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# 2020 LIFE CYCLE ASSESSMENT OF U.S. AVERAGE CORRUGATED PRODUCT

## *EXECUTIVE SUMMARY*

**Prepared for:**

Corrugated Packaging Alliance (CPA)
A joint venture of
American Forest & Paper Association (AF&PA)
Fibre Box Association (FBA)
AICC, The Independent Packaging Association (AICC)
TAPPI


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The Corrugated Packaging Industry has completed a Life Cycle Assessment (LCA) to determine the impact of corrugated boxes on the environment. An LCA is a globally accepted tool used to estimate impacts to land, air, and water based upon raw material extraction from the earth, manufacturing of those materials into products, the distribution and use of the products, and product end-of-life. In this study, processes used to manufacture corrugated products in 2020 were analyzed including managed forests, paper mills, converting plants, recycling centers, and disposal. The results were compared to previous LCAs representing operations from 2006, 2010, and 2014.

The study evaluated the environmental performance of a US industry-average corrugated product throughout its entire life cycle and was based on information from containerboard mills representing 69% of 2020 US containerboard production, as well as converting facilities representing 57% of 2020 US corrugated shipments. The life cycle assessment considers stages for the production of containerboard from pulp and papermaking operations, to converting, to use of the product and finally to end-of-life management.

The life cycle assessment was performed by Anthesis and NCASI and has been peer reviewed by The Athena Institute. The LCA conforms to all principles described in the ISO 14040/14044[1] Standards for a publicly disclosed life cycle assessment study.

Overall, the corrugated packaging industry has substantially reduced its impact on the environment since 2006. During this period, the greenhouse gas (GHG) emissions indicator has been reduced by almost 50%. In parallel, other indicators have also been substantially reduced: ozone depletion by 13%, smog by 44%, acid rain by 41%, eutrophication by 30%, respiratory effects by 54%, energy usage by 13%, and water usage by 18%. The only indicator that has increased over this period is fossil fuel extraction, which measures the energy required to extract fossil fuels from the earth. While the corrugated packaging industry has made significant strides in replacing oil and coal with cleaner-burning natural gas, the extraction of natural gas requires more energy than oil and coal.

Playing a key role in the LCA is the removal of carbon dioxide ($CO_2$) from the atmosphere resulting from well-managed forests in the United States used to supply wood fiber to the containerboard mills. In addition, the industry recycled 90.5% of old corrugated containers (OCC), keeping these old boxes out of the landfill and reducing both carbon dioxide and methane from being released into the atmosphere. The corrugated packaging industry has committed to continued reductions in its impact on the environment as part of the paper industry's ***Better Practices, Better Planet 2030*** **Sustainability Goals**.
(https://www.afandpa.org/2030)

[1] International Standards Organization (ISO) 14040:2006 Environmental management — Life cycle assessment — Principles and framework. ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines

## Industry Average Results – 2020 versus 2014

### Greenhouse Gases (GHGs)

The cradle to grave GHG profile is provided in Table 1. There has been a 20.5% reduction in GHGs from 0.52 to 0.41 kg $CO_2e$ per metric ton of corrugated product between 2014 and 2020. Carbon dioxide removals, primarily from trees grown to produce containerboard, are equivalent to 83% of all 2020 emissions. The recovery rate for OCC has increased from 89.5% in 2014 to 90.5% in 2020, leading to reduced carbon dioxide and methane emissions resulting from fewer boxes ending up in the landfill. Emissions attributed to purchased electricity for pulp and papermaking and converting have decreased by 38% due to increased usage of the greener US electrical grid between 2014 and 2020 and reduced electricity purchases.

*Table 1. Cradle to grave greenhouse gas profile for US containerboard. All units kg $CO_2e$ per metric ton of containerboard product*

| Biogenic $CO_2$ | $CO_2$ Removals | All Other GHG Emissions | Total |
|---|---|---|---|
| 1.12 | -2.07 | 1.36 | 0.41 |

### Air related indicators

The respiratory effects indicator was reduced by 26% between 2014 and 2020 primarily due to the reduction of emissions of $SO_2$ and particulates from containerboard mills. Increased usage of clean-burning natural gas in the fuel mix and less combustion of other fossil fuels was the driver for the reductions. The smog and acidification results showed reductions of 27% and 26.7%, respectively, between 2014 and 2020. There was no meaningful change in the ozone depletion indicator between 2014 and 2020.

### Water related indicators

There was no meaningful change in water usage or water consumption[2] between 2014 and 2020. There was no substantial change in the eutrophication indicator between 2014 and 2020.

### 100% Recycled vs. Industry Average

The improvements seen in the 2020 industry average LCA is attributable to several key factors which include the shift from coal and oil to cleaner-burning natural gas for energy generation, increasing the usage of the greener electrical grid, improvements in energy efficiency at production facilities and the high industry recycling rate. The introduction of fresh[3] fiber into the system drives the removal calculations of $CO_2$ from the atmosphere, while the use of OCC in recycled-content board contributes to the avoidance of $CO_2$ and methane from the landfill. Looking at either stream of production in isolation has advantages and disadvantages, while the

[2] Water consumption: The portion of water removed from a water source that is not immediately returned to the water source. Examples of consumptive water losses that contribute to water consumption include evaporative losses and water leaving with product and solid residuals.

[3] Fresh fiber: Fresh, new, and virgin are common terms used to describe the first-time use of fiber into the system.

combination of new, fresh fibers and recycled fibers maximizes fiber reuse and enables circularity. When comparing 100 percent recycled-content product with the industry average product using the cut-off method, all impact indicators are equal to or favorable to the environment, except for GHG emissions. These better-than-average indicators help drive the improvements in land, air, and water impact categories for the entire industry.