JDMT, Inc

October 16, 2010

Ms. Lea Yamashita
California Air Resources Board
Stationary Source Division
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Sacramento CA 95812
via email: lyamashi@arb.ca.gov

SUBJECT: PUBLIC COMMENTS TO DRAFT DOCUMENT
Air Quality Guidance for Siting Biorefineries in California, October 11, 2010

Dear Ms. Yamashita:

We are pleased to submit comments to the Draft Air Quality Guidance for Siting Biorefineries in California, dated October 11, 2010 (Draft), and applaud the Air Resources Control Board (ARB) for an excellent effort. The need remains strong for clear regulatory guidance in all aspects of biorefinery development; the current Draft advances that understanding. Our comments include responses to specific requests made by staff for additional Conversion Technology information at the ARB workshop October 14, 2010.

We offer General Comments on the overall nature of the Draft and address staff requests during Workshop discussions, followed by Specific Comments on the Draft, referenced to page and paragraph.

GENERAL COMMENTS

1) ***Critical Need for Document:*** This Guidance can provide useful and timely clarification, by stating specific emissions criteria for conversion technologies in a biorefinery processing facility. As the ARB is the primary agency of purview over air quality concerns, this clear identification aids other agencies in their own assessment of permitting and certification of biorefining applications.

   Technical errors in Public Resources Code promulgation of criteria impacting Biorefineries (as herein defined) now impede California Energy Commission (CEC) certification as an "eligible renewable energy generation facility"[1] for conversion of *municipal solid waste* (MSW), in part due to strict prohibition of release of *any* emissions from the core conversion technology. Clarifying permissible standards for emissions controls in such processing is therefore a clear statement of ARB purview upon which the CEC, California Department of Resources Recycling and Recovery (CalRecycle) and other agencies will now be able to rely and reference.

2) ***Inclusion of References:*** This Draft is in part a revision of existing guidance. It would be most helpful to indicate what is being proposed as a change, at least by footnote if not in context of the proposed change. Similarly, the Draft text quotes language from regulation

[1] Renewable Portfolio Standard Eligibility, Draft Staff Guidebook, 4th Edition, August, 2010. CEC-300-2010-007-SD, p. 26. See http://www.energy.ca.gov/2010publications/CEC-300-2010-007/CEC-300-2010-007-SD.PDF

and law without referencing that source; this makes tracking legally binding regulatory context difficult, and lessens the usefulness of this document.

3) ***Point of Compliance Clarification:*** ARB's Draft recognizes that emissions controls are to be applied at that point in the Biorefinery process when a gaseous, liquid or solid feedstock and/or fuel are to be "refined". This is most commonly and of necessity a multi-technology, multi-step process and ARB has jurisdiction over *any* element of that process which might emit. This step-wise purview should be clearly stated in context of an *integrated* biorefinery.

   We find that the Draft confuses what might be a specific piece of equipment with what is a *process*, which is an integrated system of equipment elements that together complete a step in the overall biorefining operation. Please consider each element in terms of where testing would be accomplished in order to determine compliance, or at the "Point of Compliance" for that element of the processing. It would be useful to differentiate between provisions for regulation of accidental equipment release of gases to the atmosphere, and levels pertinent to the controlled release of gaseous emissions as a bi-product of processing.

4) ***Compliance Matrix:*** In the discussion at the October 14th Workshop, we proposed a four-level Point of Compliance approach to providing air quality policy and regulatory guidance in siting biorefineries. We would suggest that all policies and regulations associated with Biorefinery considerations be identified with one or more of the following Compliance Levels:

   - Technology Level – This comprises each major unit or module of technologic equipment. Air Quality issues associated with this level are inclusive of inadvertent releases from a specific piece of equipment to the environment, to be differentiated from controlled emissions resulting from a piece of equipment and the emissions control devices ancillary to the processing train of which the technology is a part.
   - Process Level – Each "processing train" or coupled suite of equipment modules designed to accomplish one aspect of the integrated biorefinery is at this level. It may be inclusive of discrete emissions control devices, or adjunct to a manifolded emissions control superstructure.
   - Facility Level – All processes and all technologic modules as elements of those processing trains within the permitted battery of the Biorefinery, inclusive of all Operations & Maintenance (O&M) elements under permit are at this level.
   - Supply Chain Level – This level includes external functional elements critical to and under the control (contractually or otherwise) of the Biorefinery, such as input and output infrastructure complements that result in Mobile Emissions directly associated with operations and critical to developing a Life Cycle Assessment of the project.

