

**BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH AT NEW DELHI
Original Application No. 15 of 2014**

In the matter of:

Him Jagriti Uttaranchal Welfare Society ...Applicant
Versus
Union of India & Ors. ...Respondents

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Through,


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Date: 09.09.2020

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH AT NEW DELHI
ORIGINAL APPLICATION NO.15 OF 2014**

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Vs.

Union of India & Ors. ...Respondents

Submission on behalf of Respondent No. 6 in response to the Applicant's Reply to the Report dated 15.2.2020 of the Expert Committee constituted by this Hon'ble Tribunal

1. We are filing this Submission on behalf of Respondent No. 6 ("**Tetra Pak**," for ease of reference) in response to the Reply filed by the Applicant to the Report dated 15.2.2020 of the Expert Committee constituted by this Hon'ble Tribunal ("**Applicant's Reply**"). In this context, the Reply dated 18.07.2014, further Affidavit dated 06.05.2015, the Written Submissions dated 09.09.2015 and the Note dated 19.1.2019 filed by Respondent No. 6 may be treated as part and parcel of the present Submission.
2. Tetra Pak is an industry leader in food processing and packaging solutions, having conducted operations in India for nearly 35 years, with a global history spanning 60 years. Tetra Pak works in partnership with leading food and beverage corporations like GMMFL (Amul), Parle Agro, Dabur Foods, Mother Dairy, Verka Dairy, Karnataka Milk Federation, CavinKare, Britannia, Mahanand Dairy, Nestlé (and many more). In this way, Tetra Pak plays a key role to make food safe through its aseptic processing solutions and to keep food safe through its pioneering aseptic (paper-based) packaging technology. Tetra Pak's aseptic technology thus enables producers of milk, juice and other products to offer the benefits of paper-based carton packaging across India and in export markets, without the need for preservatives or a cold chain. Tetra Pak's commitment to "make food safe and

available, everywhere” aligns with the Indian nation’s need to ensure food security and accessibility.

3. Given this unique set of benefits, Tetra Pak’s paper-based aseptic carton technology was named the most important food science innovation and invention of the 20th century by the US-based Institute of Food Technologists, a food-science think tank. Given the absence of a developed cold chain for food storage and transportation in India, paper-based aseptic carton technology enables the packaging, storage and delivery of food safely and cost-effectively to consumers across the nation, including distribution to its most remote regions.
4. Tetra Pak has for many decades and since its entry into the Indian market complied with all applicable (a) health and food safety standards and (b) environmental requirements as prescribed by the Indian authorities. India is entirely in step with modern health and food safety legislation. The laws of India permit the nation to benefit from the finest packaging technology available globally. Tetra Pak humbly submits that the proceedings before this Hon’ble Tribunal have only served to reaffirm that Tetra Pak’s paper-based aseptic carton technology has earned, and continues to earn, the privilege of serving the Indian consumer based on its numerous indispensable features and benefits and longstanding legal compliance in both food safety and environmental realms. In sum, Tetra Pak continues to satisfy not only Indian laws and regulations but also those of all other countries where Tetra Pak operates around the globe.
5. The drafters of the Expert Committee Report dated 30th August 2019 (“**Expert Committee Report**”) went beyond merely recognizing paper-based cartons such as Tetra Pak cartons as a lawful packaging format. Indeed, the esteemed experts counselled in favour of the *expanded use* of paper-based cartons to include water applications (as further addressed below). The Expert Committee Report specifically cited the advantageous lower-plastic footprint of paper-based carton packaging.

6. To assist the Expert Committee, Tetra Pak supplied all relevant information to evidence the compliance of Tetra Pak's paper-based carton packaging with stringent international leading food safety standards. This included both the EU standards and those of the US FDA, as well as the Indian standard (BIS - IS 10146) governing the use of food-grade plastic material (polyethylene) for all food and beverage categories.
7. The leading authorities across the globe have evaluated polyethylene and deemed it safe in food-contact applications subject to migration and other use limitations as set by the relevant regulations. Meeting these migration and other limitations ensures that the polyethylene used for food contact is safe and adequate for its intended use. Tetra Pak's aseptic carton, which uses a food-contact polyethylene layer, undoubtedly satisfies these requirements, as Indian, US FDA and EU testing have established countless times in support of the use of Tetra Pak's products. This should be enough to dismiss the "leaching," migration, and other claims that form the heart of Applicant's Reply.
8. To recapitulate the current context and timeline, there is nothing novel in Applicant's reply. Applicant continues to attest to a concern about public health due to the use of polyethylene plastic present in PET bottles and in the food-contact layer of Tetra Pak carton packages. Applicant claims again that the presence of heavy metals like antimony and plasticizers like DEHP in these packaging formats exceeds the limits that Applicant claims are proper, causing harmful "leaching" of these substances into the edible contents. Tetra Pak, supported by research by preeminent Indian and international scientists (provided herein), disputes both (a) the validity of Applicant's purported evidence, and (b) the validity of Applicant's conclusions that the Expert Committee did not fulfil its mandate to set proper migration limits because it did not accept Applicant's recommendations in their entirety. The Expert Committee did adopt in principle the Applicant's recommendation that the authorities should introduce the migration limits for antimony and DEHP. However, the Applicant now claims that the Expert Committee did not conduct

proper due diligence and must have failed even to consider Applicant's evidence. Tetra Pak submits that Applicant's conclusion is unfair and illogical since the Expert Committee clearly availed itself of Applicant's recommendations to a limited extent. Nevertheless, Applicant takes the position that the new FSSAI migration limits for antimony and DEHP are arbitrary, and should be far more stringent (indeed, some five times more stringent) than any limits currently imposed anywhere in the world. It is reasonable to deduce that in recommending that the FSSAI adopt the chosen migration limits for antimony and DEHP for India, the Expert Committee relied on scientific knowledge and testing that it simply deemed more credible than Applicant's evidence. Applicant also takes the position that the Expert Committee's recognition that Tetra Pak carton packaging is predominantly paper-based must mean that the Expert Committee failed to fully appreciate that Tetra Pak's carton packaging includes a food contact polyethylene layer. Tetra Pak respectfully submits that all parties are well-aware of six-layer construction of Tetra Pak packaging.

More troubling still is the misleading nature of Applicant's evidence itself. In support of the above allegations, the Applicant submits misleading test reports claiming to show excessive migration of antimony, lead and DEHP in connection with Tetra Pak carton packages. But as explained herein, the results indicate that Applicant's testing lab does not even appear to have tested Tetra Pak carton packages. As further explained below, Applicant's testing should be set aside in favor of the abundance of credible testing results provided by Tetra Pak which for years has demonstrated the safety of Tetra Pak packaging both in India, USA and EU.

9. Tetra Pak applies the same exacting food safety standards as part of its global product specifications across all of its 33 packaging material manufacturing facilities globally (including one award-winning state-of-the-art factory at Chakan, India), which serve more than 175 countries. In brief, Tetra Pak's products meet the leading international and Indian regulations governing food contact materials designed to

protect public health. Thus, the primary laws dealing with food safety and packaging in USA, EU, and India permit the use of Tetra Pak's paper-based packaging. There is simply no health concern around the use of Tetra Pak packaging for food and beverages (including alcoholic beverages). The health claims in Applicant's Reply thus fail resoundingly on this basis.

10. As this Hon'ble Tribunal ordered, the Expert Committee consisted of respected experts from various relevant fields. As directed, these experts prepared the Expert Committee Report based on their expertise, as well as in consultation with industry experts. Applicant makes the false and frankly baffling allegation that the Expert Committee failed to address Applicant's concerns. In fact, just as the Applicant proposed, the Expert Committee recommended a review of the limits of heavy metals in PET in order to fix specific migration limits for Antimony and DEHP. Accordingly, the FSSAI subsequently issued directions under Section 16(5) of Food Safety & Standards Act 2006 dated 7 February 2020, regarding operationalisation of Food Safety and Standards (Packaging) Amendment Regulations 2020 relating to Specific Migration limits of Antimony and DEHP and Packaging of Drinking Water. Thus, there is no doubt that the Expert Committee fulfilled this Hon'ble Tribunal's mandate.
11. Applicant continues to rely on a strategy of switching points of attack, alternating between health and environment claims to suit its frivolous purposes and prolong this proceeding. When Applicant's health-related evidence is exposed as weak, Applicant introduces fresh but equally specious arguments relating to the environment. Applicant's Reply has now yet again refocused on unsubstantiated health and safety allegations.
12. Though environmental matters have once again taken a backseat in Applicant's Reply, Tetra Pak recapitulates below for good order that Tetra Pak carton packaging is a paper-based, responsibly manufactured product, which is fully recyclable and increasingly being recycled in India.

13. The Expert Committee submitted its report based on this Hon'ble Tribunal's Order of 31 May 2019 directing the FSSAI to assemble an Expert Committee comprising representatives of the FSSAI, BIS, CPCB and DGHS. Once formed, the Expert Committee fully complied with this Tribunal's directions to consider whether the Indian authorities should impose yet more restrictions on the use of plastic in connection with food and beverage packaging, and to seek the guidance of any expert/institute or individuals as needed to reach definitive conclusions. The Expert Committee then timely furnished its report within three months by e-mail (to judicial-ngt@gov.in) as required.
14. This Hon'ble Tribunal, in its order dated 14 October 2019, subsequently directed the FSSAI, BIS, CPCB, DGHS and MoEF & CC to review the duly submitted Expert Report and within three months to confirm their actions taken in response to these findings by e-mail (again, to judicial-ngt@gov.in) prior to the date of the next hearing on 17th February 2020. Accordingly, the named Government bodies coordinated to produce a detailed Action Taken Report of MoEF & CC based on the Report of the Board of Experts Committee on NGT Order ("**Action Taken Report**"), which included preparation of a concept note addressing: plastic footprint issues; encouraging alternatives to plastic packaging; effective Extended Producers Responsibility frameworks; bans on single-use plastic items; development and establishment of segregation infrastructure; collection, storage, transportation, processing and disposal of plastic waste; amendments to FSSAI regulation introducing specific migration limits for Antimony and DEHP; publishing of new standards by BIS for paper-based carton packaging for liquid food, which may be used as alternatives to plastic; compostable plastic bottles; and amendments to the standards pertaining to packaged drinking water.
15. Since the inception of this matter, Applicant has made unsupported claims against the safety and environmental credentials of Tetra Pak's acclaimed paper-based aseptic carton technology. Unsurprisingly, the Expert Committee rejected Applicant's proposals rooted in these baseless claims. The esteemed Expert

Committee instead recommended that the Indian nation continue to use paper-based carton packages such as Tetra Pak packages based on these well-established environmental and food safety credentials. Specifically, point 4 of the Expert Committee Report called “Encourage Alternatives to Plastics” counsels the use of: *“Existing packaging systems of paper based cartons with minimal plastics as coatings, composite and reusable containers made up of glass, tin, metal and paper may be promoted as replacements.”*

16. Having benefitted fully from the abiding fairness of this Hon’ble Tribunal in offering the parties many opportunities to be heard, Applicant has no credible avenues remaining to overcome the unbiased scientific findings in the Expert Report. Applicant’s Reply amounts to a last-gasp attempt to breathe life into this matter yet again through sharp tactics.
17. Applicant’s Reply is also designed to mislead this Hon’ble Tribunal on matters of basic evidence. Astonishingly, Applicant falsely claims that it tested certain *specific products packaged in Tetra Pak carton*, even listing those products by brand name and manufacturer. But in fact, Applicant never conducted such testing on these particular products.
 - A. On page 7318 of the Applicant’s Reply, Applicant references certain products packaged in Tetra Pak paper-based aseptic carton; namely: Original Choice liquor, Old Tavern Whiskey, Tropicana Mixed Fruit Delight and Frooti. Applicant places the word “Tetra” [sic] within parentheses next to each of these products:

Product	Storage Temp.	Antimony	Lead	DEHP
Safety Limits	(All in mg/L)	0.005	0.01	0.006
Source		IS: 13428: 2005	IS: 13428: 2005	US - EPA
Original Choice Liquor (Tetra)	RT	0.021	0.008	0.011
	40°C	0.025	0.011	0.018
	60°C	0.042	0.021	0.022
Old Tavern Whiskey (Tetra)	RT	0.02	0.007	0.007
	40°C	0.029	0.013	0.019
	60°C	0.046	0.019	0.026
Tropicana Mixed Fruit Delight (Tetra)	RT	0.032	0.009	0.018
	40°C	0.035	0.016	0.042
	60°C	0.048	0.022	0.065
Frooti (Tetra)	RT	0.004	0.021	0.022
	40°C	0.008	0.021	0.022
	60°C	0.014	0.022	0.023

- B. Applicant then directs this Hon'ble Tribunal to "Annexure A-3" (at pages 7329-7334) of the Applicant's Reply - indicating that the corresponding testing results for the referenced Tetra Pak products supposedly appear in that Annexure A-3. However, it appears from the test results shown on pages 7332 to 7334 refer to testing Applicant claims to have conducted on products packaged by manufacturers in **PET bottles**, not Tetra Pak products (example of referenced test results, all of which correspond to PET bottle tests).

