Upcoming Diesels in Focus

Panel discussions at prestigious industry meetings have delved into the two different approaches to meeting 2010 emissions regulations. Selective catalytic reduction (SCR) is the technology of choice for most engine and truck manufacturers. International Truck and Engine is the standout, saying cooled exhaust gas recirculation (EGR) at higher flow rates will be its technology path for 2010.

At the fall Technology and Maintenance Council meeting in Nashville, a panel of engineers from Mack, Volvo, Detroit Diesel, Cummins and Paccar dispassionately described various aspects and attributes of the SCR systems as they will be applied to their companies' products. International played the counterpoint. Later, at the American Trucking Associations Management Conference and Exhibition in New Orleans, a panel of senior executives got a little acrimonious when the two alternative paths to 2010 were presented.

Engineers Explain

At TMC, Mack product manager David McKenna described the architecture of the Mack solution as three main components: the diesel exhaust fluid (DEF) tank, the low-pressure pump and controller, and the DEF injector and catalyst chamber. He pointed out that DEF turns to a mushy consistency as temperatures fall below freezing, so the tank includes a heater that warms the fluid on the way to the pump at temperatures below 12 degrees

The system is designed to drain the DEF back to the tank when the engine is keyed off to prevent any clogging of the lines in cold weather.

SCR or EGR? Education and confrontation point the ways forward to meet the EPA 2010 emissions mandate

In the catalytic chamber, the ammonia in the urea solution reacts with the NOx to form water and nitrogen. An additional sensor measures NOx out of the chamber so that any malfunction can be reported to the on-board diagnostics that are part of the federal requirement for 2010.

Volvo's marketing manager, Jim Fancher, addressed the SCR reagent, the 32.5 percent solution of urea in water that will be sold as DEF. He also noted that the use of the NOx clean-up technology in the exhaust aftertreatment means that, while EGR would still be used on the engine, the flow rates for 2010 engines will be in the 15-25 percent range compared to the 20-35 percent for the company's 2007 engines. His point is that these lower flow rates and downstream NOx treatment allow for better combustion and better fuel use. This means better fuel economy and even a slight improvement in performance with the higher power density.

As far as DEF usage and likely cost, Fancher said the probable flow rates mean that a trip from Los Angeles to New York would take around 13 gallons of DEF (most tanks will be sized significantly larger than this, maybe even allowing for the round trip before replenishing). Based on fuel prices prevailing in September, the improvement in fuel economy would pay back $2 in fuel for each dollar spent on DEF, he said.

Chuck Blake, familiar to all TMC attendees as staff application engineer and the voice of Detroit Diesel, addressed some of the likely changes as drivers interface with the requirement to fill the DEF tank.

Significantly, he said, there would be no change in maintenance intervals. Concerns about availability are largely unfounded, as the truck and engine manufacturers that have SCR solutions are all committed to having the fluid available, as are distributors.

It seems truckstops are also getting behind the distribution as well, he added. It is likely that the DEF tanks will be sized so a fill will only be required at every other fuel fill. Drivers will have a dash warning, though that is still being finalized. It is likely there will be a warning light and a DEF gauge that may be incorporated into the fuel gauge. If the DEF tank is allowed to run too low, the engine will go to a derate, though the strategy and the level of derate have yet to be defined, said Blake.

He also addressed the additional weight of the SCR components, which will likely add up to 450 pounds with a full tank of DEF.

