Cal/EPA

California Environmental Protection Agency

Air Resources Board

H A A G E N - S M I T
LABORATORY
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Mail-Out #97-07
April 4, 1997

Pete Wilson
Governor

James M. Strock
Secretary for Environmental Protection

TO: ALL MANUFACTURERS OF SMALL OFF-ROAD ENGINES
ALL MANUFACTURERS OF SMALL OFF-ROAD EQUIPMENT
ALL OTHER INTERESTED PARTIES

Workshop Notice

Small Off-Road Engine Regulatory Review

Introduction

In 1995 the first tier of standards for utility and lawn and garden equipment below 25 horsepower (hp) was implemented. More than 300 engine families are currently certified to those standards. The second tier of utility engine standards is scheduled for implementation in January 1999, and represents a 70 percent reduction from the first tier levels.

In January 1996 the Air Resources Board (ARB or Board) considered a report on industry progress toward the second tier standards. At the hearing, the Board directed staff to hold further meetings with industry to continue to assess industry's ability to meet the 1999 standards in the remaining lead time.

The ARB staff has met with various entities regarding the small off-road engine regulations since the January 1996 meeting. The staff held a general workshop on May 22 and subsequently met with manufacturers and other interested parties individually. The result of those meetings is the enclosed documents, which detail the revisions that the staff plans to propose. The revisions are intended to provide industry with greater flexibility than the existing regulations; however, meeting the State Implementation Plan (SIP) commitments remains a primary concern.

The Workshops

The staff has scheduled two general industry workshops, one to discuss handheld equipment and one to discuss nonhandheld equipment. The workshop for nonhandheld equipment will be held

Tuesday, May 6

1:30 p.m.
Annex 4
9530 Telstar Avenue
El Monte, California 91731

The workshop for handheld equipment will be held

Wednesday, May 7
9:30 a.m.
Annex 4
9530 Telstar Avenue
El Monte, California 91731

The staff encourages industry and other interested parties to contact staff with any comments or questions and to provide written comments. The staff requests that comments be submitted before the workshops to ensure that issues can be addressed at the meetings. Post-workshop comments will be most useful if they arrive prior to May 14, 1997.

The staff also encourages all manufacturers to respond to the enclosed economic survey. The information will be used to determine the cost effectiveness and economic impact of the staff's proposal. Any information provided will be kept confidential.

Please direct all comments to Mr. Michael W. Carter, Chief, Emission Research and Off-Road Controls Branch, 9528 Telstar Avenue, El Monte, California 91731. If you have questions, please call Ms. Jackie Lourenco, Manager, Off-Road Controls Section, at (818) 575-6676 or Mr. Scott Rowland, staff, at (818) 575-6683.

Sincerely,

Robert H. Cross, Chief
Mobile Source Control Division

Enclosures

Small Off-Road Engine Regulatory Proposal

Staff has identified the following amendments and additions to the existing small off-road engine regulation as necessary and cost-effective in achieving emissions reductions from small engines.

1. Applicability - The staff proposes to revise the regulations to include all engines less than 25 hp that are used in mobile applications, specifically specialty vehicle and golf cart engines below 25 hp. Specialty vehicle engines are currently regulated under the off-highway recreational vehicle regulation, and are required to meet the same standards as the engines in this category. The engines are substantially similar to other engines covered by the small off-road engine regulations. Staff believes that the consolidation of the category will improve the administration, implementation and enforcement of the regulations. Similarly, the regulations will explicitly apply to golf carts. New golf carts that will be used in areas that meet the federal ozone standards will be required to use certified engines. New golf carts for use in areas that do not meet the federal ozone standards will continue to have a zero-emission requirement.

2. Emissions Durability - The staff proposes to revise the regulations to ensure that engines are "emissions durable," i.e., controlled throughout their useful life. To accomplish this, staff proposes that certification testing be done similarly to the current durability protocol followed for automobile certification.

