June 28, 2013

Ms. Teri Wion, Senior IWM Specialist
Materials Management and Local Assistance Division
CalRecycle
1001 I Street
Sacramento CA 95812-4025
via email: ClimateChange@CalRecycle.ca.gov

SUBJECT: COMMENTS TO DRAFT WASTE MANAGEMENT SECTOR PLANS

Dear Ms. Wion:

We are pleased to have the opportunity to submit comments toward the collaborative effort of the California Department of Resources Recycling and Recovery (CalRecycle) and the Air Resources Board (ARB) staff as draft plans are being development for both the Assembly Bill (AB) 341 implementation plan and the revision of the AB 32 Scoping Plan. This work directs integrated roll-out of a complex and crucial suite of multi-agency regulations and policies that are already having a profound impact on our state's social, environmental and economic well-being. As stakeholders, our intent is to provide perspective and suggest possible shifts in the current draft concepts, enabling a more robust and defensible oversight of California's waste management sector while facilitating timely AB 32 goal attainment.

COMMENT SUMMARY

Two overarching guidelines arise for testing the conceptual validity of proposed AB 32 Scoping Plan updates from review of the technical papers, background materials, and the statutes, laws, and policies:

- The legal definition of Recycling in California, Public Resources Code (PRC) §40180, is a *technology neutral* statute that clearly identifies the steps necessary to complete the process of Recycling. This code section is the first test; if a material sourced from waste is collected, sorted, cleaned, treated, and reconstituted into a raw material ready for reuse or remanufacturing, that material has been "recycled" regardless of the technology utilized in any one step. By completion of this legally defined process, the material is removed from the legal onus of being considered a "waste" under state law. If that process cannot be proven to have been completed, the material has not been recycled according to the laws of California.

- The reduction of greenhouse gas (GHG) emissions required by AB 32 entails Life Cycle Assessment (LCA) methods, using either direct documentation or demonstrably accurate modeling. This is the second test when judging which Waste Management Sector pathways provide the best hope of meeting GHG reduction goals. If data are not available and cannot be defensibly extrapolated, LCA cannot be performed. For recycling, this must include *each encoded step* to allow assessment over time that documents the incremental reductions mandated. Single-point comparisons in absence of this full-pathway assessment may have merit, but do not meet the standards of AB 32 pertinent to updating the AB 32 Scoping Plan.

SPECIFIC COMMENTS

To aid in staff review, we have followed the ordering of issues presented in the staff's series of Waste Sector Technical Papers[1], and reference these documents in our comments. We address first the recently revised Overview of the Waste Management Sector. Following this, we comment on: Recycling Reuse and Remanufacturing; State Procurement[2]; Composting and Anaerobic Digestion; Biomass Conversion; Municipal Solid Waste Thermal Technologies; and Landfilling of Waste. We finish with our thoughts on the draft Implementation Plan, Appendix C.

Overview of the Waste Management Sector

Collaboration and Context: The cross-agency effort evident in this Overview and in the subsequent technical papers is to be commended; we recognize this is also a "work in progress" and look forward to review and comment on future refinements. The Scoping Plan revision requires a merger of legal definitions and policies to a degree not attempted by the combined regulatory bodies before. The relationship between the pertinent regulations needs expansion, in particular outlining how AB 341 implementation relates to the AB 32 Scoping Plan revision, and clarifying context of the California Low Carbon Fuel Standard (LCFS) in addition to the Cap and Trade program.

Attendant Reports: We would note that although indicated as available, the "Appendix B: State Procurement" document is not included. This matter was partially addressed in a recent formal hearing before the Assembly Accountability and Administrative Review Committee regarding CalRecycle's State Agency Buy Recycled Campaign (SABRC) program administrative effectiveness; we here incorporate by reference our comments to that Hearing.[3]

Principles and Priorities: We completely concur with the five goals established in this section and see these as the ultimate metric against which to measure all other state implementation methods and policies with regard to the Waste Management Sector. Moreover, these same goals reflect a global imperative to "close the loop" in waste management.

