UNITED STATES OF AMERICA
ENVIRONMENTAL PROTECTION AGENCY

Control of Emissions of Air Pollution
From Nonroad Diesel Engines and Fuel;
Proposed Rule

Docket No. A-2001-28

STATEMENT OF THE ASSOCIATION
OF EQUIPMENT MANUFACTURERS

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On May 23, 2003, the Environmental Protection Agency (“EPA” or the “Agency”) published a Notice of Proposed Rulemaking (“NPRM” or “Proposed Nonroad Diesel Rule”) that would establish additional emission standards for nonroad compression-ignition (“diesel”) engines and sulfur reductions for the diesel fuel that powers them. These nonroad diesel engines are used primarily in construction, agricultural, and industrial applications. This EPA proposed regulation is also known as the “Tier 4 Rule”, since it comes after three previous other sets of emission reductions referred to as Tier 1, Tier 2 and Tier 3. These comments address the impacts upon the nonroad diesel-powered equipment and the user groups in the construction trades, agriculture and industrial pursuits that purchase and utilize these machines to make their livelihoods.

The Association of Equipment Manufacturers (AEM) is the consolidation of the Construction Industry Manufacturers Association and the Equipment Manufacturers Institute, effective January 1, 2002, and is the international trade and business development resource for over 700 companies that manufacture equipment, products and services used worldwide in the construction, agricultural, mining, forestry, and utility industries. Because market demand calls for nonroad machines and equipment that are nearly 90 percent diesel-powered, AEM members have been leaders in adopting clean diesel technology in an effort to promote environmental improvement. Thus, AEM supports further improved -- but justifiable -- Tier 4 emission requirements that do not impede purchasers of nonroad equipment to invest in next generation diesel-powered equipment that deliver superior emissions control performance.

It is important to understand that the nonroad equipment manufacturing industry is very diverse in size and scope. Manufacturers vary in size and include a number of small to medium-sized family-owned businesses as well as large multi-national corporations all producing world-class machines. Another issue to keep in mind is that the nonroad equipment industry has only a few companies that produce the engines that are used in their machines. It is common for an equipment manufacturer to out-source the engine from one or more suppliers, making the equipment manufacturer subject to uncertainties concerning the final engine package size, power delivery characteristics and the continued availability of a particular engine model.

Therefore, the burden of regulatory compliance is not the sole domain of the engine maker, but is a shared responsibility throughout the entire chain of the nonroad equipment industry, including the equipment user, and for the first time, the diesel fuel and aftertreatment suppliers. Whereas AEM is encouraged by EPA’s efforts to structure a rule that is technologically feasible for diesel engine manufacturers, we still perceive that there are some critical elements of the rule that need to be
further addressed in order to ensure that technology exists and is commercially viable for application to all categories of nonroad equipment.

**Summary of the Association Equipment Manufacturers’ Major Concerns**

- EPA should broaden the 2007 Technology Review planned for the less than 56 kW (75 hp) engines to include the commercial feasibility review of Tier 4 controls for all categories.

- We recommend the creation of a government/industry sponsored “Pilot Program” to field test Tier 4 complying equipment from every power category to gather information on technology transfer, performance, and incremental costs.

- EPA must devote more effort to achieving global alignment of the nonroad standards. Anything less than complete alignment of all the major elements of the nonroad regulation will increase costs and consumption of resources for doing business internationally.

- The Small-Volume Allowance for manufacturers should not be restricted to a single engine family per power category, and the maximum number of 700 exemptions per category over a seven year period should be retained.

- EPA’s Tier 4 engine power categories should be revised to change the NOx aftertreatment control pivot point from 56 kW (75 hp) to 75 kW (100 hp) for requiring the implementation of advanced NOx emission controls. Nonroad engines from 56 – 75 kW (75 – 100 hp) do not share many of the characteristics of on-highway diesels, thus making it very costly to transfer advanced emission controls from on-highway trucks. Moving back to a 56 kW (100 hp) cutpoint would retain the cutpoint established in Tiers 1-3 and better align with the categories set by the EC Directive.

- We require a Jan. 2015 introduction date for the final Tier 4B emission limits for the proposed 56 – 130 kW (75 –100 hp) category to provide three years stability.

- We require that there be no change to the Tier 3 PM emissions level proposed for the 37 – 56 kW (50 – 75 hp) category, because less than four years leadtime is given; and to maintain the 2013 introduction of PM aftertreatment controls.