The staff proposes to differentiate engines based on expected useful life. Manufacturers would be able to choose between three durability periods for nonhandheld engines; manufacturers of handheld engines would be able to choose from two durability periods (the durability periods are similar to those detailed in the handheld equipment Statement of Principles (SOP) recently agreed upon by industry and the United States Environmental Protection Agency (U.S. EPA)). The staff believes that market forces would encourage manufacturers to choose appropriate useful lives for their engines. The staff requests comments on whether that encouragement would be sufficient to ensure proper classification. The durability periods would apply to both spark-ignition engines and compression-ignition engines. The durability periods are detailed in Table 1, below.

Table 1

Durability Periods

	Durability Periods (hours)		
Handheld	50		300
Nonhandheld	125	250	500

Staff based the proposed nonhandheld standards on the deterioration expected from overhead valve (OHV) engines at 250 hours and the proposed handheld standards on the observed deterioration of small four-stroke engines designed for handheld use. Although the emissions compliance would be based on a given durability period, the standards would not differ from one durability period to another. A manufacturer that chose the 500-hour durability period for marketing reasons would have to meet the standard at 500 hours, while one that chose the 125-hour durability period would have to meet the same level at the shorter number of hours.

Manufacturers would be required to note the durability period on the engine label, on the equipment label, on the box, and in the owner's manual. The staff believes that this will result in products that have emissions durability commensurate with their mechanical durability and will provide consumers with greater information on which to make their purchase decisions.

3. Certification and Averaging - Upon reviewing the previous workshop proposal and industry comments, the staff has concluded that requiring manufacturers to comply with both a corporate average standard for new levels and a corporate average standard for emissions durability levels would impose design constraints that could significantly burden industry and hinder the goal of increasing industry flexibility. Therefore, the staff proposes to base the corporate average solely on emissions durability levels, weighted by sales, power, and useful life.

The manufacturer would test one engine at zero hours, at the middle of the durability period and at the end of the durability period. The manufacturer would be allowed, but not required, to test at additional points at equal intervals between zero hours and the end of the

durability period. The manufacturer may also choose to replicate tests for greater certainty. The manufacturer would use the best-fit line for those points to determine the deterioration factor (DF). The manufacturer would then test a second engine at zero hours and multiply the results by the DF to determine the nonmethane hydrocarbons (NMHC) plus oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM) certification values. Example 1 (attached) demonstrates the steps in this process.

Following determination of the engine family's certification values, a manufacturer would then determine the Family Emission Limit (FEL) for the engine family. The FEL for an engine family, which would be used to determine compliance, must be equal to or greater than the certification values for that family. In quality audit or new engine compliance testing, compliance for an engine family would be determined by applying the DF to the test values, and then comparing the result to the FEL. The FEL would also be used in determining credit generation (see Section 8, Credits).

A manufacturer's initial compliance would be determined by comparing their corporate average to the standards. The manufacturer's corporate average would be determined from its FELs as follows:

For *n* engine families,

Corporate Average

$$= \frac{\Sigma \{FEL_i\ (g/bhp\text{-}hr)*power_i(hp)*durability\ period_i(hours)*\ projected\ California\ sales_i\}}{\Sigma \{power_i(hp)*durability\ period_i(hours)*projected\ California\ sales_i\}},$$

where i=1 to *n*.

Please see Example 2 (attached) for sample calculations.

Nonhandheld equipment manufacturers wishing to average between classes would calculate the corporate average as above, but would then compare that result to the weighted standard, determined as follows:

For *n* engine families,

Weighted Standard

$$= \frac{\sum \{\text{Standard}_i\ (\text{g/bhp-hr})*\text{power}_i(\text{hp})*\text{durability period}_i(\text{hours})*\ \text{projected California sales}_i\}}{\sum \{\text{power}_i(\text{hp})*\text{durability period}_i(\text{hours})*\text{projected California sales}_i\}},$$

where i=1 to *n*.