Although a recent convert, Cummins is now squarely in the SCR camp. Mike Bastuk, director of OEM service, explained that Cummins' recent discovery of a new catalyst, copper zeolyte, accounted for the company's change of heart. Dosage rates for the DEF will be in the region of 2 percent – around the same as others' – so allowing for a truck that does 120,000 miles a year, the fuel usage would be around 20,000 gallons a year at 6 mpg. That

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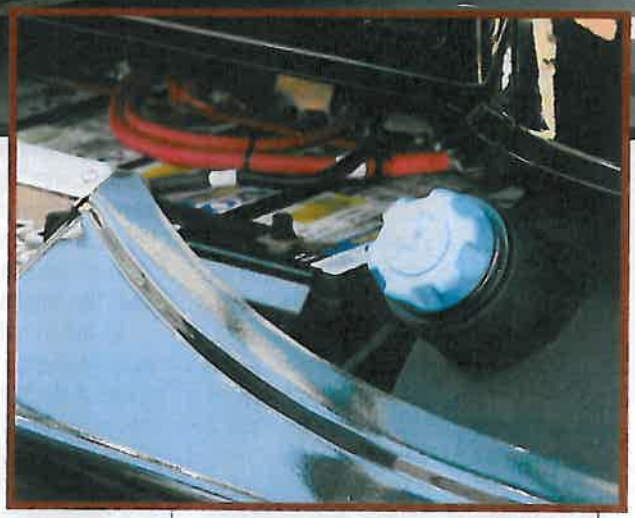


On a demonstration VNL using SCR, the driver must release two catches to swing out the side skirt and access the DEF tank. The DEF cap is colored blue, the de facto standard, and a blue restrictor in the filler neck prevents fill with diesel fuel.

would mean using around 400 gallons of DEF, or only about 20 tankfuls, meaning a driver would have to attend to the DEF less than once every two weeks.

DEF, said Bastuk, will be widely available, likely in 1- and 2.5-gallon jugs, 55-gallon drums and at regular dispensers. The price of the DEF reagent at the time of the meeting was $2.43 a gallon, he said.

Closing for the SCR camp, Brenda Kuster, senior program manager for Kenworth, representing Paccar and its upcoming MX engine, spoke to the likely OBD requirements that still have to be finalized. These requirements reflect the in-use performance of the emissions system that includes engine, DPF and SCR treatment and is measured by a tailpipe sensor.

As well as the tailpipe monitor, OBD will likely look at crankcase ventilation, fuel injection and EGR flow, she said. The interface with the driver/maintainer will be a malfunction indicator lamp like those in passenger cars, showing something is wrong in the system. Standard connectors and diagnostic tools will also parallel the passenger car example, she said. A difference is the warranty for the system, which must perform for 10 years or 435,000 miles, any component failure being the responsibility of the manufacturer.

The schedule for introduction of OBD is not as clear-cut as the emissions provision, with various stages set according to the engine model. The 2010 deadline will only apply to the most popular engine from each manufacturer. 2013 is another step, with all engines OBD-compliant by 2016. During that phase-in, the in-use compliance requirements get tighter and closer to the certification levels, Kuster said.

Tim Shick, last to the podium, is director of marketing for International, the only proponent now pursuing high EGR flow to meet the 2010 mandate. Shick said that International was confident of meeting the certification based on

the fact that the company has more than 2 million EGR engines in service since 2003. For International it is a mature technology that requires no additional equipment, he said, and will save as much as 450 pounds on the truck chassis. He said, though, it takes a "stout engine" to withstand the 30,000-psi common rail injection and the in-cylinder pressures, pointing to the MAN-derived computer-generated, image-based design of the big-bore International engines just now going in to service. He said International believes there will be no differential in the price between fuel and DEF by 2010, and the fuel economy of the injection system developed by International will mean comparable economy to SCR engines without the additional need to carry and fill the SCR aftertreatment.

An active question period saw many inquiries about the cold-weather performance of SCR systems and the freezing of the DEF. Various panelists responded, but the answers basically said EPA has allowed a "warm-up" period when the engine may be permitted to stray outside the emissions box. However, at very low ambient temperatures and with the engine itself cold, very little NOx is made. And the DEF heating systems are well-developed, as Europe has been using them for several years without any cold-weather issues. Nobody would comment on the added cost of the SCR systems – or the development cost for International's EGR solution. Detroit Diesel's Chuck Blake did mention an ROI payback would likely be two years.

