STATE OF CALIFORNIA
AIR RESOURCES BOARD

Amendments to the Current Regulations For Large Spark-Ignition Engines with an Engine Displacement Less than or Equal To One Liter	**)**	**Agenda Item: 08-10-4**
	)	**Board Hearing:**
	)	**November 21, 2008**

COMMENTS OF THE ENGINE MANUFACTURERS ASSOCIATION

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November 21, 2008

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On October 3, 2008, the California Air Resources Board ("ARB") published its Notice of Public Hearing to Consider Amendments to the Current Regulations for Large Spark-Ignition Engines with an Engine Displacement Less than or Equal to One Liter (referred to herein as the "proposed amendments" or the "proposal").

The Engine Manufacturers Association ("EMA") is the international trade association that represents the interests of the world's leading manufacturers of engines, including manufacturers of large spark-ignition engines less than or equal to one liter displacement.

I. Background

EMA has been an active participant in the development of certain of the proposed amendments concerning the large spark ignition (LSI) emission reduction program. Specifically, EMA has participated in discussions with ARB staff, industry workshops and staff meetings with industry.

At the outset, and throughout the rulemaking process, EMA and its members emphasized to ARB the importance of maintaining a subcategory of LSI engines with an engine displacement less than or equal to one liter. EMA and its members have urged ARB to maintain such subcategory because of its significant relationship to small spark ignition (SSI) engines and the strong desire to align ARB requirements with EPA regulations. EPA regulations for this subcategory of engines provide manufacturers the flexibility to determine if their engines and the products powered by their engines are related to SSI products or LSI products. This ability provides manufacturers the flexibility necessary to address the substantially different product requirements in the transition from small to large SI.

This transition is exemplified by: (i) engine families that are greater than one liter in displacement but less than 19kw; (ii) engine families that are less than 825cc in displacement but greater than 19kw; (iii) engine families that are between 825cc and one liter in displacement greater than 19kw with similar designs as small SI engines; and (iv) engine families that are between 825cc and one liter in displacement greater than 19kw with similar designs as LSI engines. The proposal clarifies that all engines less than or equal to 825cc displacement and all engines greater than one liter in displacement but less than or equal to 19kw are considered small SI. The proposal also maintains that engines greater then 19kw with displacements greater than 825cc and less than or equal to one liter are categorized as LSI but recognizes their relationship to small SI. For this narrow subset of LSI engines, the proposal maintains some aspects of the

current relationship to the small SI regulatory program by utilizing the small SI evaporative program and useful life criteria. However, the proposal deviates from this premise by setting final HC+NOx emission limits equivalent to larger LSI engines.

II. Impact of the Proposal

The proposal maintains the subcategory of LSI for engines greater than 825 cc and less than or equal to one liter in displacement and preserves the useful life period from the current regulation for less than or equal to one liter LSI engines. Based on the strong product similarities to small engine powered products rather than larger LSI engines, it is appropriate that the proposed control of evaporative emissions for this subcategory of LSI engines is equivalent to small SI engines. Additionally, the use of the small SI evaporative program allows the use of component certified products utilized for small SI engine powered products to be utilized for this segment of LSI engine powered products.

While the proposed engine exhaust emission controls will require revisions to current engines in order to comply with the 2011 model year HC+NOx standard level of 6.5 g/kw-hr, these changes are expected to be modifications to current designs rather than major engine design changes resulting in significant product redesign. In contrast, the 2015 model year HC+NOx standard level of 0.8 g/kw-hr will require significant changes to the vast majority of engine families in this subcategory. ARB Staff bases its belief that product can be developed to meet the 2015 standard levels on three engine families currently certified to HC+NOx emission levels at or below this proposed standard level. While this logic appears valid, further investigation shows that these engines are currently utilized in a very narrow range of products that are virtually identical to on-highway vehicles in every respect except that they are speed governed to a maximum speed of 25 mph, which allows them to be classified as non-road equipment. All of these engines exhibit the same type of technology as on-highway vehicles: (i) 4 cylinders; (ii) overhead camshaft; (iii) electronic fuel injection with closed loop fuel ration control; (iv) water cooled; and (v) utilize a three-way catalyst.