- We request the phase-in of Tier 4 standards for equipment larger than 560 kW (750 hp) be begun in 2012 to allow opportunity for the redesign of these low volume machines.

- EPA’s derived cost impacts of the Tier 4 standards are understated. Industry sources suggest the cost increases to the customer will be from 2 to 35 percent with the greatest impact being felt by those machines less than 75 kW (100 hp).

- AEM supports the two-step approach for the phase-in of low sulfur diesel fuel as we feel it will help to keep nonroad diesel fuel costs down and better ensure its widespread availability.
1. **AEM Recommends that EPA Broaden the Scope of the Technology Review to Investigate the Commercial Viability of Technology for the Complete Range of Nonroad Engine Power Categories.**

EPA has indicated that as a provision of the rulemaking process it will hold a Technology Review Study in 2007 to ascertain the technological feasibility of introducing further emission control technologies on those engines less than 56 kW (75 hp) for nonroad applications. The intended purpose of the Technology Review is to thoroughly evaluate progress made toward applying advanced PM and NOx control technologies to these smaller engines.

EPA has indicated that it determined the new emission standards with certain control technologies in mind. For the larger engines, the Tier 4 standards are predicated on the use of the catalytic soot filters or “particulate traps” for reducing particulate matter (PM) and for hydrocarbon control, and NOx Adsorbers for their ability to reduce oxides of nitrogen (NOx) emissions far beyond that which can be demonstrated with the use of only in-cylinder controls. EPA expects to see these technologies applied to heavy-duty on-highway diesel engines beginning with the 2007 model year, and that they see no barriers to the successful adaptation of these technologies to nonroad engines. However, one of our concerns is that EPA is not actively attempting to verify that these evolving technologies will perform as assumed when transferred from heavy-duty trucks to nonroad equipment.

As a result, AEM has concerns that the scope of the Technology Review is too narrowly focused and its objective is insufficient to answer the multitude of unknowns and concerns in introducing advanced emission controls across all the categories of nonroad equipment. A short list of the issues for resolution include the following:

- **More needs to be done towards the achievement of globally aligned nonroad diesel regulations to address the critical needs of a nonroad equipment manufacturing industry that both manufactures and markets its products worldwide.** As it stands, the European Commission (EC) intends to complete its Technology Review of the European Directive (97/68/EC amendment – known as Stage IIIIB) by the end of 2006. U.S. EPA will complete its Technology Review of the Tier 4 provisions by the end of 2007. There is limited alignment at the present time between the major provisions of these two nonroad diesel regulations that are both being developed at the same time. Further action toward accomplishing global alignment must be defined between U.S. EPA and the EC as an adjunct agenda to the Technology Review process.

- **The Tier 4 standards depend on the successful transfer of emissions aftertreatment devices from on-highway diesels.** However, the 2007 On-highway Rule has a provision allowing that on-highway NOx aftertreatment controls will only have to be fully implemented by 2010. Therefore, as a consequence, NOx aftertreatment will not be ready for application to nonroad engines by the Tier 4 introduction date of 2011, since having only one year of on-the-road experience is insufficient to assure the successful transfer of this technology to nonroad equipment.

- **More investigation is needed into the performance and feasibility of applying further PM controls and aftertreatment devices to small equipment in the 19 – 37 kW (25 – 50 hp)
category. AEM is not convinced that 19 kW (25 hp) serves as being the most commercially viable pivot point for the proposed application of more stringent PM limits. Furthermore, AEM requests that EPA delay its final decision on setting standards that require PM aftertreatment in 2013 for this category pending the findings of the Technology Review.

- There are several dedicated non-road engine manufacturers that have no on-highway product line to utilize as their proving ground. These OEMs may have to depend on third parties for outsourcing their R&D and hardware procurement.

- An on-highway developed counterpart technology may not exist for a significant segment of nonroad diesels (for example, non-road applications rated below 75 kW (100 hp) or over 449kW (600 hp). Of particular concern is that the advanced aftertreatment technology being developed for on-highway diesels may not perform as well on nonroad applications, especially for smaller engines below 75 kW (100 hp).

- Nonroad duty cycles with their fluctuations of exhaust temperatures and power demands are unique from highway diesel applications. For example, the same piece of equipment can be subjected to vastly different duty cycles depending on the job being performed, staging, and even from a change in operator. The machine can be cycling at full loading most of the time or be running at idle for hours at a time depending on the task or accessory being powered. Neither extreme is conducive to catalyst performance efficiency or the system regeneration cycles necessary to assure top reduction efficiency.

