CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

PROPOSED AMENDMENTS TO THE VERIFICATION PROCEDURE, WARRANTY AND IN-USE COMPLIANCE REQUIREMENTS FOR IN-USE STRATEGIES TO CONTROL EMISSIONS FROM DIESEL ENGINES

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EXECUTIVE SUMMARY

In 1998, the Air Resources Board (ARB or Board) identified diesel particulate matter (PM) as a toxic air contaminant. Diesel PM is the largest contributor to health risk posed by toxic air pollutants, constituting approximately 70 percent of the total statewide risk. Significant annual health effects attributed to diesel PM include 2,900 premature deaths, 2,600 cases of chronic bronchitis, and 5,300 hospital admissions including asthma-related emergency room visits (Lloyd and Cackette, 2001). To address this large-scale health concern, the ARB adopted a comprehensive Diesel Risk Reduction Plan in 2000. A significant component of the plan is the use of emission control systems to reduce PM emissions from in-use diesel vehicles and equipment. To ensure that any technology used toward that end would achieve real and durable emissions reductions, staff developed the Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines (the Procedure), which was adopted by the Board in May 2002.

The purpose of the Procedure is to ensure effective control systems are available to reduce Californians' exposure to diesel PM. The Procedure also limits secondary emissions from these controls. One common secondary emission is nitrogen dioxide (NO_2). NO_2 is classified as a criteria pollutant and has both federal and state ambient air quality standards. NO_2 emissions also contribute to formation of ozone and particulate nitrates. The Board adopted a limit for NO_2 emissions of 20 percent of the baseline oxides of nitrogen (NOx) emission level as part of the Procedure, effective in 2004. The Procedure includes a limit on NO_2 because some diesel emission control systems, while highly effective at reducing emissions of diesel PM, also increase emissions of NO_2.

In February 2004, the Board amended the Procedure. One of the key amendments was a three-year delay in the effective date of the NO_2 limit to January 1, 2007. This was necessary because manufacturers were not able to meet the original 20 percent limit without sacrificing the robustness and breadth of applicability of their products. The purpose of the delay was to enable the continued implementation of efficient PM controls while staff reevaluated what level of NO_2 control was most appropriate and the potential impacts on air quality. This evaluation has been completed.

The staff has concluded that most verified PM control devices remain unable to meet the NO_2 limit that begins next year. Catalyzed PM filters, the most common high efficiency retrofit device, need sufficient NO_2 to assure collected PM can be burned off in a wide variety of engine applications and duty cycles. Low NO_2 works against both of these desired features of catalyzed filters. Thus to avoid de-verifying many retrofit devices that play an important role in implementing the Board's Diesel Risk Reduction Plan and adopted PM reduction regulations, the NO_2 limit set to go into effect January 1 needs to be relaxed.

Staff proposes both a new structure and magnitude for the revised NO_2 limit. Instead of defining the limit as a cap on total NO_2 emissions equivalent to 20 percent of the

baseline NOx emissions, staff proposes a maximum incremental increase over the model-specific engine-out level. In other words, the new limit does not include the NO_2 emitted by the engine itself and limits only the NO_2 contributed by the device. Effective January 1, 2007, staff proposes a maximum increase of NO_2 equivalent to 30 percent of the total baseline NOx. Most of the currently verified filters would be able to meet that limit and therefore continue to serve California's diesel PM reduction needs in the near-term. Effective January 1, 2009, staff proposes that the maximum increase be reduced to 20 percent. That level would require device manufacturers to redesign their devices to reduce emissions of NO_2.

By assuring PM control devices remain available for use, staff's proposal will reduce emissions of diesel PM. However, the higher limit on NO_2 will result in a slight increase in summer ozone and an increase in localized NO_2. The magnitude of these effects is discussed next.

Modeling of the South Coast Air Basin for the year 2010 indicates that lower PM emissions resulting from continued use of verified devices, such as catalyzed filters that comply with the staff-proposed revision to the NO_2 limit, will prevent about 235 premature deaths annually. These health benefits will not likely be realized if the NO_2 limit is not changed.

The higher amount of NO_2 allowed might increase peak ozone in the South Coast Air Basin by one to two parts per billion (ppb), or about 1 percent, on the worst days. The higher ozone is equivalent to a 10-30 ton per day increase in hydrocarbon emissions. Recently, ozone has been associated with premature deaths. The increase in ozone due to the revised NO_2 limit reduces the avoided premature deaths from lower PM emissions by less than 1 percent.

Higher NO_2 emissions from catalyzed filters will also increase ambient NO_2 levels. Exposure to NO_2 has been associated with adverse health effects including respiratory symptoms, cardio-respiratory hospital admissions, and reduced lung function. Currently, all of California is in compliance with the State 1-hour ambient NO_2 air quality standard, often by a wide margin. Staff analyzed the impact on micro-scale exposures such as at schools where school buses idle and on freeways with heavy diesel traffic. The analysis showed no violations of the 1-hour standard.

The benefits of lower diesel PM emissions, the significant reduction in premature deaths in particular, clearly outweigh the adverse impacts of slightly higher ozone exposure and higher ambient NO_2. Thus staff has proposed the higher NO_2 limit for verified devices, as discussed above.

Currently verified retrofits have a wide range of NO_2 increases even within a given PM reduction level. To encourage the development and use of lower-NO_2 products where possible, staff proposes creating new classifications for the years 2007 and 2008: Level 3 Plus, Level 2 Plus, and Level 1 Plus. A control system would meet one of the Plus levels if it achieves the diesel PM reduction of the corresponding level (e.g., at least 85

percent for Level 3) and also meets the proposed 2009 NO_2 limit of 20 percent ahead of schedule. Control systems that meet a Plus level would set the standard for the Best Available Control Technology (BACT).

Staff proposes two additional amendments that would enable more accurate and representative NO_2 measurements. These would create more specific pre-conditioning requirements for emission control systems and restrict test engines to those with representative engine-out NO_2 levels.

Although staff's proposal does not have direct emissions benefits, it will enable other ARB rules to achieve greater reductions in diesel PM. When staff proposes rules to implement in-use controls for the various categories of diesel engines, it will provide more detailed estimates, taking into account the specific issues associated with each category. Staff's proposed amendments do not change the voluntary nature of the Procedure. Therefore, economic impacts will be incurred by only those entities that choose to participate in the Procedure. Staff expects that its proposal will benefit business relative to the current Procedure because more of the products that businesses have already verified will be able to comply with the proposed NO_2 limit and continue to participate in the California market.

ARB staff recommends that the Board adopt the proposed amendments to Sections 2702, 2703, 2704, 2706, 2707, and 2709, Title 13, California Code of Regulations, as set forth in the proposed Regulation Order in Appendix A.

