July 18, 2008

Via Electronic Transmission: policy@climateregistry.org
Ms. Rachel Tornek
Senior Policy Manager
California Climate Action Registry

Dear Ms. Tornek:

Thank you for the opportunity to provide comments on the Draft Local Government Operations Protocol (hereinafter referred to as the LGO protocol) for greenhouse gas (GHG) inventorying. Waste Management has operating control of a large number of municipally owned solid waste management facilities across North America that could be affected by this protocol. Additionally, we might be asked to use this or similar protocols under emerging state and federal GHG reporting programs. We therefore have a strong interest in supporting climate change policies and protocols that are based on peer-reviewed science and the state-of-the-art practice for municipal solid waste management.

Waste Management (WM) is the leading provider of comprehensive waste and environmental services in North America. Headquartered in Houston, the company's network of operations includes 354 collection operations, 341 transfer stations, 277 active landfill disposal sites, 16 waste-to-energy plants, 105 recycling facilities, 30 single-stream recycling facilities, 108 landfill gas projects with 10 more slated for construction in 2008, and 6 independent power production plants. Our company is large, and our GHG emission sources are non-homogeneous. As a consequence measuring and reporting our GHG emissions will be a time-consuming and highly complex task, but we have already begun. We are developing the most accurate and reliable tools to collect or calculate our 2009 GHG emissions to be ready for voluntary or required reporting in 2010. We are pleased to share what we are learning with you.

As a general comment, we recommend that the LGO protocol developers narrow the scope of the protocol to address only new information not covered in the TCR General Reporting Protocol, or to clarify those elements pertinent to the particular reporting sector. Further, we recommend that all reporters, whether small or large, private or public, be required to report using the same set or rules with regard to scope of emissions and quality of information.

Chapter 4 Operational Boundaries

WM supports the structure of Scope 1, 2, and 3 emissions as described in Chapter 4 of the protocol as a means to provide consistent accounting of emissions and to avoid double-counting for facilities that are owned by one entity, such as a municipality, but operated by another under a long-term lease agreement. We expect to report direct and indirect emissions from facilities over which we have operating control as a part of our company-wide carbon footprint. Direct and indirect (Scopes 1 & 2) GHG emissions from solid waste facilities that are not owned or operated by local governments but which may provide solid waste services to local governments are appropriately placed in "Scope 3". Emissions from these facilities are most appropriately reported by the entities that exert operational control – which in many cases are not the local government (or governments) that are served by these operations and facilities.

Section 4.6 Biogenic Emissions

WM recommends that the protocol not require reporting of biogenic emissions, but instead, make biogenic emissions reporting optional. International GHG inventory reporting under the protocols established by the UN Intergovernmental Panel on Climate Change (IPCC) and national inventorying in the U.S. Environmental Protection Agency's (EPA) U.S. GHG Inventory has always been on inventorying anthropogenic GHG emissions and sinks. The draft LGO protocol states, "international consensus on the net climate impact from the combustion of these [biogenic] fuel sources has not yet been reached." We recommend that this statement be deleted, as it is incorrect. Both the international and national experts on GHG inventorying (IPCC and EPA) have clearly expressed their views on this topic.

The EPA's 1990-2006 Greenhouse Gas Inventory, which closely follows IPCC guidelines and is annually reviewed approved by IPCC, states, "fuels with biogenic origins are assumed to result in no net CO2 emissions to atmosphere." Furthermore, the IPCC 2006 Guidelines, Chapter 10 on Waste Management states "The CO2 emissions from biomass sources – including the CO2 from landfill gas, the CO2 from composting, and the CO2 from incineration of waste biomass – are not taken into account in GHG inventories as these are covered by [anthropogenic] changes in biomass stocks in the land use and forestry sectors." Therefore, the draft LGO protocol's insistence on reporting biogenic emissions is inconsistent with both IPCC and EPA practices.

Requiring the reporting of biogenic GHG emissions will add significant complexity and work to an already complex and difficult task. To provide some context, reporting of biogenic emissions from the 108 landfills where WM operates landfill gas-to-energy projects, would necessitate reporting CO2 from hundreds of engines and turbines used to combust LFG to produce renewable electricity. We do appreciate and commend the careful discussion in the protocol regarding the need for separate reporting for biogenic and anthropogenic emissions. Nonetheless, we strongly recommend that biogenic emissions reporting be optional only.