5) ***Biorefinery Technologies & Processes:*** Inclusion of only a few specific "technologies" in the Draft belies the inherent diversity of what constitutes an "integrated biorefinery". Keeping in mind the difference of Point of Compliance between a "technology" and a "process", it is still important to reflect the current distinct categories of systems capable of accomplishing conversion and refinement. We suggest that this Draft be recognized as a "work in progress", with data gaps identified and requests for new data solicited.

   At the request of ARB staff for assistance in identifying types of process flows using conversion technologies that are known to be associated with Integrated Biorefineries, a table of Conversion Processes is attached to our comments for your consideration.

SPECIFIC COMMENTS

6) ***Terminology, Bagasse. p. vi.*** The definition extends Bagasse to include the "… crushed stalks of sugar crops", which would logically include sugar beets if nothing else, when the standard definition is solely for sugar cane. If this is intended, then a note of explanation regarding ARB's expansion of the term would seem appropriate.

7) ***Terminology, Biorefinery, p. vi.*** To include conversion of biomass to heat among the list of products from what is to be considered a Biorefinery must then be interpreted to mean that direct combustion for generation of heat alone would also be, by definition, a "biorefinery". I do not think this is an appropriate extension, nor do I feel this is the ARB's intent. Please do not confuse biomass disposal by incineration for heat generation, with biomass conversion for recovery of waste materials to generate energy, fuels and other commodities..

8) ***Terminology, Ethanol: A two carbon produced from biomass…, p. vii.*** This was probably intended to read "A two carbon liquid …".

9) ***Terminology, Pyrolysis, p. vii.*** Thermal conversion is a continuum, and pyrolytic processes are in a thermal range lower than gasification processes. Rely on the United States Department of Energy (DOE) definition, from their Biomass Program: "*In pyrolysis processing, biomass feedstocks are broken down using heat in the absence of oxygen, producing a bio-oil that can be further refined to a hydrocarbon product. The decomposition occurs at lower temperatures than gasification processes, and produces liquid oil instead of a synthesis gas. Oil produced varies in oxygen content or viscosity according to the feedstock used*."[2]

10) ***A.3.b. Gasification / Alcohol Synthesis, (2) Fermentation. p.14:*** *"Syngas is conditioned and compressed for fermentation. The syngas is fermented to ethanol using genetically engineered microorganisms under anaerobic conditions. Fermentation is followed by distillation and purification of the ethanol."*

    Syngas may be processed via fermentation without anything other than a significant reduction in temperature, and compression is not a necessity. More importantly: Syngas fermentation to short-chain alcohols need not depend on genetically modified organisms (GMOs); Mendelian selection of naturally occurring micro-organisms has been used successfully. Given the global concern regarding use of GMOs, it is counter-productive to state this is the sole mechanism for syngas fermentation to alcohol.

11) ***III. A. Regulatory Structure. p. 21.*** Define "SIP" at this first occurrence of the acronym in the body of the text.

12) ***IV.A. Table IV-1. Process Equipment Requiring an Air Permit by Biofuel.*** I find it disconcerting and confusing that a "Pyrolyzer" is listed as a specific type of Processing Equipment. It assumes that a type of process, "pyrolysis" is to be accomplished with a so-named type of equipment, a "pyrolyzer". However, no specific listing is provided for any other type of *thermal* conversion equipment in the biorefinery processes referenced earlier in the Draft.

    Please note also that if the term "Pyrolyzer" is indeed to be used, then this needs to be included in the Terminology section. It is important that we clearly indicate when

[2] http://www1.eere.energy.gov/biomass/thermochemical_processes.html

compliance is upon a piece of equipment, and when this is more properly targeting an integrated sub-process, process, or group of processes.

Please include reference for, as a minimum, Gasification and Reformation, or alternately, change the term “Pyrolyzer” to “Thermal Conversion Technology”, perhaps with type distinction of “non-incineration”.

Also, to state at this stage ARB has insufficient data to determine appropriate emissions for a piece of stationary equipment, *whatever* that equipment, does not serve the process for which the Draft is intended.

13) ***V. T. Other Equipment. Pyrolyzer.*** See above comment; extend discussion to Thermal Conversion Processing Equipment. Some mention of retorts in use for pyrolysis and/or gasification is very seriously needed. If the ARB finds that only emissions controls are necessary at the point of syngas usage, then this needs to be stated (see our General Comments, No. 3, above).

