Quality Review Comments from Members of the Chartered SAB on the SAB Draft Report: Draft (8/29/2018) SAB review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (2014)

List of comments received
September 24, 2018

Comments from Lead Reviewers....1
Comments from Dr. Rodney Andrews.... 1
Comments from Dr. Surabi Menon.... 3
Comments from Dr. Larry Monroe.... 5
Comments from other SAB Members....10
Comments from Dr. Deborah Hall Bennett.... 10
Comments from Dr. Alison C. Cullen.... 11
Comments from Dr. Otto Doering.... 11
Comments from Dr. John Graham.... 11
Comments from Dr. Kristina Mena.... 12
Comments from Dr. Sue Marty.... 12
Comments from Dr. Kristina D. Mena.... 13
Comments from Dr. Thomas Parkerton.... 13
Comments from Dr. Robert Puls.... 15
Comments from Dr. Kenneth Ramos.... 15
Comments from Dr. Donald vanderVaart.... 15
Comments from Dr. Kimberly White.... 16

Comments from Lead Reviewers

Comments from Dr. Rodney Andrews

Comments on Framework for Assessing Biogenic CO_2 Emissions from Stationary Sources

1. Were the charge questions adequately addressed?

As described in the report, the charge questions often overlapped in scope. In general, the charge questions were answered. However, by combining many of the sub-parts into a single response, most answers lack specificity in the response.

Charge questions 2(a) and 2(b) are not adequately addressed.

A significant portion of the report is given to Overarching Comments that address "issues outside the scope of the EPA's charge questions". At a minimum, this needs to have language along the lines of "but are necessarily included to place context around the responses to those charge questions". At the extreme, these answers should be worked into the delimited direct answers to the charge questions. However, I think the current organization is logical, and therefore recommend the current arrangement of the document be retained. Section 3.3, Alternate Fate Approach for Waste-Derived Feedstocks, does not directly address a charge question, nor does it provide additional context. This section should be removed.

2. Are there technical errors or emissions in the report or issues that are not adequately dealt with in the draft report?

The spatial boundaries for feedstock supply to a specific facility are bounded and can be estimated utilizing economic and logistical limitations or opportunities tied to cost of electricity and dispatch models. The factors affecting such boundaries include those listed; but could also be driven by demand/price for food crops versus market prices on energy content basis. The logic for use of regional modeling is sufficient in justifying as the better choice, but should not be stated as definitive.

The land stock base approach to determining carbon balance is accurately described as allowing for use of a mass balance. However, the statement that what is lost from the ground stock is completely converted to a carbon emission is not necessarily true. The percentage of unburned or vitreous carbons in solid residuals or fine particulate emissions can be significant (several %) and is dependent on the conversion technology and unit efficiency. This is asserted several times throughout the document.

Throughout the document, "bioenergy" is used as shorthand. This needs to be used carefully, as the terminology is not a strict synonym for electricity production at stationary sources utilizing biomass feedstocks. More appropriate in most places would be "biomass feedstocks".

Throughout the document, the varying emissions that will result from differing technologies for

conversion are ignored. As the recommendation is to model regionally rather than on a specific unit-by-unit basis, this is understandable, but when being more specific (pg 6, ln 24-26) the conversion technology used would also be a variable that should be included.
Stating (pg 7, ln 21) that "employing models of this complexity is likely beyond the capabilities of many practitioners" seems out of place here. The appropriate models to achieve the desired level accuracy should be used. As complex, but no more complex, than needed.

The key principals for calculating changes in net carbon stocks (pg 10, ln 4) should also include clarifying language that one of the factors is identification of appropriate region size and delineation with respect to biomass generation (regional climate boundaries, harvest per year, seasonal versus annual growth, etc).

Stated that for agricultural feedstocks that are harvested annual, the harvested carbon will be full regained annual (pg 11, ln 22). Does this consider the use of fertilizers? Or is it strictly true as written.