Alternatively, a manufacturer could choose not to include any or all of its engine families in the corporate average calculations by certifying those engine families directly to the emissions standards.

In general, a high FEL relative to the certification value would provide more certainty of passing a compliance test and generating credits. An FEL nearer to the certification value would make attaining the corporate average easier. The staff believes that the ability to determine its own FELs will enable a manufacturer to develop an emissions control strategy tailored to the specifics of that manufacturer's design and production practices.

4. Nonhandheld Spark-Ignition Engines

NMHC+NOx - The staff plans to propose a combined NMHC+NOx standard roughly equivalent to the emission levels attained by Phase 2 federal SOP level engines. The standards would consist of two stages. The first stage would be an early introduction of federal Phase 2 engine technology (i.e., engines that demonstrate the emissions capabilities of overhead valve engines). The second stage would be based on the use of a relatively low efficiency catalytic converter on those engines.

The available information indicates that Class 1 side valve (SV) engines deteriorate much more than Class 2 SV engines or OHV engines of either class. Accordingly, the staff disagrees with the approach taken in the Federal SOP which allows for the continued use of Class 1 side valve engines with high deterioration in Class 1. As staff noted in 1990 and subsequently, it believes that standards based on the emissions capabilities of SV engines would be insufficient for California's public

health and air quality needs. Instead, staff continues to take the position that the second tier standards should be based on the capabilities of the more efficient and durable OHV engines -- i.e., new Class 1 engines (whether SV or OHV) should initially be no dirtier than the current Class 1 OHV average certification values, and that over the durability period the new Class 1 engines should possess emissions durability equivalent to that achievable by an OHV engine.

Staff does expect that some manufacturers will, for market reasons, wish to continue to produce some SV engine models. Certainly, manufacturers would be able to market any SV engine that complies with the standards, either directly or through the averaging approach. However, staff does not believe it is appropriate to base those emissions standards on the status quo of existing SV engines when cleaner alternatives are readily available.

Staff has determined what levels the emissions standards should be set at by the methodology described below. Any discrepancies are due to rounding the figures to one significant decimal place.

Class 1 - Staff began by looking at the average of the current Class 1 OHV certification levels, which is 8.7 grams per brake-horsepower hour (g/bhp-hr). Staff then used a 1.3 DF to determine an end-of-life (250 hours) level of 11.3 g/bhp-hr. The staff realizes that attaining a DF of 1.3 may be difficult for some engine models in this category; therefore, staff also added a small compliance margin to yield a standard of 12.0 g/bhp-hr. Thus, this standard would essentially modify the existing Tier 1 standard from a new engine standard to an emissions durability standard.

For the second stage standard, staff assumed the use of a catalyst that could convert 3.0 g/bhp-hr NMHC+NOx (25 percent reduction) at the end of useful life. That results in a second stage standard of 9.0 g/bhp-hr.

Class 2 - Determining the class 2 standard was simpler, because the U.S. EPA standard assumes all OHV emission levels and durability. The first stage of the staff’s proposed standards would consist of the early introduction of federal phase 2 engines, at 9.0 g/bhp-hr NMHC+NOx. This figure is consistent with the reasoning used for class 1 engines; the application of a 1.3 DF to

the average Class 2 OHV certification level of 6.8 g/bhp-hr provides a result of 8.8 g/bhp-hr.

For the second stage, staff assumed the use of a catalyst at the same efficiencies noted above. At the end of useful life, the engine-out emissions would be 9.0 g/bhp-hr, as per the U.S. EPA/Industry nonhandheld SOP. At the end of useful life, the catalyst would need to reduce 2.3 g/bhp-hr HC+NOx (25 percent reduced). Staff then added a small compliance margin to the resulting value of 6.8 g/bhp-hr to determine the proposed 7.0 g/bhp-hr standard.

