Proposed Policy Revisions to the *IBI Biochar Standards* Version 2.0 – For Review and Voting by IBI Membership

August 2014

Overview

In Fall 2013, IBI initiated a process to incorporate policy and technical revisions into the *IBI Biochar Standards* which would result in a Version 2.0 of the document. To date, the process has included a 30-day public comment period in December 2013 on initial versions of proposed policy revisions; two public webinars hosted by IBI in March 2014 to explain proposed revisions in detail; and two rounds of external review by an expert panel of biochar researchers convened by IBI.

IBI has now incorporated comments from expert and public feedback and amended the proposed policy revisions accordingly. To finalize the revision process, we are requesting that dues-paying IBI members review and vote on the four proposed policy revisions outlined in this document. Following is an overview of the proposed revisions as amended since first posted for public comment in December 2013:

1) **Testing Requirements for Weathered Biochar.** IBI is proposing that biochar that has experienced "significant weathering"—defined as exposure to precipitation events—must be re-tested.

2) **Timing of Testing for Post-Processed Biochar.** IBI is proposing to specify that sampling and testing of biochar occur *before or after* post-processing depending on the type of post-processing method utilized. IBI provides a list of potential post-processing methods and classifies them with respect to when sampling and testing are required.

3) **Provisions for High Carbon Biomass Ash.** IBI is proposing that material derived from the ash fractions of bioenergy generation facilities be permitted for consideration with strict requirements around permissible feedstocks, sampling and testing for potential toxicants, and documentation of extraction and segregation processes.

4) **Biochar Sampling Procedures.** IBI is proposing new biochar sampling procedures to simplify and customize sampling approaches for biochar.

Instructions

In the following pages each proposed policy revision is described in detail, and new proposed definitions are listed. Please carefully review each proposed revision, and then cast your votes on our online ballot form by clicking here. **You may send any questions or comments on the proposed policy revisions to Stefan Jirka, IBI Program Manager, at stefan@biochar-international.org.**

1 Testing Requirements for Weathered Biochar

Rationale:
Biochar weathering may occur when biochar is exposed to precipitation, ice, freeze-thaw cycles, fluctuations in temperature, deposition of atmospheric chemicals, and/or exposure to ambient air. All of these factors may alter the biochar and its physicochemical properties by changing its physical structure and/or its chemical properties through oxidation, hydration, leaching, or other processes. In many instances biochar weathering can be a beneficial process that enhances the material properties of the biochar.

Biochar that is stored uncovered outdoors is subject to the most extreme physical and chemical weathering. Furthermore, weathering affects biochar differentially depending on the type and extent of exposure, the properties of specific biochars, and biochar storage conditions. For example, if a large pile of biochar has been stored outside and rained on extensively, material at or near the surface may experience differential weathering than material at the center of the pile.

Proposed Policy Revision:
Because of the non-uniform and unpredictable changes caused by weathering, the *IBI Biochar Standards* provide specific testing requirements for biochar material that has been exposed to "significant weathering" which, for the purposes of the *IBI Biochar Standards,* is deemed to occur when *biochar has been stored outdoors uncovered and has experienced any precipitation events*.

The testing requirements for biochar that has experienced significant weathering depend on whether the material has already been sampled and tested as follows:

- In cases where significant weathering occurs *before* biochar has been sampled and submitted for testing, the entire batch of weathered biochar must be thoroughly mixed to achieve material uniformity prior to sampling; and
- In cases where significant weathering occurs *after* biochar has been sampled and tested, *the entire batch of weathered biochar must be re-sampled and re-tested* for all of the required tests. Prior to re-sampling the entire batch of weathered biochar must be thoroughly mixed to achieve material uniformity.

Furthermore, it is the responsibility of the biochar producer to re-sample and re-test a biochar if any other weathering events besides precipitation are believed to substantially change the physicochemical properties of the biochar that has already been sampled and tested.

New Definition:
Weathering: Changes in biochar physicochemical properties due to precipitation, freeze-thaw cycles, fluctuations in temperature, deposition of atmospheric chemicals, and/or exposure to ambient air. (IBI, 2014)

2 Timing of Testing for Post-Processed Biochar

Rationale:
After thermochemical conversion of feedstock(s) to biochar, additional steps may be taken by the biochar manufacturer to enhance, transform or otherwise alter the physical, chemical or biological properties of the biochar material. For the purposes of these *IBI Biochar Standards*, such actions are called post-processing. In order for test results to accurately reflect biochar material properties, the timing of testing with respect to different types of post-processing treatments is critical. Therefore, biochar manufacturers who utilize post-processing must adhere to the guidelines described in the proposed policy change for timing of testing.