It is inaccurate to state that readjustment of the baseline (pg 15, line 32) "would create" incentives for sustainable management of land resources. This might create incentives, but decisions on land management practices are complex and include many factors besides carbon stocks (economic, private vs public ownership, etc).

3. Is the draft report clear and logical?

The draft report is clear and logical, but it does deviate from the specific set of charge questions provided by the EPA. However, the inclusion of these issues outside the scope of the charge questions adds to the clarity and logic of the report.

By condensing the response to many of the sub-questions included within the charge questions, specificity to the questions asked is lost. However, this needs to be weighed against the gain in clarity and the reduction of redundancy that would result from answering them item by item.

4. Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Overall, the conclusions and recommendations are supported by the body of the draft report. There are a few specific items that are perhaps more editorially suggestive rather than strictly within the charge. For example, pg 12, ln 20-21 states that time horizon specification is the purview of policy and not science but is written as to indirectly propose what time horizon to use. Similarly, a sentence on the same page (ln 12) also suggests what time horizon should be selected and needs some clarification such as "within the context of the stated policy goals".

5. Relationship between Letter to Administrator, Executive Summary and Body of the Report.

The Executive Summary represents the body of the report well and provides a reasonable summary. It provides 5 specific recommendations. These recommendations align well with

those drawn within the body of the report (although the minimization of transaction costs in Recommendations 1 and 5 is not directly defined or addressed in the body of the report).

The Letter to the Administrator aligns less well with the body of the report, but rather provides both background on the origin of the current draft and deficiencies in the EPA request to the SAB and in the underlying information provided for its assessment. It makes clear that the time horizons are inherently tied to a particular policy framework, and that example policy frameworks should have been provided with multiple sets of applications, calculations and boundary assertions for more comprehensive SAB review. This point is important, and it is appropriate to raise it directly in the Letter. This deficiency in approach could have been included in the executive summary as well.

Editorial (Optional) Comments:

Letter to Administrator, Pg 3, Ln 16. Random "1" between issues and remain.
Pg 5, Ln 18. "burning biomass" should be "biomass conversion"
Pg 6, Ln 28. "black carbon" may be shorthand, but it is bad shorthand. Other than diamond, carbon allotropes are all black in color. What is meant is carbon particulates.
Pg 9, Ln 12. Suggest "convert" is more accurate than "burn"
Pg 9, Ln 33. Suggest "several" rather than "a couple of"
Pg 18, Ln 13. Suggest "unintentionally negative" rather than "perverse"

Comments from Dr. Surabi Menon

General: The framework looks at the extent to which production, processing and use of biogenic material at stationary sources results in a net atmospheric contribution of biogenic CO_2 emissions. The report does a good job of detailing what previous reports did and did not address and provides an easier to read review of recommendations compared to the earlier reports.

A key deliberation of the report that addresses problems with the previous version was related to the time horizons selected to estimate bio assessment factors (BAF). The recommendations in the report allows for flexibility in the framework - transient trends in stocks are not easy to capture and therefore adjustments that take place in stocks should be reflected by choosing time frames that are not long. This is the central piece and the recommendation is supported well in the report. Another important suggestion is on the modeling choice which was not requested from the SAB and therefore the report does not address this but does point out that criteria for choosing a model and the sensitivity of the BAF to modeling features must be looked into. The recommendations on page 4 in the executive summary are right in its brevity because of the lack of policy and modeling questions posed by the EPA. I understand that a policy context was specified earlier and removed for the 2014 framework but general guidance on temporal, spatial and production scale was being requested for a policy neutral context.

Without policy considerations, we have ambiguity and default assumptions will not work, especially given the challenges and uncertainties in estimating— rate of afforestation, deforestation, demand for bioenergy, age of trees when harvested, carbon sequestration, all of

which add complexity, making it difficult to get baselines and changes from baseline captured right.