To achieve the proposed standard level, changes to the typical LSI ≤1 liter engine are expected to include: (i) replacement of existing air cooled engine designs with water cooled engine designs; (ii) replacement of open loop carburetor fuel controls with closed loop fuel injection systems with electronic controls operating at stoichiometric air-fuel ratios; and (iii) addition of 3-way aftertreatment systems. These major engine changes also will require significant design changes to the equipment that these engines power. EMA anticipates that, based on the small market potential for these products, engine and equipment manufacturers will not invest the design and manufacturing resources to produce products that comply with the 2015 standard level. Consumers that utilize the equipment currently powered by these engines will be forced to either prolong the use of their existing equipment and/or replace the equipment with diesel powered alternatives. While diesel powered alternatives currently exist in many cases, such products typically cost more than today's spark ignition products.

Increased manufacturing costs combined with capital amortization for creating a spark ignition engine powered product compliant with the proposed 2015 standard is expected to result in equipment costs equal to or greater than diesel powered alternatives. Accordingly, the added benefits of equal or lower cost, longer product life, and lower operating costs inherent with diesel powered products will eliminate any market interest in gasoline powered product. In order to avoid this result, EMA proposes a viable alternative HC+NOx standard level of 5.0 g/kw-hr to be implemented in 2014 that would preserve the ability to produce air cooled, open loop carburetor

fuel controlled spark ignition engines for this product category with a minimal impact on the projected air quality benefit of the program.

EMA has enlisted the services of Air Improvement Resources (AIR) to evaluate the emission inventory benefit of the ARB Staff's proposal in comparison to the EMA alternative proposal. See Exhibit A attached hereto. While ARB Staff has made a number of emission inventory adjustments over the course of the proposal's development, the inventory assessment recently provided by Staff, as an update to the inventory in the amendment hearing notice, remains controversial due to population projections. The projected population is based on a significant growth rate in annual sales in 2002 through 2011, resulting in a 50% increase between 2008 and 2011. EMA member company projections, compiled prior to the recent collapse of the housing market, were for limited growth of less than 1% per year or 4% for the period. EMA members believe that the market potential for this category is directly linked to new home construction because of the direct linkage between home construction and general industrial equipment as well as turf care markets. As a result, the previous EMA member growth projections are considered highly optimistic given the realities of today's market. EMA believes that the population in 2020 and 2030 will be less than the Staff's projections, significantly reducing the projected emissions benefits assumed by the Staff's proposal. Using the industry's projected volume growth, the EMA proposal provides almost an equivalent air quality benefit to that of the proposed amendment (not taking into account the expected shift from spark ignition to diesel product). The impact of the reduced population indicates the significant sensitivity of the projected benefits to the population growth, reducing the benefit for the ARB Staff proposal from 8.39 tons per day to 1.57 tons per day, a reduction of 6.82 tons per day. EMA anticipates, that if a sensitivity analysis was conducted, the inventory impact of diesel replacement rather than LSI conversion to meet the 0.8 g/kw/hr requirement would show that EMA's proposal that would allow the continued use of air cooled spark ignition engines in this category would be both environmentally sound and economically viable.

III. Recommendation

EMA recommends that ARB treat LSI engines less than or equal to one liter displacement in the same fashion as EPA. Specifically, the engine manufacture should be provided the flexibility to determine, based on the intended market for the engine, if the engine will be certified to comply with the small SI regulatory requirements or the LSI greater than one liter displacement regulatory requirements. If ARB continues with the current segregation of the LSI category above and less than or equal to one liter in displacement, the proposal is acceptable with the exception of the 2015 exhaust emission standard level. EMA recommends that the 2015 exhaust emission standard level requirement be replaced with a 5.0 g/kw-hr standard for HC+NOx applicable in the 2014 model year.