Proposed Policy Revision:
1) Biochar testing shall occur *before* the following types of post-processing, which constitute the addition of non-biochar materials to the biochar:
    a) *biological activation* including, but not limited to, treatment with microorganisms, organic compounds, and/or nutrients in a biologically active environment; or
    b) *mixing, blending, or adding* any non-biochar material including, but not limited to, compost, fungal mycorrhizae, ash, minerals, chemical fertilizers, animal manure, microbes, and seaweed.
2) Biochar testing shall occur *after* the following types of post-processing:
    a) *steam activation*; or
    b) *chemical activation* including treatment with acid or alkaline substances or oxygen (O_2); or
    c) *UV or concentrated solar light treatment*; or
    d) *microwave or ultrasonic treatment*; or
    e) *crushing, grinding, milling, pelletizing, selective segregation* or any other form of processing intended to alter or limit biochar particle size; or
    f) *weathering* of biochar—whether intentional or unintentional—that has been stored outdoors uncovered and experienced precipitation events.

Further, for those types of post-processing where testing is required to occur after post-processing treatments (listed in (2) above), *the biochar material must be re-tested if post-processing parameters are altered such that the physicochemical properties of the post-processed biochar material are rendered substantively different from the previously tested material*.

New Definition:
Post-processing: Any action undertaken by the biochar manufacturer to enhance, transform or otherwise alter the physicochemical properties of the biochar material after completion of the thermochemical conversion process. (IBI, 2014)

3 Provisions for High Carbon Biomass Ash

Rationale:
Biomass-fueled power generating stations produce biomass ash as a byproduct of energy generation. Biomass ash—or fractions thereof, including bottom ash and flyash—may display physicochemical properties that are similar to biochar materials, including high organic carbon content. Such materials may pass the required tests in Test Categories A and B of the *IBI Biochar Standards*. However, concern exists around 1) the potential formation and accumulation of toxicants in biomass ash including PAHs, PCDD/Fs, and heavy metals (Van Loo and Koppejan 2007; Vassilev et al 2013), and 2) the ability of the operator of the biomass boiler or furnace (i.e., the biochar manufacturer) to meet and document "material change" requirements outlined in the *IBI Biochar Standards*.

Proposed Policy Revision:
Because of concerns outlined above, IBI requires the following provisions for consideration of high carbon biomass ash under the *IBI Biochar Standards:*

1. Only biomass ash produced from clean cellulosic biomass may be utilized. A statement signed by the producer of the biomass ash (see 2. below) stating that the facility only utilizes clean cellulosic biomass must be provided.
2. The producer of the biomass ash (i.e., the operator of the biomass boiler or furnace) is deemed to be the biochar manufacturer. Note that this means that an intermediary (i.e., an entity that acquires and distributes and/or markets the biomass ash) does not qualify as the manufacturer of the biochar pursuant to the *IBI Biochar Standards*.
3. In cases in which some fraction of the high carbon ash is segregated from the total ash product, the following applies:
    a) Material flow through the bioenergy production facility including the segregation process whereby the high carbon ash fraction is segregated from other ash fractions must be documented and clearly describe the ability to produce a consistent and uniform product.
    b) The manufacturer must state which fraction of biomass ash is being utilized (bottom ash and/or flyash).
    c) All documentation related to the segregation process must be retained per the requirements of Section 5.9 Conformity and Record Keeping.
4. In addition to testing requirements described in Section 5.3 Timing and Frequency of Testing, the following ongoing sampling and testing plan must be adhered to:
    a) A grab sample shall be taken of every batch of biomass ash produced by the manufacturer. All grab samples shall be clearly labeled and archived for a period of one-year.
    b) At the end of each quarter, all grab samples shall be composited into one quarterly composite sample. All quarterly composite samples shall be clearly labeled and archived for a period of one-year.
    c) Composite samples shall be tested every quarter by an independent laboratory (see Section 5.2 Laboratory Standards) for: PAHs, PCDD/Fs, arsenic, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, and zinc.
    d) If tests results for any of the parameters in (c) above exceed the Maximum Allowed Thresholds (see Appendix 5 Toxicant Assessment and Determination of Thresholds),

that batch of biomass ash does not meet the requirements of the *IBI Biochar Standards* and may not be considered for certification under the *IBI Biochar Certification Program*.