Q1: Were the charge questions adequately addressed?
Various charge questions are mostly addressed fairly adequately, especially charge questions 1. Key considerations are where is the demand being met from? Source, type, growth, use are many factors that need to be included in looking at what the carbon change may be. Capturing this is tricky depending on the context. I agree with the recommendation that the cumulative BAF is needed over a time horizon specified by a policy context and must have a few principles defined —such as net change - positive and negative demands— which then needs to be aligned with a policy outcome. In that regard, the recommendation to charge question 1 could be a bit stronger than outlined — cumulative BAF over a policy relevant time period and how one accounts for positive and negative changes could include appropriate caveats which are explained in the text (type of feedstocks, age, harvest and regrowth and such important factors). Just an additional line that includes caveats would suffice.

1a—looks into the science and policy question regarding specifying time horizon without a policy context. Science can tell us what integration over different time horizons mean and this is useful for policy setting. So I think the report rightly looks at that. Rest of the charge questions related to 1, on the temporal and spatial scale are adequately addressed.

On charge question 2 regarding the scale of use and how to appropriately represent change in demand -- BAF is sensitive to feedstock produced so capturing demand changes matter, not sure how one looks at scale for demand shock without many time and policy relevant details -- the recommendation that BAF for a feedstock reflect methods used to produce the feedstock, not quite easy to follow what it boils down to. An example would be useful perhaps. A recommendation was lacking and perhaps the recommendation could be that the complexities are large and any predictions on scale of demand shock can only be done in a policy context and very challenging to define otherwise. It's a very important question and it might be useful to be more specific in the response, even if it might be similar to that for 2c.

On the request for recommendation on shocks implemented in isolation and aggregate — for 2d to 2e – the suggestion that in the absence of knowing scale one must look for different threshold levels of demand seems reasonable. The rest of the charge questions 2f to 2h are adequately addressed.

Q2: Are there technical errors or omissions or issues that are not adequately dealt with in the draft report?
In an earlier review, the alternate fate approach of waste-derived feedstocks was thought to be not treated well. It is included in this report, but the context and recommendation needs to be elaborated on. As presented it does not fit well, and a recommendation is not included on what needs to be done. Since it is not a charge question, I think it needs some justification/recommendation and should be caveated appropriately.

Q3: Is the draft report clear and logical?
The report is clear and logically presented. I think the exec summary is especially well written

and presented in a very readable manner compared to the earlier drafts. In the introduction and response to charge questions some of the same statements from the executive summary are not always in the body. Some more details on why technology/production characterization is needed for looking at demand scale for Q2, and for Q1 landscape versus stand approach, etc. could be included in the responses. These are discussed but it sometimes feels like the next step on what that might mean is not stated.

Q4: Are the conclusions drawn or recommendations provided supported by the body of the draft report?
Yes, the conclusions and recommendations are mostly supported by the body of the draft. In some instances, an elaboration of the recommendation or supporting caveats for the conclusion would help strengthen the recommendations.

Comments from Dr. Larry Monroe

Policy Context

While I understand that a specific policy formulation can help clarify the scope and extend of carbon accounting, I disagree with the statement in the Recommendation that "Biogenic carbon accounting will vary depending on the policy context". I can make the case that certain aspects of the accounting framework cannot be determined or included in a specific policy outline, but the accounting should be universal. I believe the Agency is trying to build a large framework that can then be applied to specific policy proposals, instead of building a framework for each different policy approaches that might need to be evaluated.

Baseline Approach

The Agency's anticipated baseline approach is a generally accepted way in order to assess proposed policy changes. The Agency uses the Integrated Planning Model (IPM) broadly to assess policy implications on the utility industry, and has for years. It is complicated, but necessarily so – because the industry and the US economy are complicated. The Recommendation listed is good advice for any of the Agency's modeling efforts.

Temporal and spatial considerations in Biogenic Assessment Factors

The discussion of temporal considerations falls back on the perceived need for a policy goal for the choice of time scales. While for a specific policy goal, it is necessary to estimate the impact of biogenic carbon combustion, it is also straightforward to use a cumulative balance across a long time period with interim results reported to evaluate the short, medium, and long-term carbon balances. Hence, it appears that the Agency's desire is to create a more universal framework to be able to view a projected future on multiple policy considerations. The interesting question is then how long in totality to view the time horizon (say 100+ years), and how granular the interim results need to be in order to accomplish any evaluation, i.e., every 5, 10, 20 years. In theory, I could use a carbon price proxy to both increase biomass demand and then calculate out beyond 2050 the total impact, but also model interim summaries of the carbon stocks every 5 years.

