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Using a Carbon Balance to Estimate Greenhouse Gas Emissions and Mitigation from Municipal Solid Waste Management

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Municipal solid waste (MSW) management is internationally recognized for its potential to be both a source and mitigation technology for greenhouse gas (GHG) emissions. Historically, GHG emission estimates have relied upon quantitative knowledge of various MSW components and their carbon contents, information normally presented in waste characterization studies. Aside from errors associated with such studies, existing data do not reflect changes over time or from location to location and are therefore limited in their utility for estimating GHG emissions and mitigation due to proposed projects. This paper presents an alternative approach to estimate GHG emissions and mitigation using the concept of a carbon balance, where key carbon quantities are determined from operational measurements at modern municipal waste combustors (MWCs).

The proposed approach considers five major MWC and landfill process variables including total carbon in MSW, CO2 from combustion, CO2 and CH4 in landfill gas, landfill gas collection efficiency, and landfill carbon storage. The only variable common to both MWCs and landfills is the total carbon in MSW. A review of the literature did not yield a verifiable reference for total carbon; only selective grab sample data are reported. In order to determine the value(s) of this important parameter, two independent procedures were used, 1) the higher heating value of MSW was determined using a derivation of ASME Performance Test Code 4 and the Boie formula was then used to define a corresponding range of carbon content, and 2) certified continuous stack emission monitoring data was used to quantify annual CO2 emissions from a known quantity of waste. The biogenic/non-biogenic split of stack CO2 was determined in accordance with ASTM –D6866.

The results of the carbon mass balance were used as input to the Municipal Solid Waste Decision Support Tool (DST) developed by the U.S. Environmental Protection Agency (USEPA) and RTI to yield a lifecycle assessment and comparison of MSW management options in the U.S. The results of the study show that the MWC scenario significantly

outperforms every landfill scenario on an environmental basis for GHG emissions, regardless of the landfill gas management technique and collection efficiency.

Biography:
Brian Bahor has 28 years of experience in the environmental engineering industry and is presently the VP of Sustainability at Covanta Energy Corporation. His education includes a Bachelors of Science Degree in Environmental Engineering from The Pennsylvania State University, a Graduate Certificate in Environmental Process Engineering and Master of Science in Technology Management from Stevens Institute of Technology.

Mr. Weitz is an Environmental Scientist in RTI International's Environmental Engineering group. With RTI in 1992, he specializes in sustainable environmental solutions by helping public and private clients achieve environmental goals through interdisciplinary research, interactive tools, and conceptual frameworks and analytic methods. Mr. Weitz's current work areas include municipal solid waste management, global climate change, integrated (economic, environmental, social/institutional) technology assessment, and life cycle assessment. Mr. Weitz holds a Master of Environmental Management from Duke University (1992) and a B.A. in Economics and Business Administration from Augustana College (1990).

Andrew Szurgot has over 30 years in waste and energy businesses and is the Principal of Stratosphere, LLC an environmental management consulting firm. He has held safety and environmental management positions with three leading WTE companies. His education includes a B.S. from Purdue University in Civil Engineering and a Master of Science degree from the University of Illinois in Environmental Engineering.