Under this proposal, the OHV-based standards would be implemented in the 2000 model year, prior to the federal Phase 2 program; this would allow industry to use California as a proving ground prior to nationwide implementation and allow them to slowly increase production of second tier engines.

Carbon Monoxide - Many manufacturers have indicated that the existing second tier CO standards would prove an impediment to control of NMHC and NOx. Specifically, industry has argued that the high level of CO reduction needed would require an oxidation catalyst, and that the heat generated by the CO conversion would become another problem for engine designers to address. They further contend that if the regulation did not require extensive CO reduction, technologies other than oxidizing catalysts could be applied. For example, a reducing catalyst would be effective in decreasing NMHC+NOx emissions at a more reasonable temperature, and would not have much effect on CO emissions.

The primary pollutants of concern from these engines are the ozone precursors, NMHC and NOx. Although CO emissions do pose health concerns, the existing ARB programs have proven sufficient to maintain them at a relatively low level. Given the above, the staff plans to propose that CO levels be capped at the 1996 standard level, 350 g/bhp-hr when new. Because the 1996 standard is a new engine standard, staff has applied the U.S. EPA's CO DF of 1.17 and determined that the equally stringent emissions durability level would be 410 g/bhp-hr.

Implementation - The staff proposes that the OHV-based standards be implemented in the 2000 model year. Some delay is warranted by the change to emissions

durability standards, but the delay should be minimal, because the new standards would relax the present second tier standards and would be more in harmony with the U.S. EPA SOP programs. Staff believes that a limited number of currently certified engines are capable of meeting the proposed 2000 standards.

Staff proposes to implement the catalyst-based standards in the 2004 model year, which should provide a sufficient period of stability for industry. Table 2, below, shows the resulting standards in g/bhp-hr, with the equivalent grams per kilowatt hour (g/kW-hr) indicated by parentheses.

Table 2

Proposed Nonhandheld Spark-Ignition Emissions Standards

Year	Engine Class	Displacement	Standards g/bhp-hr (g/kW-hr)	
			NMHC+NOx	CO
2000	1	< 225 cc	12.0 (16.1)	410 (549)
	2	≥ 225 cc	9.0 (12.0)	410 (549)
2004	1	< 225 cc	9.0 (12.0)	410 (549)
	2	≥ 225 cc	7.0 (9.4)	410 (549)

5. Nonhandheld Compression-Ignition Engines - The staff proposes that compression-ignition engines be regulated as per the Compression Ignition Statement of Principles (SOP) that ARB, U.S. EPA and various industry members agreed upon. The SOP standards would be a relaxation of the existing 1999 standards; however, the staff is uncertain of the industry’s ability to meet a 3.2 g/bhp-hr HC+NOx standard. Moreover, the population of diesel engines below 25 horsepower is relatively small, so the benefits gained from harmonization of the regulations and the assurance of control over preempted

farm and construction equipment engines outweigh the slight increase in emissions. The staff estimates that the emissions impact would be minor, approximately 0.5 tons per day HC+NOx statewide in 2010. The standard levels for HC+NOx, CO and PM are shown below in Table 3.

Table 3

Compression Ignition Engine Standards
ARB/U.S. EPA/Industry Agreement

Year	Horsepower	Emissions Standards g/bhp-hr (g/kW-hr)		
		NMHC+NOx	CO	PM
2000	<11	7.8 (10.5)	6.0 (8.0)	0.74 (1.0)
	≥11-<25	7.0 (9.5)	4.9 (6.6)	0.6 (0.8)
2005	<25	5.6 (7.5)	6.0 (8.0)	0.6 (0.8)

6. Handheld Engine Standards

NMHC+NOx - The Portable Power Equipment Manufacturers Association (PPEMA) suggested that California should adopt the U.S. EPA Phase 2 standards, which are emissions durability standards designed to be 30 percent lower than the current Tier I/Phase 1 new engine standards. However, the U.S. EPA Phase 2 standards will not achieve the emissions reductions that California needs from handheld equipment. Additionally, several manufacturers have indicated support for more stringent levels. Ryobi, for instance, has developed an engine that can meet the adopted standards and has publicly stated that the 1999 standards should be retained with no changes. Honda has also developed a handheld four-stroke engine that can meet the 1999 standards. Both engines can also meet the United States Forest Service temperature requirements.

