ATTACHMENT A

TECHNICAL COMMENTS RELATING TO CARB CONCERNING DETAILED ANALYSIS FOR INDIRECT LAND USE CHANGE

Steven Gust

Neste Oil Corporation

Senior Associate

Renewable Feedstocks & Processes

P.O. Box 310, 06101 Porvoo, Finland

steven.gust@nesteoil.com

www.nesteoil.com

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Introduction and Summary

This analysis supports the Comments of Neste Oil concerning the ARB ISOR posted Dec. 30, 2014 and specifically the document Appendix I: Detailed Analysis for Indirect Land Use Change which can be found here: http://www.arb.ca.gov/regact/2015/lcfs2015/lcfs15appi.pdf

Neste believes that in many key areas, ARB staff have employed extremely conservative data and analytical approaches that collectively produce a substantial overestimation of the ILUC effect of fuels derived from palm oil.

List of Comments

1. CI comparison. The CI savings of future biofuels is the sum of the direct and indirect emissions compared to the emissions of the appropriate fossil fuel counterpart. This implies that a similar analysis for the fossil fuel counterpart including both the direct and indirect emissions produced in the same period as the biofuel should be conducted. Comparing the emissions for a biofuel produced in the future to that of the fossil fuel counterpart produced today is not valid. The comparison should be for the marginal or new fossil fuel production. The mix of crudes used in refineries is changing and the value for a future "average crude" should be estimated in a similar manner to that of a "future feedstock" for biofuel production.

Proposed improvement: That ARB model future marginal oil production and use the fossil fuel counterpart result as the CI comparator for future biofuels.

2. Additional indirect effects. The ISOR states that ARB staff have only identified one indirect effect that has a measurable impact on GHG emissions (Appendix I, paragraph 1, line 8). This statement illustrates the authors have not fully appreciated all of the effects of the biofuels' industry requirement for a GHG reduction in the agricultural as well as other sectors. Other indirect effects as a direct consequence of the biofuel industry are taking place already today. One very clear and important example of this is the indirect effect concerning biogas (methane) capture and avoidance outside of / in addition to what is happening within the biofuel industry.

Methane is a powerful greenhouse gas and significant amounts are released during the milling of oil palm fresh fruit bunches into crude palm oil. The capture and use of this biogas is a direct consequence of the biofuels' GHG reduction requirements. As such, when the methane is captured and used, this CI effect is attributed to the oil palm pathway as a direct effect. But in addition to this biofuel sector methane captue, the GHG reduction mechanism is spreading to the agro and oleochemicals sector. GHG reduction is not a requirement in the food or oleochemicals sectors. That the current economic models have failed to capture this effect clearly illustrates an area which should be explored further. (See Annex I for a further description.)

Proposed improvement: ARB model the GHG reduction effects of methane capture in oil palm mills outside of the biofuel sector and include these in the oil palm GHG net emissions reduction calculation

3. Over-simplification of ILUC analysis. ARB staff state:

> *A land use change effect is initially triggered when an increase in demand for a crop-based biofuel begins to drive up prices for the necessary feedstock crop. This price increase causes farmers to devote a larger proportion of their cultivated acreage to that feedstock crop.*

There is in fact a wide range of options and alternatives to farmers and their decisions are much more complex than this simple analysis implies. One of the major considerations is soil suitability as well as weather and climate issues. In addition, farmers consider the cost for additional fertilizers and of switching to new plant varieties etc.

Concerning biofuels and the effect of increased demand on feedstock prices, the facts do not at all coincide with the model. Vegetable oil prices have been decreasing as biofuel volumes have been ramped up. See for example: http://www.nesteoil.com/default.asp?path=1,41,538,2035,14053

There is thus a correlation between biofuel production and decreasing of vegetable oil prices. This should then trigger, by the ARB staff's logic above, that land is taken out of production and by doing this, the biofuels have in fact caused carbon sequestration.

Obviously, there are a number of other factors which come into play when farmers expand or reduce production and it is an over-simplification to focus on commodity prices.