Emissions Successes a Big Win, But it's Not Over Yet

An earlier engines session at ATA's management conference featured a lively interchange between Jeffrey Holmstead, former assistant administrator of the Environmental Protection Agency, and Jed Mandel, president of the Engine Manufacturers Association.

Holmstead said the Clean Air Act was an enormous success for EPA and for the nation, as the societal benefits far outweighed the costs, especially in the case of diesel particulates. His take on the situation is that EPA is now focused on the successful implementation of the 2010 limits and that there is "no appetite for further regulation of traditional emissions," leaving it open on the question of limits for CO_2.

He did say, though, that there is considerable pressure, which will only increase, in non-attainment areas such as the Los Angeles South Coast Air Quality Management District. Holmstead said increasingly stringent air quality standards were simply impossible to meet, certainly within our lifetimes.

Mandel agreed that the go-it-alone state efforts to clean up emissions from the legacy fleet of older equipment would be a burden on all kinds of truck operators. And other initiatives like California's stringent OBD proposals – far stricter than the federal plan – make life next to impossible for manufacturer and user alike. He said that regulation goals need to be cost-effective and also must be perceived as cost-effective by the user. Otherwise the user won't buy new equipment but merely refurbish old. In such a case, the OEM could not recover the high costs of developing technologies to meet the mandates.

As for climate-change regulation, Holmstead says there is a shift as government realizes the enormous cost of regulating greenhouse gases. "The debate is going to be longer and more intense," and trucking is not necessarily a target in whatever will be next.

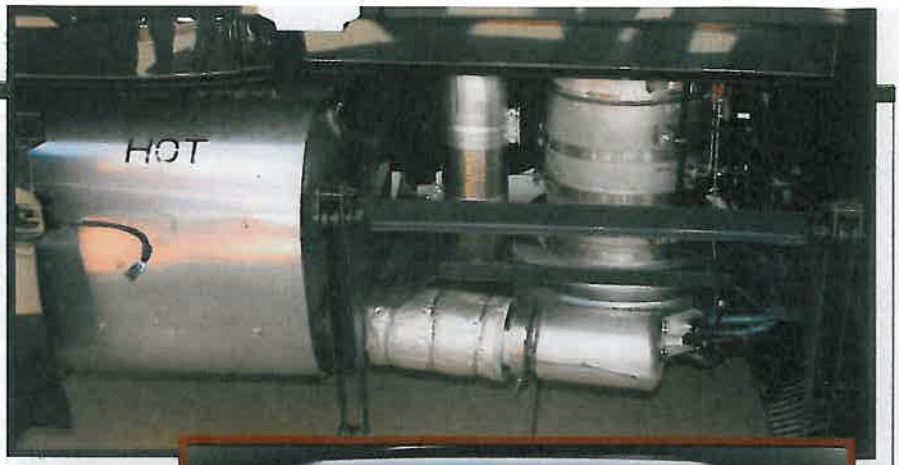
Mandel said trucking would be a target if fuel economy standards like passenger car CAFÉ requirements were to be mandated, as has been suggested. It is complicated by the fact that three independent agencies are vying for the rights to dictate the standards. "NHTSA, EPA have a massive proposed ruling that will impact every aspect of our lives. And the California Air Resources Board is poised to file its own emissions fuel economy standard while mandating Smartway [specs]." Mandel was far less optimistic of the outcomes than Holmstead.

ATA Altercations

In New Orleans the panel was more prestigious – and outspoken – with Daimler Trucks head Andreas Renschler, Paccar Vice President and Peterbilt General Manager Bill Jackson, International Truck Group President Dee Kapur, and Volvo Senior Vice President of Sales Scott Kress bringing to the table the perspectives of the four manufacturers of America's eight different Class 8 nameplates (now down to seven with the demise of Sterling.)

