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Construction Industry Air Quality Coalition
Summary of Justice Associates Study on Cost of Compliance
April 27, 2006

The following is a summary of the Justice & Associates study on the cost of compliance with ARB's concept for controlling PM emissions from off-road engines:

At CIAQC's request, Justice & Associates prepared a study estimating the cost to 19 construction companies of complying with the 2010, 2013, 2017 and 2020 PM emissions limits for their fleets of off-road diesel powered construction machines as proposed in the fleet emission averaging pathway of the January 20, 2006 California Air Resources Board's (ARB) conceptual diesel off-road equipment regulation.

The following assumptions were used in the cost estimate:

- 1) The ARB deadlines for attaining conceptual PM emission fleet averages expressed as grams per brake horsepower-hour (g/bhp-hr) for the three horsepower ranges are shown in the table below:

Compliance Date	26-174 hp	175-750 hp	>750 hp
January 1, 2010	0.30	0.15	0.16
January 1, 2013	0.13	0.07	0.09
January 1, 2017	0.10	0.05	0.07
January 1, 2020	0.08	0.04	0.06

- 2) The proposed regulation includes all off-road engines of 25 horsepower and greater except for agricultural equipment, Combat and Tactical Support equipment, fleets with less than five pieces of equipment and equipment to alleviate an emergency event.
- 3) It offers a BACT pathway as well as an emission averaging pathway.
- 4) The regulation is scheduled for ARB adoption in December 2006.

The study includes 19 construction companies of medium to large size with a diverse array of types and numbers of machines and control technology. To maintain their confidentiality, they are identified by descending letters instead of company names.

Several principles were used to determine the extent of repowering and after-treatment needed to comply with the schedule of increasingly

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stringent composite emission factors:

- 1) All Tier 0 and Tier ½ machines were repowered to Tier 3.
- 2) A minimum of after treatment devices were installed for 2010 emission limits because of the limited availability of retrofit options in the early part of the program.
- 3) The retrofit technology met Level 2 (50% PM reduction) for 2010.
- 4) For the later years, Level 3 after-treatment had to be used extensively to meet the emission targets.
- 5) Finally, to the extent possible, the number of Tier 1 engines that would be repowered to Tier 3 technology was postponed to the last few years.

To date, only one "cleaner" fuel has been verified and only one diesel particulate filter meets Level 3 criteria, but not for a high displacement volume for larger off-road equipment. For Level 2 supplemental treatment, the study assumed that a lower emission fuel costing 20 cents per gallon was used for four years in conjunction with an oxidation catalyst. For Level 3 after-treatment, it assumed that a diesel particulate filter was utilized. It assumed a supplemental treatment cost of \$35 per horsepower.

Using these assumptions, 77% of the 2010 inventory would be powered with Tier 3 engines and 90% by 2020.

The study finally concluded that the cost for the 3,800 machines owned by the 19 companies to comply with the ARB concept would be \$294 million by 2010 and \$351 million by 2020.

Extrapolating these costs to the approximate 180,000 off-road engines in the California inventory, the cost of compliance would be on the order of \$13.9 billion by 2010 and \$16.6 billion by 2020.

Note:

The Justice Associates cost estimate to the California Construction Industry of the ARB Proposed off-road engine PM reduction concept and supporting inventory data may be significantly understated because:

- The average statewide cost estimate of the ARB concept was extrapolated from the estimated cost of complying with a limited number of off-road construction machines owned by contractors who had received Carl Moyer funding to repower many of their machines with Tier 1 and Tier 2 engines.

- The Justice & Associates cost estimate assumed that all existing machines could be repowered with Tier 3 engines. Currently only a limited number of industry's off-road machines have the capability of being repowered with Tier 3 engines due to physical limitations on the machine for additional cooling systems or other engineering design requirements needed to meet the EPA/CARB Tier 3 emissions level. Although designs are being engineered to accommodate Tier 3 engines in older machines, many of these machines will not have a Tier 3 solution, requiring the owner to purchase expensive new machines to meet the proposed requirements of the ATCM.