Proposed improvement: ARB continue to work with GTAP modelers in order to validate and calibrate the model to better reflect current reality

4. <u>Peat emissions.</u> On attachment 2-25 of Appendix I, it states:

> *the most robust current estimate of peat CO_2 emissions is 86 Mg CO_{2e} ha^{-1} y^{-1} assuming 50-year annualization; annualized over 30 years, the value is 95 Mg CO_{2e} ha^{-1} y^{-1}. We adopt this 30-year value in AEZ-EF.*

The basis upon which this value has been derived is from a series of papers by Page et al. (*see* list of references at bottom of the page 2-25). That this value is robust is highly questionable. There is in fact a large body of literature and full agreement that the long term emissions from drained peat forest are in the 60 to 70 t CO_2 / hectare / year depending on depth of drainage and peat type. The rule of thumb is that emissions are 1 ton CO2 for each centimeter of drainage with drainage levels of 60 to 70 cm. The depth of peat drainage here is the key issue as a more shallow drain exposes less peat to the air and thus less oxidation (references to this effect can be supplied later). Staff analysis correctly states that of the two techniques used for determining peat loss, that the direct gas flux measurements is subject to difficulties in factoring out respiration of roots but neglects to acknowledge that the subsidence method has major uncertainties with the extent of peat oxidation in the first few years. Page et al repeatedly state that a high subsidence of 75 cm occurs in the first year and that by peat density measurements they attribute a high-level oxidation to occur during this period and further that:

> *Bulk density profiles indicate that consolidation contributes only 7 % to total subsidence, in the first year after drainage, and that the role of compaction is also reduced quickly and becomes negligible fter 5 years. Over 18 years after drainage, 92 % of cumulative subsidence was caused by peat oxidation[1].*

This assumption on high levels of oxidation during the first year then increases the time averaged emissions from the lower commonly accepted values of 60 to 70 t CO_2 / hectare / year to the value adopted in the analysis of 95 t CO_2 / hectare / year. Running the GTAP-BIO model with this lower value has a significant effect on the final results.

The only evidence that Page present for the high oxidation rates are the differences in peat density. They do not seem to be aware that during plantation establishment, a deep drain occurs and soil compaction is carried out in order to provide a good base for the palm trees. Obvious examples can

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[1] REVIEW OF PEAT SURFACE GREENHOUSE GAS EMISSIONS FROM OIL PALM PLANTATIONS IN SOUTHEAST ASIA Page, S. E., Morrison, R., Malins, C., Hooijer, A., Rieley, J. O. & Jauhiainen, J. www.theicct.org White Paper Number 15 | September 2011

be seen in the region where this practice is not carried out to a sufficiently high degree where palm trees lean over.

Proposed improvement: ARB use the IPCC value in the model of 73 Mg CO2/hr/yr for peat emissions and solicit expert opinions on the percentage of oxidation during the initial subsidence.

5. Expansion onto peat. ARB states that of the oil palm expansion in Malaysia and Indonesia that one-third (33%) of oil palm expansion in Mala_Indo occurs on peatland (Edwards, Mulligan et al. 2010, Appendix III). It is interesting that ARB has not been able to find a more recent reference. It is highly questionable that the situation concerning expansion has not changed in the past 6 years as the reference to Edwards uses data from 2009. The analysis on expansion by Edwards is given in Appendix III of staff's report. For Malaysia, they state:

> *Tropical Peat Research Institute [TPRI 2009] (quoted in "Status of Peatlands in Malaysia" July 2009 report by Wetland International), displayed a conference poster showing that that the area of oil palm on peatlands in Malaysia increased by roughly 200 kha between 2003 and 2008. The Malaysian Palm Oil Board report that the total area of oil palm in Malaysia increased by roughly 600 kha in the same period. So according to this source, roughly* ***one third*** *of those new plantations are on peat.*

So, for Malaysia, we see that the basis for the data was a conference poster from 2009. Neste Oil strongly suggests that due to the importance of this issue in the ARB ILUC analysis, staff use more than mere conference posters as the source of the basis of the analysis.

With respect to Indonesia, Edwards used the following source:

> *In Indonesia, palm oil is mostly grown in Sumatra, and some in Papua. [Hooijer 2006] superimposed maps of concessions granted for palm oil plantations in these areas, on maps of peatland (table 4 in [Hooijer 2006]), and found that 25% of concessions were on peatland.*
>
> *[Hooijer 2006] argues that the % oil-palm on peat is likely to rise in future, and estimates that probably more than 50% of future palm oil plantations will be on peat.*
>
> ***Conclusion: at least 33% of new plantations in Indonesia and Malaysia are likely to be on peat.***

In this case, a much older reference was used. We understand that Hoojier, who is a peat scientist and is very concerned about peat conversion to estates and the emissions that occur, is not an expert on estate expansion in the region.