1 INTRODUCTION

This report, written by the staff of the Air Resources Board (ARB or Board), describes proposed amendments to the Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines (Procedure), which is in the California Code of Regulations, Title 13, Sections 2700-2710. The primary purpose of the Procedure is to support California's Diesel Risk Reduction Plan, which aims to dramatically reduce Californians' exposure to diesel particulate matter (PM). Verification of an emissions control system under the Procedure is the key to participating in the diesel emission control market in California. Staff determined that changes could be made to improve the Procedure and better enable ARB to meet the goals of the Diesel Risk Reduction Plan. This report describes those changes and the rationale behind them.

2 BACKGROUND

2.1 The Diesel Risk Reduction Plan and the Verification Procedure

In 1998, following a ten-year review process, the ARB identified diesel PM as a toxic air contaminant. A toxic air contaminant is an air pollutant that contributes to mortality or serious illness, or poses other potential hazards to human health. Diesel PM is of particular concern because it is distributed over large regions, thus creating widespread public exposure.

Diesel PM is the largest contributor to health risk posed by toxic air pollutants, constituting approximately 70 percent of the total statewide risk. To address this large-scale health concern, the ARB adopted the Diesel Risk Reduction Plan in 2000 (ARB, 2000). One of the primary goals of the Diesel Risk Reduction Plan is to reduce emissions of diesel PM from the long-lived in-use fleet. The Plan outlines measures that include the use of diesel emission control systems with existing diesel vehicles and equipment in on-road, off-road, and stationary applications. To be able to implement those measures, ARB must first verify that candidate emission control technologies are effective in reducing emissions.

In response to that requirement, ARB staff developed a procedure to verify systems that provide real and durable reductions in diesel PM emissions. For systems able to achieve a verifiable PM reduction, the Procedure can also assess and recognize NOx reductions of at least 15 percent. The Board adopted the Procedure at the public hearing held on May 16, 2002. The Procedure encompasses on-road, off-road, and stationary applications and is designed to evaluate a broad range of technologies, including aftertreatment systems, alternative diesel fuels, and fuel additives. It establishes emission testing requirements that manufacturers of emission control technologies must meet in order for their products to receive verification, as well as warranty and in-use compliance testing requirements.

2.2 Development of the Current NO_2 Limit

The focus of staff's proposal is the limit on emissions of NO_2 in the Procedure. The limit is a performance requirement that diesel emission control systems must comply with to be verified. Exposure to NO_2 has been associated with adverse health effects including respiratory symptoms, cardio-respiratory hospital admissions, and reduced lung function. As a result, NO_2 is classified as a criteria pollutant and has both federal and state ambient air quality standards. The Procedure includes a limit on NO_2 because many diesel emission control systems, while highly effective at reducing emissions of diesel PM, were also found to increase emissions of NO_2 (though not total NOx emissions). These systems use a platinum catalyst to oxidize nitric oxide (NO) in the exhaust to NO_2, which is useful for burning off collected PM (as in the case of a catalyzed diesel particulate filter). Excess NO_2 enters the exhaust stream and can lead to a significantly higher fraction of NO_2 than was originally present in the engine's exhaust.

As described in the Procedure's Initial Statement of Reasons released on March 29, 2002, ARB conducted atmospheric modeling for the year 2010 to investigate the effects of large-scale implementation of high-NO_2 strategies (ARB, 2002). The model assumed an aggressive retrofit scenario: 90 percent of all diesels were equipped with diesel particulate filters that increase emissions of NO_2. After reviewing the results of the modeling and presenting them before the International Diesel Retrofit Advisory Committee (IDRAC) at its February 6, 2002 meeting, staff determined that an NO_2 emission limit of 20 percent of the total baseline NOx emissions (by mass) would both minimize potential negative side effects (such as increases in ozone exposure) and potentially leave the door open for effective strategies that rely on NO_2 formation to work properly. To give manufacturers time to redesign their control strategies to meet the limit, the Board approved an effective date of January 1, 2004.

In December 2003, the Board heard proposed amendments to the Procedure that it was later able to formally adopt in February 2004. One of the adopted amendments was a delay in the effective date of the NO_2 limit to January 1, 2007. The primary reason for the delay was that none of the manufacturers were able to develop and verify a compliant particulate filter. There were also questions concerning direct exposure to NO_2 in the near-field (or at the "micro-scale"), variability of engine-out NO_2, and whether the assumptions that lead to the 20 percent limit were realistic. The Board adopted a three-year delay to enable the continued implementation of PM controls while staff reevaluated what level of NO_2 control was warranted.

2.3 Post-Hearing Activity

Following the February 2004 public hearing, staff convened an NO_2 working group comprised of representatives from the emissions control system industry, the diesel engine industry, end-user groups, and government entities. The working group focused on the concern of micro-scale exposure to NO_2, alternatives to the current form of the NO_2 limit, and gathered data on engine-out NO_2 emissions. In October 2004, the working group presented its findings and recommendations at another IDRAC meeting.

Subsequent to the adjournment of the working group, staff conducted another round of regional-scale atmospheric modeling to investigate the impacts of a more realistic implementation scenario using an updated emissions inventory. Rather than assuming that 90 percent of all diesel engines would be retrofit with catalyzed diesel particulate filters in 2010, staff assumed a mix of control options that acknowledged the limitations of filter technology and used revised market penetration estimates. Both the working group's recommendations and the results of the new regional-scale modeling are discussed in more detail in Section 4 of this report.

Taking all post-hearing activity into consideration, staff has developed a proposal that redefines the NO_2 limit. Staff's proposal is briefly summarized in the next section and discussed in more detail in Section 4.

3 SUMMARY OF PROPOSED AMENDMENTS

3.1 NO_2 Limit

Staff proposes to change the limit on emissions of NO_2 from retrofitted diesel engines to facilitate the verification of high-efficiency diesel PM control technologies. Currently, the Procedure limits total tailpipe-out NO_2 emissions regardless of how much NO_2 is contributed by the engine. Staff proposes to limit the increase in NO_2 emissions, not the total emissions level. Staff also proposes to relax the level of control of NO_2 emissions to enable the verification of the most effective PM control systems. The proposal could result in higher NO_2 emissions on average, but achieves a balance between the adverse impacts of increased NO_2 and the benefits of PM reductions from retrofitting diesel engines.

Under staff's proposal, the maximum total NO_2 emission level would depend on the baseline or engine-out NO_2 level. On average, about 7 percent of the NOx emitted by diesel engines are in the form of NO_2 (see Appendix B). Staff proposes that retrofitted engines have a maximum incremental increase in NO_2 of no more than 30 percent of the baseline NOx emission level effective January 1, 2007, and 20 percent effective January 1, 2009. For in-use compliance testing, staff proposes a maximum NO_2 increase of 33 percent for the 2007 limit and 22 percent for the 2009 limit. These levels are consistent with the ten percent allowance included in the PM reduction requirement for passing in-use compliance testing.

