

GREEN PAPER

Proposed Recycling and Waste Diversion Reporting Project Protocol

Greenhouse Gas Emissions Reduction Accounting from Recycling, Composting, and Biomass Feedstock Energy Production

Prepared for: Meeting of the Ad-hoc Recycling and Waste Diversion Reporting Protocol Working Group (Recycling Protocols Group) on January 28, 2008, from 1:00 pm to 3:30 pm, in Cal-EPA Building Room 1810.

Presented to: Climate Action Team Recycling & Waste Management Subgroup as follow-up to the January 14, 2008, meeting, CARB's Economic and Technology Advancement Advisory Committee for comments due by January 18, 2008, and CIWMB's Life Cycle Assessment and Economic Analysis for Organics Stakeholder Meeting on January 28, 2008, and CARB's on-going Scoping Plan meetings.

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Objective: The primary objective is to establish a credible suite of reporting protocols to measure the GHG emission reduction benefits due to recycling, composting, and biomass energy feedstock production to assist local government and businesses in determining their carbon footprint. It would be premature to pre-suppose the amount of potential additionality or potential allocation of carbon credits. However, the process to develop the suite of reporting protocols should be open and transparent to produce protocols that are independently verifiable.

This paper is meant to provide a basis for discussion leading to a Recycling and Waste Diversion Reporting Protocol for submittal to: 1) the California Air Resources Board (CARB), as part of their Scoping Plan process, 2) the Climate Action Team (CAT) Recycling & Waste Management Subgroup, and 3) the California Climate Action Registry (Registry), as an "optional reporting" protocol for California Climate Action

Registry members to inventory greenhouse gas emissions reductions related to recycling, composting, and biomass feedstock energy production to assist cities and counties determine their carbon footprint.

State and Federal Activity:

California Air Resources Board

The California Air Resources Board (CARB) is currently following the Scoping Plan development process and have adopted additional Early Action Measures that includes the development of Recycling Protocols. CARB is supporting Local Government Protocols (I.D. No ARB 2-6) to include recycling as an Early Action Measure, where a recycling protocol would quantify GHG emissions reductions from recycling, composting, and biomass energy feedstock production that may not be fully accounted for under current models and inventories by local government. CARB is also supporting Business Protocols (I.D. No 2-7) to include recycling as an Early Action Measure. The upcoming February 4, 2008, CARB public workshop “Local Action for Climate Change” is a welcome step towards achieving these early actions.

On December 14, 2007, at the CARB Scoping Plan Workshop Series public workshop, there were Sector Presentations for Energy, Transportation, Business and Industry, Forests, Agricultural, and Land Use and Local Initiatives. Scoping Plan Sector Activities include line items for Waste Management/Landfills, focusing on Landfill Methane Control Measures. Since then, however, the Climate Action Team has established the Recycling & Waste Management Subgroup. This is a positive step towards recognition in the Scoping Plan Process that an industry has developed in California, in response to AB 939, that is successful in removing materials from the waste stream upstream of disposal facilities and has the potential to deliver significant greenhouse gas emissions reductions.

The CARB Economic and Technology Advancement Advisory Committee (ETAAC) issued a draft report on December 21, 2007, with comments due on January 18, 2008, for discussion during their meeting on January 25, 2008. ETAAC is recommending that both CARB and CIWMB develop a suite of Emissions Reductions Protocols for Recycling as their first recommendation for the Waste Reduction, Recycling, and Resource Management Sector. As stated in the ETAAC report:

“The development of the appropriate protocols for the recycling sector will results in GHG emission reductions far beyond the limited success available through minimizing fugitive methane emissions from landfills. Recycling itself can truly act as a mitigation measure to reduce GHG emissions across all sectors of the economy.”

Climate Action Team Recycling & Waste Management Subgroup:

The CAT Subgroup met for the first time on January 14, 2008, and is comprised of CARB, CEC, CIWMB, CPUC, DOC, SWRCB, and Cal-EPA staff, and the meeting was attended by many stakeholders. The Open Discussion portion pointed out the need to focus on a suite of protocols to measure GHG reduction benefits for recycling, composting, and biomass feedstock to energy. This Green Paper will be submitted to the CAT Subgroup as a follow-up item, as CARB and CIWMB, being part of the CAT, have been recommended by the ETAAC to develop recycling protocols.

California Climate Action Registry.