In fact other authors reached different conclusions: ***Spatial Modeling of Future Oil Palm Expansion in Indonesia, 2000 to 2022*** *Nancy Harris, Sean Grimland and Timothy Pearson;* Report submitted to EPA July 2011

> *3.4.2 Expansion by Soil Type*
>
> *The area of predicted palm oil expansion between 2000 and 2022 per soil type is important primarily for determining how much expansion occurs on histosols. In both the FAO soil classification and the USA soil taxonomy, a histosol is an organic soil with an organic carbon content by weight of 12 percent or more. Histosols are sometimes referred to as organosols. When palm oil is cultivated on a histosolic soil, the water must be drained as part of site preparation activities and results in significant GHG emissions. Approximately 9% (531,366 ha) of palm oil expansion are predicted to occur in histosol soils with an additional 4,894 ha in the palm only model.*

The following table illustrates the value that EPA used in their analysis based on a detailed investigation of soil types and land suitability etc.

TABLE II–6—PERCENT OF PALM OIL PLANTATIONS ON PEAT SOIL, HISTORICAL AND PROJECTED

Year	Indonesia %	Malaysia %
2009 (Historical) ...	22	13
2022 (Projected) ...	15	10
2022 (Projected Incremental Expansion)	13	9

RSPO commissioned the following report, which is on the TROPENBOS website: **HISTORICAL CO2 EMISSIONS FROM LAND USE AND LAND USE CHANGE FROM THE OIL PALM INDUSTRY IN INDONESIA, MALAYSIA AND PAPUA NEW GUINEA**[2]

Table 2. Oil palm development in Indonesia and Malaysia on peatland and mineral soils (million hectares).

Country, soil	1990	2000	2005	2010
Indonesia	1.34	3.68	5.16	7.72
Peat	0.27	0.72	1.05	1.70
Mineral	1.07	2.95	4.10	6.02
Malaysia	2.08	3.53	4.59	5.38
Peat	0.15	0.28	0.40	0.72
Mineral	1.93	3.25	4.19	4.66

Proposed improvement: That ARB use a value in the range 15- 20% expansion onto peat OR alternatively perform a more detailed analysis of the current situation.

6. GTAP-BIO model constraints In the analysis on palm oil, the model has been constrained assuming that all future palm oil would be coming from Malaysia and Indonesia. Neste Oil disagrees with this approach and feels that the constrain is not warranted.

For example, 1.5 million hectares of land have been approved for palm oil development in Liberia, Cameroon and Gabon alone.[3]

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[2] http://www.tropenbos.org/publications/historical+co2+emissions+from+land+use+and+land+use+change+from+the+oil+palm+industry+in+indonesia,+malaysia+and+papua+new+guinea

[3] http://www.sustainablepalmoil.org/palm-oil-by-region/africa/#sthash.Q0jnJsao.dpuf

In early 2011, Ghana was the first country in Africa to have its National Interpretation (NI) of the Roundtable on Sustainable Palm Oil (RSPO) Principles and Criteria for sustainable palm oil approved. Ghana has 336,000 hectares planted with oil palm; it is a net importer to meet its demands for palm oil.

Proposed improvement: Neste Oil therefore feels that the constraint of all future palm oil coming from Malaysia and Indonesia is not valid.

7. AEZEF model YieldTable sheet. All references to palmf have a value of 0. Neste Oil cannot understand what staff have used in the model for the accumulated time averaged biomass for oil palm plantations.

Proposed improvement: Include values for the dry fraction, AGB C- factor etc. for palm trees.

