

August 24, 2012

EPA Science Advisory Board
c/o Dr. Angela Nugent
Designated Federal Officer
via email to nugent.angela@epa.gov

Re: Comments on SAB Review (7-26-12 Draft) of EPA's Accounting Framework for Biogenic CO₂ Emissions from Stationary Sources (September 2011)

Dear Dr. Nugent and the EPA Science Advisory Board:

The following is in three parts. Part A contains personal observations, Part B comments on specific sentences in the SAB Review, and Part C is a summary table for the 21 questions that the SAB addressed in their 26 July Review, with a Biochar slant.

A. Personal Observations relating Biochar to the SAB Review.

1. Personal Background I write with a concern that the final accounting rules discussed in the above-identified SAB Review may not adequately take into account the many climate benefits of the technology called "Biochar". More specifically, I am concerned that the SAB, in its 7-26-12 draft review, may not have understood the unique role that Biochar can play in advancing the mandates of the EPA. In part I write because I am on the Board of the United States Biochar Initiative (USBI) [www.biochar-US.org], am a member of the Advisory Council of the International Biochar Initiative (IBI) [www.biochar-international.org], and am the coordinator of the Biochar-Policy discussion list-serve. [<http://tech.groups.yahoo.com/group/biochar-policy/>]

But I do not claim here to represent any of these groups. Rather, I write as an individual who has chosen to devote my time since 2005 to advancing "Biochar". (previously "Agrichar", "Terra Preta", and (unfortunately and erroneously) "Black Carbon"). For ten years prior to that, and still today, I have also been active in the production of charcoal in third-world cookstoves. From these experiences, I am convinced that Biochar should not be considered equivalent to any other means of utilizing raw biomass to achieve carbon negativity. Below I expand a bit on the underlined "any other". Here, I am specifically referring to the similarly carbon-negative, energy-producing technology called BECCS, which cannot provide the multi-year soil improvement values that are addressed so strongly in this SAB Review.

2. Other pertinent LCAs I was delighted to see that the Accounting Framework, which preceded and necessitated the SAB document to which I am responding, included Biochar in its example #4 on pp 107-116. This example has several good features, but I am concerned that neither it nor the SAB comments on this example demonstrate sufficient knowledge of the rapidly changing face of Biochar. For instance, here are no citations to the more recent Life Cycle Analyses (LCAs) performed by Dr. Kelli Roberts (Cornell), Mr. John Hammond (UKBRC) and Dr. Annette Cowie (Australia). [These and similar citations available upon request.]

I am familiar with the background citation for Case Example 4 (by Prof. McCarl et al – Chapter 19 in the well known compendium edited by Drs. Johannes Lehmann and Stephen Joseph. Dr. McCarl's chapter is the only economics reference along these lines which doesn't show at least one possibility for cost competitiveness. I cannot yet supply a citation for an important result provided at last month's Sonoma conference in a Powerpoint slide by Dr. Lehmann. [<http://2012.biochar.us.com/299/2012-us-biochar-conference-presentations>] He noted that in the most recent Life Cycle Analyses (LCAs) performed at Cornell University (publication pending), they had extended the analysis period to 50 years (I think from 5 years) and the net benefit had jumped from 6 to 30 (units not obtainable from the slide). [Citation at <http://hawaii.biochar.com/four-days-one-inspiring-event-usbi-conference-in->

[sonoma/](#)] The point is that the results given in the existing EPA framework for Case #4 (using data from about 2008) are not representative of present thinking about Biochar sequestration effectiveness.

3. What Biochar is not. Another example of my concern is this footnote definition on p 17 of the September 2011 Framework document, stating: “21. Biochar is charcoal created by pyrolysis of a biogenic feedstock”. This (the same definition on p 69) will greatly bother the Biochar community, who insist on the additional words “when placed in the ground” (see the site www.biochar-international.org). This is NOT a minor point within the Biochar community. Placement of char in soil is critical.

4. Re Final Appendix: I am sympathetic to the dissenting views expressed in Appendix E by Dr. Roger Sedjo. From everything I know, the positive CDR (carbon dioxide removal) aspects of Biochar are so compelling that an analysis need not be performed to satisfy the EPA concerns on sustainability. This (minimum analysis) view seems especially justified in terms of the difficulty of modifying the existing analysis appropriately. Numerous new terms would have to be inserted that would apply only to the analysis of Biochar – because the sequestration benefits are largely in out-years.

