further assumes that vehicle tires would be re-inflated or “topped-off” every time the vehicle was taken to an ASP for service. Alternatively, vehicle tires could be re-inflated or “topped-off” at retail fuel dispensing facilities, which are also required by State law (Assembly Bill 531) to offer free air with fuel purchase. Staff therefore factored costs for equipping retail fuel dispensing stations with nitrogen inflation systems. Staff notes that engineering costs for integrating the nitrogen inflation system with the air compressor, and installation costs for permanently mounting the nitrogen inflation system to the ground were not estimated. These costs could drive the total costs for installing nitrogen inflation system at retail fuel dispensing facilities much higher.

TOTAL COSTS FOR NITROGEN INFLATION

Total costs for Alternative 2 were determined by first estimating nitrogen inflation system present value costs for an estimated 40,000 ASPs and 9,700 retail fuel dispensing facilities in California (CEC, 2008). System costs for an additional 3,300 ASPs were also factored during subsequent years. These units are expected to cost approximately $6,500 each. Total system costs were estimated

to be $370 million (2008 dollars). The total system costs of Alternative 2 are presented in Table X-1 below.

Table X-1: Total System Present Value Costs for Alternative 2 (Nitrogen Inflation System)

Nitrogen Inflation System	Year	Total Number of Facilities Affected	Unit Cost (2008 dollars)	Total System Installation Costs (2008 dollars)	Total Cost (2008 dollars)
Cost to ASPs	2010	40,050	$6,467	$0	$259 million
Cost to ASPs	2011 through 2020	3,298	$6,467	$0	$21 million
Cost to Retail Fuel Dispensing Facility	2010	9,700	$6,467	Greater than $2,500[13]	$87 million
				Average Annualized Costs to Businesses	**$43 million**
				Total Annualized Costs (2010 – 2020)	**$470 million**

Note: Summary totals are rounded values

Staff then estimated initial labor costs for inflating vehicles with pure nitrogen and subsequent labor costs for quarterly re-inflation service. Staff estimates that the minimum amount of time it would take a tire specialist to raise the vehicle, dismount tires, deflate tires, purge tires, re-inflate with nitrogen, re-mount tires on the vehicle, and lower the vehicle would be 15 minutes. Initial labor costs to ASPs were estimated to be $160 million (2008 dollars). These costs are presented in Table X-2.

Table X-2: Initial Labor Costs for Alternative 2 (Nitrogen Inflation System)

Year	Total Number of Vehicles Affected	Compensation / Labor Rate (2008 dollars)	Estimated Time to Service Vehicle	Cost Per Vehicle	Total Annual Labor Costs (2008 dollars)
2010 through 2020	29 million	$21.94	15.00	$5.49	~$160 million

Note: Summary totals are rounded values

[13] Staff obtained one estimate at $2,500. Staff believes that actual installation costs may be higher due to the complexity of integrating such systems with the existing air compressor, providing weather resistant and theft-proof housing for the unit, and due to the need for electrical, piping and instrumentation, and civil engineering services with the permanent installation of the unit.

Subsequent labor costs for quarterly top-offs to proper inflation levels are estimated to be $1.0 billion for the period 2010 through 2020. These costs are presented in Table X-3 below.

Table X-3: Subsequent Labor Costs for Alternative 2 (Nitrogen Inflation System)

	Year	Total Number of Vehicles Affected	Compensation / Labor Rate	Estimated Time to Service Vehicle (min)	Cost Per Vehicle	Total Annual Labor Costs (2008 dollars)
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2010	25,025,399	$21.94	5[14]	$1.75	$43,875,066
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2011	25,477,989	$21.94	10[14]	$3.58	$91,253,495
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2012	25,939,575	$21.94	10	$3.58	$92,906,740
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2013	26,410,318	$21.94	10	$3.58	$94,592,781
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2014	26,854,611	$21.94	10	$3.58	$96,184,088
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2015	27,307,409	$21.94	10	$3.58	$97,805,856
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2016	27,692,450	$21.94	10	$3.58	$99,184,942
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2017	28,083,926	$21.94	10	$3.58	$100,587,076
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2018	28,481,987	$21.94	10	$3.58	$102,012,795
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2019	28,886,800	$21.94	10	$3.58	$103,462,698
Nitrogen Inflation Labor Costs - Quarterly Top-Off	2020	29,298,271	$21.94	10	$3.58	$104,936,447
					Total Labor Costs for Subsequent Nitrogen Inflation at ASPs	**~$1.0 billion**

Note: Summary totals are rounded values

[14]The estimated service time for quarterly visits after the initial year is based on an additional 2 annual visits per year and 5 minutes of time required to service each vehicle per visit (2 visits / year x 5 minutes / visit = 10 minutes per year). The estimated service time for subsequent top-off in the year 2010 is based on 10.46 minutes per year less 5 minutes (initial service visit).

Staff expects the minor capital and operating costs related to tire gauge and tire reference manual purchases incurred by the ASPs and the test-only smog check centers to be the same. In addition, the one-time programming and record-keeping charges (discussed in Appendix C) of $25 million (2008 dollars) applicable to all ASPs in the Proposed Regulation would also be applicable to ASPs offering nitrogen inflation for tires.

Total Costs for Alternative 2 to the Proposed Regulation which includes nitrogen inflation system costs, initial and subsequent labor costs for nitrogen inflation at ASPs, minor capital and operating costs at ASPs, and one-time programming and record keeping costs are summarized in Table X-4 below. Staff notes that total nitrogen inflation system costs identified in Table X-1 were annualized over an 11 year period (2010 through 2020) at a discount rate of 5 percent.

Table X-4: Total Costs for Alternative 2 to Proposed Regulation (Nitrogen Inflation System)

Year	Nitrogen Inflation System Costs (2008 dollars)	Total Labor Costs for All Facilities (2008 dollars)	Smog Check Centers Total O&M Costs (2008 dollars)	Auto Service Centers O&M Costs (2008 dollars)	All Facilities One-Time Programming & Record-keeping Costs (2008 dollars)	Total Cost of Regulation (2008 dollars)
2010	$41,652,410	$204,585,337	$161,125	$2,743,748	$2,226,265	$251,368,885
2011	$41,909,168	$91,253,495	$161,680	$2,743,748	$2,243,951	$138,312,042
2012	$42,165,925	$92,906,740	$163,105	$2,776,376	$2,261,777	$140,273,923
2013	$42,422,682	$94,592,781	$164,558	$2,793,151	$2,279,746	$142,252,919
2014	$42,679,440	$96,184,088	$166,005	$2,826,300	$2,297,857	$144,153,689
2015	$42,936,197	$97,805,856	$96,709	$2,826,300	$2,316,111	$145,981,173
2016	$43,192,955	$99,184,942	$98,535	$2,877,156	$2,334,511	$147,688,099
2017	$43,449,712	$100,587,076	$98,557	$2,877,156	$2,353,057	$149,365,559
2018	$43,706,469	$102,012,795	$99,487	$2,911,371	$2,371,751	$151,101,873
2019	$43,963,227	$103,462,698	$100,443	$2,928,962	$2,390,593	$152,845,922
2020	$44,219,984	$104,936,447	$101,387	$2,795,292	$2,409,584	$154,462,695
TOTAL	**~$470 million**	**~$1.1 billion**	**~$1.4 million**	**~$30 million**	**~$25 million**	**~$1.7 billion**
Average Annual Costs	**~$43 million**	**~$110 million**	**~$128,000**	**~$2.8 million**	**~$2.3 million**	**~$160 million**

Note: Summary totals are rounded values

TOTAL BENEFITS OF NITROGEN INFLATION

Benefits of Alternative 2 also include fuel savings and improved tire life from reduced tread wear as a result of proper inflation practices. While total costs for Alternative 2 were found to be substantially higher than the Proposed Regulation, both fuel savings and the estimated number of reductions in annual tire waste generation for all vehicle categories and fuel types were also found to be higher

than those for the Proposed Regulation. A summary of annual benefits is provided in Table X-5 below.

Table X-5: Summary of Total Benefits of Alternative 2 (Nitrogen Inflation System)

Year	Total Annual Fuel Savings (gallons)	Annual Savings from Reduced Fuel Consumption (2008 dollars)	Reduction in Annual Tire Waste Generation Due to Proposed Regulation	Estimated Savings Due to Reduction in Premature Tread Wear (2008 dollars)	Total Annual Savings from Proposed Alternative (2008 dollars)
2010	$99 million	$310 million	$850 million	$110 million	$410 million
2020	$70 million	$260 million	$760 million	$100 million	$350 million
Average Annual Savings	**~$80 million**	**~$280 million**	**~800,000**	**~$100 million**	**~$380 million**

Note: Summary totals are rounded values

Average annual CO_2 reductions from fuel savings of 84 million gallons are estimated to be 0.76 $MMTCO_2E$. Staff estimates that further reductions of 0.08 $MMTCO_2$ can be achieved from reducing tire waste. These emissions are related to lifecycle GHG emissions associated with the production and disposal of 800,000 tires. Total CO_2 reductions from implementing nitrogen tire inflation are estimated to be about 0.8 $MMTCO_2E$.

The basic check and inflate program is required for both the staff's Proposed Regulation and the nitrogen tire inflation proposed alternative. The difference is basically the additional capital costs associated with installing and maintaining the nitrogen inflation system, On an incremental basis, the net annual costs for the nitrogen inflation system is about $60 million, the net annual benefits are $40 million, and the net emissions benefits are (0.8 – 0.7) or 0.1 $MMTCO_2E$. Therefore, the incremental cost-effectiveness is $200 per $MMTCO_2E$.

C. Tire Pressure Monitoring Systems

Staff estimated total costs for a third alternative (Alternative 3) to the Proposed Regulation (retrofitting or equipping vehicles with a tire pressure monitoring system (TPMS)). Alternative 3 would impact an estimated 25 million vehicles in the year 2010. Thereafter, staff assumes that newer model year vehicles in subsequent years would be equipped with a TPMS that is capable of alerting the driver when the tire pressure drops 1 psi or lower than the recommended level. Staff also assumes that the tire pressure monitoring systems purchased in the year 2010 would transfer when older vehicles are being retired, replaced, or traded, enabling the owner to derive full utility from the TPMS device during the 2010 to 2020 period.

TOTAL COSTS OF TPMS

Staff determined that the TPMS systems can be purchased on average for ~$260 per unit. Staff further estimated professional installation costs based on the amount of time required to install the unit at prevailing auto mechanic total compensation rates. Total costs for Alternative 3 to the Proposed Regulation were determined to be $7.9 billion (2008 dollars) and are summarized in Table X-6. Staff also assumes that newer model year replacement vehicles would also be equipped with TPMS. There would be no other costs applicable to ASPs or affected businesses.