New Definitions:

Batch: 75 m^3 or 20 metric tonnes of biomass ash i.e., the quantity of biomass ash approximately equivalent to a tractor trailer load of material. (IBI, 2014)

Biomass Ash: Ash generated as a byproduct of energy generation in biomass-fueled furnaces or boilers. Biomass ash is subdivided into bottom ash and flyash. (IBI, 2014)

Bottom Ash: The component of biomass ash that falls to the bottom of the burner unit of a biomass-fueled furnace or boiler and that has a consistency of ash or a semi-solid slag material. (Oregon DEQ, 2011)

Clean Cellulosic Biomass: Those residuals that are akin to traditional cellulosic biomass such as forest-derived biomass (e.g., green wood, forest thinnings, clean and unadulterated bark, sawdust, trim, and tree harvesting residuals from logging and sawmill materials), corn stover and other biomass crops used specifically for energy production (e.g., energy cane, other fast growing grasses), bagasse and other crop residues (e.g., peanut shells), wood collected from forest fire clearance activities, trees and clean wood found in disaster debris, clean biomass from land clearing operations, and clean construction and demolition wood. These fuels are not secondary materials or solid wastes unless discarded. Clean biomass is biomass that does not contain contaminants at concentrations not normally associated with virgin biomass materials. (US CFR, 2014)

Composite Sample: Grab samples from one source of biomass ash that are thoroughly mixed to produce a consistent sample. (IBI, 2014)

Flyash: The lightest-weight component of biomass ash in a biomass-fueled furnace or boiler that rises with the flue gases and is captured by a boiler or incinerator's air contaminant control equipment. (Oregon DEQ, 2011)

Grab Sample: An individual sample collected at a selected time. (IBI, 2014)

References

Oregon Department of Environmental Quality. *Fact Sheet: Management of Wood Ash Generated from Biomass Combustion Facilities.* Updated 5/5/2011. http://www.deq.state.or.us/lq/pubs/factsheets/sw/ManagementWoodAshGenBiomassCombustionFac.pdf (Accessed November 2013)

US Code of Federal Regulations, 40 CFR § 241.2

Vassilev, Stanislav V.; David Baxter; Lars K. Andersen; Christina G. Vassileva, An overview of the composition and application of biomass ash: Part 2. Potential utilisation, technological and ecological advantages and challenges, Fuel, Volume 105, March 2013, Pages 19-39, ISSN 0016-2361, http://dx.doi.org/10.1016/j.fuel.2012.10.001.

Van Loo, S., & Koppejan, J. (Eds.). (2007). *The handbook of biomass combustion and co-firing*. Earthscan.

4 Biochar Sampling Procedures

Rationale:
The *IBI Biochar Standards* currently require using sampling procedures developed for compost, according to the US Composting Council's *Test Methods for the Examination of Composting and Composts* (TMECC). This guidance is highly complex and not well adapted for biochar testing. IBI proposes to simplify biochar sampling procedures while maintaining scientific rigor through the inclusion of new sampling guidance adapted specifically for biochar but drawing from established protocols for compost and soil sampling.

Proposed Policy Revision:
Strict adherence to standardized biochar sampling procedures is critical to ensure reliable, representative, and replicable test results. Manufacturers should adhere to the sampling procedures outlined in the Appendix (on the following pages), drawn from established compost sampling procedures but adapted specifically for biochar. Adherence to these biochar sampling procedures will ensure that the sample collected is representative of the entire biochar material being analyzed.

Appendix – Biochar Sampling Procedures

Equipment required for sampling

All equipment should be clean and residue-free.

- Spade or shovel
- Plastic container for mixing: a 5-gallon bucket is ideal
- If necessary, a clean plastic tarpaulin for mixing
- Permanent marking pen
- Sample submission form (provided by testing laboratory)
- Sample containers (described in detail below)

Sample containers

Gallon- or quart-sized zip-loc plastic bags (or glass jars) are adequate containers for most of the parameters to be tested in the *IBI Biochar Standards*. However, because organic pollutants including PAHs, PCDD/Fs, and PCBs are prone to volatilization, samples to be tested for those compounds and for the germination inhibition assay must be packaged in special glass containers with Teflon lids, or exclusively Teflon containers. Manufactures should check with the testing laboratory to confirm sample amounts to be collected as well as container types. In most cases, labs will provide the Teflon containers for the PAHs, PCDD/Fs, and PCBs tests. Table 1 below lists the container types allowed as well as the maximum recommended holding time by each testing parameter.