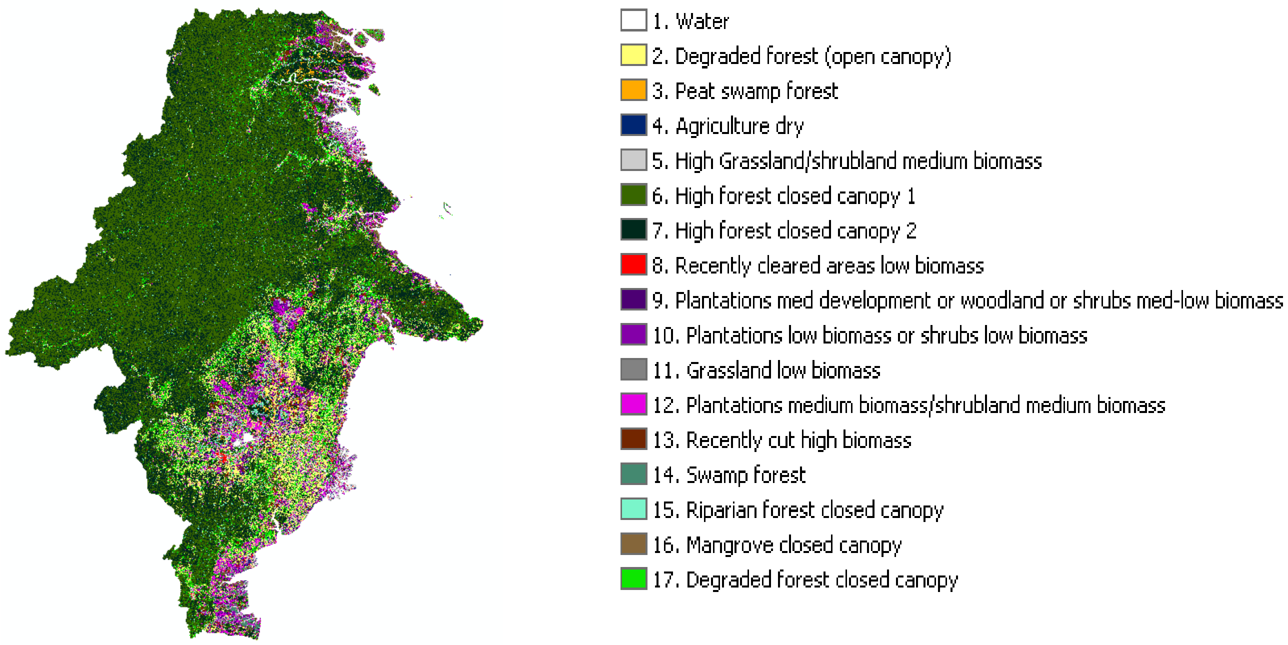
8. AEZEF model forest types for Mala_Indo ARB uses the following forest types for the region

4	Tropical	Sub-humid	Tropical-Sub-humid
5	Tropical	Humid	Tropical-Humid
6	Tropical	Humid (year round)	Tropical-Humid (year round)

It is unclear from this analysis what classification degraded forests or logged over forests would be given. For example the below map for North-East Kalimantan indicates land cover types. A very large part of the region is covered by degraded forest.

Also see this reference for land types:

http://www.isric.org/isric/webdocs/docs/ISRIC_Report_2007_01_web.pdf



Large areas of grassland and scrub land have also been converted for plantations, especially in Kalimantan. These areas were typically once forested but gave way to scrub and grassland after the large-scale el Niño fires in 1982-1983 and 1997-1998.

According to an article in Geoderma 149 (2009) 76–83*:*

> *… in Indonesia, forests are under increasing pressure of population growth, illegal logging, forest fire, and land use change for agriculture, transmigration and estate crops such as timber and oil palm.*
>
> *Imperata grasslands in Indonesia cover 8.5 million ha, or about 4.5% of Indonesia's total land area. In Kalimantan alone, Imperata grasslands cover an estimated 2.2 million ha (Garrity et al., 1997). Imperata grasslands are seen as a final stage of land degradation and are very difficult recover for more valuable land uses (Murniati, 2002). Regeneration*

of grassland areas is becoming increasingly important, not only to create new secondary forest, but also to recover the original biodiversity.

