

Now Is Not Too Soon to Retire Tier 0 Diesels

California's model for the nation suggests the only sure way to comply with diesel rules profitably is to dispose of the oldest engines well before you're forced to

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The handwriting on the wall says your Tier 0 diesels have to go. Same thing goes for most Tier 1 machines. Owners have some control over when, but by 2013 or 2014 in California, few firms will be able to afford to keep pre-1998 off-road diesel engines. You won't want them and, here's the kicker, neither will anybody else.

Regardless of whether or not your state adopts California's In-Use Off-Road Diesel Vehicle rule, in the next five years most major metro areas in the United States are going to force by regulation or lure by incentive heavy equipment owners to retire or replace Tier 0 and Tier 1 diesel engines and upgrade Tier 2 and Tier 3 engines to the cleanest possible exhaust emissions standard.

Modernizing fleets will be expensive, and the cost will only increase with time. Before regulations begin to demand compliance, there are government grants to help pay for replacement engines and exhaust filters. (The American Recovery Act — our federal stimulus package — for example, supplies \$300 million to support EPA's Diesel Emissions Reduction program.) After regulations go into effect, government support



Cleaire's Allmetal diesel particulate filter is not yet verified, but designed to deliver Level-3 performance (reduces PM more than 85 percent) for 300- to 600-horsepower diesels. The filter regenerates passively, but exhaust temperatures must run to 500 degrees Fahrenheit or more at least 25 percent of the time.

(See chart below)
Some California fleets find they can comply while

funding goes away.

The next couple of years will provide a measure of just how crushing waiting until the last moment to act will be for contractors in California. March 1, 2010, is the first hard compliance date for large (more than 5,000 horsepower) fleets to meet either CARB's fleet-average targets or apply best available control technologies (BACT) to 20 percent of their machines. The intent is to slash production of today's key diesel-exhaust pollutants: oxides of nitrogen (NOx, which combines with ozone to make smog) and particulate matter (PM, unburned diesel soot).

Medium fleets (2,501 to 5,000 horsepower) don't have to meet emissions targets until 2013, and small fleets have until 2015 to comply. But the important fact is that almost nobody in California should expect to make decent money selling machines with Tier 0 engines ever again.

"I'd start getting rid of the Tier 0s immediately," Andy Recalde, equipment manager at The Don Chapin Co. in Salinas, Calif., recommends to contractors working in areas nationwide that fail to attain the Clean Air Act's standards for PM and/or NOx. "You got to get rid of them way ahead of time, while they're still marketable. The markets are flooded with Tier 0s in California, and equipment values have dropped substantially because everyone is selling Tier 0 equipment."

Complicating disposal of unregulated engines is a provision in the CARB rule that forbids California contractors from adding Tier 0 machines to their fleets as of March 1, 2009.

The off-road diesel rule is complex. Rod Michaelson, equipment manager with Bay Cities Paving and Grading in Concord, Calif., estimates he has 500 hours of study and participation in an industry advisory committee to CARB invested in developing his firm's compliance strategy. He has retired 10 of Bay Cities' Tier 0 machines since 2007 and will have retired 18 Tier-1-powered machines by year's end.

retaining a few Tier-0-powered machines if they retire the rest and retrofit select high-horsepower Tier 2 and Tier 3 engines with diesel particulate filters. "About a year and a half ago," says Andy Recalde, a Salinas, Calif.-based fleet manager, "we decided there's just no way we could possibly buy anything less than new."



Engine Control Systems' (ECS) Combifilter is a CARB-verified, Level-3 VDECS verified for 2007 or older off-road diesels. The electrically regenerated, active system must be plugged in (typically once per day) to burn soot off the element, or a clean filter can be swapped into the vehicle in a couple of minutes when the dirty filter is removed for cleaning.



Volvo dealers are selling the HUSS M-K diesel particulate filter as a Volvo-approved

“We really haven’t changed too much of our mode of operation, except maybe getting rid of some of the older dirty equipment earlier than planned,” Michaelson explains. “Some of it was bigger dirt equipment. As we slide into the recession, dirt work is not going to be as big for us. When big earthwork work comes back, we’ll buy newer machines then.”

Nevertheless, more than 20 percent of Bay Cities’ fleet is expected to remain Tier 1 or older until at least 2013. The algorithm that calculates compliance offers some flexibility for fleets that start cleaning up early.

CARB is spurring equipment owners to act early on fleet compliance with a provision in the rule that, until the end of this year, counts horsepower credits toward PM compliance for engines to which firms apply diesel particulate filters (DPFs), and NOx compliance for engines they replace in excess of what CARB assumes is a common fleet replacement rate of 8 percent per year. Equipment owners earn double the horsepower credit toward PM compliance for DPFs until Dec. 31.