Staff's proposal differs in structure from the present NO_2 limit. The Procedure currently limits the total post-control NO_2 emissions to 20 percent, which includes the engine's contribution to NO_2. In contrast, staff's proposal focuses on NO_2 contributed by the device, not the engine. Two advantages of staff's proposal are that manufacturers are given a fixed design target and that the Procedure would directly regulate the effect of the emission control system itself. As a result, staff expects that the proposal will enable broader verifications than the current NO_2 limit.

Although staff's proposal would result in higher NO_2 emissions from diesel engines relative to the current NO_2 limit, modeling and analyses indicate it would still be

protective of public health. Besides enabling significantly greater reductions in exposure to diesel PM, the proposal would also keep general exposure to NO_2 below the 1-hour ambient air quality standard and limit increases in exposure to ozone to a few percent.

3.2 New Verification Levels

To create an incentive for manufacturers to verify lower NO_2 systems ahead of schedule, staff proposes creating new classifications called "Level 3 Plus" and "Level 2 Plus" and "Level 1 Plus" for the years 2007 and 2008. A system would meet one of the Plus levels if it achieves a diesel PM reduction of at least 85 percent (Level 3), 50 percent (Level 2), or 25 percent (Level 1) and also meets the proposed January 1, 2009 NO_2 limit of 20 percent ahead of schedule. Systems that meet a Plus level would set the standard for the Best Available Control Technology (BACT) beginning January 1, 2007. Note that a Level 3 system would be considered a higher level than a Level 2 Plus or Level 1 Plus system, and a Level 2 system would similarly be higher than a Level 1 Plus system.

3.3 Additional Pre-Conditioning Requirements

Staff is proposing additional pre-conditioning requirements for emission control systems whose NO_2 emissions may be influenced by the presence of soot and ash. The proposal covers pre-conditioning for the new and aged units for the original verification as well as the units involved in first-phase in-use compliance testing.

To control the amount of soot and ash in the new unit, staff proposes a more specific pre-conditioning procedure that entails repeating an appropriate certification test cycle for 25 to 30 hours. For the purposes of stabilizing catalyst performance, an applicant may, as part of the 25 to 30 hour period, choose to run the engine for up to ten hours under conditions that include significant high load operation. Following the pre-conditioning period, the unit must be run on the emissions test engine using the emissions test cycle, and the backpressure must be recorded. The unit would then be ready for testing.

Verification requires that a unit be aged via field use or prolonged operation in a laboratory, and that the aged unit undergo emissions testing to demonstrate durability. Staff proposes that at the time of emissions testing, the average backpressure of the aged unit must be within 30 percent of the average backpressure recorded for the new device. Further, in-use compliance testing is performed on units operated by customers. For these, the backpressure must also be within 30 percent of the value recorded for the "new" reference unit. If the backpressure is too high, the applicant may burn off excess soot and clean out excess ash as necessary until the backpressure requirement is met. Units selected for in-use compliance testing that do not initially meet the requirement may not be replaced by other units that do comply.

More information on the proposed pre-conditioning requirements can be found in Appendix E.

3.4 Test Engine Requirements

Staff proposes that the test engine's NO_2 emission level serve as one of the criteria by which a given test engine is approved for verification testing. In particular, staff proposes that the test engine must not have engine-out NO_2 emissions that exceed 15 percent of the total NOx emissions by mass as measured over the emissions test cycle. If there is a special category of engines with NO_2 emission levels that normally exceed 15 percent, this requirement may be adjusted for those engines at the discretion of the Executive Officer.

3.5 Other Proposed Amendments

3.5.1 Support for Verification Extensions and Design Modifications

As written, Sections 2702(g) and (h) suggest that all listed forms of support for verification are required. Staff proposes a clarification that not all are required, but that those listed are the types of support that staff will consider. The "and" in the list of sources would be changed to an "or".

3.5.2 Warranty Report Requirements

Section 2707(c) of the Procedure requires that applicants submit a warranty report to ARB by February 1 of each calendar year. A number of applicants have indicated that they need additional time to prepare the report. Staff proposes to change the annual deadline to April 1. This gives applicants two additional months to comply with the requirements.

3.5.3 Verification and Other Legal Requirements

To clarify how verification interacts with regulations of other agencies and other legal requirements in general, staff proposes adding Section 2706(l). This section would simply state that when a diesel emission control system is verified by ARB, the applicant is not released from complying with all other applicable legal requirements.

4 DISCUSSION OF IMPACTS

This section of the report includes discussion on the potential impacts of staff's proposal.

4.1 Impacts of Staff's Proposal

Staff's proposal would prevent California from losing large reductions in emissions of diesel PM. As shown in Table 1, only two of the currently verified Level 3 diesel emission control systems comply with the existing NO_2 limit. By contrast, staff estimates that the proposed 2007 limit would enable three-quarters of the Level 3 systems to remain verified as well as at least two of the Level 2 systems. Compliance is also somewhat better for the proposed 2009 limit.

Table 1. Estimates for Compliance of Verified Systems with Proposal

PM Level	Verified System	Complies with existing limit	Complies with proposed 30% increase (2007)	Complies with proposed 20% increase (2009)
Level 3	1	+	+	+
	2	+	+	+
	3	--	+	+
	4	--	+	--
	5	--	+	--
	6	--	+	--
	7	--	+	--
	8	--	+	--
	9	--	+	--
	10	-	--	--
	11	--	--	--
	12	--	--	--
Level 2	1	--	+	+
	2	--	+	--
	3	unknown	unknown	unknown
	4	unknown	unknown	unknown
Level 1	1	+	+	+
	2	+	+	+
	3	+	+	+
	4	+	+	+
	5	+	+	+
	6	+	+	+
	7	+	+	+
	8	+	+	+
	9	+	+	+

If the current 20 percent NO_2 limit remained in place, and Level 3 devices such as PM filters complied with the limit, as staff envisioned in 2002 and 2004, in-use emission reduction regulations and programs, both adopted and planned, would result in about 345 fewer premature deaths due to PM exposure (South Coast Air Basin in 2010). As discussed above, staff now expects that most Level 3 catalyzed PM filters will be de-verified if the current NO_2 limit remains in place. Should this occur, most in-use diesel clean-up will rely on Level 1 devices which reduce PM emissions by about 25 percent, compared to 85 percent for Level 3 devices such as PM filters. This will reduce the number of avoided deaths from the diesel clean-up program to about 116 deaths.

