Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions 2005 Update

Summary

As policy makers seek to reduce greenhouse gas (GHG) emissions, many in Canada and elsewhere have found that waste-related mitigation opportunities are both significant and cost-effective. Several analyses at the local and national scales have suggested that potential reductions are on the same scale as energy efficiency and electricity repowering. To better evaluate these opportunities, emission factors are needed for key materials and waste management techniques.

The report Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions - 2005 Update, prepared by ICF Consulting and presented by Environment Canada and Natural Resources Canada, represents the culmination of a series of projects to develop and refine life-cycle GHG emission factors for specific materials commonly occurring in the Canadian residential and industrial, commercial, and institutional (ICI) waste streams.

This report reflects efforts to improve the modeling of paper recycling by simulating open loop recycling – i.e., where the second generation products differ from the product being recycled – for each of the paper grades. Previously, it was assumed that all recycling was "closed loop" (e.g., newsprint is recycled and made into more newsprint). Open loops are also assumed for electronics and white goods. The emission factors provided in this report also reflect updates to the data used to calculate emissions from electricity use.

Emission factors, in tonnes of eCO2 per tonne of waste, for each of the waste management methods and material types studied are shown in Exhibit ES-1. Negative numbers represent GHG reductions, while positive numbers are GHG contributions. ICF recommends that carbon sequestration be included in the calculations, to provide a holistic perspective on net GHG emissions.

In these tables, the landfilling emission factors are based on national average conditions in terms of landfill gas collection and use for energy recovery. That is, 63 percent of landfilled waste is assumed to be disposed in landfills without gas recovery, 15 percent is destined for landfills that collect and flare the gas, and 23 percent is destined for landfills that use the gas for energy recovery. The assumptions on landfill gas affect the emission factors only for forest products and organics.

In general, the results show that source reduction and recycling both reduce GHG emissions relative to landfilling. The emission reductions, per tonne of material, are quite significant in some cases.

More broadly, users of the emission factors should beware that they incorporate many limitations and carry considerable uncertainty. Although the analysis is based on the best available data we could collect within the time and resource constraints of the project, and the assumptions are believed to be reasonable, the accuracy of the analysis is limited by the use of these assumptions and limitations in the data sources. Where possible, the emission factors reported here can be improved by substituting process- or site-specific data to increase the accuracy of the estimates.

Despite the uncertainty in the emission factors, they provide a reasonable first approximation of the GHG impacts of solid waste management, and we believe that they provide a sound basis for evaluating voluntary actions to reduce GHG emissions in the waste management arena.

Exhibit ES-1. GHG Emissions from MSW Management Options, with Carbon Sequestration (tonnes eCO_2/tonne)

Material	Net Source Reduction Emissions	Net Recycling Emissions	Net Composting Emissions	Net Anaerobic Digestion Emissions	Net Combustion Emissions	Net Landfilling Emissions (NLE) - National Average	NLE Without Landfill Gas (LFG) Collection	NLE With LFG Collection and Flaring	NLE With LFG Collection and Energy Recovery
Newsprint	(3.81)	(2.81)	NA	(0.49)	(0.05)	(1.22)	(1.13)	(1.36)	(1.36)
Fine Paper	(5.93)	(3.33)	NA	(0.34)	(0.04)	1.18	1.71	0.31	0.28
Cardboard	(5.22)	(3.34)	NA	(0.32)	(0.04)	0.29	0.75	(0.48)	(0.51)
Other Paper	(5.51)	(3.36)	NA	(0.23)	(0.04)	0.71	1.19	(0.07)	(0.10)
Aluminum	(4.55)	(6.49)	NA	0.01	0.01	0.01	0.01	0.01	0.01
Steel	(1.95)	(1.15)	NA	0.01	(0.99)	0.01	0.01	0.01	0.01
Copper Wire	(6.26)	(4.10)	NA	0.01	0.01	0.01	0.01	0.01	0.01
Glass	(0.40)	(0.10)	NA	0.01	0.01	0.01	0.01	0.01	0.01
HDPE	(2.74)	(2.27)	NA	0.01	2.85	0.01	0.01	0.01	0.01
PET	(3.50)	(3.63)	NA	0.01	2.13	0.01	0.01	0.01	0.01
Other Plastic	(3.01)	(1.80)	NA	0.01	2.63	0.01	0.01	0.01	0.01
Food Scraps	NA	NA	(0.24)	(0.10)	0.02	0.80	1.14	0.23	0.21
Yard Trimmings	NA	NA	(0.24)	(0.15)	0.01	(0.33)	(0.17)	(0.60)	(0.61)
White Goods	NA	(1.44)	NA	0.01	(0.24)	0.01	0.01	0.01	0.01
Personal Computers	NA	(1.59)	NA	0.01	0.41	0.01	0.01	0.01	0.01
Televisions	NA	(0.22)	NA	0.01	0.74	0.01	0.01	0.01	0.01
Microwaves	NA	(1.24)	NA	0.01	(0.52)	0.01	0.01	0.01	0.01
VCRs	NA	(0.94)	NA	0.01	0.16	0.01	0.01	0.01	0.01
Tires	NA	(3.29)	NA	0.01	(0.49)	0.01	0.01	0.01	0.01

*The values shown for national average landfills are based on estimates of national average landfill gas collection and utilization rates.