Double credit means a contractor who fits a 220-horsepower diesel engine with a Level-3 VDECS this year banks PM BACT credit for 440 horsepower to be used toward meeting the fleet’s BACT target if they fail to hit the fleet-average target for PM. Owners who have some large-frame Tier 0 machines they want to keep, like Bay Cities, might buy those engines’ passage through the next couple of years by retrofitting engines more suited to exhaust filters, such as Tier 2 and newer Tier 1 machines. The oldest engines —pretty much anything built before 1998 — make too much soot for today’s DPFs.

This is where good fleet management intersects with compliance. Buying a DPF or repowering changes the costs of a machine pretty dramatically, but it is still just a cost/benefit decision. Those who want to make as few of those choices as possible should gather a complete inventory of diesel engines. Year of manufacture and horsepower is all you need, but it’s best to organize them by machine unit number. A great place to keep

product. The active-regenerating filter has a diesel burner that clears accumulated soot from the media. The M-K is a Level-3 VDECS for on-road and off-road engines from 50 to 750 horsepower, in rubber-tired and tracked applications.

California Lightens the Load

State legislators used the horsetrading over California’s delinquent budget to soften the short-term impact of CARB’s In-Use Off-Road Diesel Vehicle rule, but the changes are subject to CARB interpretation and final rulemaking. The mess should be cleaned up some time this year. It’s a process worth watching because one of the legislators’ amendments seems to have thrown a lifeline to contractors that might not have survived an effort to comply.

CARB assumed that off-road-fleet owners replaced at least 8 percent of their horsepower every year. The original rule gave credit toward NOx compliance for any horsepower in excess of 8 percent of the fleet total retired — not replaced — before the first official compliance year. For example, if a 1,000-horsepower fleet retired a

this inventory is in CARB's Fleet Average Calculator. The online spreadsheet can be downloaded with no registration requirement or information to submit.

The calculator shows a fleet's compliance status relative to the current CARB off-road diesel rule. Modifying the data to reflect various engine repower, retrofit, retirement and replacement choices shows the affect on fleet-average PM and NOx relative to prescribed targets. It also calculates how much horsepower must have exhaust filters in order to comply using the BACT approach.

Tier 0, and perhaps some Tier 1, machines are the only real candidates for emissions-compliance repowers. Long lives of frames and other major components make repowering larger machines most cost effective. Wheel loaders, crawler loaders, motor graders and scrapers are machine types most capable of productive lives extending beyond the 15,000-hour range, according to *Construction Equipment's* lifecycle research. Of course, consistently high utilization is necessary to make investments like this pay.

Retrofitting CARB-verified diesel emission control strategies (the official acronym for compliant exhaust filters is VDECS) is typically going to work best on Tier 2 and Tier 3 engines.

"If you've got your Tier 2 and 3 equipment retrofit and you've put a modest amount of Tier 4 Interim equipment into your fleet, you can keep your Tier 2 or 3 equipment because you're more than likely going to make the fleet average," says Mike Buckantz, principal with environmental consultancy Associates Environmental. "But for people outside of California right now, if I could avoid retrofitting anything, I would avoid it. We've seen a slew of (technology-verification) activity recently with respect to retrofit devices, and I think that we're probably going to see a lot more activity like that over the next year or two. And the technology is getting better."

Californians should plan to order VDECS by Aug. 31.

160-horsepower tractor, the owner banked 80 horsepower of NOx-compliance credit to be applied in the first year the fleet failed to meet the NOx fleet-average target.

The California statesmen ordered CARB to honor all off-road diesel retirements between March 1, 2006, and March 1, 2010, with no 8 percent floor. And the amendment allows horsepower credits that will apply to both NOx and PM compliance. The only caveat is that total fleet horsepower must fall from year to year — retired machines are not to be replaced, at least during the period.

A second amendment conceived of a credit based on reduced machine usage between July 1, 2007, and March 1, 2010 — clearly a nod to pollution avoided by today's stalled construction economy. It's hard to anticipate how CARB will interpret and administer this credit, but seems likely it will be a horsepower-equivalent credit. Consistent with its more short-term nature, this credit will only apply to compliance in 2010 and 2011, whereas the horsepower-retirement credit is durable and can be used whenever it is

Filters ordered four months in advance of the Dec. 31 deadline count toward double credit even if they're not installed by Jan. 1, 2010. Given widespread ignorance of CARB's in-use off-road diesel rule within California, there will almost certainly be a last-minute rush for VDECS in the waning weeks of the year.

Advance work is necessary to get the right kind of filter. There are two basic types of VDECS: the first regenerates passively — burning excess soot and ash off the element at the high-temperature points in the vehicle's duty cycle. But vehicles must operate at 500 degrees Fahrenheit or hotter for significant portions of their shift in order for passive filters to be effective.

The second type of VDECS is an active system. Active electric systems must be plugged in to shore power, and active diesel systems have a built-in fuel burner to regenerate the filter medium. Active VDECS — particularly fuel burners — tend to be more expensive than passive filters, and their added complexity is expected to demand added maintenance. Some equipment managers are not even considering them.

