SUR Center for the study of Sustainable Use of Resources

Advancing the Goals of Sustainable Waste Management

Summary of the LF-WTE Meeting on Climate Impacts of U.S. Waste Management Industry, Washington, DC, Wednesday, January 28, 2009 (contains all comments and revisions submitted to SUR till March 27, 2009)

Objective: To identify areas of shared interest, agree upon data and information disseminated to the public regarding waste management, and establish better communication between the landfill and waste-to-energy industries, particularly with regard to the greenhouse gas footprint of the U.S. waste management industry.

Reason for meeting

Federal and states legislation and policy on climate change will impact the solid waste industry. Northeastern states have established a cap and trade system under the Regional Greenhouse Gas Initiative (RGGI) and Western states are completing policies and proposing legislation in state houses as part of implementation of the Western Climate Initiative (WCI). Congressional leaders and the Obama Administration have announced their intent to develop federal law governing Climate Change. The waste management industry is taking care of a major and growing environmental problem and has an important role in addressing the issue of greenhouse gas emissions. However, its message requires the communication of complicated estimates, calculations, and policy assumptions to policymakers and lawmakers. Given the complexity of calculations made to quantify the greenhouse gas profile of the solid waste industry, it is important that the industry communicate consistent information to ensure that policymakers understand the issues and make the appropriate policy choices.

Participants: The meeting was attended by representatives of the U.S. landfill and WTE industry and by scientists involved in waste management research. The list of attendees is shown at the end of this report.

Presentations made (all the presentations are attached to this summary)

a) **Methodology for Estimating the Carbon Footprint of Landfills**
   - Standard life-cycle methodology (Morton Barlaz, NCSU and SUR Center)
   - Key input data, description of defaults, and current research (Morton Barlaz)
   - The SWICS protocol and internal efforts at WMI (Roger Green, WMI)
   - Combining information on site-specific landfills in the development of national average estimates (Nickolas Themelis, Columbia U. and SUR Center).

b) Methodology for Estimating the Carbon Footprint of WTE Facilities

- Standard life-cycle methodology (Keith Weitz, RTI)
- Waste-to-Energy Industry Perspective (Brian Bahor, Covanta Energy)

c) New important information: Mr. Gary Crawford of Veolia ES brought to the attention of the meeting the *Protocol for the quantification of greenhouse gases emissions from waste management activities* – 2008 that was developed by Entreprises pour l'Environnement of France (SECHE ENVIRONNEMENT, SUEZ ENVIRONNEMENT and VEOLIA ENVIRONNEMENTAL SERVICES; www.epe-asso.org/ang/5-1.php?id_rap=20).This is a very detailed study that may be used for developing a similar protocol for waste management in the U.S.

Consensus reached

- Development of a consistent message by both landfill and WTE industry spokespeople is most important for the interests of the industry and for furthering the use of best available practices in solid waste management. Representatives of the LF and WTE industries must work cooperatively to explain to policymakers that the avoided emissions associated with energy recovery must be considered as part of a facility's carbon footprint. Also, policymakers are currently debating whether to treat all CO2 equally, thus dismissing the difference between biogenic and anthropogenic carbon emissions. In this way, policies would treat a WTE facility in the same way as a fossil fuel fired power plant. This approach fails to recognize the fact that over 50% of the heat value of MSW is from biogenic sources (i.e., paper, yard waste, food waste) and needs to be changed
- The WTE and landfill industry position should be clear in stating that the waste management industry must not be part of a "cap and trade" system, but, instead, the industry can be regulated directly by EPA and state environmental regulations.
- California is leading efforts on Climate Change and the state's regulations appear to be setting the trend for other states and may significantly influence federal Climate Change law.
- The % recovery of LFG at landfills is site-specific. The range of LFG recoveries expected are shown in Figure 2 (Barlaz presentation) and Figure 5 (Roger Kelly presentation). During the building up of a landfill cell (first two to five years), there is no methane recovery, unless the cell is provided with horizontal pipes for gas collection. After capping, landfills that are provided with a well-maintained gas collection equipment can attain 95% methane.
- On an overall LCA basis, WTE is environmentally preferable to landfilling because it recovers much more energy per ton of MSW from WTE facilities. However, for certain geographic locations, landfilling with gas recovery (LFTGE) can be economically preferable to WTE.
- Morton Barlaz will summarize the findings of all LCA studies reported in the literature on landfilling and WTE disposal of MSW. This report will be reviewed by

Keith Weitz of RTI. and will be circulated to members of the LF-WTE Group by June 2009.

– The participants agreed to continue sharing scientific and policy information regarding GHG emissions and mitigation potential of WTE and landfill facilities. This will be done by means of a mailing list to be maintained by the Center for Sustainable Use of Resources of Columbia University and North Carolina State University (www.SURcenter.org) and by periodic meetings of the LF-WTE group.