Table X-6: Total Cost for Alternative 3 to the Proposed Regulation (Retrofit Vehicles with Tire Pressure Monitoring Systems)

Year	Total Number of Vehicles Affected	TPMS Unit Cost (2008 dollars)	Installation Costs (2008 dollars)	Total System Costs (2008 dollars)	Total Cost (2008 dollars)
2010	~25 million	$257.00	$57.50	$314.50	~$7.9 billion
				Costs to California Automotive Owners:	**~$7.9 billion**
				Annualized Costs (2010 to 2020)	**~$950 million**

Note: Totals are rounded values

TOTAL BENEFITS OF TPMS

Benefits of Alternative 3 also include fuel savings and improved tire life from reduced tread wear as a result of proper inflation practices. Staff assumes that once the system is purchased and installed in the vehicle, proper tire inflation levels would be maintained at all times. Consumers would take immediate action to restore the tire pressures to proper inflation levels when alerted about an under inflation condition. While total costs for Alternative 3 were found to be substantially higher than the Proposed Regulation, both fuel savings and the estimated number of reductions in annual tire waste generation for all vehicle categories and fuel types were also found to be higher than those for the Proposed Regulation. A summary of annual benefits is provided in Table X-7 below.

Table X-7: Summary of Total Benefits of Alternative 3 (Tire Pressure Monitoring System)

Year	Total Annual Fuel Savings (gallons)	Annual Savings from Reduced Fuel Consumption (2008 dollars)	Reduction in Annual Tire Waste Generation Due to Proposed Regulation	Estimated Savings Due to Reduction in Premature Tread Wear (2008 dollars)	Total Annual Savings from Proposed Regulation (2008 dollars)
2010	125 million	$390 million	1.0 million	$138 million	$524 million
2020	90 million	$330 million	1.0 million	$134 million	$453 million
Average Annual	**110 million**	**$360 million**	**1.0 million**	**$130 million**	**$490 million**

Note: Totals are rounded values

Average annual CO_2 reductions from fuel savings of 110 million gallons are estimated to be 1.0 $MMTCO_2E$. Staff estimates that further reductions of 0.1 $MMTCO_2$ can be achieved from reducing tire waste. These emissions are related to lifecycle GHG emissions associated with the production and disposal of an estimated 1.0 million tires reduced annually from implementing the proposed alternative. Total CO_2 reductions from implementing the TPMS measure are estimated to be 1.1 $MMTCO_2E$.

For the costs and benefits (cost savings) determined above, the cost-effectiveness is determined to be ~$950 million (average annualized costs) less $490 million (average annual benefits or costs savings) divided by an estimated 1.1 $MMTCO_2E$ reduced.

Therefore,

Cost Effectiveness = ($950 million - $490 million) / (1.1 $MMTCO_2E$)
Cost Effectiveness ~ $430 / $MTCO_2E$

COST EFFECTIVENESS DETERMINATION FOR MAJOR REGULATIONS

A summary of the cost-effectiveness for the Proposed Regulation and the alternatives to the Proposed Regulation considered is presented in Table X-8 below:

Table X-8: Cost Effectiveness Determination for the Proposed Regulation and Alternatives to the Proposed Regulation

	Average Annual Costs (2008 dollars)	Average Annual Benefits (2008 dollars)	Net Costs Less Benefits (2008 dollars)	Average Annual Emissions Reduction ($MMTCO_2E$)	Cost Effectiveness ($/MTCO_2E$)
Proposed Regulation	$100 million	$340 million	($240 million)	0.7	($320)
Alternative 1 (Outreach)	NA	NA	N/A	NA	NA
Alternative 2[15] (Nitrogen Inflation)	$160 million	$380 million	($220 million)	0.8	($200)*
Alternative 3 (TPMS)	$950 million	$490 million	$460 million	1.1	$430

*Cost-effectiveness calculated relative to Proposed Regulation

Staff believes that the Proposed Regulation achieves the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions as required by the AB 32. When compared to the alternatives proposed, the provisions of the Proposed Regulation can be easily and expeditiously implemented without a substantial investment in business capital or operating costs.

XI. Requirements of AB 32

AB 32, at Health and Safety Code section 38560.5, requires that ARB adopt regulations by January 1, 2010, to implement discrete early action GHG emission reduction measures. These measures must "achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions" from the sources identified for early action measures. AB 32 contains additional standards in Health and Safety Code section 38562 that apply to regulations that will be adopted for general emissions reductions consistent with ARB's scoping plan. In addition, AB 32 requires that the reductions be real, permanent, quantifiable, verifiable, and enforceable. Furthermore, section 38565 requires the Board to "ensure that the greenhouse gas emission reduction rules,

[15] Staff determined an incremental cost-effectiveness compared to the Proposed Regulation.

regulations, programs, mechanisms, and incentives under its jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California and provide an opportunity for small business, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions." Staff believes that the tire pressure program was developed in accordance with the requirements of AB 32 and has outlined the additional requirements set forth in section 38562 below.

1. Design the regulations, including distribution of emissions allowances where appropriate, in a manner that is equitable, seeks to minimize costs and maximize the total benefits to California, and encourages early action to reduce greenhouse gas emissions.

The Proposed Regulation utilizes existing consumer vehicle maintenance routines in order to maximize benefits and minimize costs. See Sections IX and X for the (Economic Impacts and Alternatives Considered) for a detailed discussion.

2. Ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities.

Passenger vehicles operate throughout California; no disproportionate localized impacts are expected. Greater GHG and PM reductions would occur in regions located near interstate highways, typically where low-income communities are located.

3. Ensure that entities that have voluntarily reduced their greenhouse gas emissions prior to the implementation of this section receive appropriate credit for early voluntary reductions.

This requirement is not applicable to the proposed regulation.

4. Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions.

The Proposed Regulation would support ARB's efforts to achieve federal and State standards for PM. Vehicles with properly inflated tires will consume less fuel. Reductions in PM emissions are due to the decreased consumption of fuel. See Section VIII (Health Impact Assessment) for a detailed description.

5. Consider cost effectiveness of these regulations

The Proposed Regulation is expected to result in a net benefit for Californians by reducing fuel consumption; reducing emissions and increasing tire tread life. See Section IX (Economic Impacts) for a detailed discussion.

6. Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy environment and public health

The Proposed Regulation for under inflated vehicle tires is expected to achieve multiple benefits to society and the environment. California would benefit from the reduction of GHG and PM emissions that result from vehicles operating with under inflated tires. In addition, Californian's would eliminate over 1.3 million tires from entering the waste stream annually. See Section VII (Environmental Impacts) for a detailed description.

7. Minimize the administrative burden of implementing and complying with these regulations.

The administrative burden of the Proposed Regulation is expected to be minimal. The proposed regulation requires an indication on the vehicle service invoice that a tire pressure service was conducted. Compliance inspections would be conducted by ARB authorized representatives. See Section IV (Proposed Regulation) for a detailed description.

8. Minimize leakage.

Leakage occurs when an emission limit or regulatory requirement set by the State causes business activities to be displaced outside of California. If leakage were to occur, emissions, jobs and other economic benefits to California would be lost. Leakage is not expected as a result of the proposed regulation.

9. Consider the significance of the contribution of each source or category of sources to statewide emissions of greenhouse gases.

The transportation sector, which includes on-road vehicles, aviation, rail and ships, is the largest contributor to the total statewide GHG emissions inventory, producing approximately 38 percent of the state's total GHGs or 179 $MMTCO_2E$. Emissions from the transportation sector must be significantly reduced in order to achieve 1990 GHG levels by the year 2020.

The statewide GHG emission benefits of the proposed regulation are projected to be 0.6 $MMTCO_2E$ emissions in 2020. From 2010 through 2020, the cumulative

GHG emission benefits are estimated to be approximately 8.0 MMTCO$_2$E statewide. See Section VII (Environmental Impacts) for a detailed description.

XII. Issues

One of the key issues with the Proposed Regulation is determining the appropriate tire inflation level (i.e., cold verses hot tire inflation). Vehicle manufacturers recommend a tire inflation specification for cold tires. A tire is considered cold if it has not been driven for at least three hours. A tire is considered hot if it has been driven for over three miles causing the air pressure to increase as the temperature in the tire increases. Due to the variation in hot verses cold tire inflation conditions and the difficulty of ensuring that tires are filled under cold conditions, staff is proposing that all tires be filled to the manufacturers recommended pressure, and that consumers are made aware that the tires pressures should be rechecked after they have sat idle for more than three hours. Staff plans to work with industry experts to develop a tire inflation guideline and will make it available electronically at www.arb.ca.gov/tirepressure.

XIII. Recommendation

Staff recommends the Board approve the Proposed Regulation for under inflated vehicle tires as presented in Appendix A of the staff report. The Proposed Regulation supports AB 32 by achieving real, quantifiable, enforceable, and cost-effective reductions of GHG emissions. The Proposed Regulation also reduces exposure to PM and the number of vehicle tires entering the waste stream.

XIV. References

ARB, 2001. California Air Resources Board. Policies and Actions for Environmental Justice. Sacramento: December 13, 2001 http://www.arb.ca.gov/ch/programs/ej/ej.htm

ARB, 2002a. California Air Resources Board. California Air Resources Board Strategic Plan. Sacramento: January 2002 http://www.arb.ca.gov/planning/plan01/plan01.htm

ARB, 2002b. California Air Resources Board and Office of Environmental Health Hazard Assessment. Staff Report: Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates, available at http://www.arb.ca.gov/research/aaqs/std-rs/pm-final/pm-final.htm

ARB, 2007. California Air Resources Board. "Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration. " Sacramento: October 2007 http://www.arb.ca.gov/cc/ccea/reports/reports.htm

ARB, 2008a. California Air Resources Board. Greenhouse Gas Inventory Data – Draft 2020 Forecast. July 29, 2008 http://www.arb.ca.gov/cc/inventory/data/forecast.htm

ARB, 2008b, California Air Resources Board. Climate Change Proposed Scoping Plan. Sacramento: October 2008 http://www.arb.ca.gov/cc/scopingplan/document/psp.pdf

CEC, 2005. California Energy Commission, Optimization of Product Life Cycles to Reduce Greenhouse Gas Emissions in California, August 2005. http://www.energy.ca.gov/2005publications/CEC-500-2005-110/CEC-500-2005-110-F.PDF

CEC, 2007. California Energy Commission, Transportation Energy Forecasts for the 2007 Integrated Energy Policy Report, September 2007. http://www.energy.ca.gov/2007publications/CEC-600-2007-009/CEC-600-2007-009-SF.PDF

CEC, 2008. California Energy Commission. Fuel Deliver Temperature Study Staff Report. CEC-600-2008-012-SF. November 2008 http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-600-2008-012-SF

CIWMB, 2007. California Integrated Waste Management Board. Used Oil Source Reduction Study: "Busting the 3,000 Mile Myth" March 2007 http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1240

EMFAC2007. Air Resources Board, Emission Factors Model (EMFAC2007 version 2.3), 2007.

