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Reference: **Comments on Ethanol Verification**

Gentlemen,

Life Cycle Associates would like to provide comments on the Ethanol Verification Workshop and related documents. We believe that all fuel producers and auditors will benefit from a better definition of what data are required and what defaults are to be used in the analysis. In addition, the inputs should be based on production data with verification based on sales and purchases. ARB uses the term inventory, which implies that the stock of materials is directly measured. ARB should clarify that inventories are appropriately based on more accurate measurements of the net change in production and sales or purchases.

In brief, here are our recommendations.

- Ask for anhydrous ethanol plus denaturant data rather than denatured ethanol rather than denatured ethanol and fixed denaturant percentage.
- Ask for monthly production data for un-denatured ethanol. The production report is the same as change in inventory + sales. Production is estimated by various methods but the in tank inventory has to date never been used as an LCFS measurement tool and the uncertainty is unclear.
- Use Sales/purchase + production data instead of beginning and ending inventory values to calculate GREET inputs. All fuel pathway applications are based on either monthly production reports or 2 years of sales/purchases. Use the same data for verification and do not develop a new system.
- Allow for the option to use actual chemical inputs rather than defaults
- Allow for appropriate use of correct fuel properties in inputting the data to CA_GREET.

ARB Inquiries in Concept Paper

ARB posed *several questions* in its concept paper. Responses follow with analysis of more complex issues described later.

Staff is seeking stakeholder feedback on the concept of using default blend percentages when the actual ethanol content in the exported blend is not available for reporting. This uncertainty is not relevant for the determination of CI where ethanol production and denaturant usage are accurately measured. Fuel producers should be allowed to use actual denaturant volumes as well as the CI for natural gasoline as the blending component.

Staff is seeking stakeholder feedback describing product inventory metering and tracking methods that facilities currently employ, whether the input fields provided in the form align with those methods, and if the methodology provided is suitable for verification. This recommendation involving product inventory requires better definition of the term inventory. The implication is that an inventory measurement is the source of the inventory volume. The production reports from ethanol plants that identify inputs and outputs are sufficiently accurate. Fuel producers can simply report corn purchases and estimated corn consumption and demonstrate that the sum of both measurements are equal over time. Similarly, the sum of ethanol sales and estimated production over time will demonstrate the accuracy of the production report. An interim measurement or representation of inventory will not improve the accuracy or provide a useful mechanism for enforcement. I would recommend defining the term inventory to refer to the balance of inputs and storage rather than a physical measurement of tank level. The use of the term is puzzling as it has not been part of LCFS pathway development or provisional pathway reporting.

At what conditions are product quantities recorded? What adjustments (unit conversions or adjustment to normalize climate variations) are made to metered or measured quantities? Are there variations in the types of meters used, meter location within the production stream, calibration requirements, or other potential sources of inconsistency across producers that staff should be aware of? Liquid fuels are sold at a reference temperature of 60F. Note that the reference temperature for liquid fuels in the GREET model is 20C. In addition, natural gas is marketed with a reference temperature of 60F and hydrogen with a reference of 70F. This reference temperature is also different that the density and energy density value in GREET.

Staff is interested in feedback from participants on the units of energy and whether the appropriate documentation sources for validation should be indicated in the input sheet (such as “Natural gas use from Invoices”). Energy flows are no different than feedstock or ethanol production. The purchases of natural gas and power are documented with monthly invoices that may not match the calendar month. Our experience has been that calculation of the month by month CI when combining billing period natural gas and electricity with calendar month production inputs results in stable results when the plants operate at steady state. In some cases invoices contain carry over volumes from a prior reporting period. If the question refers to whether the form should include a note on documentation type, such notes could be provided for all inputs and outputs. Such a note would include the source of data and not just “the inventory”. It should be within the scope of the verifier’s effort to describe the source of data.

Will the fields offered in this form accommodate the majority of starch ethanol production processes? Fuel producers should be allowed to customize their form to match actual measurement methods. Wet mill plants will have different co-products. All co-products should be calculated on a dry matter basis.