Chapter 8 Power Generation Facilities

Chapter 8, relative to power generation facilities, appears to require the use of 40 CFR Part 75 CEMs for calculating annual CO2 mass emissions. WM recommends that Part 75 CEMs not be exclusively used. A large number of waste-to-energy (WTE) facilities, including our own, use 40 CFR Part 60 CEMs and 40 CFR 60 Appendix A EPA test methods, including Method 19, for determining compliance with applicable emissions limits under our Title V permits. These comparable methods should be included as acceptable alternatives for calculating annual CO2 emissions.

Table C.2 on Page 154 includes a default biomass CO2 emission factor for municipal solid waste (MSW). Interestingly, a fossil based default CO2 emission factor is not provided. We recommend that the final protocol should provide default emission factors for both biomass and fossil based CO2 emissions, since the two factors are directly related and derived on the same basis.

We noted that the proposed default MSW biomass CO2 factor is 788.7 kg/ton or 1739 lbs CO2/ton based on a 65 percent biomass carbon fraction. The 65 percent biomass carbon fraction is consistent with the ASTM D-6866 radiocarbon dating results that we, and the waste-to-energy industry have been obtaining and translates directly to a 35 percent fossil based carbon fraction. The default biomass CO2 emission factor used in the draft LGO protocol appears to be based on California MSW specific information retrieved from Energy Information Administration (EIA) Forms EIA-906 and EIA-920 database.

The protocol should provide flexibility to use site-specific or regional data. We recommend that where site-specific or regional data are not available for emissions calculations, that any recommended default emission factor provided in the protocol should be based on national information and not on one state's data. National MSW information from EIA Forms EIA-906 and EIA-920 database provides a MSW HHV of 5000 btu/lb. Using EIA national HHV average, the 40 CFR 60 Appendix A EPA Method 19 CO2 F-Factor of 1820 dscf MMBtu and 65 percent biomass carbon fraction provides a national MSW biomass CO2 emission factor of 614 kg/ton or 1352 lbs/ton and a fossil based CO2 emission factor of 331 kg/ton or 728 lbs/ton.

Chapter 9 Solid Waste Facilities

Section 9.2 Ongoing Research and Development

WM endorses the draft LGO protocol statements regarding lack of a broadly accepted protocol for measuring the methane emissions of landfills and the likelihood that future versions of the protocol will need to change to accommodate ongoing research and field data. However, the LGO protocol can benefit now from work of the solid waste sector to evaluate the peer reviewed literature describing the state-of-the-practice for evaluating the carbon mass balance of MSW. This information can significantly refine the EPA national default factors incorporated in the draft LGO protocol. Waste Management and other landfill operators, with the State of California, and in cooperation with the EPA

Office of Research and Development, are investing significant resources to further refine and improve existing models and develop new ones based on site-specific data.

To voluntarily report methane emissions from landfills to the California Climate Action Registry, the Solid Waste Industry for Climate Solutions (SWICS), of which WM is a member, commissioned SCS Engineers to conduct an in depth review of peer-reviewed literature and make recommendations on refining current landfill emissions models. The protocol, titled *Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills* (SWICS protocol), has been shared with the California Air Resources Board and EPA. It replaces default values for landfill gas collection efficiency and methane oxidation in existing EPA models with ranges, which better account for effects of climate, landfill design and landfill cover types. The SWICS protocol has undergone rigorous review by a team of landfill academicians and practioners, and their recommended revisions incorporated in the final version attached to these comments. The SWICS protocol represents a first step in refining existing EPA models and default values to improve landfill methane estimation. We recommend that the LGO protocol not exclusively use EPA national default values. Public and private entities reporting landfill methane emissions should have the flexibility to use the SWICS protocol, where they can employ more site-specific information to better characterize their landfills in place of national default values.

As a second step, WM is conducting field emissions testing using tunable diode lasers and flux boxes, to measure landfill gas (LFG) emissions under a variety of conditions including: slopes and flat surfaces; daily cover and active working face; intermediate cover; final cover (with and without a geomembrane); and seasonal variations in methane oxidation and capture efficiency. Ultimately, WM hopes to develop a database that describes methane emissions over the range of conditions one finds at both operating and closed landfills using field-validated numbers instead of uncertain models. The three-year testing program, now in its second year, will evaluate a minimum of ten cover types over a minimum of two seasons. Concurrently, WM and other waste sector members have also volunteered sites and are cooperating with research and inventory methods development being conducted by Dr. Jean Bogner for the California Energy Commission. Additionally, WM and Veolia are developing field research for a comparative analysis of several landfill methane estimation techniques (flux box, tracer gas, micrometeorological, plume mapping, DIAL measurements). This research initiative will begin in the last half of 2008 and will conclude in 2009. The EPA's office of Research and Development has expressed strong interest in participating in the research with us.