5. New Large Biochar Company One example that EPA should be aware of is that provided by the largest Biochar-producing firm, found at www.coolplanetbiofuels.com (I recommend the 14 minute video by the company founder, Mr. Michael Cheiky.) Being primarily a biofuels producer, it might seem their approach need not be considered by the SAB in the present point-source proceedings. However, as the producer of a low cost liquid biofuel, compatible with any turbine or IC engine, theirs could also be the least-cost biomass-based approach to electrical generation (for both new and retrofit systems). Their pyrolysis approach is of special importance to the Biochar community because of the large amount of char that necessarily is co-produced. Char is of major importance in their corporate advertising (roughly “drive more to remove more atmospheric CO₂” [and could be extended to “use more electricity”]). Their production example, although unique and proprietary should not be that difficult to model, but the benefits after the char is placed in soil seems difficult to demonstrate within the existing EPA numerical framework, .

Part B. Comments on Specific SAB Sections

1. N₂O p16/80, line 31ff. *“In addition to the anticipated baseline, a noticeable omission is the absence of consideration of nitrous oxide (N₂O) emissions from fertilizer use, potentially a major on site greenhouse gas loss that could be induced by a growing bioenergy market.”*

RWL1: Agreed. Biochar is beginning to be recognized as being able to play a large role in the retention of N₂O. See especially the publications of (Australian) Dr. Lukas van Zwiiten.

2. Time as part of the analysis P27/80 1127-30 *“There is also insufficient treatment given to the existing literature on the impact of different land management strategies on soil carbon, which is important for understanding how carbon stocks may change over many decades.”*

RWL2: Agreed. And for Biochar, the recalcitrance will change a little in the first few years, but then be hardly changed for centuries if not millenia. The important point is that the EPA analysis must have a larger time component than presently configured.

3. Other than CO₂. p 27/80 1 32 *“The Framework does not incorporate greenhouse gases other than CO₂.” Also 1 42 “...this needs to be explicitly discussed. “*

RWL3: Besides N₂O, numerous articles on Biochar have discussed CH₄ retention. See extensive Biochar bibliography at www.biochar-international.org – adding a new technical peer-reviewed paper about every 2 days.

4. Question on one SAB sentence. p30/80 ll 23-30 “ *In other cases, the production of bioenergy could result in by-products like **biochar** which sequester significant amounts of carbon. A large value of the SITE_TNC and/or SEQP variables in the accounting equation could result in a negative BAF for such feedstocks. The Framework should clarify how a negative BAF would be used and whether it could be used by a facility to offset fossil fuel emissions. Restricting BAF to be non-negative would reduce incentives to use feedstocks with a large sequestration potential* “ (Emphasis added).

RWL4: This final SAB sentence is not understood. I have seen no evidence that the EPA had any such “non-negative BAF restriction” intention. Certainly incentives are needed.

5. Agreement with the SAB P31/80 ll 29-30 *The scientific justification for constraining the range of LAR to be greater than 0 but less than 1 is not evident since it is possible for feedstock production to exceed feedstock consumption.*

RWL5: For Biochar, there are several ways that LAR can be negative.

6. Correction on reversibility p34/80 ll 37-39 “*Since soil carbon sequestration is easily reversible with a change in land management practices, the implementation of this Framework will need to be accompanied by frequent monitoring to determine any changes in soil carbon stocks and to update the BAF value for a facility.* “

RWL6: Biochar soil-additions are definitely not “easily reversible”. This is considered to be an advantage.

7. Biochar lifetime P35-36 LL 43-2 *There is no scientific literature cited to support the idea that all the materials produced by biogenic fuel use do not decompose. This is the subject of ongoing research, but it seems clear that these materials do decompose. The solutions to creating a more realistic and scientifically justified estimate are the same as for the Products term (see above).*

RWL7: Certainly Biochar does not have an infinite lifetime. But for almost every Biochar-soil combination, lifetime is very long compared to anything else under consideration in the Framework. So this other aspect of the time issue may further indicate a need/value to treat Biochar production and application as a special case.

8. Needed additional factors. P37 ll 17-18 3(c). ***Are there additional factors that EPA should include in its assessment? If so, please specify those factors.*** :

RWL8 - All Biochar analysts would wish a much wider range of additional factors to be considered
Examples are

- the ability to provide for larger annual growth (after 500 years, there is still a doubling or tripling of Amazonian Terra Preta soil productivity)
- the ability of char to control N₂O and CH₄
- the ability to both use and release less fertilizer
- the ability to both use and release less irrigation water
- the ability to support a larger weight of soil microbes, etc
- Consideration of a large analytical time period (and a low discount rate)

9. Recommendation for a data source p44 ***Question 4(c). Does the Framework utilize existing data sources?***

RWL9: I believe that there may be excellent and sufficient data available at www.footprintnetwork.org
– run by the Oakland-based NGO: Global Footprint Network.