Staff's proposal to revise the NO_2 limit will allow the continued use of Level 3 catalyzed PM filters. As shown in last line of Table 2, this will result in about 235 avoided deaths.

The lower number of avoided deaths, compared to staff's assessment in 2002 and 2004, is due to increased NO_2 emissions that form additional nitrate PM, and a revised estimate of the mix of PM control devices that will be used to comply with the Board's regulations (more less effective Level 1 and 2 devices that earlier estimates).

In addition to positive impacts of the proposal, staff also analyzed potential adverse impacts. With a higher NO_2 limit, emissions of NO_2 from diesel vehicles and engines will increase on average. As a result, exposure to NO_2 and ozone could increase. To estimate these possible effects, staff assessed both near-source and regional air quality impacts of its proposal.

Results indicate that peak ozone may increase by one or two ppb (about one percent) during severe ozone episodes. For the South Coast Air Basin, the increase in ozone is roughly equivalent to a 10 to 30 ton per day (tpd) increase in hydrocarbon emissions, a precursor to ozone formation.

As discussed in Section 4.2.2, staff also analyzed impacts on localized exposure to ambient NO_2. The analysis showed that increased NO_2 emissions will not cause an exceedance of the 1-hour ambient air quality standard for NO_2.

Table 2 summarizes overall impacts for the South Coast Air Basin. The benefits of staff's proposal far outweigh adverse impacts.

Table 2. Estimated Impacts of Staff's Proposal (South Coast Air Basin)

Pollutant	$PM_{2.5}$*	Ozone*	NO_2**
Exposure	Decreases	Increases	Increases
Result	230-240 premature deaths avoided	1-2 ppb ozone - 1-2 more premature deaths	None; Exposure remains below 1-hr State standard

*Based on a regional air quality model simulation of a multi-day episode for 2010 in the South Coast Air Basin (see Section 4.2.1). Premature deaths avoided are for the year 2010 only.
**Based on micro-scale analyses (see Section 4.2.2).

4.2 Modeling and Analysis of Potential Impacts

In this section, staff provides additional detail on the potential regional and micro-scale air quality impacts of the proposal.

4.2.1 Simulated Impacts at the Regional-scale

The original NO_2 limit was based on modeling simulations of air quality for the summer, fall, and winter in Southern California for multi-day periods in 2010 (Table 3). It assumed that 90 percent of all diesel vehicles and equipment were retrofitted with filters

and considered a range of 15 to 50 percent for the NO_2 fractions. Based on the results of the modeling, staff selected a conservative NO_2 limit of 20 percent at the tailpipe. This limit ensured that no violation of the State ambient air quality standard for NO_2 would occur and that there would be no effect on regional ozone formation. Staff now believes that the original analysis was overly conservative because catalyzed PM filters will be applied to less than 90 percent of all diesel engines due to application limitations and the availability of other control options (e.g., actively regenerating filters and engine replacement). Some of these options do not significantly increase NO_2 emissions.

Table 3. Summary of Simulated Impacts of Diesel Particulate Filters* in Southern California, 2010 (Original Rulemaking)

Diesel NO_2/NOx: (90% of all diesel engines)		Baseline 10%**	15%	20%	25%	30%	50%
		(Percent change from baseline)					
Summer	Peak 1-Hour O_3	0	-1	0	0	0	1
	Cumulative Daily 1-Hr O_3 Exposure > 90 ppb	0	-3	-2	0	+2	+5
	Peak 24-Hour $PM_{2.5}$	0	-3	n/a	n/a	-2	-1
Fall	Peak 24-Hour $PM_{2.5}$	0	-6	n/a	n/a	-5	-3
Winter	Peak 1-Hour NO_2	0	+1	+6	+12	+18	+41

*90 percent of all diesel engines assumed to be retrofitted with catalyzed diesel particulate filters.
**Consists of 5 percent engine-out NO_2 plus 5 percent NO_2 from in-plume conversion of NO to NO_2.

To estimate regional air quality impacts that would result from a more realistic mix of various emission control technologies, staff developed a new scenario. Instead of 90 percent of all diesel engines being equipped with NO_2-generating filters in 2010, staff applied a mix of technologies to 90 percent of the fleet (Table 4). This new scenario is as aggressive as the original scenario in terms of implementation, but it recognizes that fewer passive (NO_2-generating) filters will be used and that other options are available.

The mix of emission control options that staff assumed includes NO_2-generating filters, non-catalyzed filters, flow-through filters, diesel oxidation catalysts (DOCs), and engine repowers or vehicle/equipment replacements (see Appendix C for details). Staff applied a 30 percent increase in the NO_2 fraction for NO_2-generating filters, consistent with the proposed NO_2 limit. The penetration of NO_2-generating filters into the off-road market is assumed to be lower than that for on-road engines because of the less predictable and more diverse duty cycles of off-road applications. No off-road repowers or replacements were assumed because in the 2010 timeframe, regulations also require retrofit. For stationary engines, staff assumed all prime engines would use NO_2-generating filters.

Table 4. Revised "Most Likely" 2010 Penetration Scenario

Control Option	On-road Diesels	Off-road Diesels
NO_2-generating filters	50%	30%
Non-catalyzed filters	10%	15%
Flow-through filters	25%	25%
Diesel oxidation catalysts	10%	30%
Repower/Replacement	5%	0%
Percent of fleet using the control option mix	90%	90%

Staff updated the estimates of impacts of widespread diesel retrofits to include the revised "most likely" scenario. The results also reflect the more recent 2003 State Implementation Plan (SIP) emissions inventory for 2010 and not the interim inventory used to generate the results in Table 3. Also, the updated estimates for ozone are based on a different photochemical model (CAMx). Additional information can be found in Appendix C.

Presented in Table 5 is staff's updated assessment of the impact of the NO_2 limit on avoided premature deaths. The last row reflects the staff's proposal to revise the NO_2 limit, and the more realistic estimate of the mix of technologies that will be used to reduce PM emissions from in-use engines. As shown, the number of avoided deaths is about 235 in the South Coast Air Basin in 2010. Had catalyzed filter manufacturers been able to reduce NO_2 emissions to the currently required 20 percent limit (represented in the table as a 10 percent increment), premature deaths avoided would be about 345. As discussed previously, NO_2 emissions of catalyzed filters have not been reduced and exceed the current limit. Thus if the limit is not revised, these devices will not be available for use in reducing PM emissions. The alternative under the Board's regulations is to use less effective devices. Most of these would be Level 1 devices that reduce PM emissions by about 25 percent, as compared to the 85 percent reduction of catalyzed filters. Staff estimates that if the current NO_2 limit is not revised, the avoided deaths will be reduced to about 116, due to the lower PM emission reductions. Clearly, the staff proposal achieves the greatest reduction in premature deaths, given the general unavailability of low NO_2 catalyzed filters that meet the existing NO_2 limit.