TEST CERTIFICATE			INTERIM/FINAL REPORT	
पर्याप्त प्रमाण पत्र सं Test Certificate No NTH(ER)/CH(S)/2014/0088A	जारी होने की तिथि Date of Issue 21/08/2014	कोड नं Code No 1407750395305	पृष्ठ Page 2	पृष्ठों की संख्या No of Pages 5
Sl. No.	Test Name	Test Result	Limit	
1	Sample in Plastic/PET bottle as received ,(a)Antimony, mg/L	0.004	..	
2	Sample in Plastic/PET bottle as received ,(b) Lead, mg/L	0.021	..	

This attempt to mislead this Hon'ble Tribunal reflects the Applicant's mala fides.

- C. Tetra Pak submits that Applicant's testing results should be disregarded for all purposes as it casts doubt on the credibility and integrity of the testing process.
 - D. The premise of Applicant's case is that leaching will take place from the inner-most plastic layer of Tetra Pak paper-based cartons coming in contact with edible content detrimentally impacting the health of consumers. Any purported testing that would find any food safety noncompliance in relation to Tetra Pak carton would fly in the face of an abundance of internationally derived evidence. Tetra Pak has reliably proven its comprehensive Indian compliance through TUV India Private Limited, a laboratory of the highest calibre. Tetra Pak's testing had consistently determined that Tetra Pak aseptic carton produces health and safety results that are well within the parameters of the Food Safety Standards (Packaging) Regulations 2018 and the Food Safety Standards (Packaging) Amendment Regulations 2020 ("FSSAI Packaging Regulations"). Again, Tetra Pak has duplicated these successful results in many international laboratory settings as well.
 - E. Tetra Pak submits that this Hon'ble Tribunal should thus reject Applicant's health claims because (a) Applicant provides no test data whatsoever for the particular Tetra Pak products it referenced and (b) because of the mountain of credible evidence reflecting the compliance of Tetra Pak aseptic carton with the amended FSSAI Packaging Regulations and comparable international regulations.
18. Applicant has displayed unconscionable tactics in having purported to test certain Tetra Pak products without having offered any corresponding evidence. We respectfully concur that the findings of the Expert Committee Report should stand.
19. Applicant also appears unconcerned by the disruption to the food supply that would result from acceptance of its reckless and unsubstantiated criticisms of Tetra Pak aseptic carton technology. At root, the Applicant's Reply is aimed at reducing

competition from proven and safe packaging modalities at any cost to the public good. Applicant's mala fide intent is especially evident in relation to the spirits/alcohol category where a large segment of the consuming public strongly prefers Tetra Pak's tamper-evident technology to glass bottles.

20. Tetra Pak hereby offers as additional proof in support of the merits of this matter a recapitulation of certain conclusions of the Expert Committee Report and related evidence; namely:

A. **Approved migration limits of Antimony and DEHP set by FSSAI.**

FSSAI has duly issued a direction under Section 16 (5) of Food Safety and Standards Act, 2006 dated 07th February 2020 regarding operationalisation of Food Safety and Standards (Packaging) Amendment Regulations, 2020 relating to Specific Migration Limits of Antimony and DEHP and Packaging of Drinking Water. The specific migration limits of Antimony and DEHP as specified by the FSSAI Packaging Regulations are aligned with the EU Regulations 10/2011, which are the internationally recognised regulations on specific migration limits for the food contact layer.

(1) **Tetra Pak complies with FSSAI migration limits.** Tetra Pak paper-based carton packaging complies with specific migration limits (including for Antimony and DEHP) and with overall migration limits as specified under the Food Safety and Standards (Packaging) Regulations, 2018 and Food Safety and Standards (Packaging) Amendment Regulations, 2020. (For Test reports please refer to **Annexure 1** of the Written Submission. Copy of the Certificates dated 3.6.2015, 23.06.2015, 17.10.2018, 5.7.2019 and recent test reports dated 21 August 2020 are annexed herewith.)

(2) **Applicant takes the position that FSSAI Packaging Regulations are inferior to international standards, but this assertion is completely moot since Tetra Pak complies with both.** Regardless of Applicant's

claims, Tetra Pak paper-based carton packaging also conforms to the US FDA and EU Food Contact standards, which are internationally recognised as leading regulations.

- B. **The Expert Committee Report proposes increased use of paper-based carton packaging based on environmental considerations.** The Expert Committee proposes to explore the use of lower-plastic-footprint alternatives such as paper-based carton packaging. To enable this change, the Expert Committee’s Action Taken Report specifically recommends (at pages 14-15) to remove the restriction against using non-transparent bottles for drinking water from the Food Safety and Standards (Packaging) Regulations, 2018 and IS 14543.
- C. **Despite Applicant’s attempt to muddy the facts, Tetra Pak cartons are *not* the same as Multi-layered Plastics (“MLP”) – nor have Tetra Pak cartons ever been deemed “difficult to recycle” anywhere in the world.** Paper-based cartons are properly and routinely recognized as a category separate and different from MLP. MLP was described by the Expert Committee Report at page 3 as having “difficulties in its recycling.”
- D. Indeed, the Plastic Waste Management Rules 2016 as amended in 2018 (“PWMR”) directed phasing out of manufacture and use of non-recyclable multi-layer plastics over a period of two years. By contrast, aseptic carton paper-based packaging is readily recyclable, unlike MLP (as that type of packaging is typically understood). But Applicant appears to seize upon an ambiguity (now in the process of being rectified in various ways) in the PWMR that broadly defines “Multi-Layered Packaging” as: *“any material used or to be used for packaging and having at least one layer of plastic as the main ingredient in combination with one or more layer of materials such as paper, paper board polymeric materials, metalised layers or aluminium foil, either in the form of a laminate or co-extruded structure.”* Regrettably, this current PWMR definition thus broadly

includes all formats of plastic packaging including multi-layered plastics such as metallized plastics used for chips packages, and shampoo sachets. But unlike paper-based cartons such as Tetra Pak packages, MLP products are notoriously difficult to collect and recycle. The PWMR definition does not itself (as yet) explicitly differentiate aseptic cartons (which contain predominantly paper in combination with small amounts of other materials such as plastic and aluminum foil). But the practical reality as already recognized by other government stakeholders and as experienced daily by environmental infrastructure and waste stream participants is that *aseptic carton has superior recyclability and is vastly preferable to MLP in regard to environmental impact*. Applicant's conflation of MLP with paper-based aseptic carton seeks to sow confusion by avoiding these basic and common distinctions, which are well-recognized in the industry. Furthermore, as explained below, government and agency initiatives have sought repeatedly to remedy this ambiguity in the phrasing of the definition with the aim of distinguishing Tetra Pak cartons from MLP.

(1) Recognizing the need to differentiate paper-based aseptic carton from MLP, the Maharashtra Government issued a Notification dated 30 June 2018 (in amendment of its Notification dated March 23, 2018) to include the definition of **"Paper-Based Carton Packaging"** under Para. 1 Serial No. 15 (as below) while also defining Multi-layered Packaging as a separate category from Paper-Based Carton Packaging: *"Paper-Based Carton Packaging using one layer of plastic means a container for liquid and solid food and beverages (e.g. milk, juice, etc.) where the **primary constituent material is paper-board** and which may have one or more layer of plastic, foil necessary to allow safe and hygienic consumption."* Such clarification and inclusion of Paper-Based Carton Packaging as a separate definition has enabled the recyclable

beverage carton industry to successfully create and implement actionable EPR plans for used paper-based cartons for Maharashtra and numerous other states.

(3) In parallel, the BIS likewise sought to eliminate any doubt on this point by formulating Indian Standards that clearly distinguish paper-based carton packaging such as Tetra Pak cartons (which the BIS calls **“Paper-based multilayer composite carton for processed liquid food products”**) from MLP as typically understood. The BIS has now issued the corresponding draft Indian Standard for wide circulation with a last date of comment of 22/01/2020.

(4) Further reflecting the reality on the ground, several other States and Union Territories including Chandigarh, Kerala, Odisha, Maharashtra have issued pictorial advisories in connection with their various environmental initiatives. These advisories depict **paper-based carton packaging as a separate and permitted category - which they thereby explicitly distinguish from MLP**. (Extracts of pictorial advisories issued by these local governments annexed as **Annexure 2**.)

(5) Indeed, there is even a separate international **HSN Code for “Aseptic Packaging Paper”** that differentiates Aseptic Packaging Paper such as Tetra Pak packaging material from Multi-Layered Plastics in general. Under Indian Customs tariffs and GST tariffs, “Paper based packaging such as ‘Aseptic Packaging Paper” falls under Chapter 48, which describes paper and paper-based products. MLP falls under an entirely different Chapter and HSN code 7602.

D. **The Expert Committee Report’s conclusions urging further adoption of lower-carbon/lower-plastic footprint packaging favors setting aside Applicant’s environmental criticisms of Tetra Pak’s products.** Applicant’s Reply once again attempts to wrongly paint Tetra Pak paper-

based cartons as posing an environmental hazard due to what amounts to a 20% plastic food-contact layer within its six-layer carton package design. Applicant takes this position despite the Expert Committee Report's explicit praise of Tetra Pak's paper-based aseptic carton technology as conferring cutting-edge food safety benefits while maintaining a lower plastic footprint. Life Cycle Analysis (LCA) studies conducted at various locations including in India over many years consistently show that paper-based carton packaging has a lower carbon footprint than any alternative food and beverage packaging. (Please see "The Life Cycle Assessment of Beverage Carton" annexed at **Annexure 3**).

- E. **Tetra Pak has supported Indian environment initiatives with funding and resources long before operative legislation emerged.** Tetra Pak has further invested in and supported the creation of a robust and sustainable waste management ecosystem in India for some 18 years. Indeed, environmental sustainability is a global strategic priority for Tetra Pak in every market where it operates, regardless of any legal obligations in place. Tetra Pak initiated its efforts in India in the mid-2000's by establishing a nationwide network of NGO collection partners to recover used paper-based cartons. In parallel, Tetra Pak has identified recyclers to purchase used paper-based cartons and recycle them into numerous value-added products. For example:

- (1) The chipboard used as the base for the seats of three-wheeled auto rickshaws manufactured by Bajaj Auto since 2004 is actually manufactured from recycled Tetra Pak cartons. In 2018 alone, Bajaj Auto sold more than half a million three-wheeled auto rickshaws using this recycled Tetra Pak carton-based chipboard. Since then, other vehicle manufacturers such as TVS Motors and

Atul Auto are likewise using recycled Tetra Pak carton-based chipboard for similar vehicle seating applications.

(2) Tetra Pak carton-based chipboard is also used to manufacture school and garden benches, roofing sheets and also serves as a substitute for general-purpose plywood.

- E. **Tetra Pak is gratified that its pioneering work in building a used carton recycling ecosystem (well in advance of any legislative requirement that it do so) is respected in industry and waste-trade circles.** Tetra Pak's latest initiative has been to serve as a founding member of Action Alliance for Recycling Beverage Cartons ("**AARC**"). AARC, a first-of-its-kind initiative through which leading corporations have joined together with government authorities, NGOs, local communities and other stakeholders in the service of an ambitious mission: *To radically transform the recycling landscape and positively impact millions of citizens who earn their livelihoods in the waste trade for beverage cartons.* The AARC is focused on creating a modern end-to-end waste management ecosystem to rival that of any nation. Along with Tetra Pak India as its founding member, the AARC is proud to count among its members companies such as CavinKare, Coca-Cola, Dabur India, Diageo India, Parle Agro, Halewood Laboratories, John Distilleries, Karnataka Milk Federation, Parag Milk Foods, Radico Khaitan, Schreiber Dynamix Dairies, SIG Combibloc, Hector Beverages, Johnson & Johnson and Varun Beverages.
- F. **Tetra Pak is likewise gratified that it has achieved a remarkably high recycling rate in India.** The most recent nationwide study by The Energy and Resources Institute (TERI) across 16 cities, which concluded that *fully 1 of 2 used aseptic cartons are collected and recycled / recovered* (please see executive summary of TERI report at **Annexure 4**).

G. Tetra Pak continues to invest massively in improving its offerings.

Tetra Pak's top priority is to innovate rapidly toward the introduction of a carton package (1) made from renewable or recycled packaging materials, (2) which will continue to be fully recyclable and play a key role in a low-carbon circular economy, (3) all without ever compromising on food safety requirements. Even today, Tetra Pak carton packages are primarily paper-based and recyclable. In the years to come, Tetra Pak packaging will continue to reduce its environmental footprint by continuing to minimize fossil-derived plastic and carbon emissions and by increasing its use of sustainably-sourced plant-based packaging materials.

Conclusion:

- i. Tetra Pak respectfully submits that Applicant's Reply offers no credible evidence to show that the use of Tetra Pak paper-based carton packages is in any manner prejudicial to health or that the food or beverages packaged in Tetra Pak cartons are in any manner adversely affected. Nor has Applicant provided any reasonable basis to counter the conclusions of the Expert Committee report that the nation of India should promote the adoption of paper-based cartons such as Tetra Pak low-carbon/low-plastic footprint products due to environmental considerations.
- ii. By relying upon misleading testing data and merely sidestepping an abundance of credible evidence that devastates its case, Applicant has failed to provide any basis to justify its allegations against Tetra Pak's paper-based carton as a safe and reliable food and beverage packaging.
- iii. Tetra Pak humbly submits that based on the above that Tetra Pak should be excused from this matter by this Hon'ble Tribunal. Accordingly, Tetra Pak further requests that this Hon'ble Tribunal reject all contentions in Applicant's Reply as to Tetra Pak, and dismiss the application with costs.

