Biochar Characterization Standard Meeting Minutes

Meeting Title:	WG1 and WG2 Second Conference Call
Date:	January 17 and January 20, 2011
Location:	Conference call

Attendees:

Name	Organization
Keith Driver	Leading Carbon – CA
Alison Lennie	Leading Carbon – CA
Ian Kuwahara	Leading Carbon – CA
Joseph Pignatello	WG1 – US
Johannes Lehmann	WG1 – US
Jason Aramburu	WG1 – US
Sunguo Wang	WG1 – CA
Jim Amonette	WG1 – US
Hugh McLaughlin	WG1 – CA
René Pigeon	WG1 – CA
Marta Camps	WG2 – NZ
Stephen Joseph	WG2 – AU
Lukas Van Zwieten	WG2 – AU
Amran Salleh	WG2 – MY
Saran Sohi	WG2 – UK
Thomas Harttung	WG2 – DK
Balwant Singh	WG2 – AU

Agenda: -

1. Brief Introduction of participants in attendance
2. Administrative notification of schedule Doodle to be sent for planning third working group conference call mid- to late-February.
3. Recap of what occurred during the last meeting, using the minutes from previous call.
4. Outline of revised Draft Standard – Run through the draft standard, identifying areas where changes have been made. Key areas of discussion identified:
    a. Definitions
    b. Product Classification, both for organization and test selection
5. Next Steps:
    a. Revised draft to include greater clarity in definitions
    b. Product Classification to undergo more directed discussion with working group, mediated via e-mail and/or web-based Survey Monkey to assess appropriate order of classification, and effective biochar properties tests.
6. This bullet is just in case I need it.

The following provides a summary of the issues discussed on each of the working group calls.

WG2 – Meeting January 17 th2011 – 9 pm (GMT -7h)

Definition of Labile Carbon – Description should change to identify the portion of carbon likely to be released to the environment in less than 1 year, not less than 100 years. Or, failing that, change the time-length reference to week or months or "approximately 1 year", not "under" or "less than 100". "Carbon that is likely to be converted to either carbon dioxide or methane within a year."

Discussion then led to concern over comparisons of identifying labile soil carbon and labile biochar carbon, and how chemical analyses may be different. Time limits may also be restricting (e.g. the "less than x years" notation). Must be assured that tests of labile C recognise appropriate C types, not glucose C, but non-recalcitrant C.

Recommendation that the Dumas combustion test with the removal of carbonate C be re-labelled to require testing "after removal". Dumas test is for total C, not stable C. However, the removal of carbonates is generally done by acidifying the sample, removing the soluble salts (as a by-product), which implies that additional sample weight will be lost in the process, and should be recorded. Alternatively, Total C and Total C in Carbonates could be measured to develop an estimate of organic C by calculating the difference. While this may be easier, or require less intensive math, it then requires a methodology for assessing the total C in carbonates.

Definition of Pyrolysis – thermochemical decomposition of organic material at elevated temperatures in LOW CONCENTRATIONS OF OXYGEN. 0.2 stoichiometry = pyrolysis, 0.2 – 0.6 = gasification, >0.6 = combustion

Definition of Good Agricultural Practices – why is this necessary? Not applicable within the parameters of biochar characterization. The biochar product definition and standard will not be prescribing agricultural practices. The document may encourage them, but it is beyond the purview of this group to direct agricultural behaviours.

If removing "Good Agricultural Practices", may want to include "to improve soil" in another section, but not necessarily improving soil functions.

Definition of Anthropogenic Carbon and Biogenic Carbon need to be augmented and better-explained. Identify what types of materials (examples) are included in each category. Suggested definition: Anthropogenic Carbon is carbon which has not participated in the present or recent biosphere (and is currently being used in anthropogenic activities (e.g. production of energy, plastics, etc.). When released to the atmosphere, it has an associated CO2 equivalence which can be assigned based on the molecular form in which the carbon is released." (the anthropogenic activities clause is required to differentiate fossil C which is not ye

Definition of Torrefaction – temperature range is inadmissible as a descriptor unless it is accompanied by a time range. The time-temperature relationship exists for all phases of pyrolysis and resulting end-products. Upper temperature limits are not necessarily indicative of materials torrefaction. Perhaps identify torrefaction as occurring when volatile compounds (dark smoke) is off-gassed during pyrolysis process.

Remove definition of "Agrichar" and all other commercial product references. IBI should not promote any commercial products within the product standard.

Need definition of Carbonization Process – to include pyrolysis and other thermal conversion processes; bond-splitting processes that are thermally driven. No temperature references. Can include microwaves, regular heating, pressure exposure and a wide range of temperatures without time-ranges or –limits. (without a time reference, temperature exposure doesn't imply any process effectiveness (highest temp. reached)) Make no reference to resulting particle size.