Firebaugh, 2004, Assembly Bill 923 September 23, 2004 http://www.leginfo.ca.gov/pub/03-04/bill/asm/ab_0901-0950/ab_923_bill_20040923_chaptered.pdf

IPCC, 2007. Climate Change 2007: The Physical Science Basis Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Solomon, S., D. Qin, N. Manning, Z. Chen, M. Marquis, K.B. United Kingdom and New York, NY, USA. http://www.ipcc.ch/ipccreports/ar4-wg1.htm

NHTSA, 2005. U.S. Department of Transportation, National Highway Transportation Safety Association, Tire Pressure Monitoring System FMVSS No. 138. March 2005 http://www.nhtsa.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/TPMS-2005-FMVSS-No138.pdf

Nunez, 2006. Assembly Bill No. 32 September 27, 2006 http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf

Pavley, 2002. Assembly Bill No 1493 July 22, 2002 http://www.leginfo.ca.gov/pub/01-02/bill/asm/ab_1451-1500/ab_1493_bill_20020722_chaptered.pdf

RMA, 2008, Rubber Manufacturer's Association, "Be Tire Smart, Play Your Part" (Consumer Education Program), 2008. http://www.rma.org/tire_safety/tire_maintenance_and_safety/how_to_take_care_of_your_tires/

Steinberg, 2008. Senate Bill SB375 September 30, 2008 http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf

U.S. EPA, 2006. U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Fuel Economy Labeling of Motor Vehicle Revision to Improve Calculation of Fuel Economy Estimates, EPA420-R-06017, December 2006 http://www.epa.gov/fueleconomy/420r06017.pdf

Appendix A: Proposed Regulation to Reduce Greenhouse Gas Emission From Under Inflated Vehicle Tires

Proposed Regulation Order

Regulation for Under Inflated Vehicle Tires

Adopt new section 95550 of article 1, chapter 1, subchapter 10, division 3, title 17, California Code of Regulations, to read as follows:

Section 95550 Purpose and Definitions

(a) Purpose. The purpose of this regulation is to reduce greenhouse gas emissions from vehicles operating with under inflated tires.

(b) Applicability.

(1) This regulation applies to all automotive service providers performing or offering to perform automotive maintenance or repair services in California.

(2) This regulation does not apply to:

(A) auto body and paint facilities;

(B) auto glass installers;

(C) auto parts distributers or retailers;

(D) auto wreckers or dismantlers;

(E) vehicles with a GVWR over 10,000 lbs.;

(F) tires determined to be unsafe by an automotive service provider;

(c) Definitions.

(1) “ANSI B40.1 Grade B Tire Pressure Gauge” means a dial-type tire gauge that meets or exceeds the American National Standards Institute mechanical accuracy rating.

(2) “ARB” means the California Air Resources Board.

(3) “Auto Body and Paint Facility” means a business that repairs, reconstructs, or paints motor vehicles and does not perform or offer to perform automotive maintenance or repair services.

(4) “Auto Glass Installer” is a business that repairs or replaces damaged automotive windshields and windows and does not perform or offer to perform automotive maintenance or repair services.

(5) “Auto Parts Distributer” is a business that sells replacement parts or performance accessories for cars, trucks, vans and sport utility vehicles and does not perform or offer to perform automotive maintenance or repair services.

(6) “Auto Wrecker or Dismantler” means an automotive dismantler, as defined in title 13, California Code of Regulations section 220 of the vehicle code and does not perform or offer to perform automotive maintenance or repair services.

(7) “Automotive Maintenance or Repair Services” includes, but is not limited to, the performance of any automotive diagnostics of or repairs made to a motor vehicle.

(8) “Automotive Service Provider (ASP)” is any business or person who performs or offers to perform automotive maintenance or repair services (including, but not limited to, automotive dealerships, maintenance garages, oil change facilities, tire centers, and smog check or test only facilities).

(9) “Gross Vehicle Weight Rating (GVWR)” is defined in Vehicle Code Section 350.

(10) “Tire Inflation Guidebook or Yearbook” is a book that contains tire inflation specifications for original equipment tires and wheels and non-original equipment sized tires and wheels. Tire inflation Guidebooks and Yearbooks can be purchased online, from local tire dealers, or from most tire manufacturers.

(11) “Under Inflated Tire” means a tire that is one pound per square inch (psi) or more below the manufacturer’s recommended pressure.

(12) “Unsafe Tires” means any tire deemed unsafe by the Automotive Service Provider due to tire wear, age, tread irregularity, or damage. Examples include any tire with exposed ply or cord, sidewall crack, bulge, knot, or ply separation.

(13) “Vehicle Service Invoice” is a document given to the customer that meets the invoice requirements of Business and Professions Code section 9884.8 of the California Code of Regulations section 3356.

(d) **Requirements and Compliance Deadlines.** Automotive service providers must meet the following requirements:

(1) By July 1, 2010, all automotive service providers are required to:

(A) check and inflate each vehicle's tires to the manufacturer's recommended pressure at the time of performing any automotive maintenance or repair service; and

(B) indicate on the vehicle service invoice that a tire inflation service was completed and the tire pressures after the service was performed. If a tire inflation service was not performed (i.e. tire(s) were deemed unsafe the automotive service provider must indicate on the vehicle service invoice why the service was not completed; and

(C) use and maintain a ANSI B40.1 Grade B tire gauge for checking tire pressure; and

(D) maintain, on the premises, a tire inflation guidebook or yearbook that is current within three years; and

(E) keep the vehicle service invoice onsite in accordance with the Business and Professions Code Section 9884.11 of the California Code of Regulations section 3356; and

(F) provide documentation of the vehicle service invoice to authorized enforcement personnel upon demand.

Any tires inflated with pure nitrogen gas are also subject to the requirements in section (d)(1)(A-F), but may refuse the inflation portion of the service if a nitrogen inflation system is not available at the time of the service.

(e) **Penalties.** Any automotive service provider or owner or operator who fails to comply with the requirements of this regulation may be subject to penalties pursuant to Section 38580 of the Health and Safety Code.

(f) **Enforcement.** Enforcement of this section may be carried out by ARB personnel, and any authorized representatives of ARB.

(g) **Relationship To Other Law.** Nothing in this section allows automotive service providers to operate in violation of other applicable laws, including but not limited to:

(1) California Vehicle Code

(2) any applicable ordinance, rule or requirement as stringent as, or more stringent than the requirements in section (d) of this regulation.

(h) **Severability.** If any subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of this regulation is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, such portion will be deemed as a separate, distinct, and independent provision, and such holding will not affect the validity of the remaining portions of the regulation.

Note: Authority cited: Sections 38510, 38560, 39600, and 39601, Health and Safety Code. Reference: Sections 38510, 38560, 39600, Health and Safety Code.

Appendix B: Tire Pressure Survey

B.1: Staff Tire Pressure Surveys

Since the National Highway Transportation Administration (NHTSA) On road Tire Pressure Survey (U.S. EPA, 2006) was conducted in 2001, staff conducted surveys to corroborate the results of the original study. Staff conducted two public tire pressure surveys during the month of November 2008 to confirm that the NHTSA under inflation study is representative of the current conditions of California registered vehicle tires.

Staff conducted the first survey on November 3, 2008 at a retail fuel dispensing facility in Sacramento, California. Two shifts of two ARB staff persons each polled customers at the Pocket Road Shell fuel dispensing facility. Upon their consent, staff measured the tire pressures to profile levels of inflation. The first shift was conducted from 8:00 AM to 12:30 PM. The second shift was conducted from 12:30 PM to 5:00 PM. Staff randomly sampled 93 passenger vehicles during the first survey. The staff measured the pressures of all vehicle tires and recorded the vehicle's manufacturer recommended tire inflation level(s). In the absence of the manufacturer recommended rated tire pressure level, staff noted the make and model year of the vehicle and retrieved the appropriate tire inflation level for the vehicle. Staff recognized that a majority of the vehicles sampled had "hot"[16] tire pressure conditions. However, for the purposes of the survey, the measured tire inflation levels were compared to the vehicle manufacturer recommended or rated tire inflation levels. The rated tire inflation levels are typically measured during "cold"[17] tire conditions.

The results of the first survey were divided into two vehicle categories to correspond with the vehicle categories defined in the NHTSA study. These categories include passenger cars and light duty trucks up to 3,750 pounds loaded vehicle weight (LVW), and all other light duty, medium duty, and light heavy duty vehicles with LVW from 3,751 pounds to 10,000 pounds gross vehicle weight ratings (GVR). Both front and rear measured tire pressures for each vehicle were recorded and then compared to the manufacturer recommended rated tire pressure to profile a level of inflation. If the average tire pressure for all four tires was found to be between 6 and 12 psi below the rated pressure, the vehicle was classified as being a severely under inflated vehicle. Similarly, if the average tire pressure for all four tires was found to be between 1 and 6 psi below the rated pressure, the vehicle was classified as being a moderately under inflated vehicle. Lastly, if the average tire pressure of all four tires measured was found to be less than 1 psi below the rated pressure, the vehicle was classified as being a properly inflated. The first survey results for all 93 vehicles are presented in Table B-1 below.

[16] A tire is considered to be a "hot" tire if the vehicle has been indriven for over three miles. Operation of the vehicle causes the air in the tire to expand and the inner tire air temperature to rise. As a result, "hot" tires are likely to have higher measured tire pressures than tires measured in "cold" or non-operational conditions.

Table B-1: Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVWR)								
Toyota	Sienna	35	25	23	35	25	21	-11.50
Chevrolet	Silverado	45	33	33	45	34	34	-11.50
Ford	F150	35	25	25	35	25	23	-10.50
Toyota	Sienna	35	25	25	35	25	26	-9.75
Dodge	Dakota	35	28	27	35	20	28	-9.25
Chevrolet	1500 4X4	35	30	17	35	30	30	-8.25
Land Rover	Range Rover	28	17	24	41	30	38	-7.25
Ford	Explorer	35	28	28	35	28	28	-7.00
Toyota	Sienna	35	29	28	35	28	28	-6.75
23.7%	**Population of SUV[17]**						**Mean Pressure**	**-9.08**
							Std Dev	**1.87**
Nissan	Quest	35	29	30	35	30	28	-5.75
Dodge	Caravan	35	29	28	35	30	31	-5.50
Toyota	Rav4L	29	29	30	29	17	18	-5.50
Toyota	Sienna	35	30	28	35	35	26	-5.25
Ford	F150	30	27	27	35	27	28	-5.25
Toyota	Unknown	29	28	27	35	26	27	-5.00
Ford	Expedition	30	31	25	35	32	24	-4.50
Ford	Ranger	32	27.5	28	32	29	28	-3.88
Ford	Explorer	35	31	31	35	32	31	-3.75
Ford	F150	35	32	32	35	32	30.5	-3.38
Toyota	Sienna	35	30	33	35	33.5	35	-2.13
Ford	Expedition	35	33	33	35	33	33	-2.00
Chrysler	Pacifica	33	33	34	33	28	31	-1.50
Chevrolet	S10	30	40	39	35	23	23	-1.25
36.8%	**Population of MUV[18]**						**Mean Pressure**	**-3.90**
							Std Dev	**1.61**

[17] Vehicles determined to be severely under inflated vehicles (SUV). A vehicle is classified as a SUV if the average measured under inflation level of all four tires on the vehicle was found to be between -12.00 and -6.00 psi.