Table 5. Estimates for Premature Deaths Avoided (South Coast Air Basin, 2010)

NO_2 (Increment)		$PM_{2.5}$ Deaths Avoided* (Modeled)	O_3 Deaths Avoided (Modeled)	Net Deaths Avoided
90% of diesels with filters	5%	370	<1 to 4	370
	10%	340 to 350**	1 to 2	340 to 350
	15%	320 to 340**	<1	320 to 340
	20%	290 to 320	-2 to -1	290 to 320
	30%	240 to 280**	-5 to -2**	240 to 280
	40%	190 to 240	-9 to -3	180 to 230
Most Likely Scenario		230 to 240***	-2 to -1	230 to 240

* Range reflects two modeled PM episode days (Dabdub and Knipping, 2002) and 3-5 modeled ozone episode days, which are not necessarily representative of the annual averages of these pollutants. There is +/- 50 percent uncertainty behind each estimate due to uncertainty in concentration-response relationships between exposures to the pollutants and premature death.

** Derived via linear interpolation.

*** The most likely scenario reflects a mix of retrofit technologies (not just 90 percent filters as in the other scenarios) that results in a 16 percent increase in the NO_2 fraction. The estimate for deaths avoided uses the result for the 15 percent increment scenario adjusted for the difference in diesel PM reductions (55 percent for the likely scenario vs. 77 percent for the other scenarios).

Staff's proposal to revise the NO_2 limit will result in greater NO_2 emissions. Staff updated its assessment of the impact of these higher emissions on ozone. Table 6 contains the results. For the most likely scenario (right hand column), peak ozone is expected to increase by about 1 percent in southern California in 2010. This is equivalent to 1 to 2 ppb ozone. Also shown for reference are the original scenarios used to establish the existing 20 percent limit. The 10 percent NO_2 column represents the current limit, and as shown there is no increase in ozone, which was the criterion for selecting the NO_2 limit in 2002. Unfortunately, a tradeoff now exists. To achieve the lower PM emissions and substantially reduced premature deaths, higher NO_2 emissions must be allowed, and a small increase in ozone is the result. This increase is further reduced once the allowable NO_2 increase is reduced to 20 percent in 2009.

Table 6. Updated Simulated Impacts of Diesel Retrofits on Ozone in Southern California, 2010 (2003 SIP emissions inventory)

Air Quality Parameter		Baseline 10%* NO_2/NOx	90% of diesels with filters NO_2 increment					Most Likely Scenario
			5%	10%	15%	20%	40%	
			(Percent change from baseline)					
Summer	Peak 1-Hour O_3	0	-1	-1	0	0	2	1
	Cumulative Daily 1-Hr O_3 Exposure > 90 ppb	0	-6	-3	1	4	19	8
	Peak 8-Hour O_3	0	-1	-1	0	0	2	1
	Maximum Daily 8-Hr O_3 Exposure > 70 ppb	0	-2	-1	0	1	4	1

*Consists of 5 percent engine-out NO_2 plus 5 percent NO_2 from in-plume conversion of NO to NO_2.

In addition to health impacts, staff also estimated the reduction in ozone precursor emissions that would be required to offset the modeled increase in ozone for the South Coast Air Basin. To do this, staff used year 2010 air quality simulations[1] to examine the sensitivity of the maximum daily 8-hour ozone concentration to changes in precursor emissions. At emissions rates that are expected to achieve attainment of the 8-hour ozone standard for the modeled episode, simulated ozone concentrations showed almost no response to changes in NOx emissions. For hydrocarbons, however, reductions of 8-14 tons per day caused a one ppb reduction of the 8-hour ozone concentration[2]. If it is assumed that increases in peak 1-hour and 8-hour ozone concentrations are equivalent, a reduction in hydrocarbon emissions of roughly 10 to 30 tons per day would be required to offset the increase in peak 1-hour ozone expected from staff's proposal (one to two ppb).

4.2.2 Estimated Micro-scale Impacts

In addition to investigating potential air quality impacts at the regional-scale, staff also considered micro-scale impacts. The concern at the micro-scale is the potentially high acute exposure to NO_2 at short distances from the source, such as might occur when closely following a vehicle equipped with an NO_2-generating filter. Staff evaluated conservative, worst-case scenarios based on both actual field measurements, described first, and dispersion modeling, described second. The results show that

[1] Based on the August 3-7, 1997, episode conditions used for the 2003 South Coast 1-hour Ozone SIP update.

[2] This ozone concentration response estimate is based on reductions of all volatile organic compound species by the same percentage. Therefore, it does not necessarily represent an actual emissions control strategy.

staff's proposal to allow higher NO_2 emissions will not result in local exceedances of the 1-hour ambient air quality standard for NO_2.

A. Evaluations of Measurement-based Exposure Scenarios

ARB staff in the NO_2 Working Group conducted an assessment of several worst-case micro-scale exposure scenarios (Fruin et al, 2004). In brief, these scenarios were:

(1) Driving on a diesel-dominated Freeway – This scenario focused on the segment of the 710 Freeway from Long Beach to the 5 Freeway (16 miles long), which is the busiest diesel truck corridor in California. For the analysis, staff assumed that 50 percent of all the diesel trucks on this freeway segment were equipped with filters that generate excess NO_2. Also, on-road concentrations of NO and NO_2 were assumed to be those obtained by staff from recent on-road measurements taken on the 710 Freeway.

(2) Riding in a self-polluting, filter-equipped diesel school bus – This scenario considered the re-entrainment of a fraction of the bus' own exhaust ("self-pollution") into the passenger cabin and made use of tracer gas measurements from the ARB Children's School Bus Exposure Study[3].

(3) Following a filter-equipped diesel vehicle – To estimate potential NO_2 exposure immediately behind a vehicle exhaust plume, staff used dilution measurements from an ongoing ARB School Bus follow-up study. In these experiments, two school buses followed each other closely while driving in real-world traffic conditions. A conservative approach was taken, and the lowest-observed, short-term dilution rates were assumed for the analysis.

The NO_2 concentrations staff used as threshold to assess the potential exposure in each scenario were the State 1-hour ambient air quality standard of 250 ppb and a 15-minute level of 370 ppb derived from the 1-hour standard. This derivation used an exponential relationship derived from animal studies of NO_2 exposures (ten Berge et al., 1986 as cited in Fruin et al., 2004). Scenarios (1) and (3) are suited to the shorter 15-minute timescale since the 710 Freeway segment is only 16 miles long, and vehicles usually do not follow each other for long periods of time. In addition, the 15-minute interval is also appropriate for the simultaneous occurrence of all three scenarios, which amounts to being in a filter-equipped vehicle that is following behind another filter-equipped vehicle on the 710 Freeway.