Progress Measurement: California is a vast and varied territory, and GHG reduction requires close attention to distance of transport first and political boundaries second. It is imperative that an LCA basis be requisite to determinations of optimal pathways between waste generation through completion of recyclate reprocessing.

Implementation Mechanisms: This "localization" aspect of instilling a Circular Economy will change through time as the in-state reprocessing infrastructure is increased, thus LCA guidance will need to be repeatedly sought. This very process can drive infrastructure investment by identifying local areas of specific recyclate abundance that lack sufficient reprocessing capacity and diversity. This repeated assessment and tracking can be implemented by state agency oversight, and constitutes a wise and appropriate use of funds.

---

[1] Public Meeting Notice: June 18, 2013 - Waste Management Sector Plan Workshop. All technical papers available on-line at this website location.
http://www.calrecycle.ca.gov/Actions/PublicNoticeDetail.aspx?id=986&aiid=900

[2] State Procurement (lacking technical paper; refer to Presentation, slide 24). CalRecycle, June 18, 2013.
http://www.calrecycle.ca.gov/Actions/Documents/77/20132013/900/Waste%20Management%20Sector%20Presentation.pptx

[3] Comments to Hearing on "RECYCLED AND ENVIRONMENTALLY PREFERRED PRODUCTS", JDMT, Inc., filed June 7, 2013. http://www.terutalk.com/pdf/20130607-JDMT-Comments-SABRC-EPP.pdf

Recycling, Reuse, and Remanufacturing

Definition of terms: The *technology neutral* legal definition of "Recycling" from the Public Resources Code is needed at this juncture:

> PRC §40180: "Recycle" or "recycling" means the process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw material for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace. "Recycling" does not include transformation, as defined in Section 40201.

With this encoded definition, we know that a material segregated from the municipal waste stream has not been legally "recycled" until the defined pathway has been effectively completed. Conversely, recycling is *not* simply the act of separation or brokerage of segregated materials in absence of proof that reconstituting has occurred and the defined process has been completed.

It appears from the statute that a potentially recyclable material (recyclate") maintains its legal status as a waste until it has been reconstituted at the end of the recycling pathway. The "waste" classification is then only retained by that fraction of segregated materials that at the end of reprocessing is not actually reconstituted.

We suggest that clarification of two concepts in the context of waste management would aid future recycling expansion and offer possible definitions that we feel would reduce confusion:

(1) Recyclate: (a) a material segregated from the waste stream for the purpose of recycling, prior to completion of the pathway and its return to the economic mainstream in the form of a raw material for new, reused, or reconstituted products; (b) a material that is recyclable; a recyclable material.
(2) Reconstitute: (a) Build up again from parts; reconstruct; (b) Change the form, character, function or organization; (c) Synonyms: Restore, Convert. For recyclates, reconstituting is intended to meet "beneficial use" market specifications.

Proof of Recycling: Proof of completion of the legal process of recycling as encoded should be required of waste management services that act as "recyclers", and of *all* those intending to provide recycling services to commercial waste generators as an element of AB 341 implementation. For the state oversight agency to not require proof of recycling completion, yet require Commercial Waste Generators to *use* such services to be in compliance with AB 341, is to open the state to legal challenge. At present, no formal chain of custody or manifesting program is universally required of public or private entities that broker materials segregated for recycling, although templates for system-wide processing end-point documentation requirements have been developed and successfully trialed for some types of recyclates (bottles, for example).

Determining what is "Recyclable": The white paper explains "recyclability" in terms of what has occurred in the past, and adds that this depends highly on whether the recyclate has been contaminated:

> "Nearly two-thirds of the paper, plastic, and metal materials found in the disposed waste stream are uncontaminated when they arrive at disposal facilities and could be recycled into feedstock for reuse and remanufacturing facilities with minimal additional preprocessing."