Finally, researchers at Florida State University working with WM are developing a model to evaluate methane oxidation in landfill cover. The FSU model will represent the physical and chemical processes in cover that control emissions and oxidation. This will provide a tool that will allow the design and operation of landfill cover systems, in concert with gas collection systems, to minimize emissions. It may also prove acceptable for use as an emissions inventory tool in a year or two once field validation is accomplished. A great deal of research is underway or planned for the next two years

that will be enormously valuable to states, EPA, local governments and the waste sector in better understanding the estimation and control of landfill methane emissions.

Section 9.3 Estimation Methodologies

It is essential to recognize that the landfill methane estimation method proposed by the draft LGO protocol is predicated on the idea that we can accurately estimate the amount of landfill gas produced. In fact, there is huge uncertainty in this. So much so that the EPA publication *Emission Factor Documentation For AP-42 Section 2.4 Municipal Solid Waste Landfills* (USEPA 1997) evaluated the "agreement" between predicted and empirical landfill gas generation for 40 landfills. EPA found that the predicted generation rates using the AP-42 first order decay model ranged from as low as 29 percent to as high as 400 percent of the empirical landfill gas generation. This demonstrates the degree of variability and uncertainty that plagues attempts to model landfill methane emissions.

More Flexibility Needed to Determine LFG collection Efficiency

The proposed draft protocol uses a landfill gas collection efficiency of 75 percent that is derived from outdated EPA analyses and for which the technical basis is by no means robust.

According to the EPA's "Compilation of Air Pollutant Emission Factors" (AP-42) (USEPA, 1997), researchers and practitioners estimated collection efficiencies to typically range from 60 to 85 percent. The most commonly assumed default efficiency has been 75 percent although higher efficiencies have been demonstrated at some sites, particularly those engineered to control emissions. Eastern Research Group, Inc. (ERG) conducted a more recent review of information regarding LFG collection efficiency, for EPA in 2002. However, most of the published sources cited by the study were at least 15 years old at the time. Consequently, neither review (particularly AP-42) reflect LFG system operational experience achieved after implementation of EPA's New Source Performance Standards (NSPS; 40 CFR Part 60, Subpart WWW), which by December 1998, required significant performance improvements to meet compliance.

The default 75 percent collection efficiency is not only outdated, but does not take into account the different LFG collection systems that are utilized at landfills. For example, a LFG collection system designed for NSPS compliance is far more capable of higher collection efficiencies than a LFG migration control system. Using a default value of 75 percent for both types of systems makes little sense. A default value or range of values should take into account the type of collection system employed at the landfill and the regulatory requirements or other drivers for installation and operation. These factors are addressed in the SWICS protocol.

LFG system owners and operators believe that collection efficiencies greater than 75 percent are commonly achieved at individual landfills with well designed and operated gas collection and control systems. WM strongly recommends that public and private

landfill operators have the flexibility to use the default 75percent value if they choose, or alternatively, use the default ranges in the SWICS protocol, or provide a site-specific demonstration of LFG collection efficiency.

Methane Oxidation Default Factor is Outdated

EPA's 1997 AP-42 study is the source of the default factor of 10 percent methane oxidation for landfills adopted by EPA as a "conservative approach." This default methane oxidation rate is dated and should be replaced in the draft LGO protocol with methane oxidation ranges updated based on technological advancements in measurement approaches, soil engineering and state-of-the-practice applications in cover design. The SWICS protocol provides an evaluation of 47 determinations of methane oxidation from peer-reviewed literature. Of the 47 determinations evaluated, only 4 oxidation values were less than 10 percent. For differing soil covers, the mean values for percent oxidation ranged from 22 percent in clay to 55 percent in sandy soils.

WM urges the protocol developers to consider the information in the SWICS protocol and allow reporters to use the ranges provided based on landfill cover type and design, rather than the outdated default value of 10 percent.

Carbon Sequestration is an Important Anthropogenic Sink that Must be Included

The LGO protocol should recognize the important role of landfills in sequestering carbon. Because carbon sequestration is an anthropogenic sink, it should be reflected in any estimate of landfill emissions so as to provide a complete, carbon mass balance. Carbon storage, or "sequestration," is important because it removes carbon from the natural carbon cycle indefinitely, reducing net emissions of GHG. The effect of this process on overall U.S. GHG emissions is very significant as it offsets over 50 percent of landfill methane emissions, and exceeds, in absolute magnitude, the emissions from 47 of the 54 source categories in the EPA's U.S. GHG Inventory. Both the IPCC and EPA for national inventories, recognize and account for carbon sequestration of undecomposed wood products, food scraps and yard trimmings disposed of in landfills.