The analysis found that the proposed 30 percent incremental NO_2 limit over the engine-out level is still protective at the micro-scale for the 1-hour and 15-minute timescales, in spite of a doubling of the total exposure calculated for the original 20 percent absolute limit. Staff found this result for the scenarios individually as well as when they occurred simultaneously (see Table 7). It is also important to recognize that although the filters in

[3] For information on the Children's School Bus Exposure Study, please see: http://www.arb.ca.gov/research/schoolbus/schoolbus.htm

these scenarios caused increased NO_2 exposures, they also caused large reductions in diesel PM exposures. Table 3 shows that when the scenarios are combined, the filters reduce diesel PM exposure from 58 µg/m³ to 20 µg/m³7.

Table 7. Micro-scale NO_2 Exposure and PM Reduction Estimates

High Exposure Scenarios	Estimated NO_2 Exposure (ppb)		Estimated Diesel PM Exposure	
	30% NO_2 increment	20% NO_2 absolute limit	No filters ($\mu g/m^3$)	Reduction with filters
(1) 710 Freeway	94	47	28	43%*
(2) Self-Pollution	57	28	14	85%
(3) Following	37	19	16	85%
Total	188	94	58	65%

*50 percent of trucks equipped with filters

B. Evaluations of Dispersion Modeling-based Exposure Scenarios

Staff simulated two worst-case, acute NO_2 exposure scenarios using dispersion modeling of exhaust:

(1) Idling School Buses – Twenty filter-equipped school buses, in groups of five, were assumed to idle five minutes each (the State limit) at the loading zone for 20 minutes total. The NOx emission rate at idle for the school buses was 81 g/hr based on the EMFAC 2002 V2.2 emissions model. Idling was assumed to take place at 8 A.M. and 2 P.M. each weekday. Staff used the U.S. EPA ISCST3 air dispersion model and assumed the impacted receptor of interest to be 20 meters away.

(2) High Volume Freeway – A segment of the 710 Freeway with high diesel truck traffic was simulated. The freeway scenario included a nominal traffic volume of 26,312 trucks per day, the 99th percentile of truck traffic on freeways in California. Staff used the CAL3QHCR roadway model, available from U.S. EPA and derived from the CALINE Model. The impacted receptor was assumed to be 20 meters from the edge of the freeway.

Table 8 shows a summary of the highest 1-hour NO_2 concentrations for the two scenarios discussed above, all of which are below the State 1-hour ambient air quality standard of 250 ppb. Because a hot, heavily-catalyzed filter may be able to produce as much as 70 percent NO_2 at idle, staff chose to model that scenario as well. Even in that case, exposure does not exceed the 250 ppb level, though it comes close.

Table 8. Summary of 1-Hour NO_2 Impacts* Anticipated from Retrofitting Diesel Engines with Filters

Scenario	Baseline (no filters) (10% NO_2/NO_x)	With Filters (40% NO_2/NO_x)	With Filters (70% NO_2/NO_x)
Idling School Buses	120 ppb	170 ppb	240 ppb
Freeway	150 ppb	180 ppb	---

*These results include ambient hourly NO_2 as background.

5 INTERACTION WITH OTHER ARB DIESEL PROGRAMS

ARB in-use diesel programs rely on emission control systems verified under the Procedure to achieve their diesel PM reduction goals. If the NO_2 limit is not changed, nearly all of the currently verified filters would be de-verified in January 2007, removing one of the most effective PM control technologies from the market. End-users would resort to lower-efficiency systems that achieve 25 to 50 percent PM reductions, resulting in lower overall PM control than what is envisioned in the Diesel Risk Reduction Plan. While it is true that participation in the verification process is voluntary and there is no prohibition against selling diesel emission control strategies in California that have not been verified by the ARB, the ARB has adopted and may in the future adopt regulations requiring reductions of PM from in-use diesel vehicles. (See, e.g. title 13 CCR section 2020, et seq., Solid Waste Collection Vehicles; 13 CCR section 1956.2, Fleet Rule for Transit Agencies; 13 CCR section 2477, Transportable Refrigeration Units; 17 CCR section 93115, Airborne Toxic Control Measure for Stationary Compression Ignition Engines; 17 CCR section 93116, Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater). One of the compliance options available to entities that must comply with these regulations is the application of verified, retrofitted diesel emission control strategies in specific situations. Entities subject to these retrofit requirements may then, under certain circumstances, be obliged to use verified diesel emission control strategies to comply with these requirements, perhaps because it is the compliance option most attractive to them. Consequently, these entities will only purchase systems from manufacturers that have obtained ARB's verification. The proposed regulatory action would make the requirements for verification less stringent than they are now, allowing for more systems to become verified and avoiding the loss of verifications by most currently verified systems on January 1, 2007.

6 ISSUES

6.1 Health Effects and the Balance Between NO_2 Emissions and Diesel PM

The current NO_2 limit for verified devices will effectively preclude the continued use of most catalyzed PM filters, beginning in January 2007. Catalyzed PM filters are commonly used to comply with the ARB's in-use diesel emission reduction regulations. If the limit is not changed, many diesel trucks and equipment will be forced to use less

effective devices, resulting in smaller emission reductions. Staff estimates this will reduce the health benefits of the regulations by approximately 50 percent.

The alternative is to increase the allowable NO_2 emissions in order to allow the continued use of catalyzed PM filters. The higher NO_2 emissions will result in a small increase in peak ozone and ozone exposure, on the order of one percent. Modeling shows ambient NO_2 concentrations will increase, but not sufficiently to cause a health problem or exceedance of the ambient air quality standard for NO_2.

Staff believes on balance that the benefits of lower PM exposure clearly outweigh the adverse impact of increased ozone exposure. This supports its proposal to continue using devices effective in reducing PM emissions. Staff's proposal to reduce the allowable NO_2 increase from 30 to 20 percent in 2009 further mitigates the tradeoff.

6.2 Fuel-borne Catalysts and NO_2

Staff views the proposal as a balance between diesel PM and NO_2 because NO_2 is a byproduct of the most prevalent diesel particulate filters on the market today. They rely on NO_2 to burn off PM collected in the filter. Restricting emissions of NO_2 hampers the basic mechanism that allows these technologies to operate properly.

During NO_2 working group discussions, it was pointed out that there are filter technologies that do not rely on this mechanism. In particular, a working group member indicated that there are metallic fuel-borne catalysts (FBCs) designed to regenerate filters that do not increase NO_2 emissions. One of the issues with this technology is that it faces considerable federal and state testing requirements. Unlike the filter technologies being used in California today, FBC systems introduce metals into the fuel. This triggers special testing requirements at the federal level and multimedia evaluation requirements at the state level. Fulfilling both requirements can be costly and time-consuming; as a result, many manufacturers choose not to undergo testing. There are no FBC-based systems verified at present. Thus, FBC-based systems cannot be relied upon to fulfill the need for devices that reduce PM emissions, at least not in the current timeframe.