- Nonroad operating conditions and its effect on engine and emissions control durability could be different from that evidenced on-highway. What is the net effect of extremes of terrain, vibration, weather, dust and ambient variations on the performance and durability of advanced emission controls?

EPA says it has taken many of these nonroad application differences into account, but to date we have noted a lack of any government-sponsored projects to demonstrate the performance of aftertreatment technology on nonroad engine applications.

2. AEM Recommends An Extensive Nonroad Equipment Pilot Study as Part of the Technology Review

There are sufficient differences in the operational characteristics of nonroad equipment to raise concerns that making the advanced control technology transition from on-highway applications to nonroad applications will be more challenging than EPA portends. AEM feels that there should be a government/industry sponsored pilot program designed to verify the transfer of advanced emission control technology to popular examples of nonroad equipment that enlists the support of government, equipment manufacturers, engine manufacturers and emission control suppliers to study the performance, durability, heat generation (fire potential) and cost issues.

The Pilot Program would sponsor the build-up and in-field testing of at least one example piece of equipment in each of the Tier 4 power categories. Each machine would be subjected to the rigors of nonroad duty cycles and real world durability before concluding the transferability of these
technologies from on-highway to nonroad. The programs could be jointly funded between the industry and government groups with the results of the project made publicly available. A working group panel consisting of representatives from government, equipment manufacturers, engine suppliers, and the emission components suppliers could direct specific aspects of the program. The completion of the pilot study should be planned prior to the 2007 Technology Review such that the study’s findings will be available.

Specific issues to investigate in the course of the Pilot Program should include the following:

a) A portion of the Pilot Program should be devoted to tracking the cost increases to the equipment being included in this evaluation, as we believe that “technological feasibility” consists of meeting emission objectives at a practical cost to the end user.

b) Special attention be paid to the 56 to 75 kW (75 to 100 hp) equipment to determine the feasibility and cost effectiveness of the new standards, and to critically evaluate the appropriateness of reestablishing the Tier 4 cutpoint at 75 kW (100 hp) and above for the application of aftertreatment technology.

c) Consideration should be given to the practicality of the emission limits proposed for the 19 kW (25 hp) and under category of equipment where the cost of adding any additional emission controls appears to be prohibitive, and could lead to the elimination of these diesel products being offered in the U.S.

The Pilot Program would be beneficial in acquiring some real world data on aftertreatment transferability from on-highway, in-field performance, packaging issues, and a better estimate of the cost impacts. The information obtained would assist in EPA’s determination of the technical feasibility of the emission standards being proposed and the appropriate power cutpoint for the introduction of aftertreatment control technology.

3. AEM Requests EPA’s Continued Efforts Towards Achieving the Global Alignment of Nonroad Diesel Regulations

The nonroad equipment market is a very low volume market when compared to the on-road sector. The nonroad industry is also very globally oriented and strives to design a single global platform for its equipment that it then markets worldwide. Anything less than complete alignment of all the major elements of the nonroad regulation will drastically increase costs and consumption of resources for doing business both domestically and internationally. It is critical that regulators worldwide understand this and achieve as high a degree of global alignment of the emission controls, implementation flexibilities and fuel requirements as possible to avoid fragmenting a small market and forcing manufacturers to divert critical design and research resources that will result in higher costs to the end customer. Non-alignment of standards in a global industry will have the net effect of restricting free trade and putting U.S. manufacturers at a cost disadvantage.

The proposed Tier 4 nonroad diesel control measures indicate that there is very limited alignment achieved between the EPA proposal and similar control measures being finalized for the control of emissions from nonroad machinery in Europe -- the European Directive (97/68/EC amendment – known as Stage IIIB). Major areas requiring alignment are:
Power categories for equipment are not aligned as the Tier 4 proposal has combined the number of power categories from nine to five. EPA has created a new cutpoint that has been revised downward from 75 kW (100 hp) to 56 kW (75 hp).

The European Commission has not adopted any additional NOx requirement, but has yet to consider adopting the 90% NOx reductions pending evidence that NOx aftertreatment devices are a mature and reliable system.

The EU requires no regulation of engines below 19 kW (25 hp), while the US proposal does.

The EU does not require additional emission controls beyond Tier 2 for the category of 19 – 37 kW (25 – 50 hp).