Need to define gasification

Seek to make definitions parallel to those on the IBI website.

If biochar is recognized in the tests, is a definition of the process of biochar creation really necessary? Or is it then circular?

Concern regarding the use of "diluent/dilutant" within the document, and appropriate definition/usage.

"Diluent" to be more clearly identified such that readers understand whether it refers to material combined with biochar after pyrolysis or if it refers to material within biochar feedstocks (as it is being pyrolised), which will not be transformed into biochar. Discussion continued to identify "diluent" to indicate materials within feedstocks which would not be pyrolised (e.g. clay as a diluent when combined with manure feedstocks; or inorganic but non-contaminant materials as diluents – which leads to the need to identify "contaminants")

This led to question of how will materials such as plastic (pulp mill sludge, etc.) be dealt with within the treatment of feedstocks and resulting biochar? Some materials (e.g. plastics) will produce effective biochars, but will not be eligible for carbon credits.

PAHs are also considered a concern, as related to inclusion of plastics (etc.) within feedstocks produce concern, but test levels are likely to come in below allowable compost levels when final biochar end products are tested. Should there be limits on % plastic content allowed in feedstock to limit the potential for toxic materials? (or allow that to be addressed within materials tests, as this is a standard for the end product, not the feedstocks)

Carbon credits identified as beyond the scope of product definition and standard document. Carbon abatement, however, is less effective when non-biogenic material is included as feedstock.

Need to define "feedstock" as to what it can/should/could be made of (would allow better understanding of 'diluent'). However there is concern about whether this is beyond the scope of the product definition and standard.

Feedstock to be of cellulosic biomass origin with little chemical or physical changes imposed (unprocessed organic material), not resulting from the direct destruction of biomass systems or conversion of land use type specifically for the generation of biochar feedstock material. (this may be too prescriptive with respect to sustainability)

Processed organic materials should be included as a parenthetical description of the "OR" category of feedstock descriptions, along with waste material or by-products.

Concern regarding policing diluent percentage of 20%. Recommended to indicate synthetic rubber, as opposed to natural rubber.

Section 5.3 General Biochar Process Requirements – this is a product standard, not a process standard, and as such we cannot mandate processes. Perhaps changing wording to "further recommendations or desirable process procedures" rather than "requirements"

Contribution to climate change mitigation is beyond the scope of the product definition and standard and should be removed from the list of recommendations. Climate change mitigation accounting would require lifecycle analyses and are far beyond the scope and expertise of this document.

Negative impacts of application on biodiversity, ecosystems and human health should not be included. Cannot be prescriptive of biochar uses within this document.

Applications and uses of biochar are also beyond the scope of the product definition and standard and should be removed from the list of requirements. Product testing may recommend use of biochar for particular activities, but cannot mandate use.

"Biochar" should not be capitalized within the document, unless it is at the beginning of a sentence. "Biochar" is not a trademark-able term, and cannot therefore be branded.

Class I – "Soil and plant enhancement properties" (e.g. better plant quality, nutrient availability) or "soil function enhancement properties" or "agronomic improvements" (allowing a broader scope without being overly prescriptive versus soil enhancement…)

Class II – Include all criteria for III (i.e. remove III)

How will persistence in soil be distinguished from carbon stability requirements?

It was recommended that the biochar definition be developed with respect to the way it is defined within the product classification (so that there is no ambiguity).

Need to identify a test that will measure C-stability. Intrinsic relative stability [to what?].

Earthworm avoidance test should follow OECD standardized approach, and use OECD standardized soils as the substrate with which biochar should be mixed. (this test implies that biochar will be added to soil, should the product definition and standard somehow address this for further clarity?)

Recommend that analysis costs (and therefore accessibility) be weighted such that there is a greater level of analysis (and more expensive tests) required to achieve the better classes of biochar. Therefore allowing those producers with little resource for testing (accessibility and affordability) to be able to claim at least a lower class of char.

Document to be forwarded: Danish (EU) soil amendment standard
Soil amendment standard indicates that no matter how benign the feedstock is, tests are still needed to achieve a particular quality status.

Within the EU, biochar is under the bio-ash regulations, requiring PAH, heavy metals, etc. testing once a year.