The California Climate Action Registry (Registry) is busy with many sector-based protocols, and the Recycling Protocols Group appreciates the November 30, 2007, announcement that they will begin to move forward on the development of a recycling and waste diversion protocol, and that the process could be up to 4 months away.

Federal Bill S. 219 – Recycling Amendment

A friendly recycling amendment by Senator Tom Harper (D-Delaware) to Federal Bill S. 2191 (Lieberman, I-CT), was introduced on December 11, 2007, in the Senate, recognizing the role recycling plays in fighting climate change. The amendment, S. 2191, will set in motion recycling methods that will help reduce, as well as avoid, emissions of greenhouse gases. The amendment, including a life-cycle study on the GHG benefits of recycling, establishing standards and a certification protocol for manufactured products, and providing funding for statewide programs.

Stakeholder and Public Process:

The Recycling Protocols Group will work in concert with the transparent public processes of the CARB, CAT, and the Registry, to enlist a broad based group of stakeholders to consider all options in developing a recycling reporting protocol.

To date, the following has occurred:

- In developing the Landfill Project Reporting Protocol, the Registry anticipated that separate project protocols would be developed in the future to facilitate emission reduction opportunities in the solid waste sector, including composting, anaerobic digestion, recycling and waste to energy. The Registry will soon embark on an effort to develop protocols to quantify and report emissions reductions resulting from those activities.
- Recognition of the previous work by the Federal EPA in developing the WARM model as a guidance methodology, and also the shortcomings of

WARM that further research and analysis will address in the development of adequately refined technical protocols.

- The California Integrated Waste Management Board (CIWMB) is currently funding a study entitled “Life Cycle Assessment and Economic Analysis for Organic Waste Management and Greenhouse Gas Reduction Options”. The first public workshop is scheduled for January 28, 2008.
- Utilizing the lessons learned from current Registry members that have reported emissions related too recycling, composting, and biomass feedstock energy production as “optional reporting” to the Registry.
- Distribution of a draft protocol for quantifying and reporting emissions related to a recycling, composting, and biomass feedstock energy production. The current version of the draft protocol is narrow in focus, and does not delve into conversion technology or alternative fuel production options.
- Creation of a balanced ad-hoc Recycling Protocols Group.

The following initial steps are envisioned in 2008:

- Follow the CARB protocol development framework and the Registry format and transparent public process in the development of Recycling Protocols that are separate from GHG protocols related to waste disposal.
- Initiate dialogue among a balanced ad-hoc Recycling Protocols Group, including manufacturers that utilize recycled materials, local government, environmental organizations, state government, recycling industry, NGOs, city/county trade associations, and composters.
- Continue to participate in the Registry’s public process as an official stakeholder group when the Registry formally begins the process of development of Recycling Protocols.

We understand the limited resources of the Registry and CARB, and at this time only request that the Registry and CARB staff member observe the first couple of meetings, and they will be aptly notified and invited. The Recycling Protocol Working Group will remain ad-hoc until such time that the Registry staff or CARB can formally join the Group and be recognized as having standing with the Registry and/or CARB. Many voices within this ad-hoc Recycling Protocols Group have made it clear that the Registry and CARB staff need to be fully informed and aware of this protocol development, and eventually be formally part of the Group. Meanwhile, all efforts will be made to follow the typical Registry process and the upcoming CARB process.

Protocol Development:

The Registry and the CARB have not yet established a protocol for calculating greenhouse gas (GHG) emissions reductions due to recycling, composting, and combustion of wood waste for energy generation. Recycling reduces the demand for raw or virgin materials, eliminating GHG emissions

associated with mining, transporting and processing virgin materials for use in manufacturing. Manufacturing with recycled materials generally reduces overall energy use and also results in increased carbon sequestration by forests since fewer trees need to be harvested for wood and paper products. Soil application of compost results in increased soil carbon storage, and reduced demand for water, chemical fertilizers and other soil inputs. The largest contributor of GHG emissions from agriculture is nitrous oxide from fertilizer (296 times more potent than carbon dioxide), the need for which can be greatly reduced through compost use. Combustion of waste wood for biomass energy generation offsets the use of fossil fuels.