The Tier 2/3 EU PM limit in 2007 is not aligned with the US PM limit in 2008 for the 19 – 37 kW (25 – 50 hp) category.

EPA relies heavily on compliance flexibility provisions (e.g. AB&T of emission credits, phase-in, and manufacturers’ Transition Flexibility), which are not recognized options in other regions of the world.

The emissions testing procedures are not aligned.

The introduction date for low sulfur diesel fuel for the nonroad markets is not aligned.

Previous to this proposal, EPA took justifiable public pride in the achievement of being closely aligned with the nonroad emission control regulations of Europe and Japan. That feat had not gone unnoticed by the nonroad engine and equipment industry that implemented a single product design that they marketed worldwide, and thereby contributed to improving the global environment.

It is also important to take into consideration that other regulations will impact equipment redesign such as the European Noise Directive. This directive is in place now and will become more stringent in 2006. Industry cannot afford, within a two year time period for example, to develop and validate the same machines twice, once for noise and once for emissions. These have to be collectively considered as they substantially impact workload issues for nonroad equipment manufacturers, and should be taken into consideration in any future rulemaking.

If this non-alignment situation is not resolved, all of the nonroad equipment manufacturers who market their products around the world will have to maintain separate product lines to address the unique regional emission controls requirements dictated for their customers. The net effect of this will restrict a manufacturer’s ability to compete in the major markets outside of the United States. Furthermore, EPA’s cost impact analysis fails to account for the additional cost and disruption that non-alignment of these standards will impose on this global industry.

Another serious concern is that U.S. nonroad machines equipped with advanced catalyst controls will find their way to Mexico and other countries that may not have low sulfur content diesel fuel. This displaced equipment will have performance issues and additional warranty liability for the OEM because the emission control systems may be irreversibly damaged by the prolonged use of high sulfur fuel during its life outside of the U.S. What resources does EPA have in place to guard against numbers of these machines returning into the U.S. used equipment market? Furthermore, the lack of alignment will discount the value of used equipment, since there will be fewer outlets for the sale of these used machines outside of the U.S.

AEM would like to see the achievement of alignment of the nonroad regulations prior to the implementation of the final rule.

AEM appreciates the efforts the Agency has put into the development of the transition provisions for equipment manufacturers to allow additional leadtime for meeting compliance with the many different models and sizes of equipment they produce. Notwithstanding, we feel there can be some further improvements made to the Small-Volume Allowance provision as proposed to reduce any inequities presented across the marketplace.

With the Small-Volume Allowance flexibility measure, EPA is proposing to allow any equipment manufacturer to exceed the Percent-of-Production Allowances provided the manufacturer limits the number of exempted engines to 700 total over the seven years, and to no more than 200 in any one year. The limit of 700 exempted engines would apply separately to each of the proposed Tier 4 power categories (engines below 19 kW (25 hp), engines between 19 and 56 kW (25 and 75 hp), engines between 56 and 130 kW (75 and 175 hp), engines between 130 and 560 kW (175 and 750 hp), and engines above 560 kW (750 hp)). In addition, the proposed rule restricts manufacturers making use of this provision to limit exempted engines to a single engine family in each Tier 4 power category.

We feel that EPA is being overly restrictive by limiting the exempted engines to a single engine family within each Tier 4 power category. There are examples of equipment manufacturers that offer the same engine in multiple variants (i.e. multiple engine family descriptors) in the same product line to provide a range of products to suit the customers’ needs. Restricting the 700 unit exemption to a single engine family will severely hamper the intended use of the Small-Volume Allowance and impact an equipment manufacturer’s ability to apportion their limited resources to redesign models for compliance.

<table>
<thead>
<tr>
<th>Proposed program</th>
<th>Engines exempted over 7 years</th>
<th>Maximum exempted engines in one year</th>
<th>Single Engine Family Restriction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variation under consideration</td>
<td>- 700 for each power category.</td>
<td>200</td>
<td>- Yes</td>
</tr>
<tr>
<td>Variation under consideration</td>
<td>- 525 for power categories &lt;175 hp. - 350 for power categories &gt;175 hp.</td>
<td>100</td>
<td>- No</td>
</tr>
</tbody>
</table>

EPA has proposed an alternative, as shown in Table VII.B-1\(^1\) that does away with the single family restriction, but in the process of doing that would reduce the maximum number of exemptions allowed to each manufacturer. Alternatively, we would argue that since the Tier 4 rule decreases the number of power categories, that provision effectively serves to cut down the total number of exemptions available under the Small-Volume Allowance.