"I'm going to limit myself to passive filters that I can take the element out for cleaning — that's the technology that makes sense for a regular contractor," says Michaelson. "We're not going to plug anything in. And having a diesel-burning system seems like a maintenance nightmare and make work."

Michaelson invested about \$300 in a datalogger with a temperature probe that he uses to find engines that can use passive VDECS.

"I'm just getting a snapshot of temperature data," Michaelson adds. "On the ones that look good, I'll do a more thorough datalog and submit that to the dealer, and we'll put VDECS on some of those."

Michaelson hopes to retrofit a number of machines that take a common filter so he can stock a cleaned element and quickly swap them into service as needed. Again, higher-horsepower engines are a priority.

needed.

The final amendment is clearly designed to lighten the compliance load in 2011 and 2012. Fleet owners are allowed to plan the total number of changes required to comply between 2011 and 2013. Rather than pace implementation evenly in each of those three years, they will be able to do 20 percent of the retrofitting, repowering, or replacing in 2011, 20 percent in 2012, and the remaining 60 percent in 2013.

This story went to press before an April CARB workshop where the agency discussed implementation details of these changes and took public comment.

"We're not going to do DPFs on backhoes and other small machines because we don't want to spend \$10,000 to put a DPF on a 70-horsepower backhoe to get 140 horsepower of credit," Michaelson says. "We'd rather do a 250-horsepower excavator and get 500 horsepower worth of credit for 15 grand.

"We're concentrating on high-horsepower Tier 2 and later model Tier 1 machines," Michaelson continues. "It doesn't make sense to spend \$15,000 or \$20,000 putting a filter on a machine that's only got a few good years of life left in it."

He also eliminates vibratory machines from consideration for VDECS.

"From what I understand, the filter elements don't like high vibration cycles," Michaelson explains. "We'll just continue to run them and use our fleet average (to comply), and later replace them with Tier 3 or 4 machines as they come along."

Using the CARB fleet calculator, which is based on the original in-use off-road diesel rule, Michaelson has identified four to eight machines to fit with VDECS.

"We are doing our four 330CL excavators with Level 3 VDECS because Caterpillar has a passive system available for them that will all use one type of element," Michaelson says. "Double horsepower buys 1,976 horsepower credit to help get us through 2013 with our normal turnover schedule for the other machines. All of those machines could last us eight to 10 more years as they are all 2002 and newer, and the cost of the VDECS will be less than 10 percent of the purchase price of replacement machines."

He hangs on to four Tier 0 (1990) engines, worth 1,216 horses, aboard a pair of twin-engine scrapers through at least 2014. So Bay Cities is an example of how relatively few, smart VDECS investments this year can help California fleets skate far enough into the next decade that new engines will meet ultimate compliance goals and VDECS choices should be more plentiful.

Keep an eye on the searchable database of verified emissions systems from CARB at <http://arb.ca.gov/diesel/verdev/vdb/vdb.php>. It will sharpen your search, but Charlie Cox of retrofit dealer Ironman Parts in Corona, Calif., warns that the database isn't perfect. Buyers will have to research VDECS carefully to be sure they suit their applications.

The Bay Cities plan is on hold while CARB remakes its rule at the behest of the California legislature. Sacramento lawmakers ordered amendments to the in-use off-road diesel emissions rule in 11th-hour wrangling over the much-delayed California budget.

"If I don't need to put as many VDECS on, I would rather put that money into a Tier 3 or Tier 4 replacement machine in the near future rather than use it to buy a filter that does nothing to improve the performance or life of an older machine," says Michaelson.

The California legislature's tinkering with CARB's finished off-road diesel regulation reflects the harsh coincidence of the rule's timing and the nation's economic crisis. The legislators' amendments are aimed primarily to take some pressure off of equipment owners in the coming three years without dramatically changing the rule's long-term affects. But they're subject to CARB interpretation and final rulemaking.

"CARB staff wants to move quickly and present the rule changes to their Board in late spring or early summer," says Buckantz. "I'll be surprised if they can move that fast. They're probably going to have to resubmit their waiver request to the EPA (the waiver allows CARB to issue air-quality rules above and beyond EPA regulations)."

"Even if CARB makes some changes, it still doesn't change the target," says Recalde. "The only thing they're going to modify is what you have to do in the first two years. After those two years are up — in the third year — they're still looking for the targets as if nothing's changed."

Ultimately, regulating diesel exhaust is not an end in itself but rather a means to making the air healthy again. And the effort is moving nationwide.

Equipment operations working under regulation or project specifications that call for low-emissions equipment will have to sharpen their tracking of actual utilization and ownership and operating costs. Compliance will inevitably make some machines more expensive, and that affects repair-vs.-replace decisions, choices to rent or own machines, and even to subcontract elements of some jobs.

“The thought of owning a used machine that you picked up very cheap because you only need it two weeks or a month a year, those days are gone,” says Recalde. “Now if you only need a machine for two weeks per year, by all means, rent it.”