[18] Vehicles determined to be moderately under inflated vehicles (MUV). A vehicle is classified as a MUV if the average measured under inflation level of all four tires on the vehicle was found to be between -5.99 and -1.00 psi.

Table B-1: (Continued) Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVWR)								
Ford	Ranger	30	29	29	30	30	29	-0.75
Honda	Odyssey	33	35	32	35	32	36	-0.25
Honda	Odyssey	36	36	36	36	35	36	-0.25
GM	Equinox LS	35	34	35	35	35	35	-0.25
Ford	Explorer	30	33	31	35	32	34	0.00
Mazda	Tribute	30	30	31	30	30	29	0.00
Toyota	Tundra	26	31	29	35	32	31	0.25
Chevrolet	Colorado	33	35	32	33	38	29	0.50
Chevrolet	Unknown	35	36	36	35	37	36	1.25
Ford	F150	35	36	37	35	36	36	1.25
Dodge	Dakota	35	40	39	35	38	38	3.75
GMC	Suburban	35	33	33	35	45	48	4.75
Ford	Explorer	26	31	31	26	31	31	5.00
GMC	Sierra	35	42	40	35	41	41	6.00
Chevrolet	Express Van	45	60	60	60	67	68	11.25
39.5%	**Population of PIV[19]**						**Mean Pressure**	**2.17**
							Std Dev	**3.36**

[19] Vehicles determined to be properly inflated vehicles (PIV). A vehicle is classified as a PIV if the average measured inflation level of all four tires on the vehicle was found to be between -0.99 or higher above the vehicle's manufacturer recommended inflation level.

Table B-1: (Continued) Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
PASSENGER CARS / TRUCKS (0 - 3,750 lb LVW)								
Toyota	Camry	32	24	24	32	15	14	-12.75
Nissan	Sentra	33	24	23	33	21	23	-10.25
BMW	740iL	32	24	27.5	39	28	22	-10.13
Honda	Prelude	32	22	21	32	21	24	-10.00
BMW	740i	35	25	27	39	28	28.5	-9.88
Toyota	Corolla	32	21	25	32	22	23	-9.25
Saturn	Unknown	30	32	22	26	14	8	-9.00
Volvo	S60	35	26	26	35	27	26	-8.75
Toyota	Camry	32	26	26	32	27	15	-8.50
Honda	Accord	32	24	28	32	22	21	-8.25
Honda	Civic	32	23	24.5	32	23	24.5	-8.25
Toyota	Unknown	32	23	23	32	24	25	-8.25
Toyota	Camry	32	31	31	32	5	29	-8.00
Plymouth	Breeze	30	29	24	30	24	12	-7.75
Unknown	Unknown	32	24	24	32	29	23	-7.00
Toyota	Camry	32	25	25	32	26	25	-6.75
Honda	Civic	30	22	21	29	25	24	-6.50
Ford	Focus	32	20	28	32	19	35	-6.50
Ford	Focus	32	26	26	32	26	26	-6.00
Ford	Focus	32	34	28	32	28	14	-6.00
Dodge	Neon	32	28	26	32	25	25	-6.00
38.2%	**Population of SUV**						**Mean Pressure**	**-8.27**
							Std Dev	**1.74**

Table B-1: (Continued) Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
PASSENGER CARS / TRUCKS (0 - 3,750 lb LVW)								
Chevrolet	Prism	30	25	24	30	24	24	-5.75
Ford	Focus	34	30	28	34	30	29	-4.75
Ford	Focus	32	32	33	32	22	23	-4.50
Nissan	Maxima	32	32	25	32	25	28	-4.50
Toyota	Corolla	30	25	26	30	26	26	-4.25
Ford	Taurus	33	29	30	33	29	28	-4.00
Honda	Civic	32	33	27	32	26	26	-4.00
Kia	Sephia	29	27	24	29	23	27	-3.75
Honda	Accord	32	26	29	32	30	28	-3.75
Acura	2.5 TL	30	31	31	29	26	15	-3.75
Lexus	LS400	32	27	27	32	31	29	-3.50
Hyundai	Accent	30	26	28	30	26	27	-3.25
Mercedes	280 CE	28	27	28	32	28	29	-2.00
Toyota	Camry	32	17.5	36	32	33	34.5	-1.75
Toyota	Camry	29	22	12	29	38	40	-1.00
Mitsubishi	Diamante	32	29	27	26	27	29	-1.00
Ford	Crown Victoria	30	31	31	34	32	30	-1.00
30.9%	**Population of MUV**						**Mean Pressure**	**-3.32**
							Std Dev	**2.21**

Table B-1: (Continued) Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
PASSENGER CARS / TRUCKS (0 - 3,750 lb LVW)								
Lexus	LS430	33	30	31	33	30	39	-0.50
Acura	TL Type-S	35	33	36	32	32	32	-0.25
Honda	Accord	29	29	29	29	29	28	-0.25
Honda	Accord	30	30	30	30	30	30	0.00
Toyota	Solara	29	29	29	29	30	28	0.00
Chevrolet	Malibu	30	30	30	30	30	30	0.00
Honda	CR-V	30	28	30	30	33	30	0.25
Mazda	Six	32	32	34	32	34	32	1.00
BMW	325i	29	23	34	32	35	34	1.00
Toyota	Corolla	30	33	32	30	33	32	2.50
Subaru	Outback	30	32	31	29	33	34	3.00
Volvo	S70	32	35	33	29	34	35	3.75
Toyota	Camry	30	34	35	30	33	34	4.00
Toyota	Corolla	30	35	34	30	36	36	5.25
Honda	Unknown	33	39.5	42	35	44	41.5	7.75
Kia	Sedona	35	46	47	35	46	47	11.50
Honda	Civic	30	47	48	29	48	44.5	17.38
30.9%	**Population of PIV**						**Mean Pressure**	**3.32**
							Std Dev	**4.89**

A summary of the results of the first staff survey are presented in Table B-2.

Table B-2: Summary of Staff Tire Pressure Survey Number 1 (Pocket Road Shell, Sacramento, California)

PASSENGER CARS / TRUCKS (0 lb to 3,750 lb LVW)			
Population of Vehicles with Severely Under Inflated Tires	38.2%	Mean Pressure (psi)	-8.27
		Std Dev	1.74
Population of Vehicles with Moderately Under Inflated Tires	30.9%	Mean Pressure (psi)	-3.32
		Std Dev	2.21
Population of Vehicles with Properly Inflated Tires	30.9%	Mean Pressure (psi)	3.32
		Std Dev	4.89
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVR)			
Population of Vehicles with Severely Under Inflated Tires	23.7%	Mean Pressure (psi)	-9.08
		Std Dev	1.87
Population of Vehicles with Moderately Under Inflated Tires	36.8%	Mean Pressure (psi)	-3.90
		Std Dev	1.61
Population of Vehicles with Properly Inflated Tires	39.5%	Mean Pressure (psi)	2.17
		Std Dev	3.36

The second survey was conducted by staff on November 13, 2008 at a fuel dispensing facility (Sheldon Road Shell) located in Elk Grove, California. Two shifts of two ARB staff persons each polled customers at the facility and upon their consent, measured their vehicle tire pressures to profile levels of inflation. The first shift was conducted from 8:00 AM to 12:30 PM. The second shift was conducted from 12:30 PM to 5:00 PM. Staff randomly sampled 92 passenger vehicles during the second survey. The tire pressures of all four vehicle tires as well as the vehicle's manufacturer recommended tire inflation level(s) were measured. In the absence of the manufacturer recommended rated tire pressure level, staff noted the make and model year of the vehicle and retrieved the appropriate tire inflation level for the vehicle. Staff recognized that a majority of the vehicles sampled had "hot" tire pressure conditions. However, for the purposes of the survey, the measured tire inflation levels were compared to the vehicle manufacturer recommended or rated tire inflation levels. The rated tire inflation levels are typically measured during "cold" tire conditions.
The results of the second survey were divided into two vehicle categories to correspond with the vehicle categories defined in the NHTSA study. These categories include passenger cars and light duty trucks up to 3,750 pounds LVW, and all other light duty, medium duty, and light heavy duty vehicles with LVW from 3,751 pounds to 10,000 pounds gross vehicle weight ratings (GVR). Both

front and rear measured tire pressures for each vehicle were recorded and then compared to the manufacturer recommended rated tire pressure to profile a level of inflation. If the average tire pressure for all four tires was found to be between 6 and 12 psi below the rated pressure, the vehicle was classified as being a severely under inflated vehicle. Similarly, if the average tire pressure for all four tires was found to be between 1 and 6 psi below the rated pressure, the vehicle was classified as being a moderately under inflated vehicle. Lastly, if the average tire pressure of all four tires was found to be up to 1 psi below the rated pressure, the vehicle was classified as being a properly inflated vehicle. The second survey results for all 92 vehicles are presented in Table B-3.

Table B-3: Staff Tire Pressure Survey Number 2
(Sheldon Road Shell, Elk Grove, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVR)								
Ford	F150	30	20	25	35	24	26	-8.75
Dodge	Durango	35	30	30	41	29	29	-8.50
Chevrolet	Astro	35	27	26	35	27	27	-8.25
Plymouth	Voyager	35	29	29	35	27	26	-7.25
Ford	Club Wagon XLT	55	62	60	80	60	60	-7.00
Chevrolet	Suburban	35	31	30.5	35	26	25.5	-6.75
16.7%	**Population of SUV**						**Mean Pressure**	**-7.75**
							Std Dev	**0.85**
Dodge	Caravan	35	33.5	30	35	26	30	-5.13
Honda	CRV	29	25	25	29	26	20	-5.00
Kia	Sedona	35	30	30	35	32	31	-4.25
Jeep	Grand Cherokee	33	29.5	29.5	33	28	30	-3.75
Chevrolet	Suburban	35	30.5	31	35	32	32	-3.63
Dodge	Dakota	35	32	31	35	32	31	-3.50
Mazda	CX7	32	30	33	32	29	28	-2.00
Chrysler	Aspen	32	30	30	32	31.5	30	-1.63
Chevrolet	Custom Deluxe	32	31.5	30	35	34	32	-1.63
Chevrolet	Tahoe	32	32	31	32	29	30	-1.50
27.8%	**Population of MUV**						**Mean Pressure**	**-3.20**
							Std Dev	**1.41**