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\(^1\) Reference 40 CFR Parts 69, 80, 1039, 1065, and 1068, “Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel. Preamble to the Notice of Proposed Rulemaking. Section VII(B.)(2.) (b.) page 326.
AEM recommends revising the Small-Volume Allowance by removing the restriction of the single engine family, but leaving the original maximum number of exemptions at 700 units total and 200 units in one year per power category. Under this recommendation, any purported degradation of the environment caused by the removal of the single engine family restriction is offset by the fact that there are fewer power categories, and therefore, there are only 700 exemptions times five categories instead of 700 exemptions times nine categories as found in Tiers 1-3.

5. The Reclassification of Engine Power Categories Proposed for Tier 4 Does Not Correctly Reflect the Cutpoint in Emissions Control Technology.

EPA took this opportunity with the Tier 4 proposal to regroup the engine power categories, and in doing so selected 56 kW (75 hp) and above as the technology cutpoint for the application of advanced NOx aftertreatment emission control measures. The presumptions being that these nonroad engines are either derived from or are similar in their characteristics to on-highway engine platforms. This progression has been reflected in EPA standards-setting activity to date in which the earliest standards are applied to engines in the most “highway-like” power categories.

However, it should be recalled that a large portion of nonroad engine manufacturers have no on-road product presence and would not have the opportunity to design nonroad engines based upon on-highway models. A precedent has already been set with the Tier 1 through Tier 3 regulations that already established the power ranges from 37 – 75 kW (50 – 100 hp) and 75 – 130 kW (100 – 175 hp) as separate power categories for regulation. Moreover, Europe and Japan have also aligned with this convention that will now be upset by the sudden switch to 56 kW (75 hp) as the new cutpoint. In the proposed rule, EPA tries to make the point that regardless of the heritage of the particular nonroad diesel engine it may display certain characteristics in common with its on-highway counterparts of similar displacement per cylinder. EPA has invited comments on this change in standards protocol.

Many nonroad equipment manufacturers disagree with this assumption, and have indicated that the similarities to on-highway diesel engines do not begin to uniformly appear until a higher power level. For example, electronically controlled fuel injection and aftercooling do not appear on the majority of the nonroad engines marketed today between 56 and 75 kW (75 and 100 hp). Equipment makers see their greatest difficulty in producing Tier 4 complying machines in the 56 – 75 kW (75 – 100 hp) range for several reasons, including: a) this size range of nonroad engines have no on-highway counterpart from which to transfer technology; b) the variable cost of adding NOx catalysts and engine electronics will increase the cost of this size range of equipment disproportionately and discourage sales; and c) because many of these machines are small in size, they will represent the greatest challenge for packaging the additional emission control equipment while striving to keep the machines small and light for maneuverability. In fact, some industry representatives predict that Tier 4 will precipitate a sharp decline in the market demand for the 56 – 75 kW (75 – 100 hp) segment as farmers and contractors make a conscious decision to defer the purchase of new equipment or opt to purchase the larger equipment ranges where they perceive a greater value for the money spent.

Therefore, AEM takes the position that the restructured horsepower categories should be reconfigured around 75 kW (100 hp) being the more appropriate power cutpoint above and below which the highway derived nonroad engine families do and do not exist. This restructuring of
power categories should also be extended to the reconsideration of the emission standards themselves to determine what is the most appropriate and cost effective level of stringency to be applied at each level of engine hardware sophistication.

Adopting this strategy would help to resolve some of the major concerns with the emission control technology including:

1. The concern that there is a technology development gap in the development of emission control systems designed for nonroad engines less than 75 kW (100 hp) because they have no direct surrogate in the on-highway market.

2. Another concern is driven by the overlap that exists between the introduction of NOx adsorbers and particle traps in the on-highway sector by 2007, and the research and development effort required to introduce the same technologies for nonroad engines that are in the intermediate power range of 56 to 75 kW (75 to 100 hp) that do not have direct equivalents on-highway. The fear is that the limited resources of the engine manufacturers and the emission control suppliers will be dedicated to on-highway development and not to the smaller volume business represented by nonroad engines. This is a genuine concern of the OEMs because the nonroad industry has experienced the same diversion of R&D resources with the recent implementation of Tier 2 amidst the pull-ahead of on-highway controls caused by the consent decree.