The CARB has included an analysis in the Early Action Measure for Climate Change Mitigation in California entitled “Guidance and Protocols for Local Governments to Facilitate GHG Emissions Reductions”, which includes strengthening recycling programs as one of several specific recommendations. The CARB has also requested ideas to reduce GHG emissions in their upcoming Scoping Plan, and a recycling reporting protocol could inventory GHG emissions related to recycling and composting that may not be accounted for under current models and inventories by local government. The CARB staff analysis envisions working with a variety of local government associations in developing the guidance documents. Additionally, the CARB has a contract with the Registry to develop a suite of protocols for reporting and certifying GHG emissions reductions for local governments. CARB emphasizes the importance of quantification and verification of emissions reductions, and is establishing a methodology for accruing and using credits associated with net emissions reductions.

The Registry has developed a General Reporting Protocol and additional industry-specific protocols that give guidance on how to inventory GHG emissions for participation in the Registry: what to measure, how to measure, the back-up data required, and certification requirements. When organizations become participants, they agree to register their GHG emissions for all operations in California. The Registry requires the inclusion of all direct and indirect GHG emissions. The Registry also allows for optional reporting for other activities to help describe GHG reduction activities, such as recycling, waste prevention, and composting that have demonstrated GHG reduction benefits, as illustrated in Federal EPA studies.

The Registry has adopted the Landfill Project Reporting Protocols for the Landfill Sector for methane emissions, which are 21 times stronger than CO₂. The Registry recognizes that recycling and composting reporting and protocols should be separate from the Landfill Sector.

Local Government Protocol Needs Assessment:

The Cities for Climate Protection™ (CCP) Campaign assists cities to adopt policies and implement quantifiable measures to reduce local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability. More than 800 local governments participate in the CCP, which is supported by ICLEI—Local Governments for Sustainability, where many of the California cities are members. Large counties from across the country joined the Sierra Club in announcing the creation of the Cool Counties Climate Stabilization Declaration, a major new initiative to combat global warming. The counties pledge to reduce global warming emissions 80 percent by 2050, an achievable average annual reduction of 2 percent. The Cool Counties Climate Stabilization Declaration also urges the federal government to adopt legislation requiring an 80 percent emissions reduction by 2050.

Industry, local government, and the environmental community are clamoring for a recycling and composting reporting protocol to fully recognize the GHG reductions associated with recycling and composting.

Federal EPA Methods:

Current best practice methodology uses EPA's Waste Reduction Model (WARM), which was developed to help solid waste managers evaluate management options with respect to their GHG emissions impact. WARM calculates the emissions impacts of several management options (landfill, recycling, composting, and combustion with energy recovery) for 34 separate categories of waste material. The WARM emission factors are based on an EPA study entitled "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks", originally published in 2002 and now in its 3rd edition (September 2006, EPA530-R-06-004).

WARM calculates and totals GHG emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling. GHG emissions reductions are calculated by comparing the emissions from an alternative scenario with the emissions associated with the baseline scenario. In this way, the reduction in GHG emissions from increasing the recycling rates of various commodities can be determined. Because of the stringent reporting requirements related to solid waste management, the recycling rates can be easily verified.

The WARM model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent (MTCO₂E), and energy units (million BTU) across a wide range of material types commonly found in solid waste. The model uses a life-cycle analysis approach, and is being used by many states to quantify GHG reductions from different solid waste management strategies. The model considers emissions associated with acquisition of raw

materials, emissions during the manufacturing process, and transportation emissions.

The WARM model can serve as the basis for a recycling protocol to assist local government and businesses in determining their carbon footprint. However, it is noted that, like all models, WARM has inherent uncertainties, embedded simplifications, and boundary conditions that limit its accuracy and applicability to all situations. However, in lieu of an alternative, and until more research is completed, WARM remains the best general model available to develop the protocol. When evaluating specific waste streams, there will be material types that do not fit neatly into one of the 34 categories provided in WARM. A standardized accounting approach is necessary, including methods of relating the WARM material types to typical recyclable commodities.

Due to data and resource constraints, the WARM methodology for composting does not account for full life cycle benefits, and this is stated explicitly in the EPA document. In WARM, the only emissions reduction benefits from composting are associated with soil carbon sequestration from the carbon storage capacity of increased soil humus content. The EPA life-cycle report referred to above states that there are additional greenhouse gas benefits related to compost use, such as increased soil water retention resulting in decreased irrigation requirements and energy for pumping water, reduced need for fertilizer, fungicides and pesticides, and the energy to produce these products. However, quantifying these benefits was beyond the scope of the EPA study.