Table B-3: (Continued) Staff Tire Pressure Survey Number 2 (Sheldon Road Shell, Elk Grove, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVR)								
GMC	Suburban SLT	35	39	29	35	35	34	-0.75
Dodge	Ram	35	33.5	34	35	35	35	-0.63
Toyota	T100	33	34	35	35	33.5	33	-0.13
Nissan	Murano	33	32	32.5	33	35	33.5	0.25
Toyota	Tacoma	29	30	29	29	30	29	0.50
Jeep	Grand Cherokee	33	34	33	33	34	33	0.50
Toyota	Sienna	35	34	36.5	35	37	35	0.63
GMC	Ext. 1500	45	50	45	45	45	43.5	0.88
Ford	E250	50	70	62	80	70	63	1.25
Ford	F150	29	32	33	32	30	34	1.75
Infiniti	FX35	32	35	32	32	35	34	2.00
Jeep	Grand Cherokee	33	37	37	33	30	37	2.25
Ford	Expedition	30	35	39	35	32	33.5	2.38
Isuzu	Rodeo	26	30	29	26	28	28	2.75
GMC	Yukon	35	39	40	35	34.5	40	3.38
Pontiac	Torrent	30	37	34	30	35.5	34	5.13
Ford	Explorer	30	40	39	35	39	34	5.50
Ford	Explorer	26	35	30.5	26	33	33	6.88
Nissan	Pathfinder	26	38	35	26	38	39	11.50
Ford	Expedition	30	67	75	35	35	37	21.00
55.6%	**Population of PIV**						**Mean Pressure**	**3.35**
							Std Dev	**5.10**

Table B-3: (Continued) Staff Tire Pressure Survey Number 2 (Sheldon Road Shell, Elk Grove, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
PASSENGER CARS / TRUCKS (0 lb to 3,750 lb LVW)								
Ford	Mustang	35	25	24	35	25	23	-10.75
BMW	328i	33	25	27	41	27	29	-10.00
Honda		32	29	19	32	21	20	-9.75
Buick	Olds	35	27	27	35	27	27	-8.00
Hyundai	Accent	30	20	29	30	20	20	-7.75
Toyota	Corolla	30	23	20	30	25	22	-7.50
Plymouth	Breeze	35	26	30	35	29	27	-7.00
Toyota	Tercel	34	27	26	32	27	25	-6.75
Volkswagen	Jetta	28	22	20	26	24	17	-6.25
BMW		33	34	32	41	30	28	-6.00
17.9%	**Population of SUV**						**Mean Pressure**	**-7.98**
							Std Dev	**1.65**
Honda	Civic	32	27	25.5	32	26	29	-5.13
Ford	Taurus	33	26	30	33	28	29	-4.75
Nissan	350Z	35	31	30	35	31	30	-4.50
Ford	Probe	32	23	20	26	21	35	-4.25
Scion	XB	35	26	31	32	30	32	-3.75
Chrysler	Sebring	30	21	31.5	30	26	28	-3.38
Toyota	Camry	30	26	26	30	27	28	-3.25
Toyota	Avalon	32	29	30	32	27	29	-3.25
Honda	Civic	30	26	27	30	27	27	-3.25
Lexus	ES300	32	30	30	32	26	30	-3.00
Honda	Civic	32	30	32	32	29	29	-2.00
Dodge	Neon	32	30	32	32	30	29.5	-1.63
Lexus	ES300	32	31	31	32	30	30	-1.50
Nissan	Altima	29	28	28	29	28	28	-1.00
25.0%	**Population of MUV**						**Mean Pressure**	**-3.19**
							Std Dev	**1.27**

Table B-3: (Continued) Staff Tire Pressure Survey Number 2 (Sheldon Road Shell, Elk Grove, California)

Make	Model	Recommended Front (psi)	Measured Right Front (psi)	Measured Left Front (psi)	Recommended Rear (psi)	Measured Right Rear (psi)	Measured Left Rear (psi)	All 4 Tires Average Inflation Level (psi)
PASSENGER CARS / TRUCKS (0 lb to 3,750 lb LVW)								
Honda	Civic	30	30	30	29	27	27.5	-0.88
Toyota	Camry	29	27	26	29	30	30	-0.75
Ford	Escort	32	31.5	30	32	32.5	32	-0.50
Chevrolet	Classic	30	31.5	29.5	30	29.5	30	0.13
Buick	Park Avenue	30	30.5	29	30	30	31	0.13
Scion	TC	32	35	38	29	24	26	0.25
Toyota	Camry LE	29	33.5	27	29	25	33	0.63
Toyota	Camry	32	32	32	32	34	33	0.75
Honda	Accord DX	29	30	30	29	30	29	0.75
Nissan	Altima	30	31	31	29	31	30	1.25
Toyota	Corolla	30	31	32	30	31	32	1.50
Nissan	Altima	28	30	30	28	30	28	1.50
Honda	Accord	30	32	32	30	32	31	1.75
Toyota	Corolla	30	32	33.5	30	31.5	32	2.25
Acura	RSX	31	35	32	31	33	33.5	2.38
Jaguar	S-Type 3.0	32	35	34	34	38	35	2.50
Toyota	Corolla	30	32.5	33	30	32	33	2.63
Geo	Prism	30	38	38	30	36	19	2.75
Honda	Accord	30	33	34	30	32.5	32.5	3.00
Chrysler	300	30	40	37	30	24	31.5	3.13
Toyota	Camry	32	35	35	32	36	35	3.25
Nissan	Maxima	29	32.5	32	29	33.5	31	3.25
Honda	Accord	32	35	36	29	30	35	3.50
Lexus	LS400	29	32.5	32.5	29	32	34	3.75
Dodge	Charger	30	38	39	30	30	30	4.25
Buick	Skylark	28	33	31	28	33	32.5	4.38
Volvo	S80	29	35	32	29	34	35	5.00
Kia	Optima	30	35	35	30	36	35	5.25
Toyota	GT	29	36.5	40	29	39	38	9.38
Chrysler	Lebaron	28	38	38	28	38	38	10.00
Chevrolet	Z28	30	43	45	30	42.5	42	13.13
Chevrolet	Impala	30	48	64	30	52	47	22.75
57.1%	**Population of PIV**						**Mean Pressure**	**3.53**
							Std Dev	**4.68**

A summary of the results of the second staff survey are presented in Table B-4 below.

Table B-4: Summary of Staff Tire Pressure Survey Number 2 (Sheldon Road Shell, Elk Grove, California)

PASSENGER CARS / TRUCKS (0 lb to 3,750 lb LVW)			
Population of Vehicles with Severely Under Inflated Tires	17.9%	Mean Pressure	-7.98
		Std Dev	1.65
Population of Vehicles with Moderately Under Inflated Tires	25.0%	Mean Pressure	-3.19
		Std Dev	1.27
Population of Vehicles with Properly Inflated Tires	57.1%	Mean Pressure	3.53
		Std Dev	4.68
LIGHT TRUCKS (3,751 lb LVW to 10,000 lb GVR)			
Population of Vehicles with Severely Under Inflated Tires	16.7%	Mean Pressure	-7.75
		Std Dev	0.85
Population of Vehicles with Moderately Under Inflated Tires	27.8%	Mean Pressure	-3.20
		Std Dev	1.41
Population of Vehicles with Properly Inflated Tires	55.6%	Mean Pressure	3.35
		Std Dev	5.10

References

U.S. EPA, 2006. U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Fuel Economy Labeling of Motor Vehicle Revision to Improve Calculation of Fuel Economy Estimates, EPA420-R-06017, December 2006
http://www.epa.gov/fueleconomy/420r06017.pdf

Appendix C: Supporting Documents for the Economic Impact Analysis

C.1 Staff Tire Price and Warranty Surveys

ARB staff conducted two tire pressure price and warranty surveys in October 2008. Tire under inflation increases tread wear and correspondingly reduces tire life. The reduction in expected tire life is an economic cost to consumers and a burden on landfills where waste tires are disposed. The staff surveys were used to determine the economic impact that severely and moderately under inflated tires have on the tire life. The results of the survey and the economic assessment of reduced tire life are presented in Section IX of the staff report.

The first survey was conducted at the internet website tirerack.com. Three representative vehicles in each vehicle category were selected to determine OEM tire sizes typically found in that vehicle category. Tire prices for up to five different brands were obtained for each vehicle's OEM tire size specification. Corresponding tread warranty information for each of the tires, if offered by the tire manufacturer, was also obtained. While the tire prices obtained from the survey were retail list prices, valuations of the tire cost were based on installed tire cost. To obtain the installed cost of the tire, staff determined that $15 per tire would be a good approximation for installation costs. In addition, applicable sales taxes of 7.75 percent were added to the retail list price to obtain the final installed cost of the tire. Delivery charges for tires purchased via tire / auto part websites were not considered in the analysis. Results of the first tire warranty and price survey are presented in Table C-1.

The second survey was conducted at the internet website discounttire.com and employed a similar sampling protocol. Results of the second warranty and price survey are presented in Table C-2.