Staff recognizes that not all manufacturers may yet be capable of meeting the 1999 standards and that the industry is not yet ready to convert all product lines to four-stroke engines. Therefore, to maximize manufacturer flexibility, the staff proposes to modify the standard to a 54 g/bhp-hr NMHC+NOx corporate average emissions durability standard that would be implemented in 2000.

Since the standard would be a corporate average standard, it would allow manufacturers to use a broader mix of

technologies in their compliance plans. The staff envisions a mix of technologies being used to meet the standard, including four-stroke engines and improved, catalyzed two-stroke engines. Although electric equipment would not be included in a manufacturer's corporate average, staff expects that the share of electric equipment in the lower power/price niches would expand as well, since offering electric products may be more economically efficient than developing controls for all engines now used.

There is no doubt that a 54 g/bhp-hr NMHC+NOx standard is technologically feasible; electric equipment and equipment with four-stroke engines are already being marketed. Additionally, Husqvarna has certified three engines equipped with catalytic converters. Husqvarna announced their catalyst technology in July 1996, stating that it could achieve a level 40 percent below the first tier standards (or 108 g/bhp-hr HC+NOx new) and had the potential to achieve emissions levels 60 percent below the first tier standards. The actual certification levels at a lean/lean setting are very close to the 54 g/bhp-hr standard; however, it remains to be seen how the system works over the useful life of an engine. With averaging and further development, catalyst-equipped two-stroke engines may play a significant role in the category.

The staff did consider proposing a separate, less stringent standard for residential handheld equipment. The proponents of this approach suggested that the U.S. EPA handheld SOP would provide sufficient control of residential equipment, and noted that the small emissions inventory of residential equipment and the economics of controlling low-priced residential equipment supported such a distinction. However, that argument is undermined because the handheld four-stroke engine offered now is in a residential trimmer. Furthermore, the preemption of construction and farm equipment below 175 hp severely limits the emissions reductions achievable from commercial equipment alone. For these reasons, staff decided not to propose a more lenient residential standard.

Carbon Monoxide - As with the CO emissions from nonhandheld equipment, the staff proposes to cap CO emissions from handheld equipment at 1996 levels. Because the deterioration of these engines is expected to

be minimal, the standard would not be adjusted for in-use deterioration.

Particulate Matter - The existing 1999 standards include a PM standard of 0.25 g/bhp-hr. As part of the federal regulatory negotiation regarding small off-road engines, PPEMA presented information that suggests that PM emissions from two-stroke gasoline engines are unlikely to pose the same risk to public health as diesel PM. PPEMA says that unlike diesel PM, which is primarily carbonaceous material, PM from two-stroke gasoline engines is primarily composed of hydrocarbons from unburnt oil. PPEMA contended that measures to reduce exhaust hydrocarbons will also result in a reduction of PM emissions and that there is therefore no need for a separate PM standard.

Staff has carefully considered PPEMA's arguments. However, all heavy hydrocarbon-based particulates are of concern, even though the health link is less certain than with carbonaceous material. Further, attaining the ambient particulate standards in California remains a daunting challenge which will require every possible control measure. The data provided by PPEMA show that hydrocarbon controls do reduce two-stroke PM emissions, but none of the test data provided approached the 1999 0.25 g/bhp-hr standard. Abandoning the standard would mean accepting higher emission levels than are currently required. At this time, the staff believes that the available information indicates that the PM standard should be retained.

