



# **WHITE PAPER: AN INDUSTRY PERSPECTIVE ON THE CALIFORNIA AIR RESOURCES BOARD PROPOSED OFF-ROAD DIESEL REGULATIONS**

## **OVERVIEW & HISTORY**

The California Air Resources Board (CARB) is currently considering regulations to reduce Particulate Matter (PM) and NOx emissions from off-road diesel equipment operated by the construction and many other industries in the state.

The Board first announced its intention to promulgate these regulations in 2000. The Board's original plan called for an 18-year timeline to meet the state's goals of reducing particulate matter emissions only. Now, after seven years of delays in developing these rules, that timeline has been reduced to 13 years. In addition, the regulation of NOx emissions has been added to the rule – which significantly alters the technology needed for companies to be in compliance.

Throughout this process, the construction industry voluntarily has begun to retrofit and replace older, high-polluting equipment with new, cleaner burning engines. In addition, the industry has demonstrated a willingness to work with CARB to develop a fair regulation that achieves the state's air quality goals while providing contractors adequate time to meet the standards. Despite these efforts, the rules before the Board in their current form are not viable from an economic or technological perspective and cut off access to critical funding for retrofitting older equipment under the Carl Moyer Program. In addition, they threaten to seriously reduce the buying power of the \$43 billion in bonds to build roads, schools, housing and improve the state's flood control system approved by voters in November.

The industry maintains its commitment to working with CARB, environmental organizations, the Legislature and other stakeholders to find a feasible solution that achieves the state's air quality goals while allowing contractors to meet the standards in a reasonable timeframe. By maintaining the original 18-year timeline for implementation of these rules, we have the opportunity to ensure California's economy, workforce, businesses, infrastructure and environment all win.

## **MOVING TOWARD THE GOAL**

The Construction Industry Air Quality Coalition (CIAQC) has been keenly aware of the concern over PM, NOx and visible emissions from construction equipment for many years. The public has also expressed a desire for cleaner burning, heavy duty, off-road construction equipment working in their neighborhoods.

The industry shares this concern and has taken action to proactively replace or retrofit older, higher-polluting off-road diesel equipment with cleaner models. A critical part of the industry's efforts is funding available through the state's Carl Moyer program for re-powering older construction engines.

The equipment most suitable for re-power includes scrapers, haul trucks, bulldozers, loaders, water pulls, water trucks, excavators, motor graders and trucks that transport cranes. Replacement engines for smaller equipment such as skid steers, backhoes and a host of other lower horsepower units are simply not available.

Since these funds became available, CIAQC has been encouraging construction companies to pursue an aggressive engine re-powering program. Over the past six years, twenty construction companies in the South Coast and San Diego Districts have re-powered 1,020 machines at a cost of \$89 million. Carl Moyer Program provided \$71.0 million with the remaining \$18 million being provided by the machine owners themselves.

This single industry effort is the largest voluntary emission reduction program in the history of California and represents about 30 percent of the total funding statewide and about 10 percent of the total engines modified. It has resulted in a reduction of 3,797 tons per year of NOx and 126 tons per year of PM emissions. This accounts for 25 percent of the PM and 20 percent of the NOx program emissions reduced statewide.

The Legislature has recently committed \$140 million a year, for the next five years, to continue the Carl Moyer Program. Under CARB's proposed rule, however the industry would lose access to these funds almost immediately. While these funds will not make a significant dent (the 1,020 engines re-powered in Southern California accounted for just one-half of one percent of all the engines in the state construction fleet) in meeting the fleet emission targets under the proposed rules, they are nonetheless an important and essential tool in improving air quality.

## **CONSTRUCTION-RELATED OFF-ROAD DIESEL EMISSIONS**

Before discussing the specifics of these regulations, it is important to note both the air quality goals CARB has set for the state and the level of construction related off-road diesel emissions.

These proposed regulations are part of CARB's strategy to reach its overall goal of reducing PM from all diesel fueled engines in California by 75 percent by year 2010, and by 85 percent by year 2020.

Construction-related off-road diesel emissions in California represent 24 percent of the total PM emissions from mobile sources across the state. They represent less than one percent of total man-made PM emissions from all sources.

NOx emissions from construction engines represent about 19 percent of all emissions from off-road sources. They are about 9 percent of all man-made NOx emissions statewide.