10. Comments on the “Biochar” Case Study P50 ll30-35 “*For example, Case Study 4 considers a scenario where corn stover is used for generating electricity. While it is possible that this scenario could be implemented, this particular case study is not realistic because very few electrical generation facilities*

would combust corn stover or agricultural crop residues only. A more likely scenario might be supplementing a co-firing facility with a low percentage of corn stover. Additionally, the assumption of uniform corn stover yields across the region is not realistic. Variation should be expected in the yield of corn stover across the region.

RWL10: A Biochar analyst could not accept the suggestion for co-firing (presumably with coal), as that would almost certainly render the Biochar of this case non-usable. The Biochar community can provide numerous (small) corporate examples – some getting near commercialization. The company (CoolPlanetBiofuels) furthest along in commercialization plans has settled on miscanthus in a “plantation” setting (planning on 25 BDT per acre-year, much higher than this case example). Although definitely not a point source, as they are today demonstrating a “drop-in gasoline”, one could imagine that this liquid fuel (or similar biofuel) being used in numerous smaller near-by combined heat and power (CHP) plants totalling the 12+MW of this example case. This is a key paragraph for Biochar proponents – and can be made much more attractive with other terms in the analysis – as mentioned elsewhere.

11. Comments on last Section: 4. DEFAULT BAFs BASED ON FEEDSTOCK CATEGORIES

“There are no easy answers to accounting for the greenhouse gas implications of bioenergy. Given the uncertainties, technical difficulties and implementation challenges associated with implementing the facility-specific BAF approach embodied in the Framework, the SAB encourages the EPA to “think outside the box” and look at alternatives to the Framework and its implementation as proposed. One promising alternative is default BAFs for each feedstock category.”

RWL11: I agree that feedstock is hugely important and I support the SAB-recommended idea of Default BAFs. But, in addition to the feedstock defaults, the conversion approach also should be considered for default characterization.

These equipment default computations should be approved by, if not developed by, experts in each technology, of course with final approval given by groups such as the SAB authors of this report.

Part C : A Summary Matrix.

In the following 2.5 pages, I have attempted to do three things. First is to give the (6-part) 21-questions prepared by EPA for SAB response. This is not of course of value to either the EPA requesters or the SAB. I give these mostly for the benefit of other Biochar analysts to whom I will be forwarding this note

The middle column gives a too-much-abbreviated flavor of the 21 SAB responses. This also will be of little value to the SAB. It might have a little value to the EPA, but again I write to engage other Biochar analysts.

The third column is hopefully of a little more value to all. This exercise helped me better understand the SAM recommendations, I found that I agree with the SAB on almost everything, but this column has given me a chance to add a few thoughts on Biochar that support the SAB's conclusions and recommendations

EPA to SAB	SAB Response	RWL Response
1. Does the SAB support EPA’s assessment and characterization of the underlying science and the implications for biogenic CO ₂ accounting?	<i>“EPA has done an admirable job . At the same time, ... issues that are not addressed ...Time”</i>	Time is espec. important to Biochar.
2(a). Does the SAB agree with EPA’s concerns about applying the IPCC national approach to biogenic CO ₂ emissions at individual stationary sources?	<i>“Yes. the IPCC national approach does not explicitly link biogenic CO₂ emission sources and sinks to stationary sources “</i>	Agree.. But OK for simpler accounting for Biochar

