Government Affairs Manager, Western Region
1415 L Street, Suite #460
Sacramento, CA 95814
Phone: 916-443-5511
Fax: 916-443-3062
Cell: 916-261-1432
tom.jacob@usa.dupont.com

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Mary D. Nichols, Chairwoman
California Air Resources Board
c/o Clerk of the Board
1001 I Street
Sacramento, California 95814
Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

Subject: Proposed Low Carbon Fuel Standard

Dear Chairwoman Nichols:

On behalf of the DuPont Company, I am pleased to offer the following comments relating to the proposed Low Carbon Fuel Standard (LCFS). Initial comments were submitted by DuPont in February, primarily highlighting areas for clarification ahead of the proposed rule publication of March 5, 2009. This document intends to address in more detail key areas DuPont believes are in need of further discussion and evaluation by CARB's rulemaking process.

General Comments

DuPont has been a global leader in greenhouse gas emission reduction for several years, having begun systematic reduction of emissions from our operations almost two decades ago. Since 1990, DuPont has reduced our global greenhouse gas emissions measured as CO2 equivalents by more than 70%; by 2015, we will further reduce our greenhouse gas emissions at least 15% from a base year of 2004. We believe biofuels have a critical role to play in the development of alternatives for the transportation fuels sector, in ways that are renewable, cost-effective, and commercially viable in multiple geographies with minimal environmental footprints.

DuPont is an industry leader in providing advantaged products for agricultural energy crops, feedstock processing and advanced biofuels. Our three-part approach to biofuels includes: (1) improving existing ethanol production through differentiated agriculture seed products and crop protection chemicals; (2) developing and supplying new technologies to allow conversion of cellulose to ethanol; and (3) developing and supplying next generation biofuels with improved performance, such as biobutanol.

The proposed LCFS is clearly a path-breaking effort that will have significance beyond California. DuPont has supported this initiative as one with the potential to stimulate

more rational evolution of biofuels as viable alternative to petroleum based fuels. The work to date demonstrates both the complexity of this undertaking and the depth to which CARB staff and their advisors have gone in thinking through this challenge. It is a very credible start, and we look forward to continuing this work as the LCFS is refined.

We do believe, however, that the pioneering character of this effort must be explicitly recognized, and that such refinement of thinking, approaches, models and assumptions be expressly provided for in any commitment to move forward with the Regulation. In particular, we believe it is extremely important that dialogue remain open regarding the Pathway analyses and the various considerations that have come together there. While the modeling foundation for these analyses may represent what we have at the moment, the reality is that this modeling was not developed with these applications in mind, and the assumptions that have been made in driving these Pathway analyses are matters of ongoing scientific and policy dialogue. That dialogue must be allowed to continue.

In that context, we urge CARB to review and reconsider the following key items in the proposed LCFS regulation:

- Treatment of perennial grasses, specifically switchgrass
- Yields and values of co-products, in particular Distillers Grains
- Impact of agricultural practices and productivity on carbon intensity calculations
- Technology timelines and economic assumptions
- Definition and inclusion of indirect effects

Treatment of perennial grasses, specifically switchgrass

DuPont and the Genencor division of Danisco have formed a joint venture, DuPont Danisco Cellulosic Ethanol (DDCE) LLC, to commercialize the leading technology package for non-food based, cellulosic ethanol production. DDCE, in partnership with the University of Tennessee, is currently constructing its first pilot-scale Biorefinery in Vonore, Tenn. and expects to be operational by the end of 2009, with commercial-scale production by 2012.

Based on our experience and the input of recognized experts in perennial grasses like switchgrass, the current CARB model significantly underestimates both the ethanol yield from switchgrass as well as the positive impact switchgrass production can have on greenhouse gas (GHG) emissions. Specifically, the CARB model assumes ethanol yields of 250 gallons/acre of switchgrass. However, there are recent field trials and experimental data to support a more realistic yield range of 400-720 gallons/acre, requiring 22.2 to 40 million acres of switchgrass to meet the RFS demand for cellulosic ethanol - at least 1/3 fewer acres than is indicated by the CARB report (Vogel et al. 2002; Varvel et al. 2008; Vogel and Mitchell, 2009).

With respect to land use and GHG emission implications, not only is the surface area required much smaller, but the CARB report appears to use the carbon debt value for grasslands to corn ethanol conversion and subjectively apply a 25% factor to estimate conversion to switchgrass production. A more realistic scenario is abandoned cropland to

prairie biomass ethanol, which was described in the February 2008 Sciencexpress paper by Fargione et. al., and which is closer to the case envisioned, i.e. grasslands or marginal lands to switchgrass production. In addition to the Fargione paper, there are several existing studies on switchgrass production which show switchgrass production as a GHG sink, not as a GHG emitter (e.g., Liebig et. al. 2007; Adler P. 2007; Schmer et. al. 2008)

Yields and values of co-products, in particular Distillers Grains

The production of ethanol from corn grain produces the valuable co-product distillers grains (DGs), a high-protein animal feed source currently being used both in the US and abroad. The current version of the LCFS appears to underestimate the value of DGs in terms of yield, GHG emissions, and land use.

The report assumes a DGs yield of 14.5 pounds per bushel of corn. In practice, a conservative (low) yield for existing ethanol plants is about 17 pounds per bushel. This difference will improve the performance of the grain to ethanol plant, both in financial and environmental terms. In addition, because DGs have a much higher protein and fat content, they are currently substituted for the base feed on greater than a pound for pound basis. DGs are also replacing some soy meal as well as corn meal. Since soy yields are lower per acre than corn yields, any soy meal that DGs replace has a greater land use credit than the corn meal it replaces.