## **FLEET TECHNOLOGY & SIZE**

Estimating the exact number of off-road diesel construction vehicles in operation in California today is difficult because this type of equipment is built to last for decades and there is no vehicle registration program for this machinery. CARB estimates that there are approximately 165,000 pieces of heavy-duty off-road construction equipment in California. CIAQC believes the number may actually exceed 200,000. Whatever the exact number, it is likely that the total fleet will expand over the next decade as the state begins to issue contracts for the transportation, school, housing, and flood protection bonds approved by voters in November.

There are four levels of diesel engines in operation in California today, from the oldest and highest polluting Tier 0 engines to the newer and cleaner Tier 3 models. Cleaner burning Tier 4 engines – which will be the only engines that meet both NOx and PM requirements under CARB's proposed rules - are not expected to come online in significant numbers until 2014. Based on a sampling of a cross-section of construction firms, CIAQC believes that 55 to 65 percent of the statewide fleet are Tier 0 engines (which are responsible for up to 70 percent of all PM emissions), 35 to 40 percent are Tier 1, approximately 7 percent are Tier 2 and less than 1 percent are Tier 3.

## **THE ECONOMICS OF RETROFITTING, RE-POWERING & REPLACING**

Currently there are five possible ways to modify the emission level of engines to achieve CARB's goals by 2020:

- Institute updated engine standards for newly manufactured equipment
- Require the use of cleaner burning diesel fuel
- Retrofit existing engines with emission control devices
- Re-power older machines with new lower-emitting engines
- Retire old equipment and reduce fleet size and workforce

The first two of these options are already in effect in California, the technology is in development for the third and the fourth is possible for certain categories of equipment.

New engine standards for newly manufactured equipment and new fuel standards have already been adopted and agreed to by the engine manufacturers (Tier 4 engines represent the cleanest version of these). Ultra-low sulfur fuel was mandated for use in California beginning in June 2006. Research and development is underway to build particulate filters and catalysts called Verified Diesel Emission Control Systems (VDECS), which can be used to retrofit existing engines, but only one model is certified for use today. Finally, for long lasting heavy-duty off-road equipment the option of re-powering with new engines rather than rebuilding an old engine can be economically feasible.

In order to achieve the emission reduction goals established by CARB, 77 percent of all Tier 0 equipment (approximately 75,000 engines) would have to be re-powered to Tier 3 by 2010 and 90 percent by 2020. The cost of re-powering a single engine averages about \$300 per horsepower. This means a dual engine, 1000-hp scraper will cost \$300,000 to re-power with Tier 3 engines. In addition, nearly all of this equipment will also require after-treatment (retrofitting) with VDECS in order to meet the 2020 goal. The cost for retrofitting with a certified VDECS device is approximately \$100 per horsepower, or more than \$50,000 for a 500-hp engine, not including the cost of expensive ongoing maintenance costs and ash disposal.

It also appears unlikely that most existing equipment can be re-powered with Tier 3 engines due to the sophistication of the technology and challenges with integrating the transmission and hydraulic systems with the engine. If a Tier 2 re-power is used instead of a Tier 3, level 3 VDECS must also be used in order to meet the year 2020 standard. This would require an additional expenditure of \$25,000 to \$50,000 per engine.

Replacing the equipment altogether is also very expensive, with a new scraper costing in excess of \$1,000,000. In addition, Tier 4 engines are the clear choice for contractors replacing their equipment, but they will not be available in significant numbers until 2014.

CIAQC believes the full cost to achieve the targets under the current timeframe set by CARB through replacing, re-powering and retrofitting would be at least \$9 billion.

In addition, this equipment is the primary asset-base of most construction companies, and is often used as collateral in financing the start-up of construction contracts. Therefore, regulations requiring early retirement of the equipment by a date certain, or a prohibition on resale, can reduce the value of the equipment and severely impact company finances and borrowing ability. As companies struggle to replace their primary assets, many will be forced to downsize or cease to operate altogether, which means the significant loss of high-wage construction jobs.

## **THE LIMITS OF TECHNOLOGY**

In addition to the enormous financial burden the Board's proposed regulations will place on contractors, there are also several significant technological barriers to meeting the standards. First, there are currently no devices on the market to reduce both PM and NOx emissions that meet CARB's standards. This means construction companies will have to invest in and "touch" many pieces of equipment twice with costly retrofits to comply with the rule.