6.3 Fewer Verified Products

The proposed NO_2 limit will likely cause the de-verification of two filters. On the other hand, if the current NO_2 limit were to remain in effect, all but two filters would be de-verified. The latter situation would be acceptable if several compliant, proven, and viable alternatives had emerged to meet California's need to reduce diesel PM emissions. Industry, however, has not yet been able to supply such products.

7 REGULATORY ALTERNATIVES

While developing the proposal, staff considered numerous regulatory alternatives, two of which are described below.

7.1 No Change to the NO_2 Limit

One alternative to staff's proposal is to retain the current NO_2 emission limit. Doing so may lead to lower NO_2 emissions, but it would also cause most of the currently approved filters to be de-verified and hinder the verification of other systems for the reasons described in Section 4. Because the success of the Diesel Risk Reduction Plan depends on having effective diesel emission control systems verified for a wide range of diesel engines and applications, staff does not recommend this option.

7.2 Do Not Regulate NO_2 Emissions

The most effective option for maximizing the number of verified emission control systems available to support the Diesel Risk Reduction Plan would be to remove any limit on NO_2 emissions. Under this alternative, all currently verified systems would remain verified, and systems with higher NO_2 could become verified in the future. The problem with this option is that increased NO_2 emissions will lead to greater ozone increases and associated health impacts. It is also possible that higher NO_2 emissions, allowed under staff's proposal, could cause localized exceedances of the ambient air quality standard for NO_2. Staff's proposal to limit NO_2 emissions assures increases in ozone and ambient NO_2 are minimized. Staff, therefore, does not recommend removing the NO_2 limit altogether.

8 ECONOMIC IMPACTS

The proposed amendments to the Procedure would modify a protocol for evaluating in-use diesel emission control technologies and make it less stringent than it now is, or will become as of January 1, 2007. Overall, participation in the verification program is purely voluntary, and businesses participate in the verification process only if they believe it to be financially advantageous to do so. The proposed amendments will not change the voluntary nature of the Procedure. At the same time, staff expects the relaxation of the NO_2 emissions limit to benefit manufacturers and users of diesel emission control systems because staff's proposal would result in fewer (if any) de-verifications of currently verified products than the existing NO_2 limit.

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. The ARB is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action. The Executive Officer has also determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action will not affect small businesses because participation in the Procedure is purely voluntary. There are no cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action. However, under certain circumstances, where the proposed amendments may have an economic effect, the staff believes that this effect will be positive, as described below.

As noted, participation in the Procedure is purely voluntary both in its current form and as amended under the proposed action. While it is true that participation in the verification process is voluntary and there is no prohibition against selling diesel

emission control strategies in California that have not been verified by the ARB, the ARB has adopted and may in the future adopt regulations requiring reductions of PM from in-use diesel vehicles. (See, e.g. title 13 CCR section 2020, et seq., Solid Waste Collection Vehicles; 13 CCR section 1956.2, Fleet Rule for Transit Agencies; 13 CCR section 2477, Transportable Refrigeration Units; 17 CCR section 93115, Airborne Toxic Control Measure for Stationary Compression Ignition Engines; 17 CCR section 93116, Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater). One of the compliance options available to entities that must comply with these regulations is the application of verified, retrofitted diesel emission control strategies in specific situations. Entities subject to these retrofit requirements may then, under certain circumstances, be obliged to use verified diesel emission control strategies to comply with these requirements, perhaps because it is the compliance option most attractive to them. Consequently, these entities will only purchase systems from manufacturers that have obtained ARB's verification. The proposed regulatory action would make the requirements for verification less stringent than they are now, allowing for more systems to become verified and avoiding the loss of verifications by most currently verified systems on January 1, 2007. Accordingly, the proposed amendments will have the positive economic effect of keeping more manufacturers in the business of producing verified systems. This will guarantee that the market for verified devices remains competitive, giving consumers the benefits of this competition in terms of increased product choices, technological innovation and price restraint. Moreover, the proposed amendments will also have the positive economic impact of avoiding the situation where previously-installed verified retrofit systems no longer meet verification requirements, driving current manufacturers out of the market and possibly necessitating either the system's removal and the installation of one of the few systems that would meet the unamended requirements, or the pursuit of one of the other less attractive compliance options. For all of the foregoing reasons, staff does not expect the proposal will result in adverse economic impacts and instead expects that the proposal will result in positive economic impacts. Several aspects of the expected economic impact of the proposed regulations are discussed below.

8.1 Legal Requirement

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 business in other states.

State agencies are also 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. The estimate shall include any non-discretionary cost or saving to the local agencies and the cost or saving in federal funding to the State.

8.2 Affected Businesses

Participation in California's diesel emission control verification program is not mandatory. However, any business or individual that chooses to participate in the program will have to satisfy the requirements of the Procedure. Businesses that choose to participate and thus follow the Procedure include manufacturers and marketers of diesel emission control technologies. Also, some businesses may be indirectly affected, such as system installers and suppliers of raw materials or equipment to participants. Overall, staff expects that the economic impacts of the proposal will be positive, because more systems will be able to meet the requirements for verification, while few, if any, systems that are currently verified will need to be de-verified. Users of verified systems will have a greater variety of products to choose from either to satisfy a compliance option or by purely voluntary action, fostering competition, keeping prices down and improving the quality of the systems available. Users who currently may be using verified systems will avoid the possible expense and inconvenience of removing their current, verified systems and replacing them with systems that would meet the requirements of the regulation if it were not amended, or pursing another possibly less desirable compliance option. The amendments may have a negative economic effect in the very limited situation where a manufacturer would be able to meet the current NO_2 limit, while others are driven out of the market by their inability to do so. Under such a scenario, the remaining manufacturer could enjoy a competitive advantage in selling one of the few verified systems available. This proposal would deprive a manufacturer of such an advantage and the staff believes that any adverse economic impact experienced by a manufacturer in this position is outweighed by the positive impacts the proposal would have in terms of keeping more manufacturers and products in the market, thereby enhancing competition along with the technological innovation and price restraint that enhanced competition brings.

