

THE EMISSIONS CORNER

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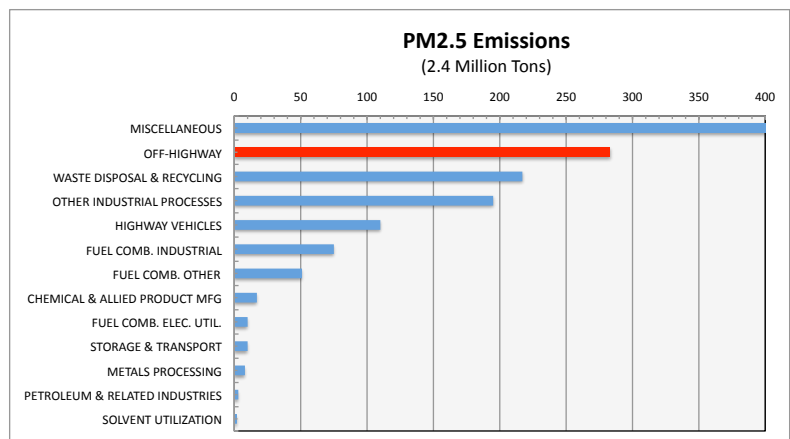


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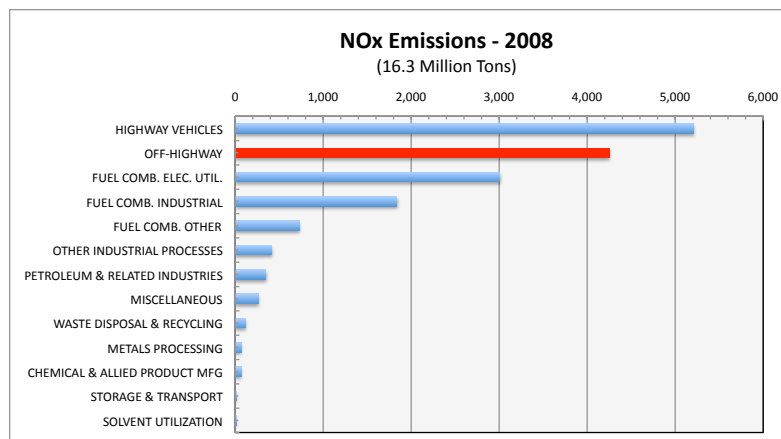
Why is the Off-Road Industry under such pressure to reduce emissions?

Every year the Environmental Protection Agency (EPA) takes an inventory of criteria pollutant emissions and more recently, greenhouse gas emissions. These emissions are then categorized into different “sources”, which can be used to identify the highest emitters (and presumably targets for regulation). The EPA just published their report for 2008, giving us the chance to see how the off-road industry stacks up to other emissions sources. Let’s do such a comparative analysis, focusing our attention on the emissions most associated with diesel engines – particulates (especially small particulates less than 2.5 microns, referred to as PM2.5), NOx and volatile organic compounds, or VOCs.

Lets begin with particulate emissions (PM2.5). As shown in the bar graph to the right, small particulate emissions in 2008 totaled 2.4 million tons. Of that total, the Off-Highway industry contributed 0.3 million tons, or about 12% (the red bar). (Note the EPA defines an emissions source called “Miscellaneous”, which is everything not specifically tied to other sources. Particulate emissions from “Misc” were 1.4 million tons, or about 60%. The scale on the chart was adjusted to highlight the more defined major source categories.)



The Off-Highway industry was the second highest emitter of small particulates. This is important, since small particulates are the ones with the greatest health hazards. Many of these emissions come from older, unregulated machines that can still be seen with black smoke coming out the exhaust stack. Eventually these machines will be retired. But we’ve seen major changes over the past decade with Tier 1, 2 and now Tier 3 machines. The newest regulation, such as Interim Tier 4 that will hit later this year, reduce particulate emissions of new machines to near zero levels. We’ll discuss the Tier 4 regulations in future newsletters. But from the above graph, it is easy to see why the EPA continues to target emissions from the Off-Road industry – we still emit more than most other sources.



NOx emissions follow a similar trend. As shown in the graph to the left, NOx emissions totaled about 16.3 million tons in 2008, with the Off-Highway industry contributing 4.3 million tons, or about 25% (the red bar). On-Highway cars and trucks (light-duty through heavy-duty) are the highest emitters. Together these “mobile” on-hgway and of-highway sources equal about 58% of all NOx emissions in the U.S.