3. The proposed switch to 56 kW (75 hp) as a main power category cutpoint is also inconsistent with an established precedent begun with Tiers 1-3.

4. Closer consideration must be given to the selection of the technology cutpoint for commercial viability reasons. The large cost increase attributable to the addition of NOx aftertreatment systems can be better absorbed by the larger equipment types present in the power categories above 75 kW (100 hp) than it can at EPA’s proposed lower cutpoint.

5. Further, it is our understanding that there are more engines from the grouping of 37-75 kW (50-100hp) that share a common machine platform than from 56-130 kW (75-175 hp). The industry would benefit from being able to spread the costs of redesign over a larger volume of machines and take maximum advantage of their scarce engineering resources.

AEM recommends that EPA give priority consideration in the Final Rule to the retention of the power categories of 37 – 75 kW (50 – 100 hp) and 75 – 130 kW (100 – 175 hp) as were previously established in Tiers 1-3.

6. **Introduction Date Revisions Are Needed in Some Power Categories to Ensure Ample Stability or Leadtime Between Required Design Changes.**

   a.) A minimum full three-year period is necessary to provide ample stability between tiers to recover manufacturers’ investment. Therefore, we require a Jan. 2015 introduction date for the final Tier 4B emission limits for the proposed 56 – 130 kW (75-175 hp) category. In the event EPA acts on our request in the previous section to revert to the
power categories as laid out before in Tiers 1-3, the 2015 introduction date for 100% NOx control would apply to the 75 – 130 kW (100 – 175 hp) category.

b.) A four year period is necessary to provide design and development leadtime between changes in standards levels. We require that there be no change to the Tier 3 PM emissions level proposed for 2008 for the 37 – 56 kW (50 – 75 hp) category, because there is less than four years leadtime being allowed. [This proposed change in PM limit was first noticed in the NPRM issued in April of this year, and we expect a final rule in April of 2004. The leadtime is measured from the beginning of the next year, and that would be Jan. 2005. Taking the period from 2005 to 2008 introduction allows only three years leadtime as opposed to the typical four years necessary.] We also require that the 2013 date for the introduction of PM aftertreatment controls be maintained without having to do the optional PM pull-ahead in 2008. Moreover, AEM requests that EPA give serious consideration in the Final Rule to reconfiguring the power categories such that this category would now in fact be changed to 37 – 75 kW (50 – 100 hp).

c.) There are issues with the transfer of advanced emission control technology to equipment powered by engines greater than 560 kW (750 hp), in that the proposed program implementation provisions do not adequately address the manufacturers’ timing concerns. We are requesting that EPA move the introduction date until 2012 (one additional year) before beginning to phase in Tier 4 standards for this category. The reason for this concern is that mobile machinery such as off-road mine haul trucks and bulldozers (as differentiated from more stationary equipment applications such as diesel generators that also use engines in this power range) present unique challenges that could require additional time to resolve than would be afforded by the proposed phase-in completion date.

If EPA provides the changes as advocated above, the proposal will provide a one-year interval between three different implementation dates to allow the industry an opportunity to comply with the new standards. It would also provide a minimum of three years of stability for each of the referenced power categories.

7. The Economic Impacts of the Tier 4 Standards on Equipment Costs and Operations Are Understated.

The equipment manufacturing industry is very concerned about the economic impacts brought on by the proposed Tier 4 regulation. AEM members have been leaders in adopting clean diesel technology and we support further improved – but commercially viable – Tier 4 emission requirements that do not impede the purchasers of nonroad equipment to invest in next generation diesel-powered equipment due to large jumps in price and higher operating costs. Additionally, any significant increase in R&D and capital investment burden required to redesign products to adopt Tier 4 controls will have to be apportioned across a relatively low volume of units, since nonroad machines are sold in much fewer numbers than found in on-highway trucks.

AEM also disputes EPA’s projected growth of the emissions inventory of nonroad equipment. We suggest that EPA direct its attention to its table that depicts diesel fuel usage by segment as the best
indicator of nonroad equipment usage. The chart shows that the farm and off-highway fuel sales is flat from 1984 – 2002, which indicates that the contribution of farm and off-highway emissions cannot be increasing at the rate EPA is projecting in its emissions inventory analysis.