The discussion of the spatial considerations is well-written, and represents what may happen in larger use of biogenic carbon for energy. Transportation costs limit the distance that biogenic materials can be transported for use as energy, typically 50 to 100 miles for the US. Although wood pellets are shipped to Europe for fuel, that result is more due to generous subsidies for that activity. Broadly, any widespread use of biogenic carbon for energy would be on a landscape scale.

1. <u>Were the charge questions adequately addressed?</u>

<u>Question 1</u> generally requested advice from the SAB on specific criteria that could be used for time scales and the tradeoffs for the framework while "using a future anticipated baseline[.]"

There is no discussion of either what might be the criteria for different temporal scales and then no discussion of any tradeoffs. I suggest that the section be rewritten to include a robust discussion of the choices between temporal scales (say 5-15, 25-50, and 100 years) and why each one would be appropriate and what the necessary tradeoffs would be from any choice of time scale.

The recommendation starting on Line 29 of Page 11 appears to answer a different question than Question 1 asks – it is more an answer to Question 1(c), but it is not repeated there.

Additionally, there are confusing statements in the body of the discussion. On Page 10, starting on Line 7, the text says

Selecting different time horizons for different feedstocks would be inappropriate since carbon emissions generated by differing feedstocks are equivalent in their impact on the climate.

Followed by the statement on the same page from Line 15

Accordingly, there is no single time horizon that will effectively address all policies or feedstocks since feedstock effects are time-dependent

These statements appear to contradict each other. Furthermore, it is obvious that among different species of trees and also between annual crops and trees that the fact of the growth, harvesting, and land use happens on different time scales. I grow grass, pine trees, fruit trees, pecan trees, and black walnut trees on my farm in north Alabama – and there is no question about the different time scales on carbon stocks.

The first statement has no background discussion, so it is impossible to understand what is being claimed. The second statement is true, so accurate accounting at any time scale less than multiple decades will necessarily require different time scales for different feedstocks.

Questions 1(a), 1(a)(i), 1(a)(ii), 1(a)(iii), and 1(b) ask the SAB for advice on temporal scales for policies, feedstocks, landscape conditions, and other factors.

The draft document rightly distinguishes between what can be addressed through scientific principles and what is policy. It is correct to recommend a cumulative BAF that accounts for both positive and negative impacts on emissions and carbon stock.

Question 1(c) asks the SAB to advise the Agency on whether to use cumulative or marginal (assumed to be annual or per period) in calculating BAFs.

While the draft document answers the question in the first paragraph, it then tangentially goes into alternative cumulative BAF calculations. I suggest that this discussion be deleted. It is better served as a comment to the Agency rather than in a SAB review. It is not part of the charge by the agency to the SAB, nor is likely to be supported as a recommendation of the SAB.

While the first paragraph is clear on the recommendation, the printed recommendation on Page 15 starting on Line 37 is not clear. The agency asks for advice on cumulative versus marginal, but – while the recommendation is cumulative, that word does not appear in the stated recommendation. I suggest a rewrite of this entire section to limit the scope to the question and make the recommendation clear.

Question 1(d) asks for considerations in evaluating the performance of a future anticipated baseline after the time period has elapsed.

The answer given is adequate, but I would suggest it should be made stronger. At least in the air pollution area, the Agency does not often look back at modeling from the policy formulation stage after the regulations are made and imposed to see whether its modeling was accurate. It is a difficult task, because so many things can change that affect the outcomes in an important way, such as technology advances, consumer preferences, and global economics.

Question 2 and 2(a) ask for advice on the scale demand changes to model and should the shock be marginal or large, and what increment should be used.