The staff welcomes comments on the issue of PM standards. The existing second tier standard was based on the assumption that the primary compliance technique would be the use of catalyst-equipped two-stroke engines. It now appears that four-stroke engines, which can meet the 0.25 g/bhp-hr standard, will be used for many applications. The staff is uncertain to what degree two-stroke engines will be used in handheld equipment. Therefore, the staff requests comments on whether the PM standard should be modified. Additional data concerning controlled two-stroke PM emissions would also be welcomed.

Implementation - Since technologies are available that meet the standards, the staff does not believe that the implementation needs to be delayed for technical reasons. However, because the regulations would change from a calendar year basis to a model year basis, and from new engine standards to emissions durability standards, staff believes that some extension of lead time is warranted. Therefore, it proposes to grant the

handheld industry a one-year extension of lead time prior to the initial implementation. Thus, the proposed

standards would begin with the 2000 model year. The staff's proposed handheld engine emissions standards are summarized in Table 4.

Table 4

Proposed Handheld Emissions Standards

Year	Standards g/bhp-hr (g/kW-hr)		
	NMHC+NOx	CO	PM
2000	54(72)	600 (803)	0.25 (0.33)

7. Production Line Testing - Although at the workshop staff proposed to use the U.S. EPA Cumulative Sum Production Line Testing (CumSum PLT) program as a replacement for Quality Audit (QA), staff has reconsidered after using both programs to evaluate the QA data from the first quarter of 1996. Although both programs generated the same compliance results, the staff believes that the larger sample size associated with QA is likely to provide a better indication of the true population mean. Furthermore, QA would provide a guarantee of sampling from the entire production year, unlike CumSum PLT, which would conclude testing on evidence of clear compliance. However, in addition to determining compliance, the emissions results from the testing of production engines will also be used in the generation of emission reduction credits and the QA program would provide staff with more data on which to base emission reduction credits. The staff does not believe that it yet has sufficient information regarding the performance of production engines to warrant the reduction in the amount of available data for the credit program. Therefore, staff does not plan to propose the adoption of CumSum PLT at this time. However, the staff welcomes comments on the possibility of adopting CumSum PLT for use in the future.

Additionally, the staff plans to propose the continuation of the New Engine Compliance (NEC) program. However, the staff also plans to develop and propose a means by which

manufacturers can remedy their QA and NEC failures by use of credits (see section 8, below).

8. Credits - Most manufacturers have indicated that they favor the concept of emissions reduction credits for overachievers. However, some manufacturers were worried about how a credit program would include electric equipment without immediately disadvantaging those manufacturers which produce only engine-powered equipment. Therefore, at this time the staff does not plan to include electric equipment in any averaging, banking or trading programs. However, staff welcomes suggestions on how to address this issue.

In general staff envisions credits being generated when QA testing indicates that the production engines are outperforming their FEL. This should ensure that there is no double counting of emissions benefits. Credits could be averaged, banked, or traded.

The staff proposes to allow the early generation and banking of credits for handheld engine families that are certified to the 54 g/bhp-hr standard in 1998 and 1999. The credits would be generated from the difference between an effective FEL baseline of the previous year’s average QA data and the engine certification levels. In the absence of an emissions durability demonstration, the credits would be calculated using a default lifetime of 50 hours. The credits awarded would be further discounted to minimize risk to the public. If a manufacturer chose to conduct a durability demonstration, the manufacturer would receive full credits, as per the general credit program.

The staff requests comments on whether a similar program should be proposed for nonhandheld engines. Specifically, staff requests comments on an appropriate trigger level for credit generation, considering that virtually all nonhandheld engines currently meet the proposed 2000 standards if durability is not demonstrated.

The staff is also considering proposing other programs to provide incentives for further development of clean technologies or early introduction of those technologies. Those incentives could include the ability to use a "green label" (a la the "Energy Star" label on personal computers) and a reduced testing burden, among others. The staff encourages manufacturers to indicate other

incentives that could spur the development and dissemination of engines or equipment that are cleaner than the regulations would require.

