

THE PASSIVE TRAP, A MEANS FOR MEETING HEAVY DUTY DIESEL EMISSIONS BEYOND 2004

P. K. Das

Navistar

The future emissions standards are very challenging. The Heavy Duty engine Manufacturers, US Environmental Protection Agency (EPA), and California Air Resources Board (CARB) have agreed to a potential legislative standard for 2004 emissions. The agreement calls for a 50 percent reduction in NO_x levels from an already low value for 1998 with no easing off on particulate. The NO_x level in 2004 will be controlled to 2.0 gms/bhp.hr while particulate level will be maintained at 0.1 gms/bhp.hr. It, however, allows for NO_x and hydro-carbon emissions to be merged into a combined value of 2.5 gms/bhp.hr.

There are also continuing discussions on ambient air quality standards beyond 2004. The regulation will likely lead to more stringent particulate levels. It becomes important to explore technologies having potential for low particulate emission.

NO_x and particulate emissions are usually linked by a tradeoff relationship. It becomes particularly difficult to drastically reduce NO_x with no sacrifice in particulate. In addition, for the solution to be practical, the system must have long life, be reliable, have little to no fuel economy loss, and be affordable. It thus becomes a major challenge.

With these goals in mind, Navistar and Rhone Poulenc embarked on an innovative approach.

The strategy was to employ extensive EGR (exhaust gas recirculation) for large reduction in NO_x. Navistar has an electronically controlled experimental EGR system which was found useful. EGR would increase particulate. However, Rhone Poulenc had an EOLYS technology which was highly efficient in reducing particulate. It employed a cerium additive to the fuel as a catalyst along with a passive trap for particulate filtering. The trap was self regenerating with no additional system.

The work was carried out in Navistar's 7.3 liter V8 engine in current production. The strategy not only accomplished a NO_x level of below 2.0 gms/bhp.hr. but also reduced particulate to an unheard of level of 0.01 gms/bhp.hr. The particulate level achieved is a 90% reduction from the 2004 standard.

A concern whether or not cerium would generate any new harmful emissions was recognized from the beginning. Rhone Poulenc has done extensive work in this area and is collaborating with EPA. While the evaluation is not complete, no harmful emissions have been identified so far. This is quite encouraging.

The technology shows good potential for lowering emissions in heavy duty diesel engines. It also offers production feasibility with further development.