Renschler was first to speak, addressing the fact that SCR had proven the technology path in Europe in preference to EGR to reach the emissions requirements of Euro 4 and the upcoming Euro 5. Daimler has very successfully implemented SCR, he said, with 200,000 BlueTec trucks already running there. BlueTec – the Daimler world-wide tag for emissions-compliant cars and trucks – is being applied to cars and will be on diesel Mercedes-Benz cars in North America in 2009.

BlueTec is a world-wide technology path for Daimler, he said, which will be applied as emerging markets like China begin to apply more stringent emission requirements in their home markets. In Europe, early distribution problems with AdBlue (DEF) have been resolved, so there are now 10,000 service points from the North Sea to the Ukraine, and



Volvo SCR hardware installed on a long-wheelbase tractor has plenty of room for the diesel particulate filter (right) with its attached SCR injector chamber. On the left is the catalyst/muffler, where NOx is reduced to nitrogen and water vapor.

The Volvo dash has two liquid gauges flanking the driver display. On the right side is fuel; the left side is for the diesel exhaust fluid, or DEF.

European registrations of SCR diesel vehicles are running at 25,000 a month. "BlueTec makes sense," he said in closing. "It's efficient, clean and reliable. More than 280 million liters of fuel have been saved, saving the environment 800,000 tons of CO_2." Renschler pointed to the fact that all European truck makers are using SCR technology, and the discussion does not have to be economy vs. environment. "For American truckers it's one piece of the puzzle: You can have a green environment *and* a green purse," he said.

Paccar's Bill Jackson got in a swift plug for Peterbilt before moving to the corporate side and focusing on the Paccar-branded engines, which include the PX6 and PX8 built for the company by Cummins. Partner Cummins' 11.9- and 15-liter ISX engines are also now all-SCR, further validating Paccar's decision to use the technology on the 12.9-liter MX, he said, currently undergoing testing and development for EPA 2010 in the company's 43 test cells, newly completed in Eindhoven, Holland. He described the combination of the base engine (running exceedingly well in Europe for the last few years) plus the SCR technology as a "high-performance package that completely meets compliance ... and exceeds customer expectations."

Next up, International's Kapur presented his company's different philosophy in developing an all-EGR strategy for the next emissions level. He talked of the difficulties of accommodating the additional componentry for SCR on the chassis and the issues the packaging raised with body-builders. But it was his comment about the cost of DEF that raised Renschler's hackles and resulted in some rather testy remarks later in the program. Kapur maintained he had seen prices for AdBlue in Europe during a recent trip to Hanover that indicated it was $12 a gallon – a price hotly disputed by Renschler. Also in dispute was Kapur's comment that at the Hanover show, MAN and Scania had introduced Euro 5 emissions-level solutions that were all-EGR, thereby supporting International's go-it-alone philosophy for 2010. Renschler responded that Euro 5 was much closer to EPA '07 in its NOx requirement and that didn't argue for EGR for EPA 2010. Kapur ended his remarks with a "Let the best man win" comment before handing over to Volvo's Scott Kress.

Kress commented that AB Volvo was competing in 140 markets around the world, all with tightening emissions limits. He said using a common technology was "doing it in a way that makes sense." Kress said that burning more fuel (as in EGR) to get lower emissions did not make sense against a background of 2,000 American carriers that had gone out of business this year, largely because of high fuel prices. He said Volvo was committed to "developing engines with lower fuel consumption and near zero emissions." And Volvo will do it without emissions credits, referencing International's use of banked credits from its medium-and light-duty engines to gain NOx compliance at higher limits than EPA 2010.

Kress also pointed to the European introduction of SCR technology, where over the last three years, 150,000 Volvos have been adopted very successfully. Underscoring his company's readiness for 2010, he said, there have been 12 Volvos with SCR technology running in fleet hands for a year. "The only difference with them is topping off the tank once in a while."