Table C-1: October 2008 Tire Price and Warranty Survey
Source: Tirerack.com

VEHICLE CATEGORY AND CLASS WEIGHT	CATEGORY VEHICLES	CURB WEIGHT + 300 lbs / GVWR	OEM TIRE SIZE	BRAND 1	PRICE 1	TREAD LIFE WARRANTY OFFERED 1	BRAND 2	PRICE 2	TREAD LIFE MANUF WARRANTY 2	BRAND 3	PRICE 3	TREAD LIFE MANUF WARRANTY 3	BRAND 4	PRICE 4	TREAD LIFE MANUF WARRANTY 4	BRAND 5	PRICE 5	TREAD LIFE WARRANTY 5
Passenger Cars (0 - 3,750 lbs LVW)	Toyota Prius (Compact)	3232	185 / 65 R 15	Goodyear Integrity	$ 70	50,000	General Altimax HP	$ 58	55,000	Michelin Energy MXV4	$ 101	60,000	Goodyear Assurance ComforTred	$ 78	80,000	Michelin HydroEdge	$ 106	90,000
Passenger Cars (0 - 3,750 lbs LVW)	Toyota Camry (Sedan)	3607	215 / 60 R 16	Michelin Energy MXV4 S8	$ 158		Bridestone Turanza EL400-02	$ 124	50,000	General Altimax HP	$ 79	55,000	Kumho Ecsta Platinum	$ 87	60,000	Michelin Pilot Exalto A/S	$ 107	45,000
Passenger Cars (0 - 3,750 lbs LVW)	Volkswagon Beetle (Sub-Compact)	3265	205 / 55 R 16	Continental ContiProContact	$ 99	60,000	Michelin Energy MXV4 Plus	$ 138		Goodyear Eagle RS-A	$ 109			-		-	-	
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Ford Ranger Regular Cab 4 X 2	3699	225 / 70 R 15	Continental ContiTrac	$ 81		Kumho Solus KR21	$ 67	85,000	Dunlop SP 60	$ 75	65,000	General Altimax RT	$ 67	70,000	Continental ContiTrac	$ 64	
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Toyota Tacoma Regular Cab 4 X 2	3699	215 / 70 R 15	Dunlop Grandtrek AT20	$ 60	60,000	Firestone Destination LE	$ 74	60,000	Continental ContiProContact	$ 69	60,000	Pirelli P4000 Super Touring	$ 124	40,000	Bridgestone Turanza	$ 84	50,000
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Chevrolet Colorado Regular Cab 4 X 2	3480	225 / 75 R 15	Kumho Solus KR21	$ 66	85,000	Dunlop SP 60	$ 64	65,000	Yokohoma AEGIS LS4	$ 72	60,000	Avon Ranger TSE	$ 79		BF Goodrich Long Trail T/A Tour	$ 85	60,000
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Ford F-150 Regular Cab 4 X 4	5392 / 6650	235 / 75 R 17	Hankook DynaPro AT RF08	$ 116		Bridgestone Dueler A/T Revo	$ 138	50,000	Firestone Destination A/T	$ 115	50,000	Goodyear Wrangler SilentArmor	$ 127	50,000	Bridgestone Long Trail T/A Tour	$ 124	60,000
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Chrysler Town & Country Minivan	4635 / 5500	215 / 70 R 15	General Altimax RT	$ 65	70,000	Kumho Solus KR21	$ 65	85,000	Pirelli P4 Four Seasons	$ 73	85,000	Yokohama AVID TRZ	$ 70	80,000	Goodyear Integrity	$ 61	50,000
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Nissan Murano AWD Crossover Vehicle	4309 / 5236	235 / 65 R 18	Goodyear Eagle LS	$ 129		Yokohama AVID H4S	$ 132	50,000	Kumho Solus KR21	$ 102	85,000	Bridgestone Dueler H/L Alenza	$ 180	65,000	Goodyear Fortera TripleTred	$ 172	60,000
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	GMC Yukon XL	5827 / 7300	265 / 70 R 17	Bridgestone Dueler H/T D684 II	$ 130		Goodyear Wrangler HP	$ 162		BF Goodrich Long Trail T/A Tour	$ 129	60,000	Continental ContiTrac SUV	$ 115	60,000	Bridgestine Dueler A/T RH-S	$ 125	
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	Dodge Ram 1500 Quad Cab 4 X 4	/ 6700	245 / 70 R 17	Michelin LTX A/S	$ 159		Continental CrossContact LX	$ 126	65,000	Firestone Destination LE	$ 112	60,000	Goodyear Wrangler SR-A	$ 149	50,000	Yokohama Geolander H/T-S G051	$ 126	60,000
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	Ford Expedition XLT 4 WD	6105 / 7300	265 / 70 R 17	Continenental ContiTrac SUV	$ 115	60,000	Yokohama Geolandar H/T-S G051	$ 122	60,000	Continenental ContiTrac TR	$ 120		-	-		-	-	
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Ford F-350 Super Cab 4 X 2	/ 9800	265 / 70 R 17	BF Goodrich Rugged Trail T/A	$ 178		Pirelli Scorpion STR A	$ 149		Goodyear Wrangler SilentArmor	$ 184	50,000	General Grabber HTS	$ 143	45,000	Yokohama Geolander A/T-S	$ 154	50,000
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Chevrolet Silverado 3500 Ext Cab 4WD	/ 9900	265 / 75 R 16	Michelin LTX A/T2	$ 197		Goodyear Wrangler SilentArmor	$ 184	50,000	Dunlop Radial Rover A/T	$ 147	60,000	Yokohama Geolander A/T-S	$ 131	50,000	-		
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Dodge Ram 2500 Mega Cab 4 X 4	/ 8800	265 / 70 R 17	BF Goodrich Rugged Trail T/A	$ 171		Michelin LTX A/S	$ 194		Goodyear Wrangler SilentArmor	$ 184	50,000	General Grabber HTS	$ 143	45,000	Yokohama Geolander A/T-S	$ 154	50,000

Table C-2: October 2008 Tire Price and Warranty Survey
Source: Discounttire.com

VEHICLE CATEGORY AND CLASS WEIGHT	CATEGORY VEHICLES	CURB WEIGHT + 300 lbs / GVWR	OEM TIRE SIZE	BRAND 1	PRICE 1	TREAD LIFE WARRANTY OFFERED 1	BRAND 2	PRICE 2	TREAD LIFE MANUF WARRANTY 2	BRAND 3	PRICE 3	TREAD LIFE MANUF WARRANTY 3	BRAND 4	PRICE 4	TREAD LIFE MANUF WARRANTY 4	BRAND 5	PRICE 5	TREAD LIFE WARRANTY 5
Passenger Cars (0 - 3,750 lbs LVW)	Toyota Prius (Compact)	3232	185 / 65 R 15	Arizonian Silver Edition	$ 54.00	60,000	Kumho KH15	$ 57.00		Falken Sincera SN 828	$ 66.00	50,000	Fisk Classic	$ 70.00		Pirelli P3000	$ 76.00	85,000
Passenger Cars (0 - 3,750 lbs LVW)	Toyota Camry (Sedan)	3607	215 / 60 R 16	Fisk Classic	$ 77.00		Falken Sincera SN 828	$ 83.00	50,000	Arizonian Silver Edition	$ 86.00	60,000	Kumho Solus KR21	$ 88.00	85,000	SA4 All Season	$ 89.00	
Passenger Cars (0 - 3,750 lbs LVW)	Volkswagon Beetle (Sub-Compact)	3265	205 / 55 R 16	Barum Bravuris	$ 75.00	45,000	Kumho KH18	$ 77.00		Hankook Ventus HRII H405	$ 81.00		Riken Raptor HR	$ 88.00		Riken Raptor ZR	$ 89.00	
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Ford Ranger Regular Cab 4 X 2	3699	225 / 70 R 15	Kumho Solus KR21	$ 70.00	85,000	Arizonian Silver Edition	$ 79.00	60,000	Continental ContiTrac	$ 81.00		Road Hugger Radial G/T	$ 95.00	50,000	Falken Sincera SN 828	$ 102.00	50,000
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Toyota Tacoma Regular Cab 4 X 2	3699	215 / 70 R 15	SA4 All Season	$ 59.00		Falken Sincera SN 828	$ 63.00	50,000	Fisk Classic	$ 66.00		Hankook Radial H714	$ 70.00	40,000	Dominator All Season	$ 70.00	50,000
Light Duty Trucks 1 (0 - 3,750 lbs LVW)	Chevrolet Colorado Regular Cab 4 X 2	3480	225 / 75 R 15	Kumho Solus KR21	$ 52.00	85,000	Hankook Radial H714	$ 58.00	40,000	Cooper Trendsetter SE	$ 64.00		BFGoodrich Long Trail T/A Tour	$ 97.00		Falken Radial A-P	$ 103.00	
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Ford F-150 Regular Cab 4 X 4	5392 / 6650	235 / 75 R 17	BFGoodrich Goodrich Long Trail T/A Tour	$ 143.00		Hankook DynaPro AT RF08	$ 145.00	50,000	Goodyear Wrangler Silent Armor	$ 165.00	50,000	Bridgestone Dueler A/T 694 Revo	$ 177.00	50,000	Continental ContiCrossContact LX	$ 194.00	65,000
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Chrysler Town & Country Minivan	4635 / 5500	215 / 70 R 15	Falken Sincera SN 828	$ 63.00	50,000	Yokohama AVID TRZ	$ 100.00	80,000	Yokohama Geolander A/T-S	$ 109.00	40,000	Michelin X-Ice	$ 114.00		Michelin HydroEdge	$ 123.00	90,000
Light Duty Trucks 2 (3,751 - 5,750 lbs LVW)	Nissan Murano AWD Crossover Vehicle	4309 / 5236	235 / 65 R 18	Kumho Solus KR21	$ 125.00	85,000	BFGoodrich Long Trail T/A Tour	$ 149.00		Bridgestone Dueler H/T 687	$ 153.00		Goodyear Eagle LS	$ 161.00		Yokohama YK520	$ 175.00	60,000
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	GMC Yukon XL	5827 / 7300	265 / 70 R 17	Prodigy H/T	$ 109.00		Hankook DynaPro AS RH03	$ 115.00		Pathfinder Sport SUV	$ 121.00	55,000	Continental ContiTrac SUV	$ 129.00	60,000	Kumho Road Venture AT KL78	$ 130.00	
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	Dodge Ram 1500 Quad Cab 4 X 4	/ 6700	245 / 70 R 17	Hankook DynaPro AS RH03	$ 135.00		General AmeriTrac	$ 143.00		BFGoodrich Long Trail T/A Tour	$ 148.00		Yokohama Geolander H/T-S	$ 152.00	60,000	GoodYear Wrangler SR-A	$ 160.00	50,000
Medium Duty Vehicles (5,751 lbs LVW - 8,500 lbs GVR)	Ford Expedition XLT 4 WD	6105 / 7300	265 / 70 R 17	Prodigy H/T	$ 109.00		Hankook DynaPro AS RH03	$ 115.00		Pathfinder Sport SUV	$ 121.00	55,000	Continental ContiTrac SUV	$ 129.00	60,000	Kumho Road Venture AT KL78	$ 130.00	
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Ford F-350 Super Cab 4 X 2	/ 9800	265 / 70 R 17	Pathfinder All Terrain	$ 168.00	50,000	Pirelli Scorpion STR	$ 174.00	65,000	Pirelli Scorpion ATR	$ 178.00		Yokohama Geolander A/T-S	$ 187.00	40,000	BFGoodrich Rugged Trail T/A	$ 192.00	
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Chevrolet Silverado 3500 Ext Cab 4WD	/ 9900	265 / 75 R 16	Hankook DynaPro AS RH03	$ 141.00	40,000	BFGoodrich Rugged Trail T/A	$ 147.00	40,000	Yokahama Geolandar H/T-S	$ 150.00		Pathfinder All Terrain	$ 159.00	50,000	Yokahama Geolandar A/T-S	$ 162.00	40,000
Light Heavy Duty Vehicles (8,501 - 10,000 lbs GVR)	Dodge Ram 2500 Mega Cab 4 X 4	/ 8800	265 / 70 R 17	Pathfinder All Terrain	$ 168.00	50,000	Pirelli Scorpion STR	$ 174.00	65,000	Pirelli Scorpion ATR	$ 178.00		Yokohama Geolander A/T-S	$ 187.00	40,000	BFGoodrich Rugged Trail T/A	$ 192.00	40,000

Table C-3 lists the mean tire price and warranty information for each vehicle category. Staff rounded the average of the tire warranties for each vehicle category to the nearest 5,000 miles. Lastly, staff believes that even though some tires sizes were sampled in more than one vehicle category, the vehicles selected (upon which the OEM tire specifications are based) are representative of the vehicle category.

