

Subject: Compliance and Enforcement Working Group
From: Bruce Buchholz <buchholz2@llnl.gov>
Date: Mon, 08 Oct 2007 12:14:39 -0700
To: Jing Yuan <jyuan@arb.ca.gov>

Dear Jing,

I was unable to connect via webcast last Thursday due to an unknown technical problem but I listened in over the phone. The webcast was working fine earlier but failed in the afternoon. I may travel to Sacramento for the next meeting so I can put names to voices. I assume you are pulling together comments for the next meeting later this month.

The tracking issue doesn't seem insurmountable to me. The biggest issues as I see them are:

- 1) How will CA credit activities that occur out of state?
- 2) Will CA give biofuel credit if a supplier/company creates a smaller carbon impact by not shipping the biofuel across the country? I'm thinking of shipping ethanol (EtOH) here.
- 3) Will CA insist that ALL the fuel in the state meet a bio-carbon content? Should every gallon have the biofuel content or can you average so that a supplier has more flexibility? Put another way, is it OK to have E5 and E15 in different parts of the state if the average is E10?
- 4) Is paper tracking enough? I don't think so, you need some sort of testing program.
- 5) How do you structure a testing program? Where do you sample? How often? What do you measure? What range do you allow?

I'd like to expand on the testing issue.

It is unreasonable to measure at every pump, although you may want some sort of random testing. The retailers sell what is provided to them so sampling should probably be done at the distributor level. Sampling frequency is a cost issue. Should it be randomly done by inspectors? Should it be hourly, daily, or weekly by the facility and sent to CARB or a testing lab for analysis?

The best signature of a biofuel is its carbon-14 (C14) content. Biofuel has a C14/C concentration of about 1 part per trillion (1×10^{-12}) while petroleum derived carbon is free of C14. Measurement limits for petroleum-derived carbon are less than 1 part per quadrillion ($< 1 \times 10^{-15}$). The C14/C concentration is independent of biological molecule, so the standard can be applied to ethanol, biodiesel, or other future fuels. Some fuels have detergent components that are bio-derived as well. The range of allowable concentrations of C14 can be written into legislation. I would lean toward it being within some range of the expected level from the paper tracking. The range needs to include realistic measurement uncertainties.

The C14/C concentration is best measured by accelerator mass spectrometry (AMS) for low biofuel content (~2%). You might be able to use scintillation counting for higher biofuel content. E85 can be measured by scintillation counting if a good counter with low background is available. E10 may need AMS. Converting the C14/C ratio into a

volume EtOH/gasoline ratio is straight forward. You need to know the fraction carbon in the fuel and it's density. Average values can be used. When looking at biodiesel, B5 might require AMS. Higher biodiesel blends might be measurable by scintillation counting. There is an ASTM method (D6866) for measuring biofuel content that has a few errors, but is mostly correct. The ASTM standard for biodiesel (D6751) addresses properties of the fuel (lubricity, corrosion, etc) but does not address measurement of bio-carbon content. D6866 was written with ethanol in mind since it is the biofuel gorilla.

There are currently about a half dozen research labs, universities or companies that can do these AMS analyses in the US. The sample load may be too great for some of them, based on the frequency of sampling mandated and QA/QC requirements.

One of the last comments on Thursday was about enforcement. I believe a reliable testing regime is critical to enforcement. AMS analysis of C14 is a robust measurement technique available now for these measurements.

I look forward to the next meeting of the Working Group.

Best regards,

Bruce