14) ***Table VI-1.*** Only one thermal conversion entry, for biomass-derived syngas fired reciprocating engines, is included. *Any* thermal conversion system producing syngas used to fuel a reciprocating engine would fall under this broad category, although it is natural to assume there are inherent differences in syngas produced by different technologies. CEC regulations specify a “clean-burning syngas”[3]; such a performance based categorization here would help coordinate multi-agency purview.

In conclusion, we believe the ARB has developed an invaluable reference tool, a framework for an actively changing body of comparison, and a structured approach to consideration of Biorefinery development in California.

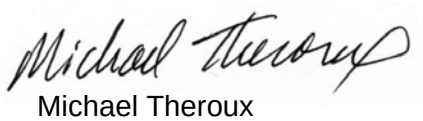
We recognize that data are difficult to obtain on diverse and sparsely distributed processing facilities, and encourage the agency to aggressively solicit documentation from other regions to increase coverage of biomass conversion and refining systems.

We feel that Point of Compliance matrix separation of technology from process, from facility, and from supply chain would accomplish much, and help identify specific areas where knowledge is needed.

Please contact me at (530) 823-7300 or mtheroux@jdmt.net if you have any questions.

Sincerely,

JDMT, Inc



Michael Theroux
Vice President

enc: Appendix A: Conversion Technology Categories

cc: Sara Michael, CEC (via email)

[3] Op. cit., CEC Guidebooks.

Process Flow Section		Process Flow Element & Activity / Capability / Tech Type	Description
Pre-Treatment		Genetically Modified Organisms (GMO)	Cellular level manipulation of genetic make-up, for "directed" plant growth and development.
		Separation	Mechanical and /or hand-line, usually a mix of +/- automation.
		Size & Moisture	Grinding, compression/extrusion, hydropulping, drying
		Autoclave / Elutrification	H2O Steam explosion and sterilization
		Pressure	Usually integrated with other pre-treamtent techniques
		Ammonia / Chemical	Pressurized chemical saturation to break down cellular structure
Conversion	Microbial	Algae	When grown as method to convert elements of waste stream to commodity
		Composting	Aerobic windrow, forced air, static, in-vessel; following 40-CFR-503: PFRP
		Anaerobic Digestion	No O2: Aqueous / dry, high / low solids, packed column, lagoon, plug flow, in-vessel;
		Aerobic Digestion Incl. ATAD	O2: Aqueous / dry, high / low solids, packed column, meso / thermophyllic
	Thermal	Pyrolysis	External heat source, no or little O2, no combustion: allothermic & endothermic
		Gasification	Self-generating heat, minimal O2, minimal syngas combustion: autothermic & exothermic
		Plasma	4th state of matter; all molecular structures dissociated. Extreme external energy source.
		Depolymerization	Low heat, low pressure break-down of long-chain polymer molecules
		Direct Combustion / FB	Excess O2, exothermic, allowed to proceed to full destruction, "render to ash".
		Microwave / RF	High-energy radiation excites and breaks down molecular structure. Incl: Radio Frequency
	Chemical and/or Kinetic	Enzymatic Hydrolysis	Active enzymes used to break down cellular structure
		Acid Hydrolysis	Strong or weak acid used to break down cellular structure
		Pressure / Steam including PSA and Autoclave	Chamber etc. maintained at pressure; incl. pressure swing absorption (PSA), Autoclave
		Super-Critical Water Oxidation (SCWO)	Hydrothermal processing: water above its critical temperature (374°C) and pressure (217 atm).
		Transesterification	Dissolution of long-chain polymers using short chain alcohols, usually methanol
		Continuous Flow Stirred Tank Reactor (CSTR)	Continuous-Flow Stirred Tank Reactor
Refining		Steam Reforming	Molecular shift in C, H, O balance using steam to increase heat value of syngas
		Catalysis - F/T	Molecular level restructuring using high surface area contact with specific metals
		Hydro-cracking	Pressurized aqueous break-down of long-chain molecular strutures
		Hydro-methanization	Pressurized aqueous molecular shift to increase % CH4
		Algal / microbial CO2 Fixation	Aqueous photosynthetic absorption and entrainment of carbon, release of oxygen
		Biogas / Syngas Clean-up	Raw producer gas from microbial and/or thermal processing cleaned to specifications
		Fermentation	Fungal (yeast) breakdown of carbohydrates and sugars to short-chain alcohols
		Distillation	Vapor pressure separation of short-chain alcohols form longer molecular structures
		Membrane / RO	Partical size separation via controlled openings in membrane effecting selective concentration