Class I

- acid neutralizing and liming effect are very similar (and could be included as one test)
- Both total and standard NPK (available portion) analysis should be conducted. NPK allows identification within the common understanding of fertilizers, but tests must be conducted on what is available, not the total ('locked in') amount. Then need to define what is "available NPK", and identify appropriate test methods. There is a challenge in that tests of what is "available" are not necessarily reflecting the truly accessible NPK, however total NPK values are guaranteed to be indicate present nutrients. (Edinburgh and A
- Sorption spelling needs to be corrected.
- CEC on a biochar-mass-basis is a many-stepped process, needing to remove dissolved solids and CaCO3, with very strict guidance required (methodology) in order to ensure effective results for analysis. Question of whether CEC should be conducted of entire biochar sample or the charcoal fraction of biochar; or whether CEC should be done after soluble salts (sulphates and chlorides) have been removed.
- Suggested use of exchangeable cations test instead – identification rather than capacity.
- pH is likely a function of application rate (biochar on soil) rather than pure materials definition. Liming equivalent or Liming value may be more effective as a variable (more easily understood by the average consumer)
- EC and pH are the easiest tests to conduct and identify, and are some of the cheapest & most easily accessible. Likely should be included in a lower category (e.g. Class IV) .
- Eh (reduction potential/ electron activity) may be more applicable than pH for biochar measurements and descriptions, however it is not an easily understood value by the public.

Class II

- Tests in Class II include stable carbon content, however C sequestration value is given in class IV, thus making it appear to be double-counted and unnecessary in class II.

Tests & methodologies for PCBs and PAHs need to be affordable & accessible.

Class IV should include the cheap/economic measurements

- TGA could be used to determine moisture content and carbon sequestration value thermogravimetric analysis

Dioxins and Furans are tested through the use of GC mass spectroscopy or TEQ (toxic equivalent) tests, which are expensive ($500-1000 per test). Important to keep threshold for dioxins and furans low, however, testing will be costly to the average producer.

Question of whether dioxin and furans levels are related to feedstock, temperature and residence time. Identified two likely routes to higher levels of dioxins and furans: gasification is more likely to produce dioxins versus pyrolysis (lower temperature/residence time), and including plastics (esp. PVC) in feedstocks will increase the probability of dioxin/furan presence in the final product.

How should/does the IBI mitigate the costliness of tests?

Could some materials testing (e.g. dioxins/furans) follow and/or comply with local legislation, rather than being required as part of product definition and standard. (due to cost).

Must consider the availability of tests.

May also want to consider whether or not the substances being tested are actually bio-available, or if they will remain locked in soils.

Identified that the NSW EPA test values listed in classes II and IV may not meet USA/EU/etc guidelines, and that a fuller, more global perspective is needed.

7.2 An MSDS is required for biochar, for materials handling and storage. This is not to direct usage, but to identify materials properties, especially as regards storage and transportation flammability. Would the MSDS vary between classes?

<u>WG1 – Meeting January 20th 2011 – 9 am (GMT -7h)</u>

Disclaimer needs more specific wording: e.g. “IBI is not liable or responsible for any harmful effect of a commercial product”

Check to see if other standards (ISO, CEN, ASTM, etc.) use a disclaimer.

Need to create provision for inter-laboratory comparison testing to ensure test procedures are following a standardized approach (otherwise all reported variables within the product definition and standard classes are meaningless). This may act as a subsequent phase for the IBI to develop QAQC (quality assurance/ quality control) procedures.

Recommended that other existing biochar standards are sought (if they exist) from Japan and other areas.

Forward – third paragraph "from concept to final product." Should instead say "from concept to final product definition and standard."

Forward – remove "E" from "ENGOs" to avoid confusion.

Scope – switch wording: "an avenue for carbon sequestration" to "a method of carbon sequestration"; "limits or terms for defining the sustainability" to "guidance or criteria for defining the sustainability"

References – All reference documents should be cited within the product definition and standard documentation, or be removed. Access to documents was requested by WG members, to determine process/standard applicability.

Definition of Anthropogenic carbon is ambiguous and should be refined & clarified.

Definition of biochar should focus less on the 'ideal' use purpose and more on material properties. Be specific, but stay within the limits of the product definition and standard doc. Recommended to remove "following good carbonisation practices that is added to soils folloing good agricultural practices" – beyond scope. What definitions should be used: material properties; purpose and outcome less effective. Biochar may be a material intended for soil application (with certain outcomes) but the product definition and standard cannot mandate that it is used for soil application.

When is a biochar not "biochar"?

Definition of biochar should reflect the subsequent document sections (e.g. chemical and material properties)

Recommended that Good carbonisation practices and good agricultural practices be removed from the list.

Question about how section 5 will be enforced?

Stove-produced and backyard-pyrolised biochar will be eliminated by requirements in section 5.3. perhaps make them recommendations instead of requirements, or reference a scale of operation.

Acknowledged that a certain degree of policing by IBI will be required to ensure label is being used appropriately. (think third-party validation/verification in other standards)

However, pointed out that there is a difference between a certification and a standard. What is the purpose of the document: materials standard or process certification?