This conceptual boundary (page 2) imposed on recycling is incorrect on numerous counts:

- The "quality" of recyclates with regard to "contamination" is more dependent upon the care taken to produce single-type materials than upon "cleanliness", as seems to be implied above. Recyclate quality is a measure of materials handling efficacy, and should be improved through application of best management practices (BMPs) within materials recovery facilities (MRFs).
- The phrase "minimal additional preprocessing" is incongruous. Judging the acceptable amount or method of preprocessing is only relevant when the economics of the raw material and the life cycle assessment of impacts associated with that recycling pathway (especially GHGs) are also taken into account.
- In the paucity of reconstituting facility infrastructure as is California's current status, CalRecycle lacks documented examples of this last step in the recycling pathway. Globally, diverse industrial methods for reconstituting waste-sourced recyclates exist, providing a breadth of options for almost any type of material segregated from the solid waste stream. It is the state's intent to increase California's infrastructure for handling its own waste and to accomplish this, it becomes the state's responsibility to understand this diversity.

Processing: The recycling pathway requires that sorting, cleaning, treatment, and reconstituting is performed according to the receiving specifications of *remanufacturing facilities*, not to the product specifications of the "end use markets." The sorting, cleaning, and treatment of recyclates that occurs at a MRF are intended to meet the specification of those performing the last stage of legal recycling, that of *reconstituting facilities*. These specifications are not the same as those for remanufacturing the final product from the reconstituted raw materials, unless reconstituting actually results in the final product.

These stages of recycling may be represented by one continuous and integrated process, may be discrete processing steps within an advanced multi-technologic "Eco-Park" complex, or indeed may occur within numerous waste management operations and often separated by great distances. It is imperative that we understand and monitor the entire encoded recycling pathway in order to utilize LCA for GHG accounting, such that incremental and continuous emissions reductions can be realized.

Another term first appearing in this paper requires definition and explanation: what is meant by "Secondary Processing", and why would *any* form of step-wise reconstituting be excluded from tallies of total recycling? Also see our above discussion of the phrase, "minimal additional preprocessing."

Current Status of the Utilization of Recyclable Materials: A "Recycled Material" by encoded definition has completed the recycling pathway and is therefore a "raw material ready for reuse or remanufacturing." This entire section lacks the clarity of the code, confusing the status of in-process recyclates from the many stages of the recycling pathway. This section also confuses what may be considered a "recyclable material" with what has been deemed to be recycled. The errors reduces utility of the resulting measurements for monitoring and reducing GHG emissions process. Simply brokering recyclates to some distant buyer in no way ensures "recycling" has been completed, nor does it provide a means of AB 32 mandated compliance.

It is also important to recognize that the recycling pathway does not by law include the next step, nor define how those resultant raw materials should be *remanufactured*. The code only states that the recyclates be made ready to the remanufacturing facility's requirements. More

appropriate would be attention to the nature and number of facilities that *reconstitute*, since their end-product is the legal last stage which establishes that recycling has actually taken place.

Goals for Increasing Recycling / Remanufacturing and Achieving GHG Benefits: The critical logical error discussed above overrides the majority of this next section's findings because:

- Once recycling is completed with the final step of reconstituting, that material is no longer legally considered a waste. Remanufacturing facilities using the raw materials from recyclate reconstituting operations *do not process waste*. The AB Scoping Plan seeks reductions per Sector, and this current work is tasked to address the Waste Management Sector, not the Manufacturing Sector.

Lack of clarity in defining, characterizing, and thus separating operations that effect "reconstituting" from those designed for "remanufacturing" defeats the intent of this assessment and by default, identifies a pervasive underlying lack of Waste Management Sector understanding and oversight.

Challenges to Meeting Goals: Considered in context of the above logical error, the white paper's statement (pg. 8) bears closer examination:

> "In general, there are a number of overarching challenges to increased recycling including: lack of sufficient domestic recycling infrastructure to remanufacture recycled materials, insufficient markets for recycled materials, and the relatively low cost of landfilling which adversely impacts the economics of recycling."

The "lack of sufficient recycling infrastructure" should focus on the need for operations designed to *reconstitute recyclates*. Were California to expedite development of localized capacity for reconstituting recyclates to the specifications for remanufacturing, those non-waste raw materials would be ready to enter the marketplace with far less negative economic and environmental impact.

