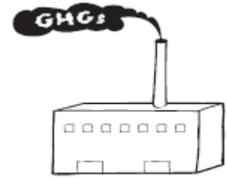


# ENVIRONMENTAL FOOTPRINT COMPARISON TOOL

A tool for understanding environmental decisions related to the pulp and paper industry



GREENHOUSE GASES

## EFFECTS OF RECYCLED FIBER USE ON GREENHOUSE GAS EMISSIONS

### Methane Emissions from Landfills

When used forest products are disposed of in landfills, they may decompose into carbon dioxide and methane. Because the decomposing forest products are biomass-based, the carbon dioxide is considered carbon neutral. Methane, however, is not considered carbon neutral because the carbon in methane is returned to the atmosphere in a much more potent form (i.e., in methane) than it was removed from the atmosphere (i.e., in carbon dioxide). On a pound for pound basis, methane is more than twenty times more potent than carbon dioxide in terms of its global warming potential. In cases where used forest products are landfilled, landfill GHG emissions are an important part of the value chain GHG profile. Some global estimates have found these emissions to be almost as important as the industry's GHG emissions from fossil fuel combustion (IIED 1996).

When paper is recycled instead of landfilled, methane emissions are avoided because, on an annual basis, less fiber goes to end of life than would have been the case had the fiber not been recycled. Estimating the avoided emissions, however, requires a great deal of information, much of which is site-specific and most of which is uncertain. Methane releases are primarily a function of (a) the type of paper or paperboard, (b) the design of the landfill as regards moisture and nutrient control, and (c) the efficiency of systems (if any) put in place to capture methane before it escapes to the atmosphere.

One of the most thorough North American studies of the effects of recycling on landfill emissions was a report titled *Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste*, first published by USEPA in 1998 and updated in 2002 and 2006. The current version exists as a series of documentation chapters to the agency's *Waste Reduction Model (WARM)*, available on the internet (USEPA 2012). The estimated impacts of landfilling on methane emissions for specific types of products, drawn from this documentation, are shown below (USEPA 2012).

Table R10.

Product	Methane generated* (metric tonnes of CO <sub>2</sub> equivalents) per Wet Short Ton of Material Landfilled	Methane Emitted (metric tonnes CO <sub>2</sub> equivalents) per Wet Short Ton of Material Landfilled**
Corrugated containers	2.52	0.82
Magazines/Third class mail	1.02	0.35
Newspaper	0.90	0.32
Office Paper	4.26	1.43
Phonebooks	0.90	0.32
Textbooks	4.26	1.43

\*Quantities pertain to methane generation and do not reflect oxidation that naturally occurs near the surface nor in capture/destruction systems.

\*\*Based on "typical" landfill gas collection practices and after assuming 10% of uncollected methane oxidizes naturally.

## Effects of Recycled Fiber Use on Greenhouse Gas Emissions

### *Methane Emissions from Landfills*

Comparing these numbers with the landfill carbon sequestration numbers shown elsewhere in this Tool, one finds that the potential detrimental effect of methane emissions is larger than the potential positive effect of carbon sequestration in landfills for paper and paperboard products made from bleached chemical pulps (e.g., office paper and textbooks). Other grades contain sufficient lignin, which does not degrade in landfills and which also helps inhibit the degradation of the cellulose, to serve as a net sink of carbon. As a result, landfilling grades other than bleached chemical pulp can actually have a positive impact on atmospheric CO<sub>2</sub> levels (due to carbon sequestration in the landfill) when you consider only the emissions associated with end-of-life management. This is not a complete picture, however, since it ignores the many other implications of landfilling instead of recycling or burning for energy.

## References

- International Institute for Environment and Development (IIED). 1996. *A changing future for paper*. Prepared for the World Business Council for Sustainable Development. Summary at <http://www.wbcasd.org/Pages/EDocument/EDocumentDetails.aspx?ID=119&NoSearchContextKey=true>
- United States Environmental Protection Agency (USEPA). 2012. *Waste Reduction Model (WARM) Version 12*. February 2012. Washington, DC: United States Environmental Protection Agency. <http://www.epa.gov/climatechange/waste/SWMSGHGreport.html>