Standard for biochar systems or for the final biochar product only?

Recognise that 5.3 could be reworded to identify intents or recommendations, not requirements. Making 5.3 voluntary or suggested/desirable process steps, instead of mandatory. The tasks outlined in 5.3 will have to be addressed by other standards/documents.

Remove "shall" from the list in 5.3.

Material properties are required and being standardized/defined in this document. All other areas of discussion are merely suggestions. A focus on material properties ensures that they are measurable and verifiable in a characterization standard.

A primary concern of feedstock composition was raised, in that feedstock composition will be an important determining factor in the final outcome of biochar production, and biochar composition.
It was recommended that feedstock recommendations be made, that they be non-binding (not mandatory requirements), but useful as guidelines for identifying materials sources.

Incomplete combustion will need to be addressed: e.g. torrefaction versus biochar, or thicker pieces of feedstock not charring through.

Concern was expressed over the choice of biochar class numbering. "higher class" and number ranking with 1 as the best, and 3, and 4 (higher, larger numbers) as 'lower class' biochar will lead to confusion.
Further, a restriction of materials ranking at this point may result in challenges later, as better testing, and greater understanding about the behaviour and properties of biochar are developed. (e.g. the best biochar by be a '1' right now, but in another 10 years, with technological improvements, a much more effective char may be developed, and there is no means by which to supercede '1'. Numbering schemes following letter grades (A, B, C; allowing for AA, AAA with improvements) or reversing the numbering scheme to improve characteristics with increasing number size, or a colour ranking (bronze, gold, silver, platinum) allows future growth in analytical and quality production.

Classes should grow from least to greatest, with the capacity to include better, more effective testing and materials analysis as technology (and test costs) improve. Class ranking should not cap improvements by using the highest known present value as the top level. Ranking should enable improvement over time, with further class differentiation (and minimal customer confusion).

An associated concern to class ranking is that whatever ranking scheme is used will need to be understandable to the marketbase. Ranking will need to be effectively intuitive that customers won't need to read chemical assays and summaries to understand the role of product ranking in the label.

Ambiguity between classes must be eliminated. All material properties should be clearly defined, and there should be very obvious breaks in quality between class rankings of biochar.

Concern was expressed over whether the definition and standard was a performance or a substance standard (as to whether chemical properties or biochar function are the primary focus).

Feedstock purity would aid in test determination, and test selection. The majority of tests reflect a need to address non-biogenic or 'impure' or 'altered' feedstock sources. When comparing a pure biomass feedstock (e.g. corn stover or wood waste from timber harvest) to a potentially contaminated feedstock (e.g. pulp and paper mill sludge or municipal solid waste), the resulting biochar chemical composition will be different.

Differentiation would require recognition of feedstocks "generally recognised as safe" and "generally recognised as un-safe" (wording is politically challenging).

It was recommended that biochars derived from "pure" biogenic feedstock be recognized as the highest class of biochar, while other feedstocks of multiple origins, or not simply made of pure biomass be subjected to more rigorous testing, due to the greater likelihood of contamination with other substances (e.g. heavy metals, PAHs, furans, dioxins, PCBs).

Feedstock classification would put the burden of proof (for biochar chemical properties) on mixed-feedstock users (e.g. municipal solid waste, pulp mill sludge, paper waste, fabrics, etc.) where feedstock materials cannot be traced back to their biogenic origin.

It was recommended that the purity of feedstock be paramount to testing. (non-virgin vs. only-biomass/ pure, un-altered biomass).

Remove PAH test from Class IV and move to Class II as a variant of improved toxicity testing.

Dosage limits on biochar use applications would potentially make classes irrelevant (e.g. heavy metal content in Class IV vs Class II).

Addressing diluents may become a *de minimis* concern regarding contamination, particularly if feedstock purity becomes a focus in product definition and standardization. If diluents exist, they are the result of using an impure feedstock, and have produced an impure biochar.

Post-process blending and resulting product labels would identify content of mixes that is biochar, and discuss biochar quality as relates to the proportion of the mix that is biochar. Product certification would not deviate to the material with which biochar has been blended. (e.g. in horticultural product sales at greenhouses, where customers could purchase bags of compost-biochar in 85-15 materials ratios, biochar product labels would only address the condition and quality of the 15% of materials within the bag that are biochar, and would not address any of the condition or quality values for the compost)

It was recommended that Leading Carbon have working group members identify their own ranking of classes and measurements for biochar, using a follow-up questionnaire to reorganize classes. This ranking would further allow working group members to recommend test values and methods, as well as providing justification for their use, further providing a paper trail of reasoning behind tests and methods selections.