Potential Solutions: If the above programmatic issues are taken into account, the "potential solutions" presented are indeed appropriate and timely. We recommend measuring each of the paper's solutions against the encoded criteria: is this concept and its proposed implementation consistent with California's legal definition of recycling, and with the AB 32 Scoping Plan's tasking for the agencies to specifically assess the Waste Management Sector?

Composting and Anaerobic Digestion

The important caveat in this technical paper is expressed only as a footnote. The extent of technical methods recognized in the broad category of "anaerobic digestion" should be brought directly into the introduction:

> "Although anaerobic digestion, the biological decomposition of organic material in the absence of oxygen or in an oxygen-starved environment, is the most common form of in-vessel digestion, there are several other digestion technologies that do not utilize anaerobic digestion. Anaerobic digestion is used broadly throughout this paper and includes other lesser used technologies."

Anaerobic Digestion - GHG Emissions Metrics and Challenges to Meeting Reduction Goals: The paper states that "GHG emissions reductions from these activities [referring to composting and anaerobic digestion or AD, operations] would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, and reduction in synthetic fertilizer and water use."

The paper's premise is that both composting and AD operations for conversion of organic recyclates to raw materials ready for reuse or remanufacturing (i.e., "organics recycling" per code) will inherently generate less GHG impact than landfilling for any one amount of organic waste. This appears sound in that the emissions from a landfill may be assumed to be less controllable than emissions from more advanced and contained conversion methods.
Yet when taken from an LCA perspective, this requires that we also make two rather illogical assumptions:

- All organics entering either composting or AD plants would otherwise be landfilled, instead of finding on-site agricultural usage or for liquids, being treated as sewage.
- No significant increase in GHG emissions attends the change in aggregation and transport methods for any one increment of organics from landfilling facilities to either the composting or AD facilities.

As California increases its reprocessing (reconstituting) infrastructure, the distance may be expected to decrease from a source of organics suitable for reprocessing to a facility that can accept and reconstitute those recyclates. The basis for AB 32 compliance over time depends largely on being able to account for incremental GHG and carbon intensity reductions as new processes are introduced, and this certainly pertains to the Waste Management Sector. Discounting as irrelevant the GHG emissions associated with transport of materials during the recycling pathway by *assuming* the landfilling alternative is "more negative" produces unsupportable data for the necessary LCA metrics.

Potential Solutions: The outline of potential solutions offered to increase use of composting and AD as a means to reduce GHG emissions yet rests on precepts with logical errors. Each proposed solution should be questioned. Is this concept supportable when the entire pathway is subjected to life cycle assessment?

Biomass Conversion

Biopower Plants and Bioenergy Generation: It is important to be current with the energy-related status of California's large scale industrial bioenergy facilities, and to account for the changes that are taking place in this industrial sector. This suggests two approaches: (1) aligning the ARB and CalRecycle assessment of Biomass Conversion with the California Energy Commission's Interagency Bioenergy Working Group efforts in updating the 2013 Integrated Energy Policy Report (IEPR)[4]; and (2) collaboration with the industry's primary association, the California Biomass Energy Alliance (BCEA)[5].

Biomass Conversion and Feedstock: Many industrial scale biomass to power plants rely heavily[6] on feedstock sourced from the construction and demolition (C&D) and municipal vegetation management (greenwaste) fraction of municipal solid waste. However, feedstock generated from forest and woodland sources is not under CalRecycle's purview, and instead is overseen primarily by the Department of Forestry and Fire Protection (CDF). Agricultural residues are similarly outside of the definition of "waste" per California regulation, falling under the auspices of the Department of Food and Agriculture, unless that material is destined for

[4] 2013 Integrated Energy Policy Report. California Energy Commission, docket #13-IEP-1; http://www.energy.ca.gov/2013_energypolicy/index.html.
[5] California Biomass Energy Alliance, http://www.calbiomass.org.
[6] Desert View 47 megawatt electric (MWe) generation capacity bioenergy facility, Mecca, California. Greenleaf Power, Owner; http://www.greenleaf-power.com/facilities/desert-view-power.html.

disposal in a solid waste landfill, or has been received at a pre-processing facility for chip/grind and or composting. Purview collaboration and conflicts need to be discussed, with the intent to streamline multi-source feedstock procurement.