9. Small Volume Manufacturers - The staff recognizes that small volume manufacturers may require special consideration to continue to serve their niche markets. To ensure continued product availability, the staff proposes to provide an assigned DF to manufacturers that produce less than 100 engines annually for California. This will eliminate the need to conduct costly durability testing and reduce the number of engines that must be used in the certification process.

10. Effect on the Inventory and the SIP - The changes being proposed will have an effect on the emissions inventory for small off-road engines and on the SIP. For example, including emission deterioration from nonhandheld engines increases the emissions inventory and the absolute emission reductions achieved by the standards. Revising the emission standard for nonhandheld engines, and delaying the effective date of the handheld regulations by one year will reduce the emission reductions achieved. Finally, engines used in applications which California is preempted from controlling will be subject to federal standards, and it is clear from recent events that the federal standards will be less stringent than assumed in the SIP. This will reduce the emission reductions achieved in California from preempted small off-road engines.

Table 5 illustrates the effect of emission deterioration on the uncontrolled emission inventory, and the emission level after controls, assuming that all engines meet the original 1999 ARB standards.

Table 5

Emission Inventory for Utility Engines
HC+NOx (tons per day in 2010)

Category	Responsibility	Uncontrolled Inventory		Controlled Inventory (assumes compliance with 1999 ARB standards)	
		Used in SIP	Adjusted for Deterioration	Used in SIP	Adjusted for Deterioration
Handheld	U.S. EPA	37.2	37.2	10.7	10.7
	CA	6.2	6.2	1.2	1.2
Nonhandheld	U.S. EPA	5.4	7.6	0.7	1.1
	CA	23.5	32.9	2.1	3.0
Total		73.3	83.9	14.7	16.0

The adjusted uncontrolled values in the table for nonhandheld engines include emission deterioration based on information provided by the Engine Manufacturers Association, which was not included in the inventory used to develop the SIP. Emission deterioration for controlled engines is based on an assumed deterioration factor of 1.4. As can be seen in the table, the effect of deterioration is to increase uncontrolled emissions by 10.6 tpd. Controlled emissions increase less (1.3 tpd).

For those engines not preempted by U.S. EPA, the proposed one year delay in the California handheld standard does not impact emissions in 2010 because full turnover to controlled engines still occurs. There will be an impact on areas which must demonstrate attainment by 2005. The relaxation of the emission standards for nonhandheld engines subject to California standards causes a 2.2 tpd shortfall in achieving the emission levels needed to demonstrate attainment in 2010, as shown in Table 6. This is in addition to the 0.9 tpd higher emission level due to revisions in the inventory from 2.1 tpd to 3.0 tpd to reflect deterioration (see Table 5).

Table 6

Impact of Proposed Changes in California Standards
HC+NOx (tons per day in 2010)

Category	Responsibility	Controlled Emissions, with Deterioration		Shortfall
		w/Existing 1999 ARB Standards	w/ARB Proposed Standards	
Handheld	CA	1.2	1.2	0.0
Nonhandheld	CA	3.0	5.2	2.2
Total		4.2	6.4	2.2

The U.S. EPA has not adopted second phase emission standards for utility engines. Instead, it has recently signed Statements of Principles which govern the next round of emission limits for utility engines. The emission limits contained in those agreements are much less stringent than those being proposed by ARB. Because ARB is preempted from controlling emissions from small off-road engines principally used in farm and construction, the U.S. EPA's actions impact California's clean air plans. As shown in Table 7, the U.S. EPA standards will increase emissions 13.3 tpd over those assumed in developing our attainment plans.