ANNEXURE -1

Test Report

Report No : TUV(I)/4238/20-21/0082001339

Date : 27 Aug 2020



TUV INDIA PRIVATE LIMITED
 TUV India House,
 Survey No: 42, 3/1 & 3/2,
 Sus, Tal. Mulshi,
 Dist. Pune - 411 021
 CIN : U74140MH1989PTC052930
 Tel. : 020 - 67900000 / 01
 Toll free :1800-209-0902
 Email : pune@tuv-nord.com
 Website : www.tuv-nord.com/in

Name and address of customer : **Tetra Pak India Pvt. Ltd.**
Plot No.53, MIDC, Chakan-Phase II, Village Vasuli, Tal- Khed,,
Pune
Pincode-410501

Name of the sample : **Packing Material : Milk**

Reg. No. : **4238/20-21**

CA No. : **0082001339**

Batch No./ Code no. : **-**

Discipline : **Chemical**

Product Category : **Plastic & Resins**

Date of sample receipt : **06 Aug 2020**

Date(s) of analysis : **11 Aug 2020 - 27 Aug 2020**

Objectives Of Examination : **To test as per FSSAI Notification 2020.**

Sample drawn by : Customer

Result Summary :

Test Requested	Conclusion
Testing as per FSSAI Notification 2020	
Specific Migration of Antimony	PASS
Specific Migration of DEHP	PASS

Refer further pages for Test Result

Report No : TUV(I)/4238/20-21/0082001339

Date : 27 Aug 2020

Specific Migration of Antimony

Sr. No.	Name of Test	Result Water	Result n-Heptane	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Antimony	<LOQ	mg/kg	mg/kg	0.02	0.04	Determined by ICP-OES

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
2) Sample kept in Simulant @ 40 deg. C. for 10 Days

Specific Migration of DEHP

Sr. No.	Name of Test	Result Water	Result n-Heptane	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Bis-(2-ethylhexyl) Phthalate (DEHP)	<LOQ	mg/kg	mg/kg	1	1.5	Determined by GC-MS

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
2) Sample kept in Simulant @ 40 deg. C. for 10 Days



Sample image is authentic only for the original test report

Authorized by
(Atulkumar Rajage)
Head – Instrumentation Laboratory

Terms and Conditions

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8. For Biological and mycotoxin Analysis: Our analytical findings reflect the quality of the sample at the time of testing. No responsibility can be accepted for the possible consequences of further development of micro-organisms or mycotoxin which may depend upon storage, handling & weathers conditions which may influence the results at a later date/time respectively.
9. The laboratory tests are conducted by TUV India as per mutual agreement without any implied warranty of merchantability and fitness for any general or particular use. TUV India will not be liable for any claims for indirect, incidental or consequential damages including but not limited to loss of revenue, loss of profits and similar claims. TUV India will also not be liable under any strict liability, product liability or negligence. The total liability, scientifically and legally proven, if any, of TUV India, in any case, shall not exceed the invoiced amount for the services provided and paid for.
10. For Pesticide Residue analysis, reported value at LOQ level may vary within analytical variation of 50% considering Uncertainty of Measurement.

-- End of Report --

Test Report

Report No : TUV(I)/4057/20-21/0082000681
ULR :TC529820000012769P

Date : 21 Aug 2020

TUV INDIA PRIVATE LIMITED
TUV India House,
Survey No. 42, 3/1 & 3/2,
Sus, Tal. Mulshi,
Dist. Pune - 411 021
CIN U74140MH1989PTC052930
Tel. : 020-6790 0000 / 01
Toll Free : 1800-209-0902
Email : pune@tuv-nord.com
Website : www.tuv-nord.com/in

Name and address of customer : **Tetra Pak India Pvt. Ltd.**
Plot No.53, MIDC, Chakan-Phase II, Village Vasuli, Tal- Khed,,
Pune
Pincode-410501

Name of the sample : **Packaging material for Juice**

Reg. No. : **4057/20-21**

CA No. : **0082000681**

Batch No./ Code no. : **-**

Discipline : **Chemical**

Product Category : **Plastic & Resins**

Date of sample receipt : **06 Aug 2020**

Date(s) of analysis : **07 Aug 2020 - 21 Aug 2020**

Objectives Of Examination : **To test as per FSSAI Notification 2020.**

Sample drawn by : Customer

Result Summary :

Test Requested	Conclusion
Testing as per FSSAI Notification 2020	
Specific Migration of Antimony	PASS
Specific Migration of DEHP	PASS

Refer further pages for Test Result

Accredited test

Specific Migration of DEHP

Sr. No.	Name of Test	Result	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Bis-(2-ethylhexyl) Phthalate (DEHP)	<LOQ	mg/kg	1	1.5	Determined by GC-MS

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
2) Sample Simulant 3% Acetic Acid @ 40 deg. C. for 10 Days



(Signature)
Authorized by
(Atulkumar Rajage)
Head – Instrumentation Laboratory

Page 1 of 3

Report No : TUV(I)/4057/20-21/0082000681
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Product Category : **Plastic & Resins**

Date of sample receipt : **06 Aug 2020**

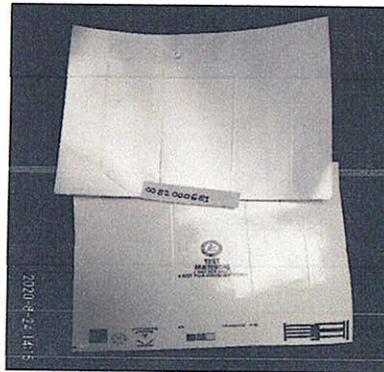
Date(s) of analysis : **07 Aug 2020 - 21 Aug 2020**

Non-Accredited test

Specific Migration of Antimony

Sr. No.	Name of Test	Result	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Antimony	<LOQ	mg/kg	0.02	0.04	Determined by ICP-OES

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
2) Sample Simulant - 3% Acetic Acid @ 40 deg. C. for 10 Days



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Page 2 of 3

Report No : TUV(I)/4057/20-21/0082000681
ULR :TC529820000012769P

Date : 21 Aug 2020

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May



Certificate No.: TC-5298



Test Report

Report No : TUV(I)/4057/20-21/0082000680
ULR :TC529820000012768P

Date : 21 Aug 2020

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CIN U74140MH1989PTC052930
Tel. : 020-6790 0000 / 01
Toll Free : 1800-209-0902
Email : pune@tuv-nord.com
Website : www.tuv-nord.com/in

Name and address of customer : **Tetra Pak India Pvt. Ltd.**
Plot No.53, MIDC, Chakan-Phase II, Village Vasuli, Tal- Khed,,
Pune
Pincode-410501

Name of the sample : **Packaging material for Spirits (Rum/Whiskey/Brandy/Vodka/ Gin and**
Country Liquor)

Reg. No. : **4057/20-21**

CA No. : **0082000680**

Batch No./ Code no. : **-**

Discipline : **Chemical**

Product Category : **Plastic & Resins**

Date of sample receipt : **06 Aug 2020**

Date(s) of analysis : **07 Aug 2020 - 21 Aug 2020**

Objectives Of Examination : **To test as per FSSAI Notification 2020.**

Sample drawn by : Customer

Test Requested	Conclusion
Testing as per FSSAI Notification 2020	
Specific Migration of Antimony	PASS
Specific Migration of DEHP	PASS

Refer further pages for Test Result

Accredited test

Specific Migration of DEHP

Sr. No.	Name of Test	Result	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Bis-(2-ethylhexyl) Phthalate (DEHP)	<LOQ	mg/kg	1	1.5	Determined by GC-MS

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
2) Sample Simulant 3% Acetic Acid @ 40 deg. C. for 10 Days



Atul Rajage
Authorized by
(Atulkumar Rajage)
Head – Instrumentation Laboratory

Page 1 of 3

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Date : 21 Aug 2020

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Pincode-410501

Name of the sample : **Packaging material for Spirits (Rum/Whiskey/Brandy/Vodka/ Gin and**
Country Liquor)

Reg. No. : **4057/20-21**

CA No. : **0082000680**

Batch No./ Code no. : **-**

Discipline : **Chemical**

Product Category : **Plastic & Resins**

Date of sample receipt : **06 Aug 2020**

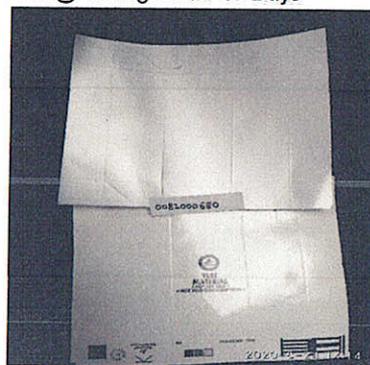
Date(s) of analysis : **07 Aug 2020 - 21 Aug 2020**

Non-Accredited test

Specific Migration of Antimony

Sr. No.	Name of Test	Result	Unit	Detection Limit	Limits as per FSSR-2018	Test Method
1	Antimony	<LOQ	mg/kg	0.02	0.04	Determined by ICP-OES

Note : 1) The sample conforms with FSSR Notification 2020 for above mentioned test parameters
 2) Sample Simulant - 3% Acetic Acid @ 40 deg. C. for 10 Days



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(Signature)
Authorized by
(Atulkumar Rajage)
Head – Instrumentation Laboratory

Report No : TUV(I)/4057/20-21/0082000680
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– End of Report –

Page 3 of 3



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SINGLE-USE PLASTIC AND POLYTHENE **BAN** IN CHANDIGARH

– A Pictorial Guidebook

June, 2019

Don't suffocate the Mother Earth



DEPARTMENT OF ENVIRONMENT
CHANDIGARH ADMINISTRATION





Shri. V.P. Singh Badnore
Administrator of U.T. Chandigarh

“City Beautiful should say
‘NO’ to Plastic.”



Shri. Manoj Kumar Parida, IAS
Adviser to the Administrator, UT, Chandigarh

“Plastic is Enemy of Environment,
We Must Minimise its Use.”



Shri. Arun Kumar Gupta, IAS
Principal Secretary Environment, UT, Chandigarh

“We are addicted to convenience of
single use plastic. Thus, individual
has to come forward to avoid
such practices.”



Shri. Debendra Dalai, IFS
Director Environment, UT, Chandigarh

“Refuse single-use plastic right from
the birth, to save ourselves and the
Mother Earth.”



Shri. T.C. Nautiyal, IFS
Member Secretary, CPCC

“Cloth bags are beautiful.
Let us use cloth bags instead
of plastic bags.”

Why say NO to PLASTIC ?



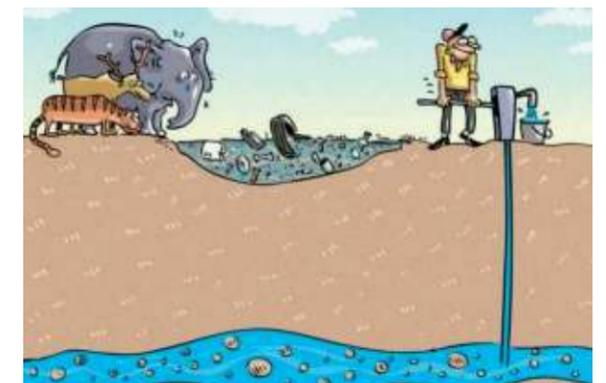
Animals eat food waste thrown in plastic materials. This affects them and their digestive system leading to death.

Plastic forms a layer within the soil which prevents rain water from seeping into the ground.



Improper disposal of plastic material can block the drainage system and further act as a breeding place for mosquitoes which will ultimately affects human health.

Open disposal of plastic waste also pollutes the surface water bodies making it unfit for use. Man has alternate source of water but animals do not.



Why say NO to PLASTIC ?



Burned plastic releases poisonous chemicals in the air.



Soil fertility affected due to plastic waste.



Disposing plastic into water risks the marine life.



Huge carbon footprints



Leaches toxins into food & drink



Causes hormone disruption & cancers



Pollutes our oceans



Will still be here in hundreds of years



Enters our food chain



Made from fossil fuels



PLASTIC BAN IN CHANDIGARH & PENALTIES

Notification no. ED/2008/684 dated 30.07.2008; issued by Department of Environment, Chandigarh Administration under Section 5 of the Environment (Protection) Act, 1986, prohibits any person to manufacture, store, import, sell, transport or use polythene/plastic carry bags in the U.T. Chandigarh.

Further, under Section 15 of the Environment (Protection) Act, 1986, whoever fails to comply with the orders issued under Section 5 of the Environment (Protection) Act, 1986, shall be punishable with imprisonment for a term which may extend to five years with fine which may extend to one lakh rupees, or with both.

DIRECTIONS OF HON'BLE NGT

Hon'ble National Green Tribunal (NGT) in it's order dated 04.12.2015 in O.A. No. 442 titled as R.D. Anand Vs. Chandigarh Union Territory Administration & Anr., directed that any person who is found to be using, storing, purchasing, dealing with or distributing plastic bags, plastic plates or plastic glasses and such allied items shall be liable to pay environmental compensation at the rate of Rs. 5000/- per event."