Bioenergy and GHGs: Emissions from biopower plants are only one element pertinent to this discussion, since GHG accounting at least recommends if not requires use of LCA methods to allow proper comparisons and identify reduction opportunities. Once again, the importance of transport emission must be stressed, as aggregation of low weight, high volume biomass to large central facilities should be balanced against other more distributed models. A less apparent yet very pertinent GHG related factor is that mountainous bioenergy plants often bring urban and agricultural sourced feedstock to their facilities as "back-hauls" in trucks taking higher value bark and clean wood chip from the forest to valley-floor markets. This is one example of the level of assessment detail needed to bring about long-term GHG reductions that can be extracted from an LCA approach to bioenergy generation. The documentation of LCA is indeed a complex matter crossing the boundaries of agency purview and responsibility, and requiring multi-agency coordination for accurate results.

Municipal Solid Waste Thermal Technologies

The "MSW Thermal Technologies" introduction neglects one of the most important resources that may be recovered from municipal solid waste derived feedstock: foundation chemicals in the form of gas, liquids, and/or solids. These complex precursors to manufacturing are briefly mentioned later under the subsection, "Conventional Gasification" but should be brought into this initial discussion. Thermochemical breakdown of MSW-sourced molecular structures into a lower molecular weight synthesis gas (syngas) in particular, lends itself to recovery of constituents. The sheer diversity of materials encompassed in "MSW" ensures that sole-source segregation and mixed-waste sorting can select for literally any form of material for reconstituting.

Thermal processing of MSW fractions generates a raw "producer gas", which through cleaning can be upgraded to syngas. Subsequent reforming and refining of this syngas (for example, by catalysis, pressure differentiation, or microbial action) provides a stepwise means of reconstituting waste source materials and can be tailored to provide a vast array of "raw materials ready for reuse or remanufacturing," and is legally another component useful in recycling pathways. Thermal conversion of waste sourced materials provides yet another technologic approach to reconstituting recyclates, in effect, diversifying California's legally defined recycling pathway.

The simplest form of thermal energy application in commercial use in California is drying, a nearly-universal and crucial step in many Recycling Pathways to reclaim benefit from waste. When assessing the lifecycle GHG emissions related to any feedstock, drying can often constitute one of the most energy-intensive and thus emissions-intensive stages. MSW varies widely in moisture content (m.c.) and especially for *organic fractions,* exhibiting a characteristic m.c. range of 35 to 60 percent. As with varying moisture content and the amount of heat needed for drying, the entire thermal energy application process is a continuum.

This technical paper states that there are "three main types of MSW Thermal systems being used worldwide", then provides two systems examples (direct combustion and gasification) and one additional refuse derived fuel (RDF) example in "the use of MSW (or components of MSW) as a supplemental along with conventional fossil fuel." This last example is not a "thermal

system" discrete from either direct combustion or gasification (the primary technologies used for conversion of RDF plus conventional fuel).

Below, we offer a more thorough breakdown of thermal processing methods, all of which are in some way represented within California and all of which find applicability in processing MSW fractions:

Table 1: **Thermal Processing Categories**

Category	Description	Result
Moisture Control	Drying through exposure to kinetic energy via grinding, compression / extrusion, radiant heat, forced air / steam or other energy source.	Recyclates are dried to meet the operational specifications of the next "reconstituting" process stage.
Microwave / RF	High-energy radiation excites molecular structure, progressively causing first drying then cellular breakdown. Includes Radio Frequency.	Recyclate materials are degraded and sterilized, increasing surface area and reducing resistance to reconstituting.
Torrefaction	Application of external or internal heat sufficient to cause off-gassing which may be used to power system, leaving a carbon char (Bio-Char, or Bio-Coal).	Biomass energy density is increased and volume decreased, improving transport cost/benefit, reconstituting to raw material for making biochar / bio-coal.
Pyrolysis	External heat source, little O2, no combustion: allothermic (requires outside force) & endothermic (absorbs energy); produces varying amounts of solid, liquid and gas.	Large molecules degraded to char, liquid and gaseous specifications for remanufacturing as alternatives to petroleum-sourced foundation chemicals.
Gasification	After start-up, driven by self-generating heat. Minimal (sub-stoichiometric) O2, minimal syngas combustion: autothermic & exothermic. Produces ash/char, gas.	Large molecules degraded to primarily gaseous raw materials, to specifications for remanufacturing as alternatives to petroleum-sourced foundation chemicals
Plasma	4th state of matter; all molecular structures dissociated. Extreme internal application of thermal / electrical energy source. Produces small molecular weight gases.	All molecular structures reduced to smallest gaseous constituents, ready for direct reuse and/or as raw material alternatives to petroleum-sourced foundation chemicals
Super-Critical Water Oxidation (SCWO)	Hydrothermal processing: water above critical temperature (374°C) and pressure (217 atm). Other liquids can be energy carrier; dissociates molecular structures.	Wet-environment thermal degradation of large organic molecules, ready for direct reuse and/or as raw material alternatives to petroleum-sourced foundation chemicals
Direct Combustion / FB	Excess oxygen present, exothermic (releases energy), allowed to proceed to full destruction, "render to ash". Includes Direct-Coupled Fluidized Bed gasification (FB).	Maximum conversion to heat for power production, rendering to ash all residual non-combustible fractions. Minimal molecular recovery.

Rather than make a blanket statement that only "combustion and supplemental fuel systems are in commercial use in California" it should be recognized that *commercialization* itself represents

a continuum. State resources would be well spent documenting examples along the entire commercial thermal continua of MSW recycling.

Differentiating Gasification from Direct Combustion: The technical paper states that for gasification, "… the process may result in fewer pollutants than combustion, depending on whether the syngas is cleaned prior to combustion." This is in error and ineffective in distinguishing between the two methodologies. Consider that (a) direct combustion does not produce a separable, recoverable "syngas" that may be cleaned, and (b) emissions from various forms of gasification are as dependent upon retention time, temperature, oxygenation, and the type and variability of the feedstock as upon subsequent cleaning and upgrading of the producer gas exiting the retort.[7]

The primary pollutants of concern by quantity exiting high-efficiency direct combustion are oxides of nitrogen (NOx) resulting from excess use of air to drive the fuel oxidation for maximum incineration (rendering to ash) Since gasification restricts available oxygen by strictly limiting the total volume of air entering the retort, NOx production is minimized. Most toxins, such as dioxins and furans, are generated as products of incomplete combustion resulting from the specific MSW Thermal system design and operation, and the inherent variability of MSW as a feedstock. The presence and toxicity of other emissions from direct combustion reflect in general the efficacy of the processing design and its operation.

GHG Reduction Measurements and Benefits of MSW Thermal Systems: By definition, a *Life Cycle Assessment* must account for *all* stages of a process, not simply provide a comparison of one stage in one processing pathway to a different stage in a different pathway. A critical factor for all of the Waste Management Sector is the *transport emissions* attendant to handling and must be considered here. As discussed previously, reduced transport emissions are one benefit of an increase in the number and diversity of reconstituting / reprocessing facilities. At present, a great number of local landfills are available, while our current in-state reprocessing infrastructure offers very few and widely separated operations. This presents a complex but approachable modeling exercise wherein GHGs are incrementally reduced as reprocessing infrastructure increases, resulting in a nexus after which total LCA of a particular MSW-sourced recycling / resource recovery pathway is less than its source-to-landfill counterpart. Using this methodology, California can prioritize what elements of that reprocessing infrastructure are most needed and where these should be located, creating a "loading order" for state incentives.

Goals for Reducing GHG from MSW Thermal Facilities: Again, a limited understanding of thermal processing capabilities reduces the validity of this technical paper's finding:

- Thermally-driven reprocessing of *any* feedstock, whether MSW sourced or otherwise, is simply one method of completing a recycling pathway if it produces a raw material ready for remanufacturing. The caveat is that *recovery* rather than *destruction* must be the processing result. How that raw material is then put to use is only pertinent to the recycling pathway to the degree that *remanufacturing specifications* dictate reconstituting parameters.
- GHG reductions through improved energy efficiency of processing may prove more significant than any after-the-fact emissions management strategy. Assessment of process efficiency must incorporate infrastructure transport data. Where data are not available for specific elements of that processing value chain, we recommend instituting chain-of-custody requirements.