Table 7

Impact of Proposed Federal Standards
HC+NOx (tons per day in 2010)

Category	Responsibility	Controlled Emissions, with Deterioration		Shortfall
		w/Existing 1999 ARB Standards	w/U.S. EPA Proposed Standards	
Handheld	U.S. EPA	10.7	20.9	10.2
Nonhandheld	U.S. EPA	1.1	4.2	3.1
Total		11.8	25.1	13.3

11. Mitigation - The emission shortfall for engines subject to state standards is 2.2 tpd compared to the deterioration-adjusted inventory, or 3.1 tpd compared to the unadjusted inventory. The staff believes that it is obligated to identify alternative ways of achieving emission reductions sufficient to achieve the original controlled levels upon which the SIP is based. The staff has identified fuel spillage as a cause of additional HC emissions from small off-road engines. Staff intends to propose that all new lawn mowers be equipped with spill-proof fuel systems. A preliminary estimate is that this would provide an additional reduction of 6 tpd HC emissions, which would help mitigate the emission increase for engines subject to state control. Staff is requesting comments on this approach, and on any other ways of providing additional reductions.

In its proposed rulemaking, U.S. EPA has committed to explore a voluntary means of reducing fuel spillage from nonhandheld equipment. U.S. EPA may also investigate a further tightening of standards at a future date. It is uncertain at this time whether such further controls will be implemented by U.S. EPA, and, if they are, what emission reductions will be achieved. Until actions are taken by U.S. EPA, there will be a 13.3 tpd shortfall from those engines not subject to ARB standards.

Attachments

Example 1: Deterioration Factors, Certification Values and Family Emission Limits							
Engine 1	Hours			HC+NOx			
	0			8.3			
	60			9.5			
	125			11.3			
	Best Fit Line	y=	mx+b				
		y=	0.024051	x+	8.216844	rsq=	0.991583
	Calculated						
	zero hour=	8.22					
	Calculated						
	end of life=	11.22					
	Calculated DF	=	Calculated end of life				
			Calculated zero hour				
		=	1.37				
Engine 2	Hours			HC+NOx			
	0			8.4			
	Certification						
	Value=	Calculated DF*Engine 2(Zero Hour)					
	=	11.47					
The Family Emission Level must be equal to or greater than the Certification Value.							

Example 2: Calculation of Corporate Averages							
Nonhandheld:							
	HC+NOx			Durability	Sales*HP*Use		FEL*Sales *HP*Use
Engine Family	FEL	Sales	HP	Period			
A	12	50,000	3.5	125	21875000		262500000
B	9	25,000	5	250	31250000		281250000
C	11	5,000	3.5	125	2187500		24062500
D	15	10,000	10	250	25000000		375000000
				Total	80312500		942812500
Corporate Average =			Total (FEL*Sales*hp*Use)/Total (Sales*hp*use)				
		=	11.74	g/bhp-hr			
Handheld							
	HC+NOx			Durability	Sales*HP*Use		FEL*Sales *HP*Use
Engine Family	FEL	Sales	HP	Period			
E	45	50,000	2	50	5000000		225000000
F	40	25,000	1	50	1250000		50000000
G	72	5,000	2	300	3000000		216000000
H	54	10,000	3	300	9000000		486000000
				Total	18250000		977000000
Corporate Average =			Total (FEL*Sales*hp*Use)/Total (Sales*hp*use)				
		=	53.53	g/bhp-hr			

Business Impact Survey

The ARB respectfully requests that you complete the following survey to assist in our formulation of the potential economic impact of the proposed control plan on the regulated industry.

Company Name _____

Manufacturing/Operating Plant Location(s)_____
_____

Type of Industry (SIC Code if available)_____

Is this an independent enterprise or a subsidiary of a larger company (please specify)?_____
_____

Number of Employees/Location_____
_____

Owner's Equity/Asset Size_____

Net Income_____ Net Worth_____

Profitability_____ Annual Sales (Most Current Figure)_____

Research and Development Dollars Expended/Needed_____

Other Incremental Costs (please specify)_____
_____

What proportion of your sales will be impacted by the proposed control plan?_____
_____

Please specify any other specific/technical concerns._____
_____
_____
_____
_____
_____
_____