Further, Hon'ble National Green Tribunal (NGT) in it's order dated 20.01.2016 in O.A. No. 442 titled as R.D. Anand Vs. Chandigarh Union Territory Administration & Anr., completely prohibit use of plastic, manufacturing, storing and/or any kind of plastic carry bag(s) including Non-woven material of Poly propylene 100% & Non-Biodegradable plastic bag(s) in the Union Territory of Chandigarh.

BANNED



Plastic/ Polythene carry bags (Directions of Chandigarh Administration)



Single use Plastic plates
(Directions of Hon'ble NGT)



Non- woven plastic carry bags (Directions of Hon'ble NGT)



Single use Plastic glasses
(Directions of Hon'ble NGT)



AVOID



One time use/single use disposable items made of Thermocol (Polystyrene)/Plastic. e.g. dish, spoon, cups, plates, glasses, fork, bowl, container.



Less than 200 ml Drinking water PET/PETE bottles, having liquid holding capacity.



Single-time use (Use & throw) razors.



Disposable dish or bowl used for packaging of food in hotels.



Single-time use (Use & throw) pens.

Disposable Plastic straws



Use of Plastic & Thermocol for decoration purpose

Plastic stationery products used for office & education



ALLOWED

All other plastic items are allowed till the time any clarification is provided by NGT on "other allied items" and any notification is passed by Chandigarh Administration. Compostable carry bags/ products are allowed.

Plastic material made up of minimum 20% recyclable plastic material & having a thickness more than 50 micron, used for wrapping the material at the manufacturing stage or integral part of manufacturing.



Plastic packaging material more than 50 micron thickness (Industrial packaging)



ALLOWED

Compostable Plastic Bags used for plant nurseries, horticulture, agriculture & handling of solid waste



Paper based carton packaging using one or more layer of plastic



Virgin Plastic bags used for milk having thickness not less than 50 micron



Multilayered Plastic



Plastic Items Used For Domestic Purpose



ALLOWED

Use of Plastic for packaging of medicine, medical equipments & medical products



Other Plastic Products



ACKNOWLEDGEMENT

Ministry of Environment, Forest & Climate Change, Government of India is continuously taking initiative by publishing guidelines to minimize production and use of single use plastic.

In continuation, Department of Environment, Chandigarh (U.T.) has taken up the task of bringing out a booklet on Single-use Plastic and Polythene Ban in Chandigarh. The booklet has all the information about items banned and allowed in Chandigarh. Also, it has information about the items that one can avoid using and help in making the environment free from the burden of plastic material.

I owe my deep gratitude to Honourable, Shri V.P. Singh Badnore, the Administrator, U.T. Chandigarh for actively supporting the initiative of publishing the pictorial guidebook on Plastic use.

I am extremely indebted to Shri Manoj Kumar Parida (IAS), Advisor to the Administration, Chandigarh for providing constant guidance in giving final shape to the booklet.

I express my sincere thanks to Shri Arun Kumar Gupta (IAS), Principal Secretary Environment, Chandigarh Administration for the valuable suggestions and inputs during the preparation of booklet on Plastic.

The co-operation of Shri T.C. Nautiyal, Member Secretary, Chandigarh Pollution Control Committee (CPCC) and his team in providing useful inputs is highly appreciated.

Constant and continuous technical support provided by Shri Vivek Pandey, Scientist SD, Department of Environment, Chandigarh Administration in the formulation of this booklet is highly commendable.

I am also thankful to Mr. Mohit Badhwar, Programme Officer, ENVIS Hub, Department of Environment, Chd Admn. for his support in preparation of this booklet.

I heartily thank Dr. Deepika Thakur, Scientific Officer, Capacity Building Division, Department of Environment, Chandigarh Administration who has made very significant and valuable contribution in compilation, designing and preparation of this pictorial guidebook on Single-use plastic and polythene ban in Chandigarh.

I finally thank one and all for making a sincere effort in the campaign to say "NO" to single-use plastic in Chandigarh.

(Debendra Dalai)
Director, Environment
UT, Chandigarh

NOTE

This pictorial guidebook is for the ready reference for the responsible citizens of Chandigarh.

The detail information of the ban on the polythene /plastic carry bags (Notification No. ED/2008/684) and direction of Hon'ble NGT is available on the website:

www.chandigarhenviis.gov.in / www.chenvis.nic.in



**"It's in our hands to make this Earth Green & Alive,
so use Less Plastic for More Life"**



**DEPARTMENT OF ENVIRONMENT
CHANDIGARH ADMINISTRATION**

Paryavarán Bhawan (3rd Floor), Sector 19-B, Madhya Marg, Chandigarh -160019
E-mail: direnvchandigarh@gmail.com; Tel.: 0172-2700065

**Government of Maharashtra
Environment Department, Mantralaya, Mumbai**

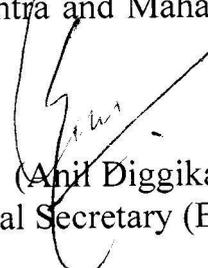
No. S1054-12018/04/05/709

Date: 10.07.2018

CIRCULAR

In exercise of the powers conferred by Clause (1) and (2) of Section 4 of the Maharashtra Non-Biodegradable Garbage (Control) Act, 2006 the Government of Maharashtra has notified the Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification 2018 dated 23rd March 2018 and amended on 11th April 2018, 30th June 2018. In order to guide the public at large about the banned and unbanned plastic and thermocol items, a booklet showing an illustrative pictorial information is published herewith.

The copy of Notification and booklet are available on the website of Environment Department, Government of Maharashtra and Maharashtra Pollution Control Board.


(Anil Diggikar)
Principal Secretary (Environment)



**DEPARTMENT OF ENVIRONMENT,
GOVT. OF MAHARASHTRA**

<http://mahervis.nic.in>



**MAHARASHTRA POLLUTION
CONTROL BOARD**

<http://mpcb.gov.in>



Shri Devendra Fadnavis

Hon'ble Chief Minister,
Maharashtra State



Shri Ramdas Kadam

Minister for Environment,
Maharashtra State



Shri Pravin Pote-Patil

Minister of State for Environment,
Maharashtra State

AN ILLUSTRATED GUIDE BOOK FOR PLASTIC AND THERMOCOL BAN NOTIFICATION



एकच ध्यास ठेवूया, प्लास्टीक पिशवी हटवूया,
समृद्ध पर्यावरणाचे रक्षण करूया!



Banned

less than 200 ml. Drinking water PET / PETE bottles,
having liquid holding capacity



Banned

Plastic Mineral Water Pouch



Allowed

PET / PETE Bottles having a liquid holding capacity 200 ml.
and more than 200 ml. (printed with deposit and
refund price or buy-back price under EPR)



Banned

**Plastic Bags
(With Handle / Without Handle).**



Plastic Bag



Non- woven Bags.



Plastic Bag or Non- woven Shopping Bags

Banned

One time use / Single use disposable items made up of Thermocol (Polystyrene) or Plastic. e.g. dish, spoon, cups, plates, glasses, fork, bowl, container.



Banned

Disposable dish / bowl used for packaging foods in hotels and Straw



Allowed

Manufacture of plastic and plastic bags for export purpose in special economic zone & export oriented units.



Allowed

Plastic material made up of minimum 20 % recyclable plastic material & having a thickness more than 50 micron, used for wrapping the material at the manufacturing stage or integral part of manufacturing. Thermocol used for wrapping the material at manufacturing stage. (printed with manufacturer's details, type of plastic with code number and buy-back price under EPR)



Allowed

Plastic packaging material more than 50 micron thickness with minimum two grams weight used to seal groceries & grain products for wholesale & retail. (printed with manufacturer's details, type of plastic with code number and buy-back price under EPR)



Banned

Any Compostable Plastic Bags except for Plant nurseries, horticulture , agriculture & handling of solid waste.



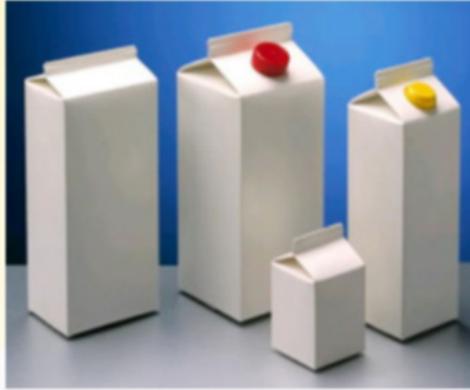
Allowed

Compostable Plastic Bags used for Plant nurseries, horticulture, agriculture & handling of solid waste.



Allowed

Paper based carton packaging using one or more layer of plastic



Allowed

Virgin Plastic bags used for milk having thickness not less than 50 Micron & printed with a buy back price.



Allowed

Recyclable multilayered plastic



Chips packet, Shampoo sachet, Oil packet, Chocolate packet etc.

Allowed

Plastic items used for domestic purpose.



Allowed

Use of Plastic for packaging of medicine, medical equipments & medical products.



Banned

Use of Plastic & Thermocol for decoration purpose.



Allowed

Use of Thermocol Boxes to preserve fish in fishery business



Allowed

Recyclable plastic stationery products used for office & educations.



Allowed

Other plastic products





Penalties under plastic & Thermocol Notification

First offence Rs. 5000/- Fine



Second Offence Rs.10,000/- Fine.



Third Offence Rs. 25,000/- Fine + 3 months imprisonment



Note :

Above pictorial information is an illustrative.

The detail information of the Maharashtra plastic & thermocol products (Manufacture, usages, sale, transport, handling & storage)

notification 2018, is available on the website

<http://mahenvis.nic.in>,

<http://mpcb.gov.in> & <https://dgps.maharashtra.gov.in>





Life Cycle Assessment of Beverage Carton

TETRA PAK INDIA PVT LIMITED

THINKSTEP SUSTAINABILITY SOLUTIONS PVT LIMITED, INDIA

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Phone: +91 124 412 4600	
Internet: www.tetrapak.com	E-Mail: Sumit.Jugran@tetrapak.com

Contact: Dr. Rajesh Kumar Singh, Managing Director Mr. Ritesh Agrawal, Senior Consultant	
PE Sustainability Solutions Pvt Ltd 421, MIDAS, Sahar Plaza, Andheri Kurla Road, Andheri East, Mumbai 400059	THINKSTEP AG Hauptstraße 111 – 113 70771 Leinfelden –Echterdingen Germany
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Signed By: Dr. Rajesh Kumar Singh 	Internet: www.thinkstep.com

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Acronyms

Abbreviation	Explanation
ACE	Alliance for Beverage Cartons & the Environment
CML	Institute for Environmental Sciences, Leiden University, The Netherlands
CO ₂	Carbon Dioxide
DCBe	Dichlorobenzene equivalent
EoL	End of Life
GaBi	Ganzheitliche Bilanzierung (German for holistic balancing)
GHG	Greenhouse Gases
GWP	Global Warming Potential
HDPE	High Density Polyethylene
HTP	Human Toxicity Potential
ISO	International Organization for Standardization
LCI	Life cycle inventory
LCIA	Life cycle impact assessment
PCCs	Post-Consumer Tetra Pak Cartons
PED	Primary Energy Demand
PE-LLD	Linear Low Density Polyethylene
POCP	Photochemical Ozone Creation Potential
SO ₂	Sulphur Dioxide
TERI	The Energy and Resource Institute

1 Introduction

Tetra Pak is a multinational food packaging and processing company of Swedish origin with head offices in Lund, Sweden, and Lausanne, Switzerland. The company offers packaging solutions, filling machines and processing solutions for dairy, beverages, cheese, ice-cream and prepared food, including distribution tools like accumulators, cap applicators, conveyors, crate packers, film wrappers, line controllers and straw applicators.

Tetra Pak® is the world's leading food processing and packaging solutions company. Working closely with our customers and suppliers, it provides safe, innovative and environmentally sound products that each day meet the needs of hundreds of millions of people.

Tetra Pak offers complete carton packaging range for consuming fresh products. All their packages offer consumer convenience, easy opening, optimal shelf life.

The objective of this study is to understand & document by facts and figures the actual environmental performance of Tetra Pak beverage carton from life cycle perspective and compare different post-consumer end of life scenarios practiced in India. The key environmental impact indicators identified are primary energy consumption, GHG emissions, acidification potential, ozone depletion potential, and photochemical ozone creation potential.



This study focusses on the Indian scenario for recycling of Tetra Pak carton. The data has been retrieved from the study conducted by The Energy and Resource Institute (TERI) for the various activities for collection and recycling of these Post Consumer Tetra Pak Cartons (PCCs) and the work taken up with various NGO's and the waste picker workforce to segregate PCCs in India.

The Tetra Pak carton is primarily made up of Paper (75% by weight) and the rest is polyethylene-aluminium (25%). With the aim to ensure that the PCCs are retrieved and recycled responsibly and that no carton ends up at the landfill, Tetra Pak has taken up several studies in the past in this regard.

The life cycle assessment has been carried out following the ISO 14040 and ISO 14044 by modelling different life cycle stages of Tetra Pak beverage carton using life cycle assessment software GaBi 6 developed by thinkstep AG (formerly PE International AG).

2 Goal and Scope of the Study

2.1 Goal of the Study

The goal of the study is to analyse the life cycle environmental performance of beverage carton and compare different post-consumer end of life scenarios practiced in India.