Table C-3: Mean Tire Price and Warranty Survey for All Vehicle Categories

Category	Vehicle Class Weight	Typical Tire Size	Average Listed Retail Price	Average Tread Warranty
Passenger Cars	0 - 3,750 LVW	185 / 65 R 15	$73.60	66,000
Passenger Cars	0 - 3,750 LVW	215 / 60 R 16	$97.80	58,750
Passenger Cars	0 - 3,750 LVW	205 / 55 R 16	$98.67	52,500
		Average	**$90.02**	**60,000**
Light Duty Trucks 1	0 - 3,750 LVW	225 / 70 R 15	$78.10	67,292
Light Duty Trucks 1	0 - 3,750 LVW	215 / 70 R 15	$73.90	50,333
Light Duty Trucks 1	0 - 3,750 LVW	225 / 75 R 15	$74.00	65,000
		Average	**$75.33**	**60,000**
Light Duty Trucks 2	3,751 - 5,750 LVW	235 / 75 R 17	$144.40	53,125
Light Duty Trucks 2	3,751 - 5,750 LVW	215 / 70 R 15	$ 84.30	69,500
Light Duty Trucks 2	3,751 - 5,750 LVW	235 / 65 R 18	$147.80	68,750
		Average	**$125.50**	**60,000**
Medium Duty Vehicles	5,751 LVW - 8,500 GVR	265 / 70 R 17	$126.50	58,750
Medium Duty Vehicles	5,751 LVW - 8,500 GVR	245 / 70 R 17	$141.00	56,875
Medium Duty Vehicles	5,751 LVW - 8,500 GVR	265 / 70 R 17	$119.90	58,750
		Average	**$129.13**	**60,000**
Light Heavy Duty Vehicles	8,501 - 10,000 GVR	265 / 70 R 17	$170.70	50,000
Light Heavy Duty Vehicles	8,501 - 10,000 GVR	265 / 75 R 16	$158.28	47,917
Light Heavy Duty Vehicles	8,501 - 10,000 GVR	265 / 70 R 17	$174.50	48,542
		Average	**$167.83**	**50,000**

C.2 Statewide Air Makeup Volume Requirements and Compressor Operating Costs

In this section, staff determined the statewide total amount of compressed air required to inflate severely and moderately under inflated tires as a result of the requirements of the Proposed Regulation. Staff project that in the year 2010, of the 24 million registered California vehicles (EMFAC2007 baseline scenario), an estimated 13.7 million vehicles could be classified as vehicles with severely or moderately under inflated tires without the Proposed Regulation. Staff determined that approximately 48 million cubic feet of air measured at 68 degrees Fahrenheit, and 14.7 psia pressure (1 atm) would be required to bring the under inflated vehicles to properly inflated levels. A determination of the statewide air makeup volume requirements for each vehicle category is presented in Table C-4 below.

Table C-4: Total Air Makeup Volume Requirements for Severely and Moderately Under Inflated Tires in Vehicles

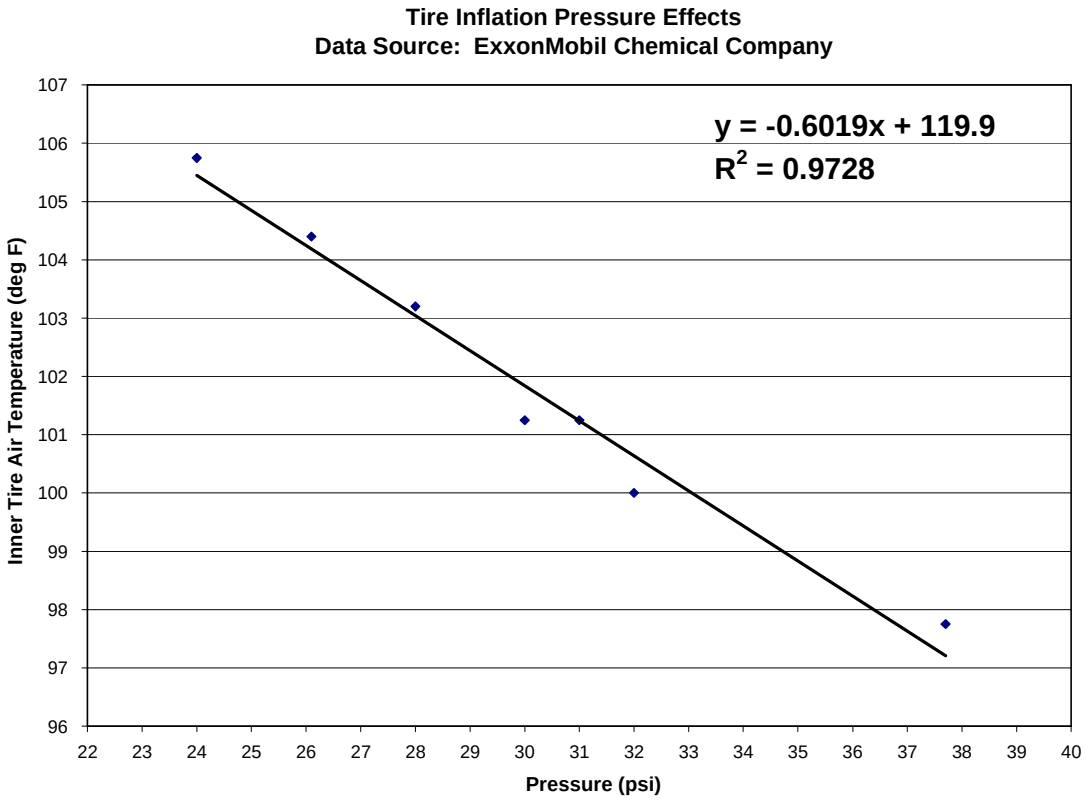
Year	Estimated Projected Number of Vehicles	Number of Severely Under Inflated Vehicles	Required Makeup Air Volume (cu.ft. @ 68F, 14.7 psia)	Number of Moderately Under Inflated Vehicles	Required Makeup Air Volume (cu.ft. @ 68F, 14.7 psia)	Total Air Makeup Volume for All Vehicles (cu.ft. @ 68F, 14.7 psia)
PASSENGER CARS (0 - 3,750 lbs LVW)						
2010	12,965,260	2,593,052	8,886,678	4,408,189	8,234,756	**17,121,433**
LIGHT DUTY TRUCKS 1 (0 - 3,750 lbs LVW)						
2010	2,860,479	572,096	2,680,623	972,563	2,483,974	**5,164,596**
LIGHT DUTY TRUCKS 2 (3,751 lbs LVW - 5,750 lbs LVW)						
2010	5,494,233	1,401,029	7,736,968	2,005,395	6,296,122	**14,033,090**
MEDIUM DUTY VEHICLES (5,751 lbs LVW - 8,500 lbs GVR)						
2010	2,411,007	614,807	4,705,210	880,018	3,894,318	**8,599,528**
LIGHT HEAVY DUTY VEHICLES (8,501 lbs GVR - 10,000 lbs GVR)						
2010	424,498	108,247	1,314,868	154,942	1,344,317	**2,659,185**
ALL CALIFORNIA VEHICLES						
2010	**24,155,478**	**5,289,231**	**25,324,347**	**8,421,106**	**22,253,485**	**47,577,832**

The methodology to determine the amount of air makeup volume required to bring under inflated vehicles to proper inflation levels is based on profiling levels of under inflation for the fleet of California registered vehicles and then performing a molar balance assuming that the air inside the tires behaves as an ideal gas. California vehicles were profiled to be severely under inflated (with average tire pressures between 6 and 12 psi under inflated), moderately under inflated (with average tire pressures between 1 and 6 psi under inflated), and

properly inflated The profiles were obtained from the tire pressure study conducted by NHTSA (NHTSA, 2005) discussed in Section VI of the staff report.

To facilitate the determination of the tire makeup volume required, tire inner volumes for OEM specified tires in each vehicle category were first calculated. Since the tire pressures of the vehicles in the NHTSA Study were based on a survey of actual passenger vehicles, staff assumes that the measurements were made during "hot tire" conditions. Inner tire air ("hot tire") temperature profiles are determined to be a linear function of the inflation pressure. The relationship developed by the ExxonMobil Chemical Company (ExxonMobil, 2008) was used to profile inner tire air "hot" temperatures for vehicles determined to be severely and moderately under inflated (see Figure C-1 below).

Figure C-1:



Having once obtained the inner tire air "hot" temperature, staff determined the makeup volume required for each severely and moderately under inflated vehicle using the ideal gas relationship (P*V = n * R*T). The end goal was to determine the impact on ASP air compressor operating costs. Table C-5 lists the annual operating costs for some typical sized compressors utilized by ASPs. Staff concluded that the differential compressor operating costs for the estimated amount of air makeup volume required as a result of the Proposed Regulation were negligible.

Table C-5: Determination of Compressor Operating Costs for Statewide Annual Air Makeup Volume Requirements (Tire Inflation of Severely and Moderately Under Inflated Vehicles)

Compressor Air Flow Rate (acfm)	Compressor Size (hp)	Annual Minutes of Operation	Annual Hours of Operation	Annual hp-hr of Operation[20]	Annual Power Consumption (kwh)	Power Rate ($/kwh)	Annual Costs
18.50	5	2,571,775	42,863	275,272.29	205,353	$ 0.13	$26,696
16.00	5	2,973,615	49,560	410,944.64	306,565	$ 0.13	$39,853
38.00	10	1,252,048	20,867	291,417.80	217,398	$ 0.13	$28,262
34.00	10	1,399,348	23,322	325,992.88	243,191	$ 0.13	$31,615
						Average	**$31,600**
						Maximum	**$39,900**
						Estimated Number of ASPs in 2010	**39,700**

C.3 One-Time Programming Costs

The Proposed Regulation requires that all automotive service providers check and inflate each vehicle's tire to the manufacturer's recommended pressure at the time of performing any vehicle maintenance or repair service; and indicate on the vehicle service invoice that a tire inflation service was completed and the tire pressures after the service was performed. If a tire inflation service was not performed, the automotive service provider must indicate on the vehicle service invoice why the service was not completed.

Staff determined that complying with this requirement would be a one-time programming change and estimated the costs to the ASPs. Staff notes that for some ASPs, the cost could be zero if manual methods are employed to record the information. Staff assumes that most ASPS would utilize their existing computer billing and record-keeping databases to keep track of the information. As a result, staff estimated the amount of time required by managerial and computer support personnel to provide this programming change. This information is summarized in Table C-6.

[20] Staff calculated compressor efficiencies of 0.60 to 0.78 for the four compressors.

Table C-6: Cost of Programming on Customer Invoice

Occupation (SOC code)[21] Area: California	Hourly Mean Wage (May 2007)	2008 Adjusted Rate[22]	2008 Total Compensation Rate[23]	Estimated Hours for Instituting Change	Total Cost of Programming
Computer Software Engineers, Applications (151031)	$46.07	$47.48	$63.22	2	$126.43
Computer Support Specialists (151041)	$24.22	$24.96	$33.23	4	$132.94
Computer Systems Analysts (151051)	$38.05	$39.21	$52.21	2	$104.42
First-Line Supervisors / Managers of Mechanics, Installers, and Repairers (491011)	$35.69[24]	$36.78	$48.97	2	$97.94
				10	**$462**

The total programming costs to ASPs were annualized for the period 2010 through 2020 to determine the average annual economic impact of the requirement. This information is presented in Table C-7 below.