Inventory vs sales/purchase data

The best determination of corn inventory is net change in corn received adjusted for estimated corn use. Measurement of inventory such as silo height are not as accurate. Therefore ARB should allow producers to continue to provide their consumption report and purchase data and demonstrate that these are in alignment. An additional measurement of inventory does not provide a more accurate measurement of net consumption. We expect that most producers will estimate their inventory from their corn purchases and estimated usage. If this is the case, requesting the inventory adds to the reporting burden without providing new data and leads to further confusion in verification.

Manufacturer’s ethanol inventory volumes are best determined from the net changes in production and sales. Even if inventories are measured, the values likely not as accurate as temperature compensated

flows measured for sales. On the other hand, purchase and sales invoice records are accurate, reliable, and easily verifiable. The amount of feedstock consumed should therefore not be based on the inventory changes but rather production reports. The manufacturers should be requested to submit the consumption data from their daily/monthly consumption reports. The monthly grain purchase invoices should support this data as both will be consistent over a relatively long time-period (with marginal differences due to inventory management). Similarly, ethanol monthly volumes be based on the monthly volume produced (already required to be reported on TTB reported) and verified through the monthly sale receipts. Please note that the volume reported on TTB is for un-denatured alcohol and is not temperature corrected. The same concept applies to co-products including DDGS, MDGS, WDGS, Syrup and corn Oil. No change is required for natural gas and electricity as their consumption can be accurately measured through purchase invoices because of no intermediate storage.

To have CA_GREET2.0 compatible inputs, the draft inputs sheet should be producing the following output values:

- Column for Feedstock monthly amount used
 - Can be calculated as
(Ending inventory + Monthly purchased - Beginning inventory)
but should be calculated from plant production reports supported by purchase receipts.
 - Column for feed moisture content (mc) is missing. Although CA_GREET2.0 takes feed input at 15.5% mc, the actual feed mc varies considerably.
- Column for Co-product monthly produced (bone dry)
 - Can be calculated as (Monthly sold * (1 - mc)) but should be based on the monthly production values
 - Applies to Dry DGS, Modified DGS, Wet DGS, Corn Syrup, and Corn Oil
- Column for Un-denatured ethanol monthly amount produced
 - Can be calculated as
(Ending inventory + Monthly sold - Beginning inventory) * (1 - Denaturant volume %)
but should be based solely on un-denatured production volumes (also reported on TTB) supported by sales invoices
 - In the current format,
 - The input for monthly denatured ethanol sold is missing
 - The denaturant volume/volume % needs to be added, can be an assumed value

Chemical use

ARB's proposed data collection sheet does not include the data for chemicals/enzymes. If the monthly chemical input data is not requested from manufacturers, then then chemical use should not be a fixed value common to all but rather be based on each manufacturer's own certified pathway values. The chemical use may vary across facilities and that may alter the CI enough to raise a verification issue. For example, the use rate of urea may vary across manufacturers from about 4 to 20 g/gal of ethanol, affecting the CI by up to 0.24 g CO₂e/MJ in the CAMX region.

Fuel Properties

Note that the fuel properties in CA_GREET do not represent the reference temperatures for commerce. Data collection should be adjusted to how the applicant prepared their original application. For example, some natural gas use is reported in 100 cubic feet (CCF) (at 60F, 15.55C). The heating values in

CA_GREET for natural gas represent a density at 32F, 0C. So, the appropriate heating value for natural gas sold to ethanol plants is $1089 \text{ Btu/cf} \times 273.15 / (273.15 + 15.55) = 1030 \text{ Btu/scf}$. This higher heating value is well supported in literature. This adjustment is necessary only when natural gas invoices are in cubic feet rather than higher heating value MMBtu or therms. Other examples of fuel property mismatches should also be corrected in monitoring plans that the ethanol plants develop.

Conclusion

To summarize:

- ARB's draft input sheet a good approach to reliably document consumption values but in theory
 - Inventory difference combined with purchase/sales should equal consumption, but measurement of inventory will conflict with reconciliation from sales.
- Production reports are much more accurate and often reported and verified for other regulatory purposes (for ex. Ethanol for TTB reports)
- Sales/purchase records also accurate and reliable, but the quantities may misalign between inputs and outputs due to storage
 - Result in considerable variation in monthly CI values because of bulk purchases/sales
- Reporting should be based on production data supported by purchase/sale invoice records. Simply requiring all fuel producers to submit their production report combined with input purchases and sales is the simplest way to verify the production data.

Best Regards,



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