The life cycle stages of product systems that were studied included:

- Cradle-to-gate production of raw and relevant ancillary materials needed for the manufacture of beverage carton,
- Transports of relevance over the life cycle of the beverage carton under study,
- Manufacture of beverage carton,
- End-of-life of beverage carton covering recycling and disposal.

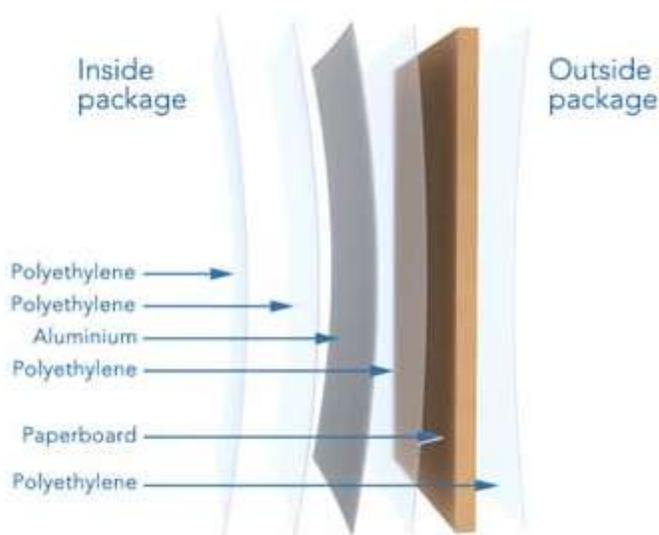
An additional goal of the study is to “compare the LCIA of beverage carton with container glass based on publicly available information.

2.2 Scope of the study

2.2.1 System Description Overview

Beverage Carton is made of paperboard laminated with a multilayer polymer film and a layer of aluminium foil (shown in Image).

The LCA methodology applied to this study comprises of an evaluation of environmental impacts of all the activities associated with extraction of raw materials necessary for production, transportation of raw material, production of packaging, and end-of-life viz. recycling and landfilling.



2.2.2 Functional Unit

A common reference has been used as the functional unit for this study. The functional unit allows quantification of the environmental impacts of the production procedure for refrigerator making format over its entire life cycle. These environmental impacts are calculated on the basis of the functional unit wherein each flow related to material consumption, energy consumption, emissions, effluent and waste is scaled to the reference flow.

The functional unit for this study is –

1 beverage carton of 180 ml volume

2.2.3 System Boundary

The system boundary of the beverage carton is shown in Figure 1.

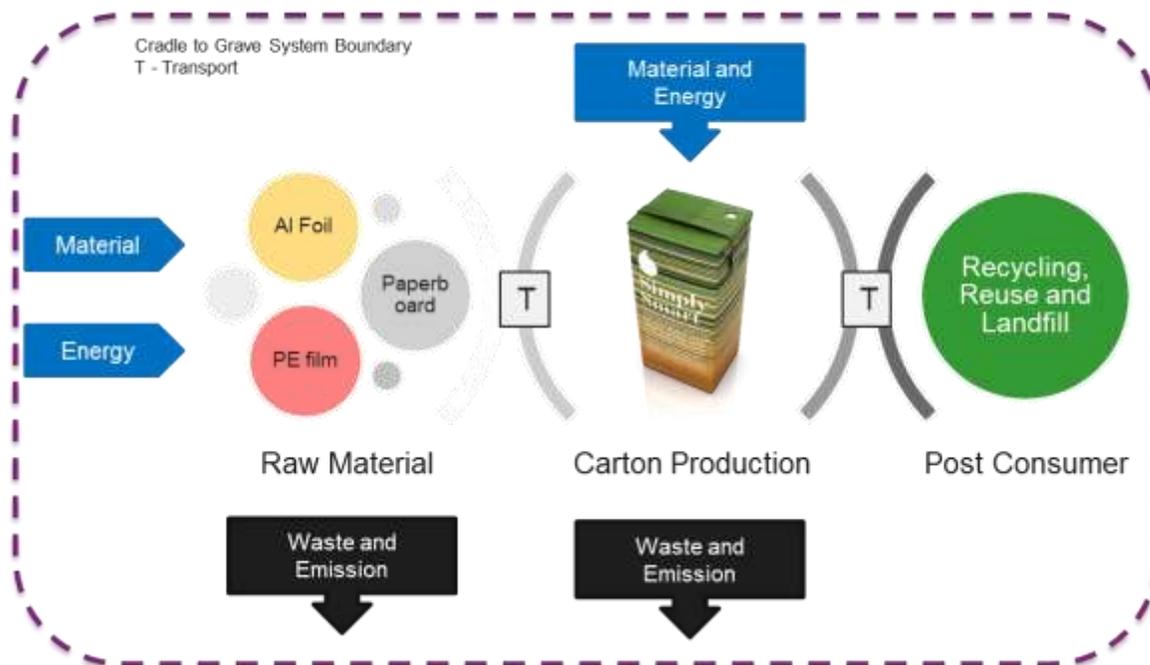


Figure 1: System Boundary for Tetra Pak Beverage Carton

Table 1 summarizes those processes that are included within the system boundaries of the study.

Table 1: Details of system boundary included in the study

Life Cycle stages	Life Cycle sub-stages	Definitions
Primary packaging	Primary packaging raw materials production	Extraction, production of the raw materials to the primary packaging producer
	Packaging Formation (converting)	Energy, water and raw materials used in the process of formation of the primary packaging production and combustion during converting
	Printing ink	Extraction and production of the raw materials of the printing ink
Upstream Transport	–	Transport of the raw materials for primary and secondary packaging, closure and label.
Downstream Transport	--	Transport of primary packaging from user
		Transport of secondary packaging from retailer to End of life
End of life	Landfill	Primary packaging and recycling treatment plant
	Recycle	Primary packaging
	Open burning	Primary packaging

The study includes upstream processing and production of materials and energies that make up the production of the stated functional unit, transport of materials to production sites, transport to customers, and end-of-life disposal.

Activities that have been excluded from the assessment are summarised in Table 2.

Table 2: Activities outside the scope of this study

Activity	Reason for exclusion
Construction of capital equipment, furnace rebuild (refractories) and moulds	It is expected that these impacts will be very small when allocated across the full production volume of packaging (hence can be excluded under the cut-off rules defined in section 3.4)
Maintenance and operation of support equipment	It is expected that these impacts will be very small when allocated across the full production volume of packaging (hence can be excluded under the cut-off rules defined in section 3.4)
Human labour and employee transport	These aspects are not the central focus of the study and are not easily attributable to product impacts
Filling process	Filling has been excluded from this study since it is independent from the finished container
Secondary and Tertiary packaging	These aspects are not the central focus of the study
Individual transport to consumer	This may vary greatly from consumer to consumer. It is common practise in LCA studies to omit this stage from the assessment
Use of product	Product use and refrigeration or other processing are not considered

3 Methodology

3.1 Selection of LCIA Methodology and Types of Impacts

CML 2001 (Nov 2010) method has been selected for evaluation of environmental impacts developed by Institute of Environmental Sciences, Leiden University, Netherlands. These indicators are scientifically and technically valid. Furthermore, they are relevant from the environmental point of view and provide a multi-criterion approach to the environmental issues. These indicators are widely used and accepted by the international community of LCA experts.

A set of environmental indicators were investigated: primary energy demand, global warming potential, eutrophication potential, acidification potential, photochemical ozone creation potential (smog formation potential) and human toxicity . Explanations of different impact assessment indicators results are given in Annex A.

Table 3: Impact Assessment Category Descriptions

Impact Category	Description	Unit	Reference
Global Warming Potential (GWP)	A measure of greenhouse gas emissions, such as CO ₂ and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may in turn have adverse impacts on ecosystem health, human health and material welfare.	kg CO ₂ equivalent	[Guinée 2001]
Eutrophication Potential	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems increased biomass production may lead to depressed oxygen levels, because of the additional consumption of oxygen in biomass decomposition.	kg Phosphate equivalent	[Guinée 2001]
Acidification Potential	A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H ⁺) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.	kg SO ₂ equivalent	[Guinée 2001]
Photochemical Ozone Creation Potential (POCP)	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone, O ₃), produced by the reaction of VOC and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be	kg ethene equivalent	[Guinée 2001]



Impact Category	Description	Unit	Reference
	injurious to human health and ecosystems and may also damage crops.		
Human Toxicity Potential (HTP inf.)	A measure of toxic emissions directly harmful to the health of humans and other species.	Kg DCB equivalent	[Guinée 2001]

Table 4 Other Environmental Indicators

Indicator	Description	Unit	Reference
Primary Energy Demand (PED)	A measure of the total amount of primary energy extracted from the earth. PED is expressed in energy demand from non-renewable resources (e.g. petroleum, natural gas, etc.) and energy demand from renewable resources (e.g. hydropower, wind energy, solar, etc.). Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account.	MJ (net calorific value)	[Guinée 2001]

3.2 Data Collection

The data for beverage carton was collected from the study conducted by the Alliance for Beverage Cartons & the Environment (ACE) for the “[LCI dataset for converting of beverage carton packaging material](#) (September 2009)¹” modelled as Indianised GaBi dataset² with some measured data³. The data has been tabulated in Annex.

The Indian scenario for Post-Consumer Tetra Pak Cartons (PCCs) Management has been studied by The Energy and Resource Institute (TERI) and articulately represented in the report⁴.

All data from the GaBi databases 2011 were created with consistent system boundaries and upstream data. thinkstep expert judgment and advice was used in selecting appropriate datasets to model the materials and energy for this study and has been noted in the preceding sections. Detailed database documentation for GaBi datasets can be accessed at <http://www.gabi-software.com/support/gabi/gabi-6-lci-documentation/> and <http://database-documentation.gabi-software.com/support/gabi/gabi-database-2013-lci-documentation/>.

¹ LCI dataset for converting of beverage carton packaging material

²http://gabi-dataset-documentation.gabi-software.com/xml_data/processes/90a3b10d-83cc-4bc7-a715-991e2ea786ad_01.00.000.xml

³ The weight and the surface area of the beverage carton was measured precisely to obtain the total weight per area ratio

⁴ T E R I. 2011; Post Consumer Tetra Pak Cartons (PCCs) Management ; New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01]

The data collected for material & energy sources mentioned in Annex A.

The flow diagram on inventory analysis step of LCA is given in Figure 2 and depicts the process of life cycle inventurisation to life cycle impact evaluation. First the life cycle inventory of any flow of unit process is prepared, checked for consistency and plausibility, converted to the functional unit and finally inventory data is characterized to the respective environmental impact categories. Each of the inventory flows characterized to the respective impact categories is finally aggregated.

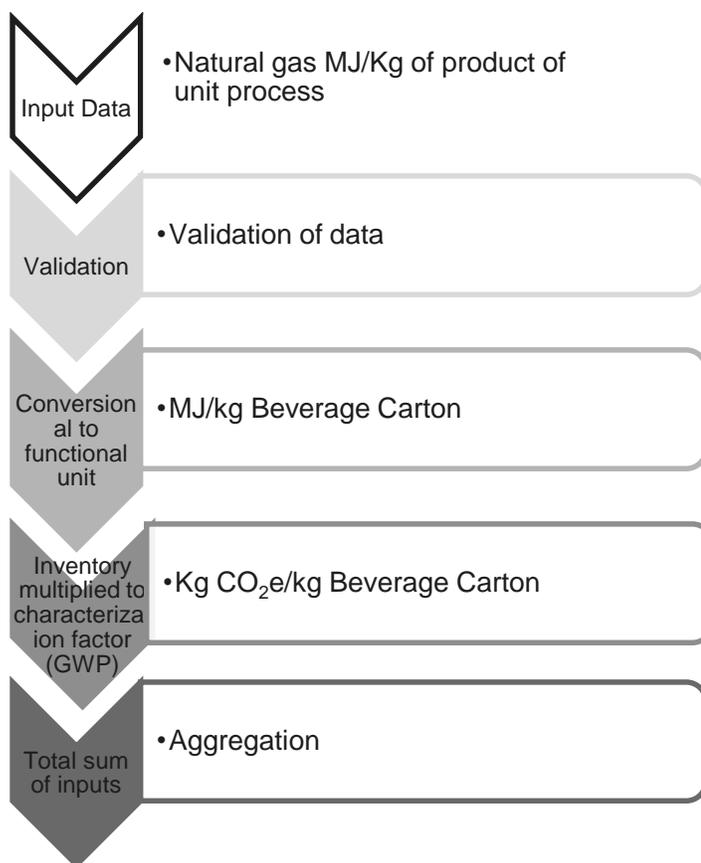


Figure 2: Flow Diagram on Life Cycle Inventory Analysis

3.3 Beverage Carton Life Cycle Stages

Data for the manufacturing of beverage carton were taken from various secondary sources as mentioned in section 3.2. The provided data represent the energies, auxiliary materials and process materials needed as well as the emissions related to the production process.