These factors are taken into consideration by the GREET model. It is unclear why CARB chose not to rely on the GREET model for the DGs calculations specifically, when nearly all other GREET inputs were used without modification (besides transportation to CA and use of the CA electricity grid when appropriate).

Impact of agricultural practices and productivity on carbon intensity calculations

The CARB proposal outlines several default pathways for determining the carbon intensity of various fuels, and it allows regulated parties to seek approval for other pathways that reflect their specific process. These pathways must be modeled using CA-GREET, show a significant change in carbon intensity value versus the default, and be approved by the Executive Officer to be used.

For most pathways, elasticity of crop yields with respect to area expansion and crop yield elasticity have the greatest influence on the land use change carbon intensity value calculation. Regional variations in soil, weather conditions, nutrient input rates, fossil fuel costs of energy and inputs, and overall farming practices all impact crop yield, thereby resulting in substantial variability in the carbon intensity value for a given biofuel.

There are multiple pathways listed for corn ethanol alone in Table IV-1. The corn ethanol pathway report details the Midwest average model, but does not describe the basis for the other models. While the CARB proposal states that the CA-GREET model uses farming and agricultural chemical use data from the USDA, no reference is listed and the information is not provided in the pathway document.

In the case of land conversion effects, the calculations described on page IV-21 assume that 90% of the above-ground carbon sequestered in plants is emitted as it is burned to clear the land for agriculture. Grassland and pasture do not contain as much above-ground carbon compared to forest, and wood from forests is a valuable building material that would likely be at least partially harvested prior to burning.

It is unlikely that the default pathways can address the multiplicity of feedstocks, farming practices, technologies, or potential external market factors. Given the requirements outlined for alternate pathway approval, fuller transparency and clarification of the CA-GREET model is required in order to ensure consistent modeling and evaluations across all fuel types.

Technology timelines and economic assumptions

At high level the technology assessment is well written and contains a large amount of information compiled from publicly available sources or private analyzed reports written from publicly available information. The report also includes good descriptions and summaries of the various technologies and processes being pursued. However, a more explicit recognition of the timing differences among the alternatives would be useful in understanding the practical application of a LCFS and establishing realistic expectations for implementation and achievement of its targets. For example, electric, hydrogen and compressed natural gas may be used to meet the requirements of LCFS but their expected time to market is much longer than grain and cellulosic ethanol, and will require significant investment in new infrastructure (with related costs and full impacts yet to be determined).

Similarly, the economic assumptions regarding construction of new biorefineries and related infrastructure appear to be too optimistic, especially in light of the overall economic situation and current ethanol industry challenges. For example, the report assumes the capital cost for a corn-to-ethanol plant at $1.42/gallon – a more realistic assumption would include capital cost and owner cost (local owner cost for other buildings, offices, rail, etc.) of approximately $1.90/gallon. The costs of procuring feedstock for California facilities are also underestimated (distance, mode of transport, etc.) and, as the authors rightly note, greatly impacted by multiple other factors including oil and agricultural commodity prices.

Definition and inclusion of indirect effects

Land use change is an important component of any effort to understand the life-cycle impact of a given fuel, and the comments above have generally dealt with calculations of direct effects of biofuel production. While DuPont supports California's efforts to continually reduce GHG emissions from transportation fuels, we are concerned about the narrow approach being considered for evaluations of indirect effects of biofuels.

Not only is it unjustified to apply indirect effects solely to biofuels and not other fuels, but the critical issue of land use change and deforestation deserves to be examined more holistically, taking into explicit account all the complex factors contributing to these changes globally.

As mentioned previously, crop yield elasticity is a major influence on the land use change impact calculations, as shown by several sensitivity analyses included in the proposed LCFS itself (e.g., Appendices C-5, C-6, and C-7). Advances in agricultural productivity have dramatically increased the availability of food, globally, and that there remains unrealized potential for enormous gains in many countries in which deforestation and other land use changes are a foremost concern.

The CARB report does not appear to provide a sensitivity for changing ratios of US and rest-of-world yields. CARB is possibly overestimating the net change in cropland and land use change. If agricultural products are more valuable, the use of more advanced farming techniques are likely to be adopted in parts of the rest-of-world. This would lead to a much faster percent increase in yields in rest-of-world compared to the US.

In the US, improved corn yields from existing acres in the past 25 years have resulted in corn production that would have required an additional 150 million planted acres had yields not steadily improved. In essence, better yield has created 150 million "virtual acres", almost double the corn acres harvested every year in the US. The advent of ethanol and other biofuels over this same period has been accommodated by these production improvements, and not been shown to cause land conversion as a way to make up for reduced food or feed supplies – in fact, US exports of both corn and soy have remained stable or increased over the years.

In the developing world, where concerns about adequate food and feed supplies are even more urgent, these productivity improvements lag far behind. Yields in sub-Saharan Africa, for example, are only about 20% of US yields. While a 5X improvement may not be realistic or appropriate worldwide, increasing the value of agricultural products can support the adoption of more advanced farming techniques, leading to faster increases in yields, and the possibility of addressing food needs, land use, and alternative fuel development – without hastily discounting the potential of biofuels as one solution to these complex challenges.

Thank you for the opportunity to comment on the proposed LCFS. Please do not hesitate to contact us if you have any questions about the points above, we will be happy to provide additional detail if necessary.

Sincerely,
(transmitted via email)

Thomas R. Jacob
Government Affairs Manager, Western Region