AEM has carefully reviewed the Agency’s economic analysis of the cost impacts attributable to Tier 4 emission controls, and we find that the Regulatory Impact Analysis understates the cost increases that the industry projects. Euromot did a good study on the economic implications of Tier 4, which aligned with EPA’s study on the cost impacts of the 2007 on-highway rule that deals with the introduction of similar emission control technology. Comparing the findings of these two reports indicates there is a greater cost increase than what EPA projected for the nonroad equipment cost increases in the proposal.

In its analysis, EPA used some assumptions that may not have been an accurate portrayal of the nonroad equipment industry cost structure and operating costs to the end user. AEM presents its findings below:

A. EPA’s projected operational savings from increased oil change intervals is overstated.

AEM agrees with some of the enhancements to engine life due to the reduced corrosion attributable to the changeover to low sulfur fuel. EPA estimates the largest operating cost savings would be the impact of lower sulfur fuel on oil change intervals. However, EPA based its projected maintenance savings on a baseline oil change interval of 250 hours that is no longer the norm. The engine manufacturers for these applications have indicated that due to improvements in design and the formulation of today’s lubricating oils, their Tier 2 engines already have a 500-hour oil change interval. This same oil change interval will be true for their Tier 3 engines as well. Whereas it is true that engine manufacturers specify different oil change intervals based as a function of the fuel sulfur levels for equipment sold in different regions of the world, it is difficult to conclude from any of this that the use of 500 ppm sulfur fuel would enable an oil change interval extension of 31 percent for Tier 3 engines and newer which is the basis of the comparison here.

In fact, there is evidence to suggest there may be a decrease in recommended oil change intervals once exhaust gas recirculation (EGR) is implemented on these engines beginning with Tier 3 standards as more fine soot particles from the exhaust will find their way past the piston rings and be suspended in the lubricating oil. Additionally, there is already a significant amount of 500-ppm sulfur diesel fuel being marketed throughout the U.S. in the nonroad diesel pool to minimize any observed gain in oil change intervals.

Taken together, we estimate the use of 500-ppm sulfur fuel would have little or no effect on the extension of oil change intervals, and certainly not the 31 percent increase here that EPA tries to project. Similarly, the additional 4% interval extension attributed to the 2010 introduction of 15-ppm sulfur diesel will have an insignificant effect on lowering maintenance costs when compared to the added maintenance required for the catalyst aftertreatment, the loss of fuel efficiency (i.e., 15-ppm sulfur fuel has a lower density than current fuel) and increased cost per gallon. The bottom line is that the owners of Tier 4 equipment should be prepared to expect significantly higher operating costs than with their Tier 3 engines.
B. The transition to electronic engine controls

The EPA’s cost analysis is derived from using a Tier 3 engine as the base case example and adding the fixed and variable cost items it will take to transition to a Tier 4 engine. The RIA for Tier 4 presumes all of the engines above 56 kW (75 hp) are already equipped with electronic engine controls that were added to comply with Tier 3 standards. Engine manufacturers have advised that there are some popular engine models in the 56 kW – 75kW (75 hp – 100 hp) range that will not have full electronic engine controls or unit fuel injection systems for Tier 3. That means that any piece of equipment that utilizes these non-electronic controlled engines will experience quite a significant cost increase going to the Tier 4 level than was stated in the RIA cost analysis.

C. Equipment variable cost mark-up

EPA in its economic analysis of equipment variable costs has assumed equipment manufacturers would apply only a 29% mark-up on the variable costs associated with installing new hardware and sheet metal. A survey of the nonroad manufacturers predicts that this value is underestimated, and that it was more common industry practice to use a variable cost mark-up of 2 to 1 to help cover indirect costs. Therefore, all of the variable cost estimates used by EPA need to be increased to better match industry practice.

To illustrate these points, we revised Table V.C-1, which was presented in the Regulatory Impact Analysis to compare the base cost of various pieces of equipment before and after the implementation of Tier 4 controls. In our analysis, we chose an example piece of equipment for each of the five Tier 4 power categories as shown in Table 5-1. Fixed costs and variable costs were calculated using the same assumptions and formulas developed by EPA found in the RIA that are based on engine displacement, with the exception that we changed some of the EPA’s assumptions that we feel are erroneous. For example, in Table 5-1 we did not assume the 50 hp Fork Lift was already equipped with engine electronics and unit fuel injection as EPA did, and we included the variable cost for adding cooled EGR to this category. Table 5-1 also deleted any maintenance cost savings for increased oil change intervals for all examples in determining the Incremental Operating Cost Increases.