Table 1. Sample containers and holding times by test category parameters.

	Container type[1]			
Parameter	**P**	**G**	**GwT or T**	**Max holding time[2]**
Category A - all parameters	x	x		14 days
Category B - germination inhibition assay			x	7 days
Category B - PAHs, PCDD/Fs, and PCBs			x	7 days until extraction
Category B – metals	x	x		2 days
Category C - all parameters	x	x		14 days

[1] P = Plastic; G = Glass; GwT or T = Glass with Teflon lid or exclusively Teflon

[2] Max holding time = Maximum holding time recommended at lab (Woods End, 2014)

Composite sampling

Because of spatial variability of biochar stored in a pile, bin or other storage method, it is necessary to take a composite sample consisting of material collected from several locations within the entire biochar material being sampled. A representative biochar sample must be collected through random selection of subsamples throughout the entire material being sampled. The sampling technique will depend on the type of storage of the material and consist of no less than 15 subsamples (USDA and USCC, 2001).

Composite sampling procedure by storage method

Pile or other uncontained storage method:

1. Remove any covers and thoroughly mix the pile, if possible.
2. Proceed to the first randomly selected sampling location and collect approximately 1 pint of material from near the surface, another pint midway through the pile, and another pint near the bottom of the pile. Place the subsamples in the 5-gallon bucket.
3. Repeat this process at least 5 times at random locations in the biochar pile.

4. When all subsamples have been collected, thoroughly mix the material in the bucket being careful to avoid stratification of the biochar based on particle size. If necessary, mixing may be facilitated by dumping the material in the bucket onto a clean plastic tarpaulin, and mixing thoroughly.
5. Collect the composite sample from the mixed material. Fill the material to overflowing in double wrapped zip-loc bags. Clearly mark the bag contents with permanent marker including name of the biochar, and sampling date and time.

Enclosed containers or bagged product:

1. Open the container/bag and thoroughly mix the material inside, if possible.
2. Proceed to the first randomly selected container/bag and take 3 subsamples consisting of approximately 1 pint of material each from several different depths inside the container/bag. Place the subsamples in the 5-gallon bucket.
3. Repeat this process at least 5 times from randomly selected containers/bags.
4. When all subsamples have been collected, thoroughly mix the material in the bucket being careful to avoid stratification of the biochar based on particle size. If necessary, mixing may be facilitated by dumping the material in the bucket onto a clean plastic tarpaulin, and mixing thoroughly.
5. Collect the composite sample from the mixed material. Fill the material to overflowing in double wrapped zip-loc bags. Clearly mark the bag contents with permanent marker including name of the biochar, and sampling date and time.

Number of samples to collect

To ensure statistical accuracy of the composite sample it is necessary to adjust the subsample size based on the overall amount of the biochar material being sampled. Biochar manufacturers should adhere to the following subsampling thresholds:

- For amounts up to 10 metric tons of biochar material the manufacturer shall take a minimum of 15 random subsamples, as outlined above.
- For each increase in 10 metric tons of biochar material, at least 15 additional subsamples shall be taken. For example, if 60 metric tons of biochar are being sampled for testing, a minimum of 90 random subsamples should be taken throughout the entire biochar material.

Shipping biochar samples

Once a composite sample has been taken, the sample must be properly packaged for shipping to the testing laboratory. Standard practice involves securely packaging the double-wrapped biochar samples in sturdy boxes or other containers. The biochar should be clearly marked with the name of the sample and the time and date of sampling. *It is the responsibility of the biochar manufacturer to confirm any special procedures for packaging and labeling, quantities needed, as well as pricing with the laboratory being used to conduct the testing*. In some cases, laboratories may provide proprietary containers for shipping. Furthermore, because of the possibility of volatilization of organic pollutants at ambient temperatures, it is recommended that samples to be tested for PAHs, PCDD/Fs, and PCBs be chilled on dry ice directly after sampling and during shipping (TMECC).

References

US Composting Council and US Department of Agriculture (2001) *Test methods for the examination of composting and compost.* (TMECC) Thompson W.H. (ed.) http://compostingcouncil.org/tmecc/. (Accessed January 2012).

Woods End Laboratories, Inc. (2014) *Principles and Practice: Compost Sampling for Lab Analysis.* http://woodsend.org/wp-content/uploads/2011/03/sampli1.pdf (Accessed August 2014)