The draft answer to this question is non-responsive. For what is essentially a sensitivity study of the impacts of increased demand, there is a bounded universe of the amount of change that can occur. Real-world examples of biogenic carbon as energy inputs have occurred and therefore suggest what the scale of demand shock that could occur. Two that have occurred recently: the production of wood pellets shipped to Europe for power plants and the increased annual crop for production of ethanol that is blended with gasoline. These would seem to indicate sensible scales for any demand increase in a future anticipated baseline.

While this question cannot have an absolute answer, it certainly can be bounded and a mean/median level identified.

Question 2 (c) asks the SAB to advise on whether the demand shock be applied to a business as usual or increased usage baseline, and should it be the marginal first ton or marginal last ton.

While it is always easier to compare to a specific policy proposal, the answer – or lack of one – in the document is a little bit of a dodge. Normally, the shock should be from a business as usual

baseline where reasonable growth and multi-sector economics are used for projections – but not the market changes due to the policy. That is, population increases and energy efficiency improvements are included in a baseline, but not the specific actions that regulated entities may take to comply.

Question 2(d) and 2(e) ask whether the demand shocks be modeled in isolation or in aggregate.

The document does answer that question well with describing the need to model in aggregate due to the fact that facilities will use the least-cost alternative fuel supply, even on a daily basis.

Question 2(f) asks for advice on the scale of the policy for default factors.

While it is true in what the draft document says that there is a difference between BAFs for 10^6 tons and 10^9 ton increases, this is also a problem that can be bounded. You can always describe the two tails of a distribution and claim there is nothing that can be done, but you can use the mean or the median of the distribution in the generally accepted manner as a first choice for a default factor.

At the end, the document does arrive at a reasonable point by stating that BAFs can be produced for different levels of demand.

Question 2(g) asks whether the answers to any of the above questions differ when generating policy neutral default factors versus those tied to a specific policy.

The document addresses this question with the insight that a specific policy will always be different as they are informed by a more detailed set of boundaries.

Question 2(h) asks for advice on evaluating the performance of the demand shock choice ex post in evaluating implications and revisions of baseline and scenarios going forward.

While the response does indicate a normal path forward, it appears that the assumption that the level of the BAF may alone drive the feedstock demand, it is just as likely to be driven by feedstock price and competitive demands.

2. Are there technical errors or omissions in the report or issues that were not adequately dealt with in the draft report?

See the discussion above for many omissions in the advice requested from the Agency. Other than the apparent contradiction on Page 10 noted above, I did not see any technical errors.

3. Is the draft report clear and logical?

Yes, for all the shortcomings noted above, it is mostly written in a clear manner. There is much confusion between the body, the Executive Summary, and the letter that needs to be addressed.

4. ***Are the conclusions drawn or recommendations provided supported by the body of the report?***

See attached pages on the Executive Summary and letter for more comments.

Does the Executive Summary adequately represent the document?

Page 1 Line 18-20 says that BACT for GHG is the context of the 2014 Framework.
The body on page 6 line4 says the Agency removed this from the 2014 Framework.

The whole section named "Region- and Feedstock-Specific Biogenic Assessment Factors, baselines, and modeling" on page 1 after line 27 has statements that are not clearly in the body of the report. It does not reflect the organization of the body of the report.

Page 1 line 41 states "the BAF for a class of feedstock should be estimated for the average effect of the last demand for that feedstock." There is no discussion or recommendation in the body that supports this statement.

Page 1 line 39 states that "Often, simple models are best." This statement is not made nor supported in the text. As Einstein says, the trick is to make it simple, but not too simple. The body is much clearer that the Agency should identify and evaluate its criteria for choosing a model (simple or complex) – at page 8 line 2.

Page 2 line 26 and the whole paragraph following includes a small recommendation that is not mentioned in the body at all.

Page 3 line 35 claims that "the stock-based approach is simpler and more transparent." While this may be true, there is nothing in the report body that discusses or even states that claim.

Page 3 line 42 says "we support EPA's cumulative BAF" but that is not stated in the body of the report – and it should be.