The flow sheet of beverage carton production, transport, EoL is shown in

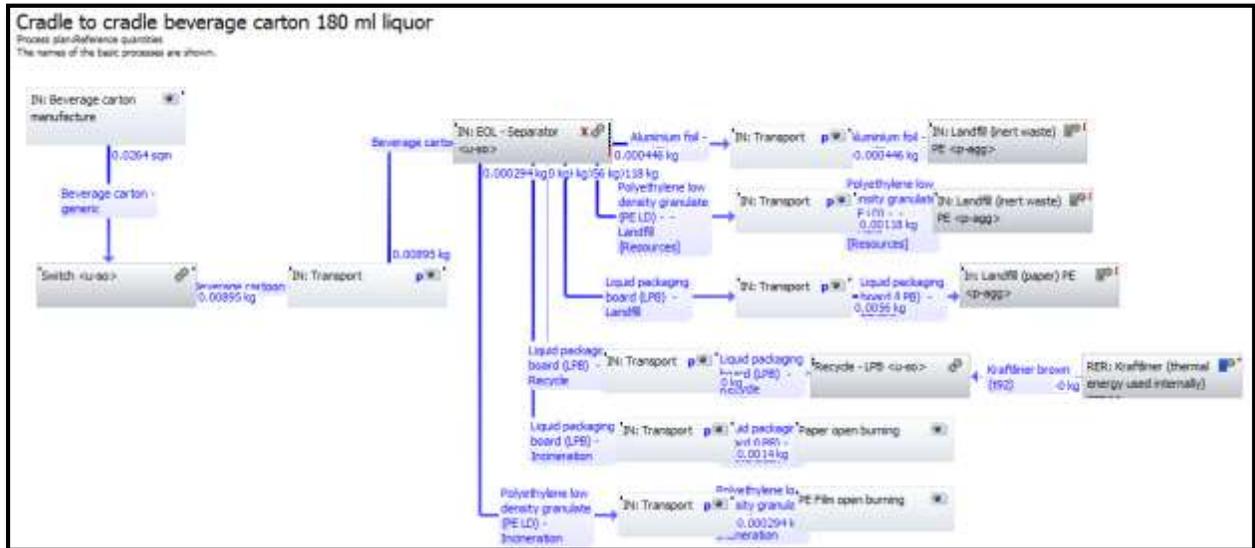


Figure 3: GaBi model for Cradle to Grave of beverage carton

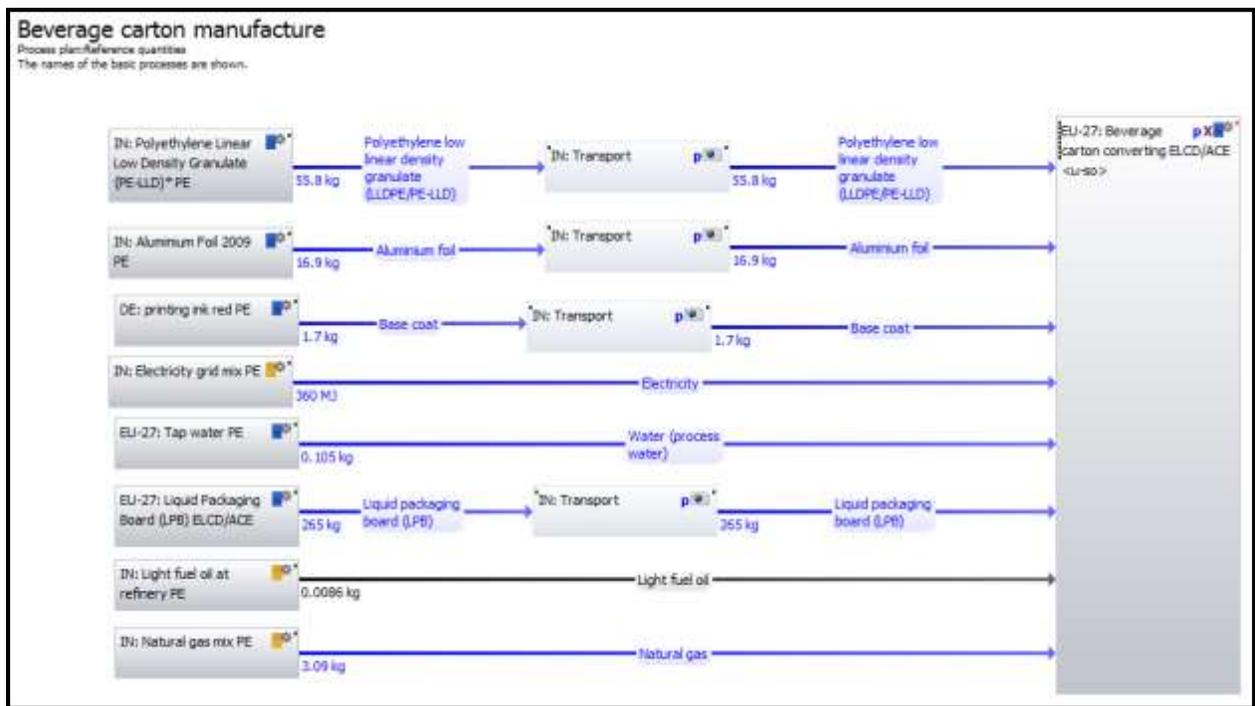


Figure 4: GaBi model for beverage carton manufacturing

3.4 Assumptions and Limitations

- No exceptions to the scope of this study on beverage carton are given
- Beverage carton dataset was adapted to the Indian scenario by considering Indian fuel and energy mix but restricting to the prevailing technology in the European region.

- System components that comprise less than one percent of total system weight were excluded. This cut-off assumption is based on past LCI studies, which demonstrate that materials that comprise less than one percent of system weight have a negligible effect on the LCI results.
- Assumptions for the collection and recycling practices of PCCs in the major cities in South Asia, were based on the study was commissioned to The Energy and Resources Institute (TERI) in April 2011⁵

3.5 Software and Database

The LCA model was created using the GaBi 6 Software system for life cycle engineering, developed by PE International AG. The GaBi database provides the life cycle inventory data for several of the raw and process materials obtained from the upstream system. Detailed database documentation for GaBi datasets can be accessed at <http://www.gabi-software.com/support/gabi/gabi-lci-documentation/data-sets-by-database-modules/professional-database/> and <http://database-documentation.gabi-software.com/support/gabi/gabi-lci-documentation/data-sets-by-database-modules/extension-databases/>.

⁵ T E R I. 2011; Post Consumer Tetra Pak Cartons (PCCs) Management ; New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01]

4 System studied

4.1 Data Collection and Data Management

The data used for studies was evaluated from secondary sources as previously noted in section 3.2.

4.2 Data and Database used

The Electricity details are used specific to the country where the processes have taken place. Table below shows the description of inventory and the source used is GaBi 6 database 2011.

Table 5: Life Cycle Inventory for Energy

Location	Description of the inventory	Source	Representativeness
Electricity, low voltage, at grid inventories			
India	IN: Electricity grid mix PE	GaBi 6 DataBase 2011	Indian Grid Mix (Hard coal 66.1%, Hydro 13.8%, Natural gas 9.9%, Heavy fuel oil 4.1%, lignite 2.2%, Others 3.9%)
India	IN: Natural gas mix PE	GaBi 6 DataBase 2011	India
India	IN: Light fuel oil (LFO) PE	GaBi 6 DataBase 2011	India
India	IN: Diesel mix at refinery PE	GaBi 6 DataBase 2011	India

4.2.1 Life Cycle Inventories of Materials

The description of the inventories of materials in the study is described in this section. Below table shows the materials along with the description of the inventory. For beverage carton materials, closures and labels materials (like aluminium, HDPE, cardboard, paper etc) details are mentioned in the Annex A.

Table 6: Life Cycle Inventory for Material

Material	Description of the inventory	Source	Representativeness
Cardboard for beverage carton	Liquid packaging board production, at plant	GaBi 6 DataBase 2011	Europe
Aluminium sheet [Metals] for Beverage carton	Aluminium	GaBi 6 DataBase 2011	India
Polyethylene low density granulate (PE LD) [Plastics] for Beverage carton	Polyethylene low density	GaBi 6 DataBase 2011	India

4.2.2 Life cycle inventories of material transformation

Table 7: Life Cycle Inventory for Material Transformation

Materials	Description of the inventory	Source	Representativeness
Primary packaging, main container materials			
Beverage Carton	Aluminium foil, paper and polyethylene are converted to beverage carton. European database for the manufacturing process has been adapted to Indian scenario with the use of India specific energy, fuel and material mix.		India

4.2.3 End of Life Inventories

Landfilling of corrugated cardboard, liquid packaging board are modelled based on German landfill model (paper in municipal waste) where in the input specifications were set to paper composition (good data basis) and no landfill gas is incinerated or used for energy recovery. Aluminium foil and polyethylene low density film are modelled based on landfill of inert waste as these are not biodegradable.

Table 8: Life Cycle Inventories for End of Life

End of Life	GaBi 6 Database 2011, India	
Beverage Carton- Liquid packaging board	Disposal, Beverage Carton - Liquid packaging board, 80% to landfill for paper/IN and 20% in open burning	
Representatives	>India, Source: GaBi Professional Database, India /2011 .	

End of Life - Scenario 1	GaBi 6 Database 2011, India	
Beverage Carton- Liquid packaging board	Disposal, Beverage Carton - Liquid packaging board, 71% to landfill for paper/IN and 29% in recycling	
Representatives	>India, Source: T E R I. 2011 Post Consumer Tetra Pak Cartons (PCCs) Management New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01]	

End of Life - Scenario 2	GaBi 6 Database 2011, India	
Beverage Carton- Liquid packaging board	Disposal, Beverage Carton - Liquid packaging board, 65% to landfill for paper/IN and 35% in recycling	
Representatives	>India, Source: T E R I. 2011 Post Consumer Tetra Pak Cartons (PCCs) Management New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01]	

4.2.4 Life Cycle Inventories Used for Transport

Transport is an important parameter for transporting raw materials, SKU from the production site to distributors and to retailers and finally the waste from each sites for disposal and recycled as per the materials.

The road transport model is being used with specific load capacity of 12-14 tons for which the database used is GaBi 6 database 2011. The default utilization rate of 85% is considered. The details of transport are mentioned in Table 9. A schematic diagram of transport of various packaging options also shown in Figure 4.



Table 9: Life Cycle Inventories Used for Transport

Material – Beverage Carton Manufacture	km	Transport medium
IN: Polyethylene Linear Low Density Granulate (PE-LLD)* PE	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity
IN: Aluminium Foil 2009 PE	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity
DE: Printing ink red PE	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity
EU-27: Liquid Packaging Board (LPB) ELCD/ACE	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity
EU-25: Corrugated board boxes ELCD/FEFCO	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity

Material - BC	from	to	km	Transport medium
Beverage Carton [Resources]	Beverage carton manufacture	End of life - Landfill	100	Euro 3, Truck: 12-14t gross weight / 9,3t payload capacity

5 Results – Tetra Pak Carton

5.1 LCIA for Beverage carton

Table 10 shows the breakdown of environmental impacts of beverage carton.

Table 10: Breakdown of Life Cycle Environmental Impacts of Beverage Carton

Impact Category	Cradle to cradle beverage carton	Primary Packaging	Upstream transport	Downstream transport	Disposal and Recycling
Acidification Potential (AP) [kg SO₂-Equiv.]	1.78E-04	1.24E-04	4.40E-07	1.76E-06	5.28E-05
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.12E-05	1.22E-05	9.67E-08	3.86E-07	8.54E-06
Global Warming Potential (GWP 100 years) [kg CO₂-Equiv.]	1.20E-02	-3.05E-03	6.92E-05	2.76E-04	1.47E-02
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	1.16E-02	5.97E-03	2.17E-06	8.66E-06	5.60E-03
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.41E-05	9.30E-06	-1.65E-07	-6.60E-07	5.65E-06
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	5.56E-05	3.75E-05	1.71E-08	6.83E-08	1.80E-05
Primary energy demand from ren. and non ren. resources (net cal. value)[MJ]	7.39E-01	7.25E-01	9.99E-04	3.99E-03	8.28E-03

The global warming potential for beverage carton is 1.2E-02 kg CO₂-equiv. out of which the major contribution is 1.47E-02 kg CO₂-equiv. from disposal and recycling and 2.76E-04 kg CO₂-equiv. from downstream transport. Similarly, the acidification potential is 1.78E-04 kg SO₂-equiv. out of which the major contribution is 1.2E-04 kg SO₂-equiv. from primary packaging and 5.28E-05 kg SO₂-equiv. from disposal and recycling stage. The eutrophication potential is 2.12E-05 kg phosphate-equiv. out of which the major contribution is 1.22E-05 kg phosphate-equiv. from primary packaging and 8.54E-06 kg phosphate-equiv. from disposal and recycling stage. The major contribution to photochemical ozone creation potential is 9.3E-06 kg ethene-equiv. from primary packaging. The primary energy demand is 0.739 MJ out of which the major contribution is 7.2E-01 MJ from primary packaging. The human toxicity potential is 1.16E-02 kg DCB-equiv. out of which the major contribution is 5.97E-03 kg DCB-equiv. from primary packaging and 5.6E-03 kg DCB-equiv. from disposal and recycling. The terrestrial ecotoxicity potential is 5.56E-05 kg DCB-equiv. out of which the major contribution is 3.75E-05 kg DCB-equiv. from primary packaging and 1.80E-05 kg DCB-equiv. from disposal and recycling.

