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Non-Road CI Engine Strawman Scenarios

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The following strawman scenarios regarding future non-road engine standards and implementation dates illustrate different implementation schedules that are consistent with certain of the principles that impact the adoption of non-road engine standards (e.g. leadtime, stability and the timing for the potential transfer of on-highway technology to non-road engines). These scenarios do not represent a recommendation by engine manufacturers. Specific future emission limits have not been included and the percentage reduction efficiencies that are included should not be presumed to be cost-effective or technologically feasible.¹

It should be noted that developing scenarios for engines <50 hp and ≥750 hp raises different issues than for engines ≥50 hp - <750 hp. First, EPA has not adopted any emission standards for engines <50 hp and ≥750 hp engines beyond the current Tier 2 standards (i.e. there are no Tier 3 standards for the three smallest and the largest engine power bands). Second, there are technical issues regarding the ability to reduce emissions from small engines and from very large engines. Third, the transferability of on-highway like technologies to small engines and to very large engines raises a host of technical issues, and may not be practical or feasible.

In addition, there are significant issues yet to be resolved that impact all scenarios and all horsepower bands. For example, the appropriateness and/or adverse impacts of requiring multiple engine and equipment redesigns must be addressed. In addition, any change from existing Tier 2 standards would require at least one fuel change, and perhaps multiple changes, from the existing non-road diesel fuel sulfur levels. Issues surrounding the implementation of fuel changes and the benefits associated with a mandated fuel change versus the obstacles that must be overcome with a market driven approach must be addressed.

Two scenarios have been developed. Scenario I leaves the existing Tier 3 NO_x standards and existing Tier 2 PM standards in place for ≥50~750 hp, but assumes that a future aftertreatment forcing standard would be proposed in a subsequent rulemaking. Scenario I also requires the use of 500 ppm (or less) sulfur fuel. Scenario II shows what might happen if the current Tier 3 program were delayed and revised to implement an aftertreatment forcing standard with 40% effective NO_x aftertreatment and 90% effective PM aftertreatment. Scenario II requires the use of 15 ppm (max.) sulfur fuel.

For both scenarios, shaded numbers indicate existing standards already adopted by EPA. Within the shading, italicized numbers are Tier 2 standards and bolded numbers are Tier 3 standards. The first number in each “box” is NO_x + NMHC. The second number is PM. No

¹ For example, there is uncertainty as to the non-road test procedure that will be used. In addition, there are inadequate data on the technologies that will be employed in the on-highway market, their effectiveness in non-road applications, and their transferability (resulting, for example, from the different duty cycles, operating conditions and horsepower ranges of on-highway and non-road engines).

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numbers have been provided for CO, which could be an issue. All numbers are expressed in grams per brake horsepower-hour. All current Tier 3 standards require the use of 500 ppm (or less) sulfur fuel. All aftertreatment forcing standards require the use of 15 ppm (max.) sulfur fuel. Scenario II is premised on a minimum 5 year period of stability between tiers of standards requiring significant engine and equipment redesign. In addition, Scenario II retains the existing staggered implementation by power bands to address manufacturers' workload issues. Scenario II is premised on the technological feasibility and cost-effectiveness of applying 90% efficient PM aftertreatment and 40% efficient NOx aftertreatment and recognizes that there is a minimum 2 year leadtime to transfer on-highway like technology to non-road engines. Scenario I assumes that engine manufacturers covered by the Consent Decrees pull ahead Tier 3 standards by one year for the two horsepower bands (≥ 300 hp ~ < 750 hp) included in the Consent Decrees. A similar assumption is made with respect to the aftertreatment forcing standards in Scenario II, with the additional assumption that for Scenario II the Consent Decrees must be modified. It is assumed that 85% of sales in the pulled ahead power bands are produced by manufacturers covered by Consent Decrees.