For combustion at waste to energy plants, the EPA life-cycle analysis uses a municipal solid waste mass burn combustion system efficiency and applies this across all waste materials, whereas a waste to energy facility processing specific materials (such as wood chips) may result in significantly different combustion efficiencies.

Composting Life-Cycle Update:

The California Integrated Waste Management Board (CIWMB) is currently funding a study to improve the life-cycle assessment of organic diversion alternatives that result in greenhouse gas emissions reductions (contract awarded to RTI International in May 2007, "Lifecycle Assessment of Organic Diversion Alternatives and Economic Analysis of Greenhouse Gas Reduction Options"). In addition to the well-known organic diversion technologies such as composting, mulch production and biomass energy, the CIWMB study will also look at alternative diversion strategies, such as acid hydrolysis to ethanol, gasification to electricity, anaerobic digestion and processing of food waste into animal feed or fertilizer. The result of the study will be a customized California GHG tool that considers the optimization of GHG emissions reductions, diversion and costs, both statewide and regionally. The protocol developed by the Recycling Protocols Group could be updated for organics at a later date using

the results of this life-cycle study upon its completion, scheduled for January, 2009.

The CIWMB's Life Cycle Assessment and Economic Analysis for Organics Stakeholder Meeting are on January 28, 2008, in the morning, and the first ad-hoc Recycling Protocols Group will be in the afternoon.

Discount Carbon Sequestration in Landfill:

WARM is generally used in a manner that allows waste diversion methodologies (recycling, composting and combustion) to be compared with the alternative scenario of landfilling. However, the policy of the State of California is to reduce and minimize the amount of waste that is landfilled (Assembly Bill 939 (1989), et al). It is a core value of the California Integrated Waste Management Board (CIWMB) that all materials be properly managed in order to minimize the generation of waste (source reduction), maximize the diversion of materials from landfills, and manage all materials to their highest and best use, in accordance with the waste management hierarchy and in support of the California Global Warming Solutions Act of 2006. It is a strategic directive of the CIWMB to assist in the development of viable, sustainable markets to divert materials from landfills and encourage source reduction and recycling. Specifically, the CIWMB intends to reduce the amount of organics in the waste stream by 50% by 2020 (adopted February 13, 2007, CIWMB Board meeting)

WARM is most often used to compare recycling, biomass energy feedstock provision and composting to landfilling as the default management practice. However, WARM gives considerable credit for GHG emissions reductions from placing wood in landfills because its decomposition is inhibited under the anaerobic conditions present in landfills, and consequently, so are methane and CO₂ generation. According to WARM, the best management practice for waste wood is to place it in a landfill with landfill gas recovery, even if the landfill gas is simply flared. The fossil fuel CO₂ emissions avoided by the generation of biomass energy are less than the avoided biogenic CO₂ emissions from landfilling the wood, because fossil fuels are more efficient fuels than wood. This serves to incentivize the burning of fossil fuels over renewable biomass energy, which is not a desired outcome. Therefore, consideration of landfilling as a management alternative that competes with biomass energy is eliminated on policy basis.

With respect to composting, WARM includes only one benefit from compost use; the increase in the soils ability to store compost that is engendered by the application of compost. The technical documentation report for WARM, "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks", (September 2006, EPA530-R-06-004), explicitly states that the life-cycle analysis of composting does not include decreased irrigation requirements and associated energy savings, and reduced demand for chemical

fertilizers, fungicides and pesticides, the production of which results in greenhouse gas emissions. Therefore, the GHG benefits of composting are expected to be conservatively estimated by WARM. However, WARM credits the landfilling of organic materials as a depository of biogenic carbon due to the inhibited decomposition of compostable organic components under anaerobic conditions, with the exception of food waste. As with the biomass energy example, according to WARM, the best management practice for compostable organics, other than food waste, is to place them in a landfill with landfill gas recovery, even if the landfill gas is simply flared. This runs counter to State and Federal integrated waste management policy and ignores the many benefits of compost use that are unrelated to greenhouse gas emissions, such as reduced soil erosion, improved soil quality and decreased eutrophication of water bodies.

The intent of this protocol is to quantify the GHG emissions reductions that occur as a result of recycling materials from the solid waste stream, providing biomass feedstock for energy generation, and/or the provision of compost for soil application. Comparing the recycling, biomass energy and composting scenarios to a landfilling scenario, and reducing their emissions reduction benefits by an amount equal to the storage of biogenic carbon in a landfill, is not appropriate. Landfilling materials that could be recycled, used to offset fossil fuels or composted, rather than disposed in a landfill, is contrary to both State and Federal integrated waste management policy.