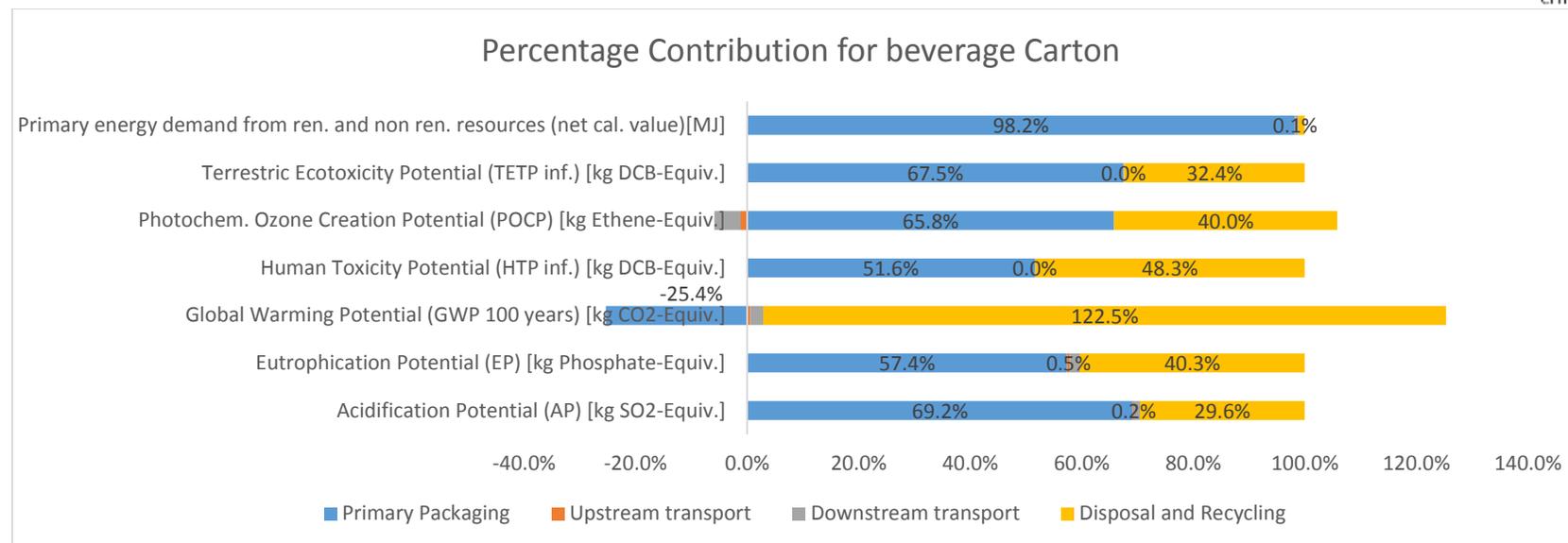


Figure 5: Percentage Contribution for Beverage Carton

Figure 5 shows the percentage contribution for beverage carton. The major contributor to all the environmental impact categories is primary packaging except global warming potential. Primary packaging contributes 69.2% to acidification potential, 57.4% to eutrophication potential, -25.4% to global warming potential, 65.8% to photochemical ozone creation potential and 98.2% to primary energy demand. Disposal and recycling stage contributes 29.6% to acidification potential, 40.3% to eutrophication potential, 122.5% to global warming potential, 40% to photochemical ozone creation potential and 1% to primary energy demand. Other stages of beverage carton value chain are contributing less than 10% to the overall results of the various environmental impact categories. The high value of global warming potential in disposal and recycling stage is because of landfill of liquid packaging board, which produces methane.

Table 11: Breakdown of Cradle-to-gate Environmental Impacts of Primary Packaging for Beverage Carton

Impact Category	Primary packaging beverage carton 180 ml liquor	Printing ink red	Beverage carton converting	Liquid Packaging Board (LPB)	Aluminum Foil	Electricity grid mix	Light fuel oil at refinery	Natural gas mix	Polyethylene Linear Low Density Granulate	Tap water
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Acidification Potential (AP) [kg SO₂-Equiv.]	1.24E-04	1.17E-06	1.04E-07	2.57E-05	3.94E-05	3.74E-05	1.03E-09	2.83E-07	1.94E-05	1.53E-12
	100.0%	1.0%	0.1%	20.8%	31.9%	30.3%	0.0%	0.2%	15.7%	0.0%
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.22E-05	3.95E-08	2.74E-08	6.40E-06	1.96E-06	2.22E-06	4.12E-11	1.86E-08	1.48E-06	5.76E-13
	100.0%	0.3%	0.2%	52.7%	16.2%	18.3%	0.0%	0.2%	12.2%	0.0%
Global Warming Potential (GWP 100 years) [kg CO₂-Equiv.]	-3.05E-03	1.97E-04	2.14E-04	-1.70E-02	5.66E-03	4.13E-03	1.24E-07	4.14E-05	3.74E-03	1.24E-09
	100.0%	-6.5%	-7.0%	559.4%	-185.8%	-135.8%	0.0%	-1.4%	-123.0%	0.0%
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	5.97E-03	4.23E-06	3.10E-07	1.88E-04	3.89E-03	1.44E-03	1.87E-08	7.15E-06	4.43E-04	3.10E-11
	100.0%	0.1%	0.0%	3.2%	65.2%	24.0%	0.0%	0.1%	7.4%	0.0%
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	9.30E-06	1.94E-07	4.33E-07	1.87E-06	2.49E-06	1.86E-06	1.26E-10	3.94E-08	2.42E-06	3.05E-13
	100.0%	2.1%	4.7%	20.1%	26.8%	20.0%	0.0%	0.4%	26.0%	0.0%
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	3.75E-05	2.20E-06	6.35E-09	1.31E-06	1.85E-05	1.11E-05	2.12E-10	6.96E-08	4.32E-06	2.26E-12
	100.0%	5.9%	0.0%	3.5%	49.4%	29.6%	0.0%	0.2%	11.5%	0.0%
Primary energy demand from ren. and non ren. resources (net cal. value)[MJ]	7.25E-01	4.67E-03	0.00E+00	4.65E-01	8.70E-02	4.72E-02	1.15E-05	4.34E-03	1.17E-01	9.85E-09
	100.0%	0.6%	0.0%	64.1%	12.0%	6.5%	0.0%	0.6%	16.1%	0.0%

The global warming potential for primary packaging of beverage carton is -3.0E-03 kg CO₂-equiv. out of which the major contribution is 4.1E-03 from electricity consumption and 3.7E-03 kg CO₂-equiv. from PE-LLD granulate. Similarly, the acidification potential is 1.2E-04 kg SO₂-equiv. out of which the major contribution is 3.9E-05 kg SO₂-equiv. from aluminum foil and 3.8E-05 kg SO₂-equiv. from electricity grid mix. The eutrophication potential is 1.2E-05kg phosphate-equiv. out of which the major contribution is 6.4E-06 kg phosphate-equiv. from liquid packaging board and 2.2E-06 from electricity consumption. The photochemical ozone creation potential is 9.3E-06 kg ethene-equiv. out of which the major contribution is 2.49E-06 kg ethene-equiv. from aluminum foil and 2.5E-06 from PE-LLD granulates. The primary energy demand is 7.3E-01MJ out of which the major contribution is 0.465 from liquid packaging board and 4.7E-01 from PE-LLD granulates. The human toxicity potential is 6.0E-03 kg DCB-equiv. out of which the major contribution is 3.9E-03 kg DCB-equiv. from aluminum foil and 1.4E-03 kg DCB-equiv. from electricity grid mix. The terrestrial

ecotoxicity potential is 3.8E-05 kg DCB-equiv. out of which the major contribution is 1.9E-05 kg DCB-equiv. from aluminum foil 2009 and 1.1E-05 kg DCB-equiv. from electricity grid mix. Table 12 shows the breakdown of environmental impacts of disposal & recycling for beverage carton in India.

Table 12: Breakdown of Environmental Impacts of Disposal & Recycling for Beverage Carton

Impact Category	Disposal and Recycling beverage carton 180 ml liquor	Paper open burning	PE Film open burning	Landfill (Al foil)	Landfill (LPB)	Landfill (PE LD)
Acidification Potential (AP) [kg SO₂-Equiv.]	5.28E-05	3.28E-05	1.78E-05	1.10E-07	1.80E-06	2.89E-07
	100%	62%	34%	0%	3%	1%
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	8.54E-06	3.66E-06	1.99E-06	1.16E-08	2.84E-06	3.07E-08
	100%	43%	23%	0%	33%	0%
Global Warming Potential (GWP 100 years) [kg CO₂-Equiv.]	1.47E-02	1.79E-03	8.06E-04	2.70E-05	1.20E-02	7.13E-05
	100%	12%	5%	0%	82%	0%
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	5.60E-03	3.58E-03	1.98E-03	1.98E-06	3.39E-05	5.22E-06
	100%	64%	35%	0%	1%	0%
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	5.65E-06	1.39E-06	7.55E-07	1.17E-08	3.47E-06	3.09E-08
	100%	25%	13%	0%	61%	1%
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	1.80E-05	1.06E-05	1.10E-06	2.58E-07	5.29E-06	6.81E-07
	100%	59%	6%	1%	29%	4%
Primary energy demand from ren. and non ren. resources (net cal. value)[MJ]	8.28E-03	0.00E+00	0.00E+00	4.15E-04	6.76E-03	1.10E-03
	100%	0%	0%	5%	82%	13%

The global warming potential for disposal and recycling of beverage carton is 1.47E-02 kg CO₂-equiv. out of which the major contribution is 1.2E-02 kg CO₂-equiv. from landfill of liquid packaging board and 1.79E-03 kg CO₂-equiv. from open burning of paper. Similarly, the acidification potential is 5.28E-05 kg SO₂-equiv. out of which the major contribution is 3.28E-05 kg SO₂-equiv. from paper open burning and 1.78E-05 kg SO₂-equiv. from PE-film open burning. The eutrophication potential is 8.54E-06 kg phosphate-equiv. out of which the major contribution is 3.66E-06 kg phosphate-equiv. from paper open burning and 2.84E-06 kg phosphate-equiv. from landfill of liquid packaging board. The photochemical ozone creation potential is 5.65E-06 kg ethene-equiv. out of which the major contribution is 3.47E-06 kg ethene-equiv. from landfill of liquid packaging board and



thinkstep

1.39E-06 kg ethene-equiv. from paper open burning. The primary energy demand is 8.28E-03 MJ out of which the major contribution is 6.76E-03MJ from landfill of liquid packaging board. The human toxicity potential is 5.6E-03 kg DCB-equiv. out of which the major contribution is 3.6E-03 kg DCB-equiv. from paper open burning and 2.0E-03 kg DCB-equiv. from PE film open burning. The terrestrial ecotoxicity potential is 1.8E-05 [kg DCB-equiv.] out of which the major contribution is 1.06E-05 [kg DCB-equiv.] from paper open burning and 5.29E-06 [kg DCB-equiv.] from landfill (LPB).

5.2 Scenario Analysis

The introduction to TERI project is mentioned below verbatim:

With the overarching objective to explore the collection and recycling practices of PCCs in the major cities in South Asia, a study was commissioned to The Energy and Resources Institute (TERI) in April 2011. Following were the major objectives of the study:

- Study the current quantum of Tetra Pak cartons getting procured/ retrieved at the waste dealers' level.
- Assess the actual quantum of Tetra Pak cartons reaching the paper mills which recycle paper from low grade paper waste.
- Understand the value chain and the economics involved in Tetra Pak cartons collection and recycling.
- Gauge, what critical stakeholders (low grade paper waste dealers and recycling paper mills) believe, is needed to upscale collection and recycling – economics, awareness, infrastructure etc.

The scope of work included a questionnaire survey of the key stakeholders (rag pickers, small and large kabadiwalas (junk dealers), low grade paper waste dealers and waste paper based paper mills). The sample size was kept to be 30 comprising of at least 10 rag pickers, 7 small level kabadiwalas, 7 medium level kabadiwalas, 5 large scale low grade paper waste dealers and 1 waste paper based paper mill. The questionnaire was prepared by TERI and after an exhaustive inhouse deliberation and discussion with Tetra Pak, it was provided to the survey partners.

From the data for post-consumer behavior this report calculates the recycling rates of waste paper according the assumption that informal sector⁶ recovers 30% and 40% of the total waste paper generated in 11 major cities. An average of 28.78% and 35.07% was calculated as the total recycling rate for the considered recovery rate. The rest of the waste paper is directed towards landfill in both the scenarios. This data has been modelled and the environmental impact results considering the recycling rate has been tabulated below:

Scenario 1 depicts 30% recovery rate resulting in 28.78% recycling and **Scenario 2** depicts 40% recovery rate resulting in 35.07% recycling.