2(b). Does the SAB support the conclusion that the categorical approaches (inclusion and exclusion) are inappropriate for this purpose, based on the characteristics of the carbon cycle?	<i>“The SAB cannot speak to the legal an alternative approach of default .. (BAFs) is offered for the agency’s consideration (see Section 4) “</i>	Support the alternative of Section 4 also.
2(c). Does the SAB support EPA’s conclusion that a new framework is needed for situations in which only onsite emissions are considered for non-biologically-based (i.e., fossil) feedstocks?	<i>“.... this question is redundant .”..</i>	OK. But this is a chance to talk of 350 ppm CO2.
2(d). Are there additional accounting approaches that could be applied in the context of biogenic CO2 emissions from stationary sources that should have been evaluated but were not?	<i>“... the DOE 1605(b) voluntarythe Climate Action Registry developed in California USDA harmonized .. synergy. “</i>	Biochar (IBI) is also developing standards
3(a). Does SAB support EPA’s conclusions on how these factors should be included in accounting for biogenic CO2 emissions, taking into consideration recent advances and studies relevant to biogenic CO2 accounting?	<i>“The SAB’s response to this question differs by feedstock. some factors suffer from significant estimation and implementation problems.”</i>	Accounting should also differ by conversion technology
3(b). Does SAB support EPA’s distinction between policy and technical considerations concerning the treatment of specific factors in an accounting approach?	<i>“A clear line cannot be drawn In fact, the lack of information on EPA’s policy context and the menu of options made it more difficult.”.</i>	Agreed. But carbon negativity needs more emphasis
3(c). Are there additional factors that EPA should include in its assessment? If so, please specify those factors.	<i>“...the factors included in the Framework capture most However, baseline is needed for time path of carbon accumulation in forests the time path of the “anyway” non-CO2 greenhouse gases in general”</i>	And add time path of Biochar sequestration out-year benefits
3(d). Should any factors be modified or eliminated?	<i>“.... PRODC, AVOIDEMIT and SEQP could be improved by incorporating the time scale “</i>	Add outyear sequestration benefits.
4(a). Does the framework accurately represent the changes in carbon stocks that occur offsite, beyond the stationary source (i.e., the BAF)?	<i>“For agricultural biomassshort accumulationfeedstocks, can accurately represent carbon changes offsite. ...However, for long accumulation feedstocksdoes not accurately account... The Framework also does not consider other greenhouse gases CH4 N2O ... ”</i>	Biochar seems to be particularly short-changed.
4(b). Is it scientifically rigorous?	<i>“The SAB did not find the Framework to be scientifically rigorous Time Scale...Spatial scale: Additionality.... Assessing</i>	A serious charge and list!

	<i>Uncertainty... Leakage.. Risks Inconsistencies ...(5) Soil... ”</i>	Soils are of particular concern.
4(c). Does it utilize existing data sources?	<i>“First, and most importantly, the Framework does not provide implementation specifics. Therefore, it is difficult to assess data availability and use. “</i>	Agreed. Biochar proponents can help
4(d). Is it easily updated as new data become available?	<i>“...would be feasible to update.... ..frequent calculation introduce considerable uncertainty”</i>	Agreed. But Biochar should be less controversial
4(e). Is it simple to implement and understand?	<i>“It is neither. “</i>	Will be much less simple with Biochar.
4(f). Can the SAB recommend improvements to the framework to address the issue of attribution of changes in land-based carbon stocks?	<i>“ an anticipated baseline approach is needed. ... uncertainties will need to be assessed .. incentives ...to favor...areas with a higher likelihood of carbon accumulation “</i>	Need to include many more Biochar benefits.
4(g). Are there additional limitations of the accounting framework itself that should be considered?	<i>..”Framework ambiguity:..... ...Feedstock groups:Potential for Unintended consequences:Assessment of Monitoring and Estimation Approaches:”.</i>	Biochar mostly needs more detailed handing of out-year benefits.
5(a). Does the SAB consider these case studies to be appropriate and realistic?	<i>“The case studies did not incorporate “real-world” scenarios “</i>	Case study #4 (w Biochar) needs updating.
5(b). Does the EPA provide sufficient information to support how EPA has applied the accounting framework in each case?	<i>“There remained considerable uncertainty in many of the inputs. . . develop default BAFs “</i>	Agreed. A Biochar default is important.
5(c). Are there alternative approaches or case studies that EPA should consider to illustrate more effectively how the framework is applied to stationary sources?	<i>“Additional case studies should be designed based on actual or proposed biomass to energy projects “</i>	And one for Biochar especially needed (and easy to do).
6(a). Does the report – in total – contribute usefully to the advancement of understanding on accounting for biogenic CO2 emissions from stationary source?	<i>“Yes, the Framework contributes ... understanding emissions... However,.... lack transparency ... justification. “</i>	Present work doesn't adequately analyze Biochar..
6(b). Does it provide a mechanism for stationary sources to adjust their total on site emissions on the basis of the carbon cycle?	<i>“Clearly the Framework offers a mechanism ... system replaces space for time “</i>	Biochar needs a large emphasis on time.

6(c). Does the SAB have advice regarding potential revisions to this draft study that might enhance the utility of the final document?	<i>“...enhanced by including a description of its regulatory context and specifying the boundaries . In the next section, the SAB suggests an alternative – default BAFs. “</i>	Agreed. Policy is critical. We need a Biochar default
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In sum, I write this because everything I have seen in both the original Framework and the SAB response suggests that the EPA team, and possibly also the SAB team, has not yet appreciated the full range of multi-year benefits and complexities associated with Biochar. With hope for greater attention to Biochar in the forthcoming analyses, I wholeheartedly endorse the SAB comments. Of course I would be pleased to expand on anything in the preceding.

Ronal W. Larson, PhD, Fellow and past chair of the American Solar Energy Society (ASES)

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