AEM believes that the estimated range of cost increases from 2 – 35 percent are closer to the true cost impacts of the Tier 4 regulation. As we previously discussed, the greatest change in relative cost impact will be on the smaller equipment less than 75 kW (100 hp) that will shoulder a cost increase from 6 – 35 percent.

AEM is concerned that the economic impact as derived in the RIA is potentially misleading to the user groups who make the purchase decision to buy new equipment. Whereas it is a logical assumption to consider the cost impact going from a Tier 3 level machine to a Tier 4 level machine, it is easy to lose the point that all the costs are additive. It will require a large amount of capital investment, R&D, and component cost to bring a machine from today’s Tier 2 level to Tier 3. New equipment is purchased on a cyclical timetable with 5–7 years between machine purchases being the norm for most contractors and farmers. The point here is that the typical new equipment purchaser will experience the sticker shock from today’s price of equipment (Tier 1 and 2) to that of Tier 4. Therefore, we are suggesting that a better gauge of the economic impact on the end user would be to use today’s equipment cost as the baseline of comparison and not a Tier 3 level machine.
The other issue to point out is that the cost impact across the power categories is not a linear relationship. EPA has been quick to publicize the projected cost increase of Tier 4 as a range from 1 - 3 percent of the value of the equipment as determined on the very high-priced equipment whose base price is from $50,000 to over $620,000. A more realistic portrayal of the cost impact would be to report the range of cost increase for the vast majority of equipment sold, which is the segment from 30 kW (40 hp) to 75 kW (100 hp) horsepower, where the cost increase is from 6 – 15 percent.

The concern is that for the smaller (and most popular) pieces of equipment, the variable cost of the new emission control components suggested by Tier 4 will approach the cost of the engine itself. The operating costs of the new equipment will increase as well due to the reduced fuel efficiency and the additional maintenance required for the aftertreatment systems. The fear is that the
increased costs we have outlined will serve to either delay the purchase of next generation nonroad equipment or lead operators to rebuild their older equipment. The equipment powered by engines less than 19 kW (25 hp) is another target of great concern, as these engines are currently more expensive than similar spark-ignited engines. This small engine segment continues to thrive because hand-startable compression-ignition engines in the performance range of 8 to 19 kW are desirable for use in small machinery found on construction sites, agriculture, and forestry where all the equipment is run by diesel fuel. The proposed additional emission control stringency increases the price of such engines considerably, which could result in the disappearance of these engines in favor of gasoline-powered replacements.

AEM recommends that the previously suggested Tier 4 Nonroad Pilot Study should monitor the equipment cost increases resulting from the transfer of advanced emission controls to each of the power categories in the proposed rule. These incremental costs and additional design efforts to accommodate the emissions controls and their support systems should be reviewed for their cost-effectiveness in reducing emissions.

8. Issues Related to the Introduction of Low Sulfur Diesel Fuel

It is our common understanding that low sulfur content diesel fuel will be required to run the next generation of nonroad diesel equipment, and in the event they are run on high sulfur fuel, the emission systems will not perform properly or may require repairs or replacement. Equipment manufacturers and the users of this equipment share concerns over ensuring the widespread availability of low sulfur diesel fuel throughout the nonroad sector. AEM supports the EPA’s efforts to assure the implementation of the new standards and low sulfur fuel as a systems approach. Furthermore, AEM also supports certain requests of the oil industry that will keep low sulfur fuel readily available to the nonroad market and perhaps help to keep costs down.

In the proposed rule, EPA suggested an alternative to the two-step introduction of low sulfur diesel fuel that called for the introduction of 500-ppm sulfur fuel in 2006 followed by the changeover to 15-ppm ultra-low sulfur diesel in 2010. EPA requested comments on an alternative program option that called for introducing 15-ppm fuel in one-step by 2006 across the board. Whereas, AEM supports the initiative for lower sulfur fuels as soon as possible to reduce PM emissions from nonroad equipment, we find the two-step low sulfur fuel introduction to be more appropriate in that its phased-in approach will help to ensure an adequate supply to all the nonroad markets and keep fuel costs lower.

In conclusion, AEM expresses its appreciation to EPA for this opportunity to present a summary of our concerns to date. We look forward to sharing further information with EPA as it becomes available. Please contact us if there are any further questions.

Respectfully submitted,

Association of Equipment Manufacturers