Conclusions from Neste Oil Analysis

Based on the above comments we suggest that ARB use a 20% peat conversion estimate for the new oil palm estates with a 73 Mg CO2/hr/yr for peat emissions. According to our knowledge, this would produce a value of around 33.6 g CO_2/MJ_{fuel}

iLUC Emissions for Alternative Scenarios	
Scenario	iLUC, gCO2/MJ
CARB Scenario 8	65.2
20% peat conversion estimate	42.0
73 Mg CO2/hr/yr for peat emissions	51.4
20% peat and 73 Mg CO2/ha/a	33.6

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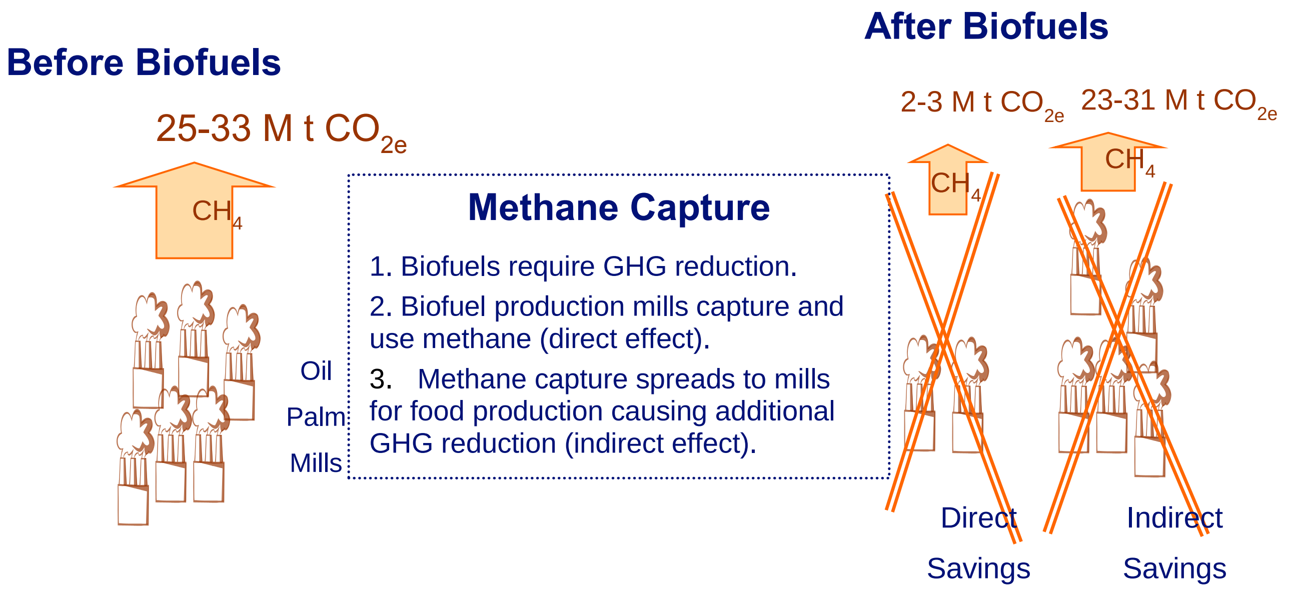
Annex I

At palm oil mills, the GHG reduction strategy with the largest and most immediate beneficial effect is methane capture and utilization. This has long been recognized as a major GHG source in the oil palm pathway but only recently, has there been much progress. There are approximately 1000 palm oil mills in Malaysia and Indonesia. These mills are self-sufficient in energy, using the fiber and shell from the palm oil fruit to produce the electricity and process steam they require. The process generates a wastewater known as POME (palm oil mill effluent), which contains about 5 percent organic materials. For most mills, approximately 3 tons of POME are generated per ton of crude palm oil (CPO). POME is fed into a series of cooling ponds and digestion ponds where the organic material is digested, producing biogas (a 50:50 mixture of methane and carbon dioxide). The digestion proceeds until the discharged water achieves a sufficiently low biological and chemical oxygen demand.



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An example of the indirect savings is:

In the milling process, there is on average 3 ± 0.2 tons of POME per ton of crude palm oil. Each ton of POME generates 28 cubic meters (varies from 25 to 45) of biogas or about 14-16 cubic meters of methane 14-16 m^3 CH4 x 0.7 kg CH_4 /m^3 = 10 - 11 kg CH_4/t POME. At an CPO yield of 3.7- 4 t CPO/ha x 3 ± 0.2 t POME/ t CPO x 10-11 kg CH_4/t POME = 110 – 140 kg CH_4/ha. Using a greenhouse gas factor of 21 for methane this becomes 2.3 - 3 t CO_{2e}/ha. In Malaysia and Indonesia there are roughly 11 M ha of mature or producing hectares or 25 -33 M t CO_{2e}.