Page 3 line 46 through page 4 line 3 describes the alternative cumulative approach and the length of time carbon stays in the atmosphere. This statement is clear and should be incorporated into the text of the body of the report.

Page 4 line 7 repeats the claim that "the BAF for the feedstock in a region should be estimated for the average effect of the last increment of demand for biomass from that feedstock in that region." This statement is not present in the body, and seems to contradict the statement on page 11 line 31 that says "A cumulative BAF is preferred because it will capture and integrate all expected negative and positive carbon effects over the policy-relevant time period." Please clarify.

Does the letter adequately represent the document and the Executive Summary?

On the second page of the letter line 39, it is presented that "Rather than offering a lengthy menu of calculation options, the EPA framework needs to define its scenarios and justify those choices." This statement is not in the Executive Summary or the body of the draft report. I suggest it be added to both, as it is a powerful recommendation that would improve the Agency's report.

On the third page of the letter, starting with line 6, the discussion claims that the Agency's calculations "were based on emissions (fluxes) with some adjustment terms". This appears to be contrary to what the Executive Summary says on Page 3 line 42, "we support EPA's cumulative BAF (…) approach, i.e., the difference in carbon stocks at the end of time horizon T." Also, it appears to be contrary to the body of the report. On page 13 line 23 says that "EPA's cumulative BAF (BAF_T) is one option that reflect carbon stocks at the end of the time horizon". It appears that the letter may be referring to the 2011 Framework, but this needs to be corrected. This paragraph is either in error, or the whole report will need to be rewritten.

Comments from other SAB Members

Comments from Dr. Deborah Hall Bennett

1) Where charge questions addressed?

   Given the difficulty of the charge questions, the report does an excellent job of answering them. My only concern is Charge question 2f, and felt that a bit more guidance could be given.

2) Are there any technical errors?
   I did not find any errors. I did have one question. Should the retrospective comparisons suggested on page 16 also be done every 5-10 years, as suggested for the re-evaluation of the baseline conditions?
3) Is the report clear and logical?
   The report was very well written and clear.

   One small note in the Executive summary, it may be good to add, under the heading "Temporal Scale", something like "There were a number of charge questions related to the appropriate temporal scale to utilize", and similarly for the Scales section.

   Also, on page 3, clarify what is meant by the clause "at the end of the time horizon T".

   The last sentence of the second full paragraph on page 10 do not include the importance of the policy question, although it is sort of implied from the prior sentence.

   The figures are really helpful, but it took me a bit of time to figure out the details and I think that the descriptions could be improved to make them clearer. Perhaps reminding the reader of the definitions of the lines or some specific examples could be helpful.

4) Are conclusions supported by body of report?
The conclusions are well supported by the body of the report.

Comments from Dr. Alison C. Cullen

1. Were the charge questions adequately addressed?
Yes, the charge questions were adequately addressed.

2. Are there are any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?
I am not aware of technical errors in the report. It is worth noting that in the absence of either a specific policy to model, or a mandate for use of specific feedstocks, or incentives for certain types of bioenergy, or information about the scale of demand, several of the charge questions were answered conditionally, for example where policy prescription or specific assumptions would otherwise be implied. These instances were explained carefully in the review document.

3. Is the draft report clear and logical?
The draft report is clear, logical, and very well organized.

4. Are the conclusions drawn or recommendations provided supported by the body of the draft report?
Yes.

Comments from Dr. Otto Doering

- The charge questions were adequately addressed
- I did not find technical errors or omissions in the report or issues that were not adequately dealt with in the draft report
- I found the draft report clear and logical
- The conclusions drawn or recommendations provided were supported by the body of the report

This review follows several iterations of this report between the panel and the board itself. This document is the culmination of that process. This document highlights the important issues of concern from the board and the panel. It expands the scope of what was initially considered. It explains the alternative views where these were not in agreement, it explains the trade-offs under different approaches, and it places policy in the appropriate context with respect to the scientific concerns about calculating BAF.

I believe that this is about the best we can do on this topic.