Table C-7: Annualized Programming Costs to ASPs

Year	Automotive Service Centers	Test-Only Smog Check Facilities	Net Number of ASPs Impacted	Programming Costs	Annualized Programming Costs[25]
2010	37,693	1,999	39,691	$ 18,326,787	$ 2,206,342
2011	37,822	2,005	136	$ 62,753	$ 2,213,896
2012	37,951	2,012	136	$ 62,968	$ 2,221,477
2013	38,081	2,019	137	$ 63,183	$ 2,229,084
2014	38,212	2,026	137	$ 63,400	$ 2,236,716
2015	38,343	2,033	138	$ 63,617	$ 2,244,375
2016	38,474	2,040	138	$ 63,835	$ 2,252,060
2017	38,606	2,047	139	$ 64,053	$ 2,259,771
2018	38,738	2,054	139	$ 64,273	$ 2,267,509
2019	38,870	2,061	140	$ 64,493	$ 2,275,273
2020	39,004	2,068	140	$ 64,713	$ 2,283,064
				$18,964,075	**$24,689,567**

[21] SOC code: Standard Occupational Classification code -- see http://www.bls.gov/soc/home.htm

[22] 2007 Hourly Wages were adjusted to account for one year of inflation.

[23] The Total Compensation Rate accounts for Cost of Total Benefits As a Percentage of Total Compensation. The cost of total benefits was determined to be 24.9% (U.S. BLS). For example, the total compensation rate for computer software engineers (applications) was determined to be $47.48 / (1 – 0.249) or $63.22.

[24] Mean hourly rate for 3 top paying metropolitan areas in California.

[25] Staff assumes a 5% discount rate consistent with ARB analysis for the Proposed Regulation.

C.4 Labor Costs

As depicted in Table C-8 below, total labor compensation costs were determined to be $1.83 (2008 dollars) per vehicle per visit. Average annual labor compensation costs to California ASPs for the period 2010 through 2020 for all affected California registered vehicles was estimated to be $98 million (2008 dollars) per year. Total labor costs for the entire period were estimated to be approximately $1.1 billion (2008 dollars).

Table C-8: Estimate of Total Labor Costs for Proposed Regulation

Year	Total Vehicles	Frequency of Additional Visits Per Year	Total Vehicle Visits Per Year	Cost of Auto Service Mechanic ($/hr) (2008 dollars)	Service Time Per Vehicle (minutes)	Total Labor Cost Per Vehicle (2008 dollars)	Total Labor Compensation Costs per Year (2008 dollars)
2010	**25,025,399**	2.0	49,400,553	$21.94	5	$1.83	$90,325,880.12
2011	**25,477,989**	2.0	50,293,974	$21.94	5	$1.83	$91,959,444.09
2012	**25,939,575**	2.0	51,205,152	$21.94	5	$1.83	$93,625,477.93
2013	**26,410,318**	2.0	52,134,407	$21.94	5	$1.83	$95,324,562.76
2014	**26,854,611**	2.0	53,011,448	$21.94	5	$1.83	$96,928,179.80
2015	**27,307,409**	2.0	53,905,279	$21.94	5	$1.83	$98,562,494.52
2016	**27,692,450**	2.0	54,665,356	$21.94	5	$1.83	$99,952,249.27
2017	**28,083,926**	2.0	55,438,137	$21.94	5	$1.83	$101,365,230.31
2018	**28,481,987**	2.0	56,223,916	$21.94	5	$1.83	$102,801,979.04
2019	**28,886,800**	2.0	57,023,023	$21.94	5	$1.83	$104,263,098.22
2020	**29,298,271**	2.0	57,835,274	$21.94	5	$1.83	$105,748,248.57
						Total Costs (2010 through 2020)	**~1.1 billion**
						Average Annual Compensation	**~$98 million**

Note: Summary totals are rounded values

C.5 Capital and Operating Expenditures

Table C-9 lists the annualized costs to ASPs in California for the period 2010 through 2020. Average total annualized capital and operating (O&M) costs are estimated to be $2.8 million (2008 dollars) per year for an estimated 38,000 to 41,000 ASPs (not including test-only smog check centers) impacted by the Proposed Regulation during the period 2010 through 2020. The total costs to the ASPs were estimated to be $31 million (2008 dollars) for the entire period.

Table C-9: Capital and Operating Costs for Automotive Service Providers (Not Including Test-Only Smog Check Centers)

Year	Number of California ASPs[26]	Tire Gauge Capital Costs[27] (2008 dollars)	Annualized Tire Gauge Capital Costs[28] (2008 dollars)	Tire Reference Manual (O&M) Costs[29] (2008 dollars)	Annualized Tire Reference Manual (O&M) Costs (2008 dollars)	Total Annualized Costs (2008 dollars)
2010	38,033	$3,803,317	$2,045,442	$1,901,658	$698,305	$2,743,748
2011	38,335		$2,045,442		$698,305	$2,743,748
2012	38,640	$3,863,986	$2,078,071		$698,305	$2,776,376
2013	38,947		$2,078,071	$1,947,342	$715,081	$2,793,151
2014	39,256	$3,925,624	$2,111,220		$715,081	$2,826,300
2015	39,568		$2,111,220		$715,081	$2,826,300
2016	39,882	$3,988,244	$2,144,897	$1,994,122	$732,259	$2,877,156
2017	40,199		$2,144,897		$732,259	$2,877,156
2018	40,519	$4,051,864	$2,179,112		$732,259	$2,911,371
2019	40,841		$2,179,112	$2,042,026	$749,850	$2,928,962
2020	41,165	$3,803,316	$2,045,442		$749,850	$2,795,292
					Total Costs for 2010 through 2020 (2008 dollars)	**~$31 million**
					Average Annual Costs (2008 dollars)	**~$2.8 million**

Note: Summary totals are rounded values

[26] The number of automotive service providers in California expected to be impacted by the Proposed Regulation was estimated from the Bureau of Automotive Repair (BAR) master list of automotive facilities. Staff excluded all auto body paint and collision repair facilities, glass and windshield repair facilities, auto parts stores, car wash and detailing facilities, and wrecking and towing companies. Staff assumed that year-by-year, the number of automotive service centers would grow at one-half the overall vehicle population growth rate specified in the EMFAC2007 model.

[27] Tire Gauge Capital Costs = $25/Gauge x 4 or 2 Gauges/Facility x # of Facilities. Staff expects the tire gauges to be replaced every two years.

[28] Staff assumed an applicable discount rate of 5%.

[29] Tire Reference Book (O&M) Costs = $50/Tire Manual x # of Facilities.

Table C-10 below lists the annualized costs to test-only smog check service centers in California for the period 2010 through 2020. Average total annualized capital and operating (O&M) costs are estimated to be $128,000 (2008 dollars) per year for an estimated 2,000 to 2,200 test-only smog check centers impacted by the Proposed Regulation during the period 2010 through 2020. The total capital and operating costs were estimated to be $1.4 million (2008 dollars) for the entire period.

Table C-10: Capital and Operating Costs for Test-Only Smog Check Centers

Year	Number of California Test Only Centers[30]	Compressor Line Total Annualized Engineering Costs (2008 dollars)[31]	Annualized Tire Gauge Capital Costs[32] (2008 dollars)	Annualized Tire Reference Book (O&M) Costs (2008 dollars)	Total Annualized Costs (2008 dollars)
2010	2,017	$69,870	$54,229	$37,027	$161,125
2011	2,033	$70,425	$54,229	$37,027	$161,680
2012	2,049	$70,984	$55,094	$37,027	$163,105
2013	2,065	$71,548	$55,094	$37,916	$164,558
2014	2,082	$72,117	$55,972	$37,916	$166,005
2015	2,098	$2,820	$55,972	$37,916	$96,709
2016	2,115	$2,842	$56,865	$38,827	$98,535
2017	2,132	$2,865	$56,865	$38,827	$98,557
2018	2,148	$2,888	$57,772	$38,827	$99,487
2019	2,166	$2,910	$57,772	$39,760	$100,443
2020	2,183	$2,934	$58,694	$39,760	$101,387
				2010 through 2020 Total Costs	**~$1.4 million**
				Average Annual Costs	**~$128,000**

Note: Summary totals are rounded values

[30] The number of test-only smog check centers that are expected to be impacted by the Proposed Regulation was provided by the California Department of Consumer Affairs, Bureau of Auto Repair, Vehicle Information Database. Staff assumed that year-over-year, the number of test-only smog check service centers would grow at one-half the overall vehicle population growth rate specified in the EMFAC2007 model.

[31] Approximately 2,000 test-only smog check centers are expected to incur one time engineering costs of ~$150 per facility to tap into their compressor lines in 2010. These costs were annualized over 5 years. Thereafter, compressor line engineering costs only apply to new facilities. Comparatively, tire gauges were annualized for 2 years, and tire inflation reference manual were annualized for 3 years.

[32] Staff assumed an applicable discount rate of 5%.

C.6 Summary of Total Costs

The total labor, capital, and operating costs to all ASPs for the period 2010 through 2020 was estimated to be $1.1 billion (2008 dollars). This cost also includes the cost of programming and record keeping applicable to all facilities as a result of the requirements of the Proposed Regulation. On an annualized basis, the total cost is approximately $104 million (2008 dollars). The total labor, capital, and operating costs are summarized in Table C-11.

Table C-11: Summary of Total Costs for Proposed Regulation

Year	Total Annual Labor Costs for All Facilities (2008 dollars)	Smog Check Centers Total Annualized Costs (2008 dollars)	Auto Service Centers Annualized Costs (2008 dollars)	Programming & Record keeping Annualized Costs (2008 dollars)	Total Annualized Cost of Regulation (2008 dollars)
2010	$90,325,880	$161,125	$2,743,748	$2,226,265	$95,457,018
2011	$91,959,444	$161,680	$2,743,748	$2,243,951	$97,108,823
2012	$93,625,478	$163,105	$2,776,376	$2,261,777	$98,826,736
2013	$95,324,563	$164,558	$2,793,151	$2,279,746	$100,562,018
2014	$96,928,180	$166,005	$2,826,300	$2,297,857	$102,218,342
2015	$98,562,495	$96,709	$2,826,300	$2,316,111	$103,801,615
2016	$99,952,249	$98,535	$2,877,156	$2,334,511	$105,262,451
2017	$101,365,230	$98,557	$2,877,156	$2,353,057	$106,694,001
2018	$102,801,979	$99,487	$2,911,371	$2,371,751	$108,184,588
2019	$104,263,098	$100,443	$2,928,962	$2,390,593	$109,683,096
2020	$105,748,249	$101,387	$2,795,292	$2,409,584	$111,054,512
Sub-Total	**~$1.1 billion**	**~$1.4 million**	**~$31 million**	**~$25 million**	**~$1.1 billion**
Average Annual Costs	**~$98 million**	**~$128,000**	**~$2.8 million**	**~$2.3 million**	**~$103 million**

Note: Summary totals are rounded values

References

ExxonMobil, 2008. Inflation Pressure Retention Effects on Tire Rolling Resistance and Vehicle Fuel Economy (Presentation to the Air Resources Board May 2008

NHTSA, 2005. U.S. Department of Transportation, National Highway Transportation Safety Association, Tire Pressure Monitoring System FMVSS No. 138. March 2005 http://www.nhtsa.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/TPMS-2005-FMVSS-No138.pdf