WM urges incorporation of carbon sequestration into the landfill GHG emissions calculation methodology adopted in the LGO protocol. Just as methane oxidation in cover and methane collection and combustion are included in the estimation of landfill emissions, so too should carbon sequestration be an integral component of the landfill mass balance calculations. This will ensure completeness, transparency and consistency with the international and national inventory protocols of both IPCC and the EPA. It will also ensure a complete characterization of all human-related GHG emissions and sinks for landfills.[1]

Subsection 9.1

[1] Freed, R., Shapiro, S. and Hurley, B. ICF International, White Paper: Landfill Carbon Storage and Greenhouse Gas Inventories, October 10, 2007, Prepared for Waste Management

Under step 1, determining the annual waste in place at a landfill, the draft LGO protocol suggests that if information about the opening year of the landfill is not available, the reporter should assume the opening date was 60 years prior to the reporting year. There is no basis for such an assumption provided in the protocol. Further, while no information on the opening year may be available, alternative information that points to a more educated assumption than the arbitrary 60 years should be used by the reporter and allowed under the protocol.

Subsections 9.3.2 & 9.3.3

Equation. 9.1 appears to be in error as written.

CH4 emitted (metric tons CO2E) =
LFG collected x CH4% x {(1 - DE) + [((1 - CE) / CE) x (1 - OX)]} x unit conversion x GWP

It appears that if the order of operations outlined in equation 9.1 is followed, erroneous results will be obtained.

The equation should be written as:

CH4 emitted (metric tons CO2E) =
[[LFG collected x CH4% x (1 - DE)] + [((LFG collected x CH4%)/CE) x [(1 - CE) x (1 - OX)]]] x unit conversion x GWP

Equation 9.2
CH4 emitted (metric tons CO2E) =
LFG collected x CH4% x {(1 - DE) + [((1 - CE) / CE) x (1 - OX)]} x AF x unit conversion x GWP

This equation has the same issue described for Equation 9.1 above. Additionally, it has the problem that it will not calculate emissions from landfills with partial gas collection as intended. This equation indicates that by multiplying the amount of fugitive methane from areas under LFG control, by the fraction of the area of the landfill not under the influence of gas control, the emissions for the total landfill are obtained. This simply does not work. To illustrate, assume a case where 50% of the landfill area is under gas control, therefore AF=0.5, and compare it to a landfill having 100% of the area under gas control, in this instance AF=1. According to this equation, less gas control results in fewer emissions, which makes no sense.

Under Step 2 of Subsection 9.3.2, the LGO protocol should allow other procedures for determining methane content besides those required by a government agency. Continuous monitoring of LFG entering a flare system should be considered, as should other routine measurements. For example, a Title V exempt facility might measure LFG

on a routine basis for other operating reasons. Such data should be acceptable as an alternative to source testing or use of the default 50 percent fraction.

Section 9.4 Composting

WM operates composting facilities. Nonetheless, we are concerned that the proposed LGO protocol has chosen to emphasize GHG emissions from landfills while choosing to ignore GHG emissions from composting operations. Both the IPCC guidelines and the EPA U.S. GHG Inventory now include estimated emissions from composting as part of the waste management inventory. While the methane emissions from composting appear to be relatively small, the N2O emissions are quite a bit larger than those of waste combustion, 1.8 Tq CO2 E compared to 0.4 Tq CO2 E. We believe that the proposed protocol should treat all solid waste management activities with equal objectivity. Only by doing so will local governments be able to make informed decisions about waste management options that can reduce their GHG emissions. We are concerned that the protocol seems to inaccurately characterize landfills with outdated default numbers and failure to incorporate carbon sequestration, while ignoring readily available information about GHG and volatile organic compound emissions from composting operations. This is particularly problematic in light of the work of the IPCC and EPA. To maintain consistency with international and national inventory methods and to improve the scientific rigor and credibility of the LGO protocol, WM urges that composting GHG emissions be addressed in this protocol. We further urge the protocol development group to carefully consider the studies previously submitted by SWICS.

Three studies of emissions from co-composting and green waste only facilities conducted by the South Coast AQMD included a summary of average methane emissions from all three compost facilities:

EKO	2.23 lbs/ton of compost
Inland Empire	0.83 lbs/ton of compost
San Joaquin	33.49 lbs/ton of compost
Average:	12.18 lbs/ton of compost

We appreciate the opportunity to provide you with written comments and concerns and we look forward to continuing to work with you as the draft LGO protocol progresses. In the meantime, if you have any questions please feel free to call me at 202-639-1218 or e-mail me at kkelly5@wm.com.

Sincerely,

Kerry Kelly, Director
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Cc: Reid Harvey
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