For purposes of this protocol, WARM will be used as tool to compute an estimate of the GHG emissions reductions for recycling, furnishing waste wood for biomass energy and producing compost for soil application. It won't be used to compare those emissions to the landfill scenario and subtracting the storage of biogenic carbon in landfills to arrive at a "net" GHG emission reduction relative to the landfill scenario.

Addtionality:

Although the current intention is to simply develop a recycling and composting reporting inventory protocol to assist local government and businesses in determining their carbon footprint, it would be beneficial to provide a framework that corresponds to the requirements of the Registry and the recommendations of the CARB's Market Advisory Committee in the event of future consideration as a candidate for carbon offsets in a "cap and trade" program. Specifically, the following criteria should be addressed in the proposed protocol to assure that reported emissions reductions can be shown to be:

1. Real, and supported by appropriate quantification protocols;
2. Additional, in that they result in greenhouse gas reductions beyond a business as usual approach and are based upon accurate and rigorous baselines with strong monitoring and verification requirements.

3. Independently verifiable as to project performance in terms of emissions reductions, and are easily monitored and verified.
4. Permanent, and backed by guarantees if reversed.
5. Enforceable, and backed by contracts, legal instruments, and official registration requirements that define their creation, provide for transparency and ensure exclusive ownership
6. Transparent, with mechanisms that assure accountability and project rigor.

The Registry strives to support only projects that yield surplus GHG reductions, which are additional to what might otherwise have occurred as also recommended by CARB's Market Advisory Committee. The GHG reductions are above and beyond business-as-usual.

The Registry Project developers satisfy the "additionality" eligibility rule by passing two tests:

1. The Performance Standard Test, and
2. The Regulatory Test

The Performance Standard Test.: Recycling Protocols Group will need to further discuss how the performance test may relate to recycling and composting.

The Regulatory Test. The Registry subjects all greenhouse gas reduction projects to a regulatory test to ensure that the emission reductions achieved would not have occurred in the absence of the project due to federal, state or local regulations. The California Integrated Waste Management Board (CIWMB) as part of the Governor's Climate Action Team (CAT) developed GHG reduction measures to be achieved in the recycling sector by 2020.

As established by the CAT report to the Governor and Legislature dated March, 2006, there are two recycling strategies that will be employed by the CIWMB to achieve the targeted greenhouse gas reduction goals which included increasing recovery of recyclables to achieve the 50% diversion goal as part of AB 939, and implementing additional recycling and other technologies to move towards zero waste. Whereas the 50% diversion goal was achieved with a statewide diversion rate of 54% in 2006, additional recycling beyond 50% was recommended as noted below in part of a CIWMB Staff Report in May 2007.

Zero Waste/High Recycling Strategy:

California has already surpassed the first CIWMB GHG emission reduction strategy of an additional 3 MMTCO₂E per year that was achieved when we reached 50% diversion. Increasing waste diversion from landfills beyond 50% provides additional recovery of recyclable materials from landfills that will further reduce the GHG emissions – directly by re-introducing recyclables with intrinsic energy values back into the manufacturing process, and indirectly by reducing need for virgin

materials extraction and fossil fuel production and the GHG emissions associated with these major activities. The CIWMB GHG emission reduction strategy targets efforts to move towards zero waste through high level recycling and waste prevention which are projected to provide an additional 3 MMTCO₂E by 2020 which equate to 1.65 million tons of recycling material diverted from landfills. There is much opportunity since an estimated 42 million tons of solid waste were disposed of in landfills in 2005 (over 88 million tons generated).ⁱ

The Zero Waste/High Recycling Strategy will target the materials in the disposed waste stream, 70% of which are carbon-based organics. To help determine the best mechanisms to achieve diversion with the greatest GHG reduction possible, CIWMB will focus on opportunities in the organics portion of the waste stream along with recycling and waste prevention opportunities.

The Regulatory Test of meeting existing statutes with 50% landfill diversion has been achieved, and the additional policy goal of record is to divert an additional 1.65 million tons of solid waste by 2020, equating to 3 MMTCO₂E, as adopted by the Climate Action Team and the CIWMB.

The 2008 legislative year could introduce new mandates to increase recycling and the Regulatory Test for “additionality” would need to be discussed as new laws are passed.