Participants:
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Weighted Average Collection Efficiency (%)

		Decay Rate (yr^{-1})				
		0.02	0.04	0.07	0.1	0.15
Year of 95% gas production	Gas Collection Scenario	>100	76	44	31	21.5
Case 1 AP-42	Years 0 – 100: 75%	75	75	75	75	75
Case 2 Phased in collection	Years 1-2: 0% Year 3: 25% Year 4: 50% Years 5-100: 75%	70.9	67.9	63.3	NA	NA
Case 3 Typical operating scenario	Years 1-2: 0% Year 3: 25% Year 4: 50% Years 5-10: 75% Years 11-100: 95% (99%)	86.9 (90.1)	81.5 (84.2)	73.6 (75.7)	NA	NA
Case 4 Worst case NSPS	Years 0 – 5: 0% Years 6 – 100: 75%	67.6	62.5	54.9	NA	NA
Case 5 Bioreactor Typical operation	Years 1-2: 25% Year 3: 35% Year 4: 60% Years 5-10: 75% Years 11-100: 95% (99%)	N/A	N/A	77.2 (79.3)	71.6 (73.2)	64.2 (65.1)

Figure 1.(Barlaz presentation). LFG collection efficiency in landfills provided with LFG collection equipment, under different operating scenarios

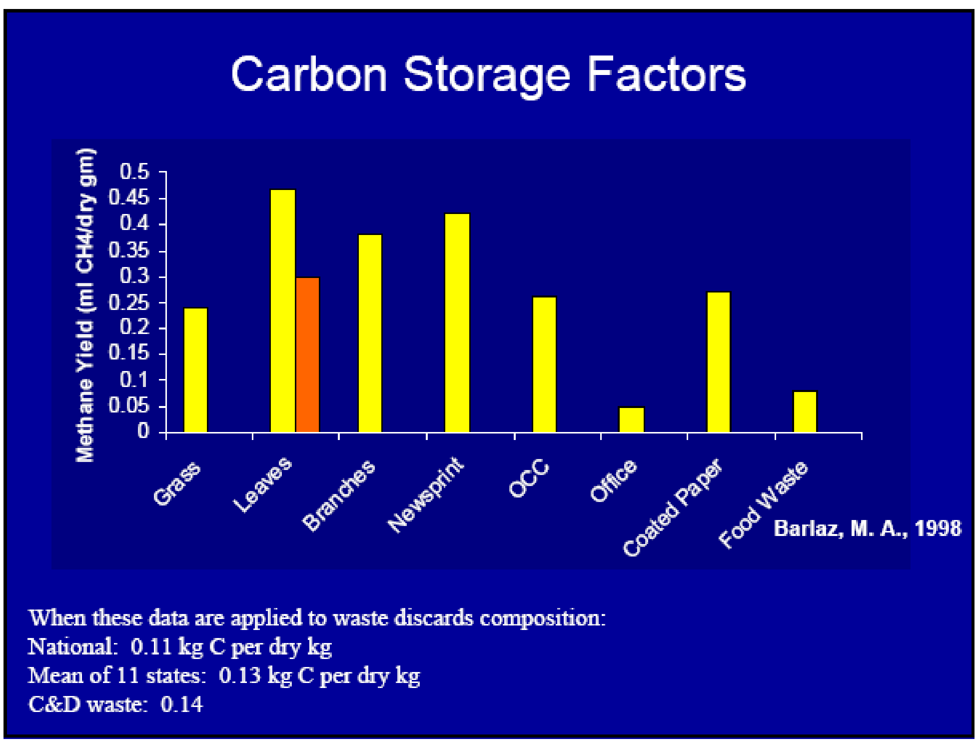

Figure 2 (Barlaz presentation): Carbon storage factors for different components of MSW

SUR Analysis of EPA Database of operating U.S. Landfills

MSW landfilled annually *(1052 landfills)*	MSW landfilled annually in landfills that recover LFG *(376 landfills)*	LFG captured in 2006	Average LFG captured per ton MSW at landfills that recover LFG
189 million tons*	125 million tons	7800 million Nm3	62 Nm3/ton (Nm3: standard cubic meters of LFG)
100%	66%		

*vs 266 million tons landfilled as per BioCycle/Columbia survey[3]

Figure 3 (Themelis presentation): LFG capture at US landfills

Capture and loss of methane from various landfills

for assumed ultimate maximum generation of methane: 70 Nm3/U.S. ton)

Type of Landfill	Nm3 CH4 captured	Nm3 CH4 lost to atmosphere
LF cell capped two years after start up	63	7
LF cell capped five years after start up	53	17
LF cell not provided with LFG capture	0	70

Figure 4 (Themelis presentation): Estimated lifetime LFG capture from landfills with and without LFG capture equipment

