Dear CARB personnel,

I have read the recent study posted on the CARB website regarding NOx, PM, and other component emissions in legacy diesel engines and NTDEs. I am not a financial stakeholder, nor a scientist or engineer involved in hydrocarbon combustion. That being said, I was a chemistry major in college who also was employed in a university organic chemistry research laboratory for 3 years and feel I have more than a layperson's understanding of the chemistry involved here. Also, as a practicing physician, I actively read and interpret scientific articles on a regular basis, and have done so as long as I can remember. Those qualifiers out of the way, my take on the study is this:

1) Why test 35/65 and 50/50 BD/RD blends? My understanding is that commercially-available BD is blended at 20% maximum, either with RD (REG Ultraclean, for example) or petroleum diesel.

2) Although the magnitude of change in NOx emissions for NTDEs was large for the higher BD blends, the absolute NOx emissions were all still very low.

3) RD production is beginning to overtake BD, and will eventually completely supersede BD for all practical purposes if current market forces continue. You understand the reasons for this better than I. A person only has to look at all the RD projects either under construction or planned for construction to see what the market has decided. California's LCFS program is obviously a large driving force in this. I find it interesting that as the value of the LCFS credit decreases, the financial penalty of higher-CI RD, such as that derived from soybean oil (versus UCO, for example) becomes smaller due to less credit incentive around CI scores. All the refiners talk about waste oil to some degree, but really it's going to be soybean oil for a lot of these projects if they come to fruition due to feedstock limitations. I digress.

4) PM emissions are reduced for all the bio-based diesels, which I assume is due to reduction in aromatic components of the bio-based fuels vs petroleum diesel. There are likely other etiologies, but once again I am not a chemical engineer so likely am ignorant in this regard. And the use of more advanced combustion parameters and exhaust gas filters in the NTDEs make tailpipe emission of these harmful PMs extremely low regardless. This leads me to...

5) Given number 4 above, should there not be a stronger push to remove legacy engines from active use? Or mandate some sort of exhaust gas filtration system to reduce PMs? Barring that, mandating bio-based diesel in legacy diesel engines would significantly reduce PMs as well as remain essentially neutral on NOx emissions given the study result that don't show the NOx issue for anything other than the 50/50 RD/BD blend for legacy engines. And that NOx increase for 50/50 blend was tiny.

6) Electrification of off-road diesel and short-haul, on-road diesel machines/vehicles seems like the best avenue to eliminate undesirable combustion products. Granted, combustion products at the engine level would just be transferred to the source of

electricity generation, but those emissions would be more easily calculated and accounted for. I understand the issues around electrification and fuel options for longer-haul vehicles and energy density, etc, which would make electrification difficult barring substantial advancements in battery/electrical energy storage.

To conclude, although the results of this study are interesting, and raise questions regarding the testing protocols and combustion chemistry that may be occurring with biodiesel, the nominal amounts of actual NOx produced are remarkably low for the NTDEs, and I wonder if there are actual real-world implications, or whether it is more an interesting experimental finding only.

Thank you for your time.

Sincerely,
Josh Kehoe MD