EMA would like to thank the ARB Staff for working with industry to develop the proposed amendments. If you have any questions about EMA's comments, or would like to discuss this matter further, please do not hesitate to contact us.

Respectfully submitted,

Engine Manufacturers Association

Exhibit A

M E M O R A N D U M

To: Roger Gault, EMA

From: Tom Darlington

Date: November 15, 2008

Subject: Evaluation of ARB LSI Inventory Comparison of EMA and ARB LSI Proposal

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This memo summarizes AIR's evaluation of ARB's November 1 inventory analysis, which presented and inventory comparison of the EMA and ARB proposal for LSI engines less than 1 L. The memo is divided as follows:

- Proposals
- ARB's inventory comparison
- Exhaust emission factors
- ARB's increased sales projections
- ARB's Age Estimates
- AIR's analysis with lower sales projections

Proposals

The current regulations are for the less than 1 L engines to meet a 6.5 g/kW-hr emission standard in model year 2011. The EMA proposal is to lower this to 5 g/kW-hr in 2014 (23% reduction), and the ARB proposal is to lower this to 0.8 g/kW-hr (88% reduction) in 2015.

The current evaporative regulations have equipment using these engines meeting the SORE evaporative emission standards. Thus, there is no difference in these proposals for evaporative emissions.

ARB's November Inventory Comparison

ARB made three changes in its latest inventory update for LSI: an increase in sales of the engines less than 1L, the elimination of forklifts with engines less than 1 L (these were driving the inventory analysis prior to the latest revisions), and some modifications to CO emission rates for engines meeting the EMA and ARB proposals.

The HC+NOx benefits of the two proposals are shown in Table 1 below. These have been estimated relative to a baseline that does not have lowered emission standards for the less than 1 L 25-50 hp engines.

The benefits in Table 1 include both exhaust and evaporative emissions, but the benefits of both programs are the same for evaporative emissions, so that the differences are only due to exhaust emissions.

Table 1. Statewide Exhaust Emissions Benefits in 2020 (HC+NOx, tons per day) of Proposals			
Category	EMA	ARB	Difference
Airport Ground Support	0.14	0.17	0.03
Industrial	1.89	2.57	0.68
Lawn and Garden	2.42	2.91	0.49
Light Commercial	2.21	2.74	0.53
Total	6.65	8.39	1.73

The ARB proposal indicates a greater benefit due to the lower exhaust standard, even though the lower standard starts one year later. The ratio of the benefits of the ARB proposal as compared to the EMA proposal does vary somewhat between equipment categories, from about 20% to 35%. Reasons for this are related to the relative activity differences between the different categories, and the effects of that activity on emissions (deterioration).

Exhaust Emission Factors

ARB's exhaust emission factors for both cases are presented in their November 1 briefing and are not repeated here. Basically, the base emission factors are represented by zero hour levels in g/bhp-hr and deterioration rates in g/bhpr per hour of use. ARB developed emission rates for the proposals by assuming that the new standards would result in engines with combined HC+NOx emissions equivalent to the respective standards at 1,000 hours of use. For example, and engine used in a light commercial generator would meet 5 g/Kw-hr at 1000 hours under the EMA proposal, but would meet 0.8 g/kw-hr at 1000 hours under the ARB proposal. The zero hour levels and deterioration rates were therefore reduced approximately proportional to the reduction in the HC+NOx standards, at 1000 hours. This is the conventional method for estimating emission reductions of new emission standards.

AIR obtained ARB's spreadsheet of new emission factors, and replicated the calculations for new emissions. We have no comments on these new emissions.