[7] For clarity, it is helpful to distinguish between the initial raw "producer gas" and subsequent "syngas" resulting from whatever combination of reforming and refining, cleaning and upgrading steps are necessary to meet next-use specifications.

Potential Solutions: We concur that following the 2012 Bioenergy Action Plan is a wise and appropriate strategy, and one that (given concurrent development toward updating the Integrated Energy Policy Report, or IEPR) requires significant inter-agency coordination. Similarly, thorough assessment of the socio-environmental costs and benefits of thermal reprocessing of waste-sourced feedstock in context of diversifying recycling can inform and broaden efforts to reduce Waste Management Sector GHGs.

Landfilling of Waste

This technical paper adequately describes the conditions of in-state landfilling and accompanying GHG emissions at each landfill site. It does not however, lend itself to a Life Cycle Assessment nor facilitate LCA comparison of alternatives to landfilling. Although social and economic pressures have forced landfilling operations further and further from population centers, the bulk of California's landfills are still relatively close to concentrations of waste generation. This proximity adds to the challenge of finding in-state waste management alternatives to landfilling that can significantly reduce GHGs.

In addition to the GHGs measured and extrapolated as emitted from California's landfills covered in the paper, GHG reduction assessment must now consider the emissions resultant from collection and transport from waste generation source to each landfill. This regionalization of waste management has been classically referred to a "waste-shed" and remains a useful concept as we compare non-disposal alternatives. To perform comparative LCAs requires that CalRecycle determine the baseline GHGs of landfills plus infrastructure per waste-shed.

If all MSW reprocessing for materials recovery occurred at landfill sites, and if all materials collected, sorted, cleaned, and treated could indeed be matched with appropriate reconstituting technologies at each landfill-based complex, the GHG metrics would cancel out. This is not a current condition or even a reasonable expectation in the near future, and each GHG comparison must stand on the merits of its own life cycle data, including transport related impacts. As an extreme example of this difficulty, consider the hypothetical GHG emissions resulting from local landfill disposal of low-grade, difficult-to-recycle waste plastics when compared to trans-oceanic shipment of those same polymers to Asian reprocessing facilities.

Reduction of GHG and Co-Pollutant Emissions at Landfills: Collection and conversion of methane-rich gases from a landfill certainly should be increased both in number and in technical efficacy. Yet to reduce the overall emissions impact of landfills in California, it is the encompassing waste management infrastructure that needs full state attention; landfill site specific solutions only address one crucial aspect. MSW-sourced recyclates must in some way be intercepted between generation and final disposal and diverted to localized reprocessing facilities. Organics diversion is advancing well, as additional facilities capable of microbial decomposition via composting or digestion is integrated within each waste shed.

Waste Sector Implementation Plan - Appendix C

Eleven types of "Category / Task" Opportunities to reduce GHG emissions and accomplish the goals set by AB 341 associated with this Waste Management Sector have been outlined in Appendix C, annotated with Actions and Timeframes. In generalities presented as with the introductory statement of Goals, this paper provides sound guidance. The test comes as thorough LCA data acquisition programs are implemented, and those begin to accumulate. Our comments follow this order.