The annual emission goals established by CARB in would also require the use of level 3 VDECS to retrofit virtually every piece of equipment. Most manufacturers have not developed a device to reduce emissions to that level. In fact, there is currently only one level 3 VDECS available for retrofitting heavy-duty off-road construction equipment and no certainty that it will ever be work reliably for many engine families. This system is also "active," requiring a burner to achieve the proper exhaust temperature and special handling to dispose of the ash material created by the PM filter. And, its cost exceeds the assumption used by CARB in evaluating the economic impact of their proposed rule.

In addition, the Board's process for VDECS certification is lengthy and costly. Some engine families may simply not be large enough to warrant the investment in producing an effective VDECS. Those engines would be unable to meet the new standards even if they are the newest available models.

Another challenge is the availability of a sufficient number of engines to re-power or replace the state's existing fleet and meet the goal. Not only are not enough engines or equipment in existence, the capacity to produce them does not exist. To compound the situation, most new engines are used in the production of new equipment. The equipment manufacturers have been clear that they are interested in selling new equipment, not new engines – which will seriously diminish the opportunities for contractors to re-power their machines.

Given these facts, CIAQC has proposed several alternatives for consideration by CARB. First, by implementing this rule based on an 18-year timeline, as it originally said it would, CARB would allow technology and manufacturing to meet the demands for cleaner engine production.

Second, building on the success of the Carl Moyer program, CIAQC has offered a "fleet averaging" formula that would provide an incentive to every contractor to achieve emission reductions as quickly as possible. A fleet average would allow contractors to operate older specialty equipment by reducing emissions from other equipment ahead of schedule. A project based fleet average calculation would also accommodate the needs of smaller contractors who may be unable to meet vigorous compliance schedules.

Since most contractors know the size of their year 2000 fleets, each would be able to calculate their own baseline for purposes of establishing an 85 percent emission reduction

target. It would offer each contractor maximum flexibility in re-powering, retrofitting or replacing equipment to meet the goal.

A critical part of making this alternative work also involves allowing contractors to use actual emission levels in determining compliance. Under the proposed rules, CARB requires the use of “certified” levels set by the Board which can be two to three times higher than actual levels.

## **THE CRITICAL ISSUES**

Put simply, the rules CARB has put forward are not viable or achievable. There are five primary reasons for this – unattainable annual limits, inadequate clean engine supply, limited clean engine technology, prohibitive cost and the fact that construction is a low-margin business.

### **Unattainable Annual Limits**

Given the available resources and technology, the annual emission limits in the draft proposal released by CARB cannot be achieved by the contractors in the State of California. Even the most progressive firms, who have been re-powering and updating their fleets in anticipation of the regulation, cannot meet the annual goals set forward in the draft rule.

### **Inadequate Clean Engine Supply**

There is an inadequate supply of engines or new equipment to meet the demand these regulations would place on the market. These rules require the purchase of more than 165,000 new pieces of equipment by 2020. Virtually all Tier 0 and Tier 1 engines will need to be replaced with Tier 2, 3 and 4 engines in 13 years. The Board consumed valuable and necessary time when they waited seven years to develop these rules and now the market is not able to meet the equipment demands. To put this into perspective, currently 10,000 new pieces of equipment are sold in California every year. Under these regulations, that number would have to grow to 15,000 each year for the next 13 years.

### **Limited Clean Engine Technology**

The addition of NOx reductions to the proposed rule will force companies to re-power more engines (a very costly alternative), and make PM reductions a low priority. First, no retrofit device is available to achieve the NOx emission reduction requirements. This means companies will be forced to re-power or replace equipment – which significantly increased costs. The NOx requirement also makes it impossible for contractors to qualify for the Carl Moyer funding that has propelled the significant voluntary emissions reductions already achieved by the construction industry.

### **Prohibitive Cost**

CARB has significantly underestimated cost of these rules. By assuming an unrealistic “natural” turnover for construction fleets and a lower number of machines covered under this rule, CARB’s economic analysis of its proposal does not accurately reflect the real

burden of this proposal. In effect, CARB has inaccurately assumed that the construction industry will spend billions on repowering, replacing and retrofitting equipment in the next 13 years without any new regulation. CARB estimates that the cost of the draft rule is only \$3 billion dollars. CIAQC estimates the total real cost to the industry to be at least \$9 billion. These costs are likely to be passed on to consumers, including the state as it contracts to build the roads, schools, housing and flood control systems voters authorized \$43 billion in bonds to construct.