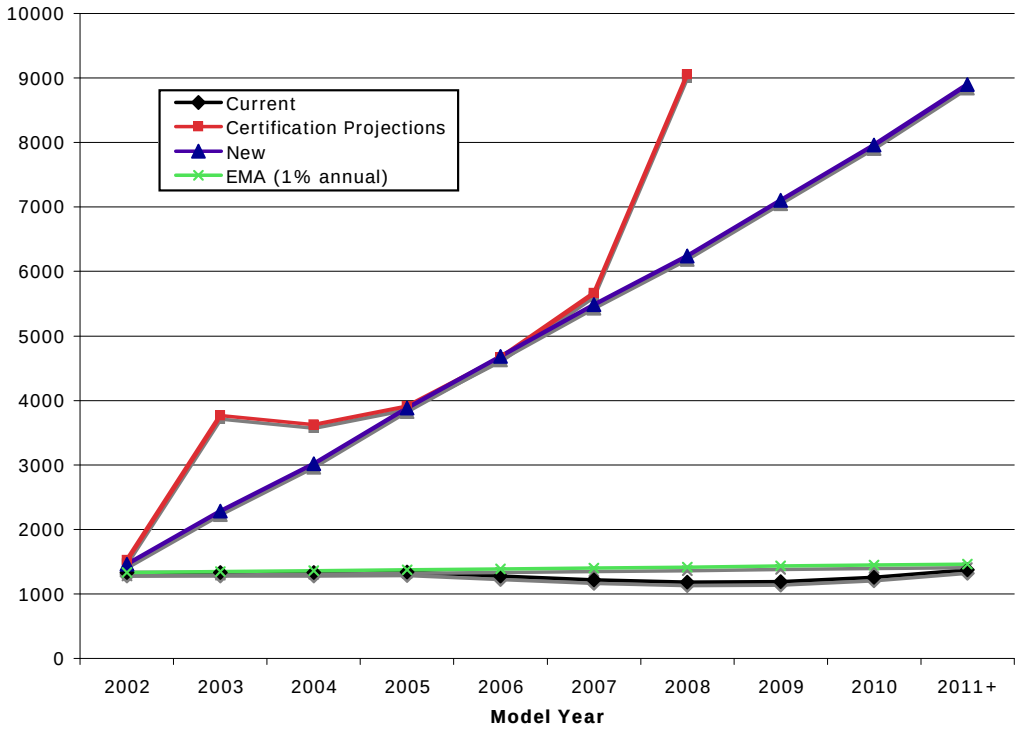
Increased Sales

ARB dramatically increased sales growth of the less than 1L engines in the latest inventory analysis. ARB examined projected sales in their certification records, and determined that the data indicates a larger growth in sales in the 2002-2011 period than they were previously estimating. The results are shown in Table 2.

Table 2. ARB's Sales Growth			
Model Year	Current	Cert Data Projections	New Sales Growth Estimates
2002	1335	1524	1459
2003	1334	3763	2284
2004	1335	3626	3021
2005	1336	3912	3883
2006	1275	4665	4687
2007	1214	5665	5486
2008	1180	9052	6243
2009	1189		7104
2010	1258		7961
2011+	1370		8896

The certification projections show an initial rapid rise form 2002 to 2003, followed by a slower growth rate from 2003-2005, followed by another rapid rise to 2008. ARB has not validated these sales by examining the final sales records, but is in the process of doing this now. The method they used to project the new sales growth estimate was to start with the 2002 certification data projection of 1524, and then draw a line connecting that year to the sales in 2005, 2006, and 2007 (where the rate of sales increase was approximately linear, and lower than it was between 2002 and 2003), and then extrapolate that line until 2011, where it is assumed to remain constant thereafter. This is illustrated in Figure 1.

Figure 1. ARB Sales Projections



These sales projections have not been confirmed by the engine manufacturers. EMA recommends using a 1% increase in sales growth. This is also shown in Figure 1.

AIR Inventory Modeling of Proposals

AIR ran the inventory modeling with ARB's emission factors, but assuming lower (1% per year) sales growth. The results are shown in Table 4. There is less than ½ tpd difference in the two proposals.

Table 4. Comparison of EMA and ARB Proposals (HC+NOx Benefits, statewide, tpd)			
Category	EMA	ARB	Difference
Airport Ground Support	0.26	0.32	0.06
Industrial	0.29	0.41	0.12
Lawn and Garden	0.40	0.49	0.09
Light Commercial	0.25	0.35	0.10
Total	1.20	1.57	0.37

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