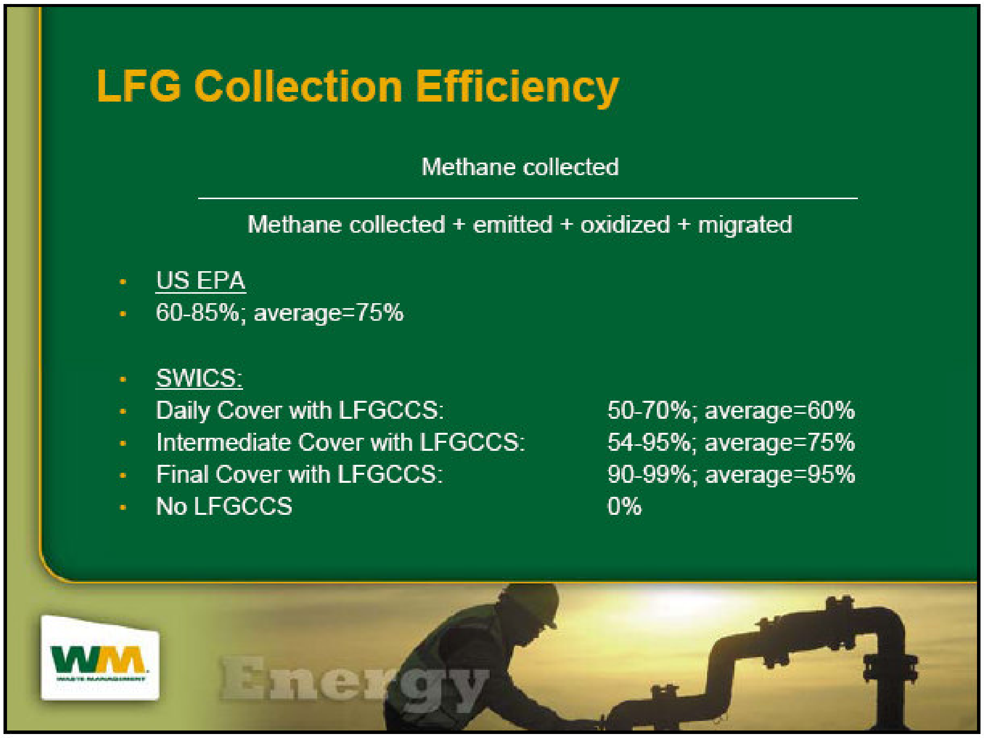

Figure 5 (Roger Green presentation). Estimated LFG recovery at various landfills

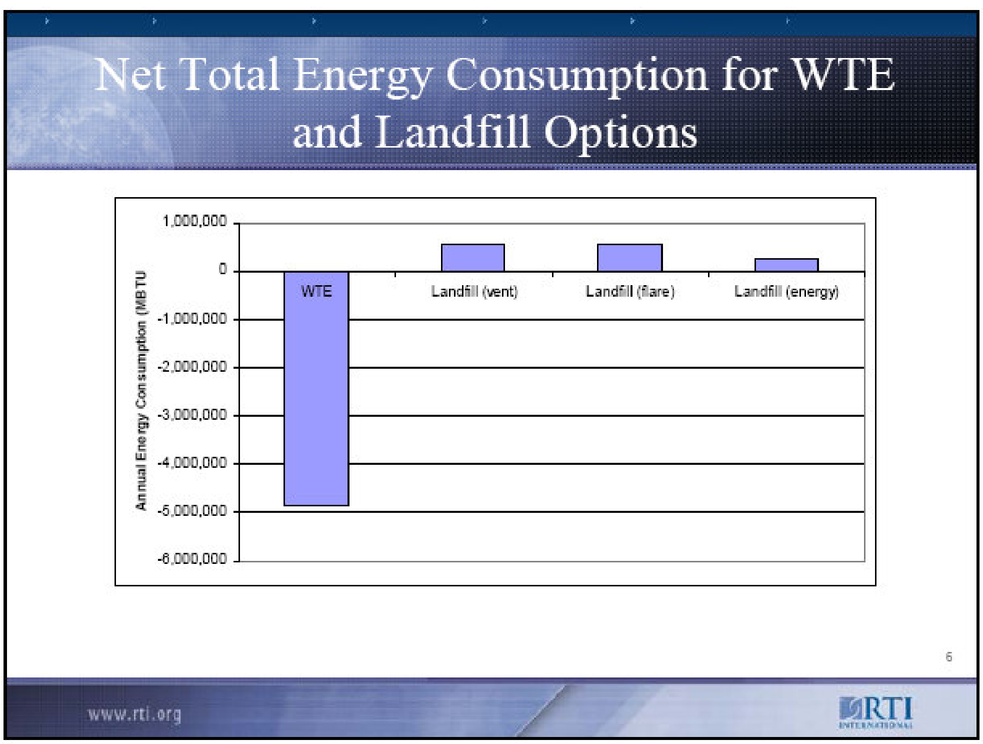

Figure 6 (Keith Weitz presentation). Net total energy consumption for WTE and LF