



By Gord Leathers

Meet the new clean machines

If you think of diesel engines as smoky and smelly, think again. Like other power plants, these farm workhorses are getting a strong dose of pollution abatement

The American Environmental Protection Agency (EPA) has established new regulations governing diesel engine emissions for off-road equipment like construction and farm machinery. The target is a 90% reduction in sulfur, oxides of nitrogen, and particulates (a fancy name for soot) by the year 2014.

This means new diesel engines will cost more to build and more to buy. But they should also be more fuel-efficient, more durable and less polluting.

The brawny diesel engine has been the workhorse of the industrial world for decades. "No other power system has the power, durability, fuel efficiency and reliability of the diesel," says Bill Buff, spokesman for the Diesel Technology Forum in Washington, D.C. "It's unmatched for its ability to work consistently and efficiently."

This combination of features puts diesels into semi-trailers, railroad locomotives and the engine rooms of many large ships. It's also the ideal engine for farm machinery such as tractors and combines.

Although they're already cleaner-burning than in earlier times, the sheer number of these engines now working in the U.S. led the EPA to set stringent new emission regulations to be phased in over time and in 4 stages or tiers. The Canadian government is moving in the same direction.

"The U.S. has the tightest emission standards in the world as far as we know and most engine manufacturers treat Canada and the U.S. as virtually one market," notes Malcom McHattie, chief of regulatory development for Environment Canada.

First step in making diesel engines burn cleaner is to tweak the fuel. Sulfur content will be lowered from a current high of 3,500 parts per million (ppm) to a projected 15 ppm by 2014.

"Getting sulfur out of fuel is inherently good because it also enables the use of advanced emissions control technology like particulate filters and oxidation catalysts which are sulfur sensitive," says Alan Schaeffer with the Diesel Technology Forum. "Sulfur is emitted as sulfur dioxide, which leads to acid rain and also contributes to fine particle levels."

Low-sulfur fuel still works in older engines and may even improve their life expectancy. The fuel will cost more but should reduce acid buildup in engine oil. Acid pits engine parts.

Another emission reduction strategy is to burn fuel more completely. The better the burn, the cleaner the exhaust. Engine designers are looking at ways to

improve combustion. One way is by adjusting exhaust valve timing to manage cylinder temperature.

"Maintaining optimum temperatures for the lowest possible emissions is challenging because you have to do it under conditions ranging from full load to idle," Schaeffer said. "Variable valve actuation and precise fuel injection and spray patterns are examples of technology being tested in the search for ways to cut emissions."

The last piece of the puzzle is the exhaust system and the devices that control emissions after combustion. A low-sulfur fuel allows more effective particulate filters and other advanced emission controls that are sulfur sensitive. These new technologies will cost more.

"Anybody who buys a diesel engine is buying essentially the same engine as they would in the U.S.," says McHattie. "But tougher emission standards will raise the cost on both sides of the border. A rough estimate of the increase is between 0.5% and 3%."

The U.S. has been introducing its new emission standards in stages commonly referred to as tiers. The last stage, tier 4, has been finalized and is set to come into force in 2008.

"Our plan for Canada is to have regulations in place such that we can also bring in tier 4 by 2008," McHattie says. "But it's not written into present regulations."

All diesel engines will ultimately have to conform to tier 4 standards but this applies only to those built after 2008. As it stands, nothing built before then should require retrofit to tier 4 standards. And these older engines should still be able to run effectively on the new low-sulfur fuel. **CG**