1. Emissions Reduction Factors (ERFs)
   Add Action: (e) Develop a "default emissions reduction factor" that establishes a baseline for any resource recovery - recycling pathway that accomplishes diversion from landfilling and reduces GHGs for use until full LCA can be determined on per case basis.
   Timeframe: Short-term / in progress by mid-2014
2. Permitting
   Add Action: (e) Clarify definitions pertinent to permitting.
   Timeframe: Short term/in progress by late 2013.
3. Infrastructure
   Add Actions:
   (d) Map waste current transport distances per waste shed to landfills;
   (e) Model transport distance optimization patterns for reconstituting facility development.
   Timeframes: Short term/2014-2016, ongoing element
4. Offsets
   Add Option: (d) Identify offset opportunities that could assist bio-sourced chemical projects.
   Timeframe: Short term/in progress by late 2013.
5. Funding / Incentives
   Add Option: (q) Develop incentive support for conversion of waste sourced feedstock to foundation chemicals
   Timeframe: Short term/2014-2016, ongoing element
6. Public Education / Acceptance
   Add Option: (d) Explore ways to identify, catalogue and establish an open dialogue with the global diversity of recycling pathways
   Timeframe: Short term/in progress by late 2013 and on-going element.
7. Markets / Quality of Products
   Modify Option: (c) Work with industry to standardize quality requirements of products from composting, anaerobic digestion and other forms of recyclate reconstituting / reprocessing
   Timeframe: Short term/2014-2016, ongoing element
8. Sustainability
   (a) Establish processing standards including chain of custody requirements for all Recycling pathways.
   Timeframe: Short term/2014-2016, ongoing element
9. Research
   Modify Options:
   (a) Improved characterization of direct and avoided GHG emissions from all forms of Recycling, focusing on mechanisms for data acquisition enabling full LCA
   Timeframe: Short term/2014-2016, ongoing element
   (c) Support research and development projects demonstrating newest best management practices for composting, anaerobic digestion and all other forms of Recycling pathways
   Timeframe: Long term/ongoing through 2025
10. Cap and Trade
    Add Options:
    (d) Determine Cap and Trade inclusion for Waste Management Infrastructure improvement development projects that can prove significant, measurable, long-term reductions in GHGs.
    Timeframe: Short term/late 2013/early 2014
    (e) Extend existing Cap and Trade off-set programs across all Recycling, Resource Recovery and Landfill Diversion projects that can prove significant, measurable, long-term reductions in GHGs.
    Timeframe: Short term/late 2014

11. Regulatory / Statutory

Add Options:

(c) Modify existing MRF and Recycling regulations and policies to incorporate mandatory chain of custody documentation and reporting, enabling LCA of GHGs associated with transport of recyclates to reconstituting/reprocessing facilities.
Timeframe: Short term/late 2013/early 2014

(d) Require "Proof of Completion" according to the encoded pathway of PRC 40180 to claims of Recycling, especially where such activities are to be adopted by Commercial waste generators in compliance with AB 341, and in all cases where state funds support Recycler activities.

(e) Establish process for identifying and vetting recycling pathways utilizing LCA and other established methods, in synchrony with regulations established for identifying and vetting Low Carbon Fuel Standard pathways and recognizing that waste recycling to low carbon fuel is also a recycling mechanism.
Timeframe: Short term/late 2013/early 2014

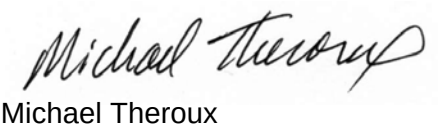
RECOMMENDATIONS

- Review all aspects of the drafts developed for implicit compliance with PRC §40180.
- Determine all recycling pathway elements that currently lack data critical to full LCA and institute programs to ensure adequate, reliable data are generated and reported.
- Remove arbitrary characterizations of recycling pathways, depending solely on methodical application of Best Available Practices for social, environmental, and economic methodologies analyses. Criteria should be performance based rather than prescriptive.
- Initiate changes in statute, regulation, and policy to coincide with above scientifically based approach to Recycling and Resource Recovery.
- Bring Waste Management policies regarding Recycling and Resource Recovery into alignment with encoded Low Carbon Fuel Standard practices of pathway identification, vetting and certification.

Please contact me at (530) 613-1712 or mtheroux@jdmt.net if you have any questions.

Sincerely,

JDMT, Inc



Michael Theroux
Vice President

cc: Teri Wion, CalRecycle, teri.wion@calrecycle.ca.gov
Mei Fong, ARB, sfong@arb.ca.gov
David Mallory, ARB AB 32 Climate Change Scoping Plan, dmallory@arb.ca.gov
M*i*chael Picker, Senior Advisor to Governor Brown, michael.picker@gov.ca.gov