Comments from Dr. John Graham

I have reviewed the Executive Summary (ES) of the draft SAB Report for logic and clarity of argument. I have no comments at this time.

Comments from Dr. Kristina Mena

1) Were the charge questions to the committee adequately addressed?

Yes, the charge questions were adequately addressed.

2) Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

Under 3.2. <u>Baseline Approach</u> Are there specific recommendations toward achieving model "validation" and is it more about demonstrating ways the model is not invalid?
Regarding "representative factors", are there recommendations in terms of the timeframe for evaluating/modifying the approach? (page 7)

3) Is the draft report clear and logical?

Yes

4) Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Yes

Comments from Dr. Sue Marty

1. Were the charge questions adequately addressed?
Yes. It is clear that the EPA considered the SAB's recommendations to the earlier biogenic CO_2 framework and is interested in working with the SAB to improve biogenic CO_2 assessments. One important point is the policy consideration for which Biogenic Assessment Factors (BAFs) are developed and how this can impact calculation factors such as temporal scale. As requested, the EPA is considering region-specific BAFs, different approaches to baseline setting, and the need to base carbon accounting on carbon stocks on land (not emissions) for mass balance. Two different approaches for calculating BAFs are provided and the need to explicitly examine how model selection and features can affect BAFs. The use of examples is valuable for practical application and understanding of these approaches.

2. Are there are any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?
Not to my knowledge.

3. Is the draft report clear and logical?
Yes, the report is well written. Overall, the report manages to make a complex subject understandable, at least on a general level.

4. Are the conclusions drawn or recommendations provided supported by the body of the draft

report?
Yes. One point for consideration is the need to retrospectively analyze model performance and the calculation of BAFs. This is valuable both for the evaluation and validation of model performance. However, there are two BAF options (BAF_T and $BAF_{\sum T}$); one of which examines changes in length of time carbon stays in the atmosphere until modified by changing carbon stocks on land ($\sum T$ approach). This BAF may be easier to determine retrospectively, which may inflate the ease of use and utility of this approach.

Comments from Dr. Kristina D. Mena

1) Were the charge questions to the committee adequately addressed?

Yes, the charge questions were adequately addressed.

2) Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

Under 3.2. <u>Baseline Approach</u> Are there specific recommendations toward achieving model "validation" and is it more about demonstrating ways the model is not invalid?
Regarding "representative factors", are there recommendations in terms of the timeframe for evaluating/modifying the approach? (page 7)

3) Is the draft report clear and logical?

Yes

4) Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Yes

Comments from Dr. Thomas Parkerton

1) Were the charge questions adequately addressed?

The report has systematically addressed the charge questions posed by EPA. Where applicable, the report provides general responses to multiple questions that relate to a common theme which seems appropriate and allows concise, targeted responses.

2) Are there are any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?

In the cover letter to the administrator the following text is provided:

As an additional caveat, the SAB is aware that the EPA report and this review are focused only on accounting for carbon dioxide related to the use of biomass for electricity generation. Neither EPA nor the SAB evaluated other concerns like

forest conservation, biodiversity, and ecosystem services. If, for example, biomass pellets were sourced from old growth forests, this would pose unique risks that would not be reflected in a BAF calculated for net effects on carbon dioxide. We offer this caution about the model boundaries as defined by EPA's method and identified in The SAB review. In addition, we recognize that biodiversity and ecosystem health are valid concerns worthy of a whole different analysis and policy response.

I agree this is an important point to highlight but such considerations are not mentioned in the actual SAB report. I suggest this text be added at the end of section 3.1 so that this critical insight is not lost.

3) Is the draft report clear and logical?

The report is clear, logical and well written. Several editorial comments are provided for consideration to improve or clarify draft text.

Page 2 line 3 Typo? additional CO2

Page 2 line 29-30 Sentence is awkward … suggest revising, e.g.

"However, since such models have not been validated, reliance on model predictions for decision-making is inappropriate."