### **Construction Is A Low-Margin Business**

Contractors do not have the financial resources to fund the program. Construction is a fiercely competitive business and contracts can be won or lost by only a few thousand dollars. Most contractors hope to achieve a profit of 2.5 percent to 7 percent and can on average, do so in three out of five years. After labor, materials, insurance, fuel and overhead, a very small portion of the \$60 billion spent on construction every year in California is available for fleet upgrades. To meet these requirements, many businesses will need to downsize, which means construction workers will be laid off and capacity to build projects will decrease.

## **WORKING TOGETHER TO IMPROVE AIR QUALITY**

The industry is committed to working with CARB to develop a solution to this to ensure the state's air quality standards are achieved through the implementation of a viable and achievable rule. By making critical changes related to time, turnover, tender and technology, the Board can make it possible for the construction industry to meet its emissions reduction targets.

### **TIME: Restoring CARB'S Original Implementation Timeline**

CARB's original plan called for an 18-year timeline to meet the 85 percent PM reductions. Delays by the Board in developing a rule have reduced that schedule to 13 years. By adopting a strategy that virtually eliminates Tier 0 and Tier 1 equipment from the fleet, and relies heavily on a Tier 4 inventory, that will not become available from the manufacturers until 2014 for the higher horsepower equipment, there is simply not enough time or Tier 4 equipment before 2020, to replace the existing fleet.

### **TURNOVER: Lower CARB's Turnover Estimate to Realistic Levels**

CIAQC estimates the statewide fleet natural turnover at between 2 and 3 percent, significantly below CARB's estimate. To achieve the CARB 2020 fleet makeup, approximately 140,000 pieces of equipment have to be repowered, retrofitted or replaced. That's means more than 1,000 pieces of equipment, every month, for the next 13 years, that will need to be repowered, retrofitted or replaced. There is not enough manufacturing capacity for that much new equipment or engines for the California market. The major supplier of construction equipment, Caterpillar, ships less than 2,000 pieces of new construction equipment to California each year. Without that new equipment and engines it will be impossible to meet the NOx reductions required by this proposal.

**TENDER: Help Alleviate the Cost Burden to Construction Companies**

This proposal not only will inflict a \$9 billion cost on the construction industry, but it will also end the availability of Carl Moyer funding for re-powering existing equipment. These funds have been an extremely important tool for accelerating the turnover of this equipment and without it many contractors will simply be unable to afford to retrofit or replace their equipment. These tremendous costs will lead many companies to downsize or go out of business completely which means the significant loss of high wage jobs for construction workers and increased costs for all construction projects, including to state and local government for building infrastructure.

**TECHNOLOGY: Re-evaluate the Conflict Between NOx and PM Reduction**

There is no retrofit device that will reduce both NOx and PM. As a consequence, the strategies proposed by CARB inherently conflict with any rational decisions that would be made by a construction company. Since most of the current fleet will have to be eliminated, no one wants to invest more money in equipment that they will have to dispose of before its useful life is completed. Having to repower one year, and retrofit two years later, and then replace completely five years after that simply makes no economic sense. As a result, it is likely that many small companies will disappear, many large companies will shrink their fleets and the overall ability of the construction industry to meet construction demand will diminish. That means higher prices, longer construction periods and fewer companies to keep prices competitive.

CIAQC believes it is possible to resolve these issues in a way that satisfies CARB's air quality improvement strategy while keeping the industry economically viable, ensuring construction jobs are not lost and making certain the state's historic \$40 billion in infrastructure improvement builds as many roads, schools, houses and levees as possible. We look forward to working together to protect our environment and to build a better future for the people of California.

*This white paper was prepared by the members of the Construction Industry Air Quality Coalition's Task Force on Off-Road Regulation. Members of the task force include:*

*AGC America  
American Road and Transportation Builders Association  
Associated General Contractors of California  
Associated General Contractors of San Diego  
Building Industry Association of Southern California  
California Alliance for Jobs  
California Building Industry Association  
California Construction and Industrial Materials Association  
Engineering Contractors Association  
Engineering & Utility Contractors Association  
Engineering and General Contractors Association  
Mobile Crane Operators Group  
Southern California Contractors Association  
The California Rental Association*