8.3 Potential Impact on California Businesses

The proposed amendments should have no disparate economic impact on California businesses, except for the positive impacts noted above. The requirements for verification under the Procedure apply to any business that wishes to sell its products in California, regardless of its location. The proposed amendments do not alter that universality. Should any manufacturer or marketer elect to participate in the verification program, it would need to provide detailed information and data on the product in accordance with the Procedure. The testing required by the Procedure may require significant expenditures of capital on the part of a company. The proposed amendments to the Procedure will either cause no change in the cost of testing or slightly increase the cost due to the additional pre-conditioning requirements for certain technologies. Relative to the current NO_2 limit, staff's proposal will also enable more of the currently verified products to continue to be sold in California. Several California manufacturers and installers therefore stand to benefit.

Should a business choose not to participate in the verification program, there are other avenues by which its products may be sold in California. A business having a Vehicle Code 27156 exemption can legally sell the product in California, but can claim no

emissions reductions. The product would not be a verified diesel emission control strategy, and would not satisfy the requirements of the fleet rules.

8.4 Potential Impact on Employment

The proposed amendments to the Procedure are not expected to cause a noticeable change in California employment and payroll. Participation in the program is voluntary, and presumably only businesses that can afford the program would participate. Any effect on employment is expected to be positive, given the fact that the overall economic effect of the proposed amendments is expected to be positive.

8.5 Potential Impact of Business Creation, Elimination or Expansion

The proposed amendments to the Procedure will enable more of the currently verified products to remain verified and continue to participate in the California market. This will have a beneficial impact on businesses, but staff does not expect considerable business creation, elimination, or expansion. Any effect on business creation, elimination or expansion is expected to be positive, given the fact that the overall economic effect of the proposed amendments is expected to be positive.

8.6 Potential Impact on Business Competitiveness

The proposed amendments to the Procedure would have no impact on the ability of California's businesses to compete with businesses in other states. Staff's proposals do not change the voluntary nature of the Procedure or its applicability to all businesses that manufacture or market diesel emission control technologies regardless of their location. Any impact on business competitiveness is expected to be positive, given the fact that the overall economic effect of the proposed amendments is expected to be positive.

8.7 Potential Impact to California State or Local Agencies

The proposed amendments to the Procedure will not create costs or savings, as defined in Government Code Section 11346.5 (a)(6), to any State agency or in federal funding to the State, costs or mandate to any local agency or school district whether or not reimbursable by the State pursuant to Part 7 (commencing with Section 17500, Division 4, Title 2 of the Government Code), or other non-discretionary savings to local agencies. The staff has not encountered information that indicates that any of these impacts is to be expected.

8.8 Estimated Costs

As noted previously, the proposed amendments do not change the voluntary nature of the Procedure. Those manufacturers that wish to market diesel emission control systems in California would find verification under the Procedure desirable. The proposed amendments to the Procedure would cause either no change in the cost of testing or a minor increase in cost due to the additional pre-conditioning requirements for certain technologies. The proposed amendments should keep the costs of verified

systems down, due to their effect of keeping more verified products in the marketplace, but this effect is difficult to quantify.

9 ENVIRONMENTAL IMPACTS

A complete discussion of the environmental impacts of the proposed amendments can be found in Chapters 4, 6 and 7 of this report. As discussed in these portions of the report, staff's proposal will increase NO_2 emissions. Modeling has shown this will result is a small increase in peak ozone and exposure and this increase constitutes an adverse environmental impact. Ambient NO_2 concentrations will also increase, but modeling has shown there will be no exceedance of the health protective ambient NO_2 air quality standard.

The revised NO_2 limit will assure that highly effective devices that reduce PM emissions will continue to be available for use by diesel vehicle operators facing ARB regulations or other pressures to reduce diesel emissions. Health assessments show that the lower PM emissions result in substantially reduced exposure to diesel PM, and at least several hundred premature deaths in southern California will be avoided annually by continued use of PM filters. The staff believes that this benefit clearly outweighs the small increase in ozone and associated adverse health impacts from this increase.

9.1 Legal Requirements Applicable to the Analysis

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed regulations. Since the ARB's program involving the adoption of regulations has been certified by the Secretary of Resources (see Public Resources Code section 21080.5), the CEQA environmental analysis requirements are allowed to be included in the Initial Statement of Reasons for a rulemaking in lieu of preparing an environmental impact report or negative declaration. In addition, the ARB will respond in writing to all significant environmental issues raised by the public during the public review period or at the Board hearing. These responses will be contained in the Final Statement of Reasons for the proposed amendments.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following: (1) an analysis of the reasonable foreseeable environmental impacts of the methods of compliance; (2) an analysis of reasonably foreseeable mitigation measures; and, (3) an analysis of reasonably foreseeable alternative means of compliance with the proposed revisions to the Regulation. Regarding reasonably foreseeable 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.

9.2 Ozone Impacts

The ozone increases described in Chapters 4, 6 and 7 constitute an adverse environmental impact. Staff evaluated alternatives to these proposed amendments

(see: Chapters 4, 6 and 7). However, staff was not able to identify any feasible alternatives that would substantially reduce the potential adverse impacts of these proposed amendments while at the same time ensuring that the positive environmental impacts (i.e. a reduction in exposure to diesel particulate) would be achieved. Staff was also unable to identify any feasible mitigation measures that would substantially reduce the potential adverse impacts, while at the same time ensuring that the positive environmental impacts would be achieved. Staff believes that reducing diesel particulate exposure is a consideration that overrides the small ozone impacts that may occur as a result of the proposed amendments.

9.3 Reasonably Foreseeable Alternative Means of Compliance with the Proposed Amendments

The ARB is required to do an analysis of reasonable foreseeable alternative means of compliance with the proposed amendments. Alternatives to the proposed amendments are discussed in Chapters 4 and 7. ARB staff has concluded that the proposed amendments provide the greatest degree of flexibility and the least burdensome approach to reducing public exposure to diesel particulate consistent with protection of public health.

9.4 Environmental Justice

The ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. Because some communities experience higher exposures to toxic pollutants, it is a priority of the ARB to ensure that full protection is afforded to all Californians. The proposed amendments are not expected to result in significant negative impacts in any community. The proposed amendments are designed to support the DRRP reduce emissions of diesel particulate throughout the state. The result of the proposed amendments will be reduced exposures to potential diesel particulate emissions for all communities in the state, with associated lower potential health risks.

10 COST-EFFECTIVENESS

Because no direct emissions benefits are associated with staff's proposal, no cost effectiveness analysis could be performed. More detailed estimates will be provided when staff develops future rules that incorporate in-use controls.

11 CONCLUSION

The proposed amendments to the Procedure, as described herein, would help ARB to implement the Diesel Risk Reduction Plan while keeping emissions of NO_2 from retrofitted diesel engines under control. ARB staff recommends that the Board adopt the proposed amendments to Sections 2702, 2703, 2704, 2706, 2707, and 2709, Title 13, of the California Code of Regulations, as set forth in the proposed Regulation Order in Appendix A.

12 REFERENCES

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