As we discussed in earlier newsletters, NOx is a precursor to smog and ground-level ozone, which has both adverse health and environmental impacts. NOx emissions from

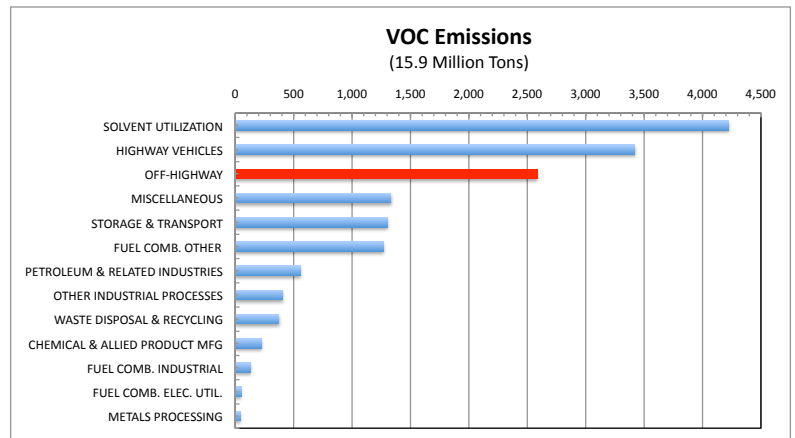
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heavy-duty trucks are being reduced as a result of the EPA 2010 rule. The Off-Road industry will see similar reductions driven by Tier 4 Final – which for many products will come in 2014.

The figure to the right shows the major sources of volatile organic compounds, or VOC emissions. If you recall from earlier newsletters, VOCs are compounds such as benzene and formaldehyde. In 2008, the total VOC emissions were 15.9 million tons, coming mostly from the industry that manufactures solvents (such as benzene and formaldehyde). But notice that On-Highway Vehicles and Off-Highway Vehicles (the red bar) are #2 and #3, respectively, at 21% and 16%.



The EPA regulates VOCs and other hydrocarbons from mobile industries in the same rules as for particulates and NOx. It doesn't seem to get as much attention as NOx or particulates, perhaps because when you reduce NOx and particulates, you tend to also reduce VOC emissions at the same time (and with the same technologies).

Overall, there has been a significant reduction in criteria pollutant emissions since the EPA started measuring them in 1970. Most of this has come from regulatory pressure, whereby our industry responded with more sophisticated engine technologies (e.g., high-pressure common rail fuel injection systems) and more recently with state-of-the-art catalytic converter technologies (e.g. actively-regenerated diesel particulate filters). While all this leading-edge technology has come at a higher product cost, as a nation we have still managed to significantly grow the economy (64% in terms of GDP since 1990). We also have more people than we did 40 years ago, making the emissions reductions even more impressive.

Rumor has it that the EPA is not looking at additional regulatory action on emissions from the Off-Road industry beyond Tier 4 Final. They will likely focus their attention on greenhouse gas reductions, which we'll discuss in future newsletters. But we might see some tweaking of current emission levels. For example, addressing particulates by size rather than weight (as we do now), or by separating NOx emissions into its constituent NO and NO₂ gases – since NO₂ is a much worse pollutant. In any event, tough regulations and the complex technologies to address them are with us for the long haul, at least as long as there are diesel engines to power our equipment.

The EPA National Air Quality Trends Report for 2008 contains a vast amount of information on emissions: what they are, their environmental and health effects, and how they are measured. Contact Aeris Analytics for a copy of the report, or you can download it directly from the EPA Website at <http://www.epa.gov/airtrends/2010>.

Now that we have a better idea why the EPA continues to put pressure on the Off-Highway Equipment manufacturers to continue to reduce emissions, we can move on to the regulations themselves and the technologies to address them. We'll start with the aftertreatment technologies that first showed up on heavy-duty trucks back in the mid-1990s, oxidation catalysts. We'll then progress to the complex technologies that are found on the 2007 and later model trucks – particulate filters. This is the technology we'll see on Interim Tier 4 construction equipment that will be introduced over the next 6-12 months. We'll wrap up our technology section with the most complex aftertreatment system out there, SCR. SCR was unveiled on 2010 On-Highway trucks, and thus far is the technology of choice for meeting Tier 4 Final regulations for the off-highway construction products. We have a lot more to cover! See you next time.



Aeris Analytics helps clients navigate through the emissions maze, reduce their financial risk of non-compliance, and enhance their competitiveness through more sustainable operations. For more information please contact Michael Readey at mjreadey@AerisAnalytics.com or visit our website www.AerisAnalytics.com. Copyright Aeris Analytics LLC, 2010. All rights reserved.