Page 3 Line 42; Page 4 Line 1 Lowercase subscripts are used in the main body of the BAF report, e.g. BAF_t, $BAF_{\sum t}$

Page 9 line 33 Suggest revising to "There are several key factors that impact the dynamic nature of BAF."

Page 12 line 41 Suggest replacing "ensuring that they help" to "ensuring that this accounting metric helps"

Page 13 line 37-38 .. See earlier comment on Page 1

Page 18 line 21-33 Sentence is awkward and redundant with point that is made succinctly in the previous sentence. Suggest deleting.

4) Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Page 1 line 39 The text states that "Often, simple models may be best."

This strikes me as too broad a generalization that is not entirely consistent with the later recommendation that improvements may be needed based on monitoring which would increase model complexity (see page 9, lines 17-19). More complex models can help integrate existing and new knowledge and provide insights on important factors that influence model outcomes that may be lost using simple models. It is suggested that this statement be revised to state that simple models should be considered and may be preferred given the advantages highlighted.

Page 4 Line 22-39 There appears to be some inconsistency in the 5 recommendations provided here with the 6 recommendations provided in the main body of the report.

The fifth recommendation highlights the need for EPA to identify and evaluate criteria for model selection and modeling features that influence BAF outcomes. While this recommendation is described in the main body of the report on page 8 (section 3.2) this point does not seem to be

adequately captured in the executive summary. In contrast, the need to validate and evaluate whatever model is ultimately selected based on new data that is discussed on page 2 is excluded from the list of recommendations provided here. It is suggested that recommendations be reconciled and made consistent in the executive summary and main body of the report.

Page 12 line 29-31 It is stated that if a time horizon of several hundred years is considered the BAF for most feedstocks would be close to zero. Suggest either providing further justification for this generalization in light of discussion on page 14 or better qualifying this statement.

Comments from Dr. Robert Puls

The charge questions were adequately addressed. The responses were relevant, comprehensive and clearly elucidated.

It has adopted an alternate fate approach and it includes a discussion of the trade-offs inherent in the selection of a temporal scale for considering net emissions. It has developed representative BAFs by feedstock and region rather than facility-specific BAFs. It includes a review of existing approaches to addressing leakage, the phenomenon by which efforts to reduce emissions in one place affect market prices that shift emissions to another location. It offers an approach to construct an anticipated baseline that allows assessment of additional CO2 emissions to, or uptake from, the atmosphere that can be attributed to biogenic feedstocks as a result of changes in biomass feedstock demand.

The draft report is clear and logical.

The conclusions and recommendations are supported by extensive discussion within the body of the report.

Comments from Dr. Kenneth Ramos

Insert

Comments from Dr. Donald vanderVaart

My only comments deal with the collateral emissions increases associated specifically with the combustion of woody biomass. Specifically, the emissions of wood combustion for most pollutants, including CO2, are higher than for coal combustion on a per mmBtu basis. Of course, the CO2 emissions may well be carbon neutral or at least less depending on the analysis discussed in this report. However, the emissions of SO2, NOx, PM, and CO are still higher. A brief discussion of the following points would help put this discussion into context:

(1) the adverse health impacts of these higher levels may be offset by the benefits of the lower (net) CO2 levels?
(2) the increases may trigger review under the New Source Review program therefore restricting conversions of coal fired units to wood fired units. While beyond the scope, a simple recognition of this may add to the completeness of the report.

Comments from Dr. Kimberly White

1) **Were the charge questions to the committee adequately addressed?**

The charge questions appear to be adequately addressed in the draft report. The draft report provides detailed responses to the questions and also includes specific recommendations.

2) **Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?**

There does not appear to be technical errors or omissions in the SAB Panel's report. The SAB Panel does however, note specific omissions of information (i.e. biogenic assessment factor calculations) that was not provided in the EPA's Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (2014) which limited their review.

3) **Is the draft report clear and logical?**

The draft report is clearly written and logically organized.

4) **Are the conclusions drawn or recommendations provided supported by the body of the draft report?**

The recommendations and conclusions provided by the SAB Panel appear to be supported by the body of the report.