Table 13: Scenario Analysis for different recycling rates

Impact Category	Base Scenario	Scenario 1	Scenario 2
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.78E-04	1.44E-04	1.43E-04
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.12E-05	1.66E-05	1.63E-05
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	1.20E-02	8.99E-03	8.07E-03
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	1.16E-02	7.98E-03	7.97E-03
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.41E-05	1.20E-05	1.16E-05
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	5.56E-05	4.09E-05	3.97E-05
Primary energy demand from ren. and non ren. resources (net cal. value)[MJ]	7.39E-01	7.11E-01	7.04E-01

⁶ This includes rag pickers, small and large kabadiwalas low grade paper waste dealers and waste paper based paper mills

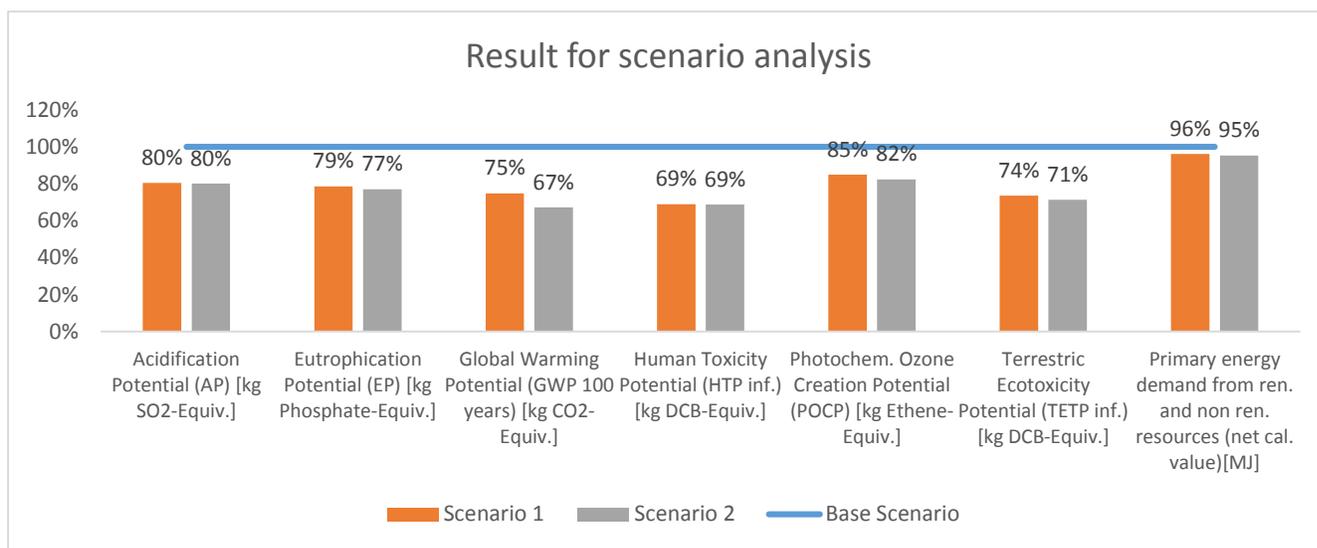


Figure 6: Percentage comparison for scenario analysis

A decline in the impact categories has been observed for both the recycling scenario. The indicators shows saving in the range of 15% to 31% except primary energy demand for Scenario 1 and savings in the range of 18% to 31% for Scenario 2. The breakup of the impact categories is shown below:

Table 14: Percentage reduction for scenario analysis

Impact Category	Cradle to cradle beverage carton 180 ml liquor	Disposal and Recycling	Downstream transport	Primary Packagin g	Upstream transport
GWP Base Case	1.20E-02	1.47E-02	2.76E-04	-3.05E-03	6.92E-05
GWP Scenario 1	8.99E-03	1.16E-02	3.39E-04	-3.05E-03	6.92E-05
% Reduction	25%	21%	-23%	0%	0%
GWP Scenario 2	8.07E-03	1.07E-02	3.52E-04	-3.05E-03	6.92E-05
% Reduction	33%	27%	-27%	0%	0%

The reduction in the impact categories is due to the shift in the end of life disposal method. The process of recycling the beverage carton offsets the emissions as it prevents the use of virgin raw materials by replacing it with waste paper. An overall reduction of 25% and 33% has been observed for 28.78% and 35.07% recycling rates, respectively.

6 Life Cycle Assessment Study of Beverage Carton and its comparison with container glass based on publicly available information

Tetra Pak, India has conducted screening Life Cycle Assessment study of beverage carton for cradle to grave perspective through PE Sustainability Solutions Pvt Ltd a subsidiary of Thinkstep AG, Germany. The study was intended to gain insight in the current environmental impacts for beverage carton and its comparison to container glass based on publicly available information. Bill of material of beverage carton was also collected from public available sources for the Tetra Pak study.

The data for beverage carton was collected from the study conducted by the Alliance for Beverage Cartons & the Environment (ACE) for the "[LCI dataset for converting of beverage carton packaging material](#) (September 2009)⁷" modelled as Indianised GaBi dataset⁸ with some measured data⁹. The data has been tabulated in Annex. No secondary packaging has been considered.

The Indian scenario for Post-Consumer Tetra Pak Cartons (PCCs) Management has been studied by The Energy and Resource Institute (TERI) and articulately represented in the report¹⁰

End of Life study by TERI:

The end of life scenario for beverage carton has changed drastically over the years and is comprehensively studied by TERI - "The Tetra Pak carton is primarily made up of Paper (75% by weight) and the rest is polyethylene-aluminium (25%). As part of environment initiatives, Tetra Pak has undertaken various activities for collection and recycling of these Post Consumer Tetra Pak Cartons (PCCs) and is working with various NGO's and the waste picker workforce to segregate PCCs. With the aim to ensure that the PCCs are retrieved and recycled responsibly and that no carton ends up at the landfill, Tetra Pak has taken up several studies in the past in this regard." (TERI Report, page 1¹¹).

The scope of the TERI study included a questionnaire survey of the key stakeholders (rag pickers, small and large kabadiwalas (junk dealers), low grade paper waste dealers and waste paper based paper mills). The sample size was kept to be 30 comprising of at least 10 rag pickers, 7 small level kabadiwalas, 7 medium level kabadiwalas, 5 large scale low grade paper waste dealers and 1 waste paper based paper mill. The questionnaire was prepared by TERI and after an exhaustive inhouse deliberation and discussion with Tetra Pak, it was provided to the survey partners.

The TERI study also computes the recycling rates according to the assumption that informal sector (This includes rag pickers, small and large kabadiwalas low grade paper waste dealers and waste paper based paper mills) recovers 30% and 40% of the total waste paper generated in 11 major cities. An average of

⁷ LCI dataset for converting of beverage carton packaging material

⁸http://gabi-dataset-documentation.gabi-software.com/xml_data/processes/90a3b10d-83cc-4bc7-a715-991e2ea786ad_01.00.000.xml

⁹ The weight and the surface area of the beverage carton was measured precisely to obtain the total weight per area ratio

¹⁰ T E R I. 2011; Post Consumer Tetra Pak Cartons (PCCs) Management ; New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01]

¹¹ T E R I. 2011; Post Consumer Tetra Pak Cartons (PCCs) Management ; New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01] [page 1]

28.78% and 35.07% was calculated as the total recycling rate for the considered recovery rate. The rest of the waste paper is directed towards landfill in both the scenarios. This data has been modelled and the environmental impact results considering the recycling rate and reported in the TERI report.¹²

In this LCA study, of beverage carton for Tetra Pak, the conclusion has been drawn based on the following three studies:

1. LCA study of 180 ml beverage carton conducted for Tetra Pak by PE Sustainability Solutions Pvt Ltd
2. Waste management study carried out by TERI for Tetra Pak [TERI 2011; Post Consumer Tetra Pak Cartons (PCCs) Management, New Delhi: The Energy and Resources Institute. 79 pp., [Project Report No. 2011 EE 01]]
3. Publically available study carried out by All India Glass Manufacturing Association (AIGMF) for “Container Glass and Comparison with Alternate Packaging Mediums (PET, Beverage Carton, Aluminum Can and Pouch)”¹³.

Summary of AIGMF Abridged Study

The following table shows the **functional unit** of different packaging solution which are considered in the AIGMF study:

Bottle Type	Glass Bottle	Beverage Carton
Packaging size (ml)	180	180
Packaging Use	Liquor	Liquor

The **assumptions** for the “Publically available AIGMF Study”¹⁴ includes,

- site-specific (for 24 sites) data for glass container representative of current technology used in India (72% of production volume) of reference year 2010-11 were collected and analyzed for container glass
- no impact due to the filling process and the use phase of the container
- The container glass packaging solution undergoes multiple reuses. The recycling of post-consumer container glass back into container glass is based on primary data collected from container glass manufacturing companies. About 37.98% of the glass is send to landfill, followed by 32.02% recycling and about 30% of the glass is reused. (“Publically available AIGMF Study”)
- The liquid packaging board’s end of life stage is limited to landfill and open burning as mentioned in the “Recycling” table (page 9 of the “Publically available AIGMF Study”). About 80% of the waste is send to landfill and rest (20%) is incinerated via open burning.

Table 15 has been represented in “Publically available AIGMF Study” showing the environmental profile of 180 ml container glass.

¹² T E R I. 2011 Post Consumer Tetra Pak Cartons (PCCs) Management; New Delhi: The Energy and Resources Institute. 79 pp. [Project Report No. 2011 EE 01] [table 27 and 28]

¹³ http://www.aigmf.com/GlassLCA_AbridgedReport_AIGMF.pdf

¹⁴ http://www.aigmf.com/GlassLCA_AbridgedReport_AIGMF.pdf

Table 15: Environmental profile of 180 ml container glass [Source: page 11; Publically Available AIGMF Study¹⁵]

Impact Category	Cradle to cradle Glass 180 ml (1)
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.20E-03
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	9.40E-05
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	1.60E-01
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	3.40E-02
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	4.70E-05
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	4.20E-04
Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]	2.30E+00

The environmental impact on a scale of 100 of glass (column 1) and beverage carton (column 2) as mentioned in Table 6, Column 1 and Column 7, Page 11 of “Publically available AIGMF Study”¹⁶ are shown in Table 16 below.

Table 16: Comparison of 180 ml Glass with Beverage Carton

Impact Category	Glass Ref (1)	Beverage Carton Ref (2)
Acidification Potential (AP) [kg SO ₂ -Equiv.]	100	18
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	100	36
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	100	12
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	100	35
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	100	39
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	100	24
Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]	100	44

Based on the relative information for glass and beverage carton and absolute values of LCIA of glass, Table 17 represents the absolute values of LCIA for beverage carton.

Table 17 Absolute LCIA for Beverage Carton

Impact Category	Glass Ref (1)	Beverage Carton Ref (2)
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.20E-03	2.16E-04
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	9.40E-05	3.38E-05
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	1.60E-01	1.92E-02
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	3.40E-02	1.19E-02

¹⁵ http://www.aigmf.com/GlassLCA_AbridgedReport_AIGMF.pdf [page 11; table 6]

¹⁶ http://www.aigmf.com/GlassLCA_AbridgedReport_AIGMF.pdf [page 11; table 6]



Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	4.70E-05	1.83E-05
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	4.20E-04	1.01E-04
Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]	2.30E+00	1.01E+00

6.1 Comparative Discussion

This section compares the result generated in all three studies for comparative functional unit – container with 180 ml capacity to hold fluid.

Column (1) of Table 18 represents the environmental profile of container glass as per “Publicly Available AIGMF study”. Based on the absolute results of container glass in Table 15, the absolute value of beverage carton as per AIGMF study is shown in column (2) of Table 18. Column (3) represents the results of beverage carton study conducted by Tetra Pak considering end of life of beverage carton as 80% landfill and 20% going for open burning. Column (4) and (5) represents the results of beverage carton considering *scenario 1* [71% to landfill and 29% recycling] and *scenario 2* [65% to landfill and 35%] of TERI End of Life study respectively.

Table 18: Environmental profile of glass container and beverage carton based on AIGMF and Tetra Pak Study

Impact Category	AIGMF		Tetra Pak + TERI		
	Cradle to cradle Glass 180 ml (1)	Absolute Result for Beverage Carton (2)	Cradle to cradle beverage carton - Tetra Pak Study (3)	Scenario 1 - 30% Recovery (4)	Scenario 2 - 40% Recovery (5)
Acidification Potential (AP) [kg SO₂-Equiv.]	1.20E-03	2.16E-04	1.78E-04	1.44E-04	1.43E-04
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	9.40E-05	3.38E-05	2.12E-05	1.66E-05	1.63E-05
Global Warming Potential (GWP 100 years) [kg CO₂-Equiv.]	1.60E-01	1.92E-02	1.20E-02	8.99E-03	8.07E-03
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	3.40E-02	1.19E-02	1.16E-02	7.98E-03	7.97E-03
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	4.70E-05	1.83E-05	1.41E-05	1.20E-05	1.16E-05
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	4.20E-04	1.01E-04	5.56E-05	4.09E-05	3.97E-05
Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]	2.30E+00	1.01E+00	7.39E-01	7.11E-01	7.04E-01

Table 19 represents the environmental profile of container glass and beverage carton on a scale of 100, based on AIGMF, Tetra Pak and TERI studies.

Table 19: Percentage comparative environmental profile for glass container and beverage carton based on AIGMF, Tetra Pak and TERI Study

Impact Category	AIGMF		Tetra Pak + TERI		
	Cradle to cradle Glass 180 ml	Absolute Result for Beverage Carton	Cradle to cradle beverage carton - Tetra Pak Study	Scenario 1 - 30% Recovery	Scenario 2 - 40% Recovery
Acidification Potential (AP) [kg SO₂-Equiv.]	100%	18.0%	14.8%	12.0%	11.9%
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	100%	36.0%	22.6%	17.7%	17.3%
Global Warming Potential (GWP 100 years) [kg CO₂-Equiv.]	100%	12.0%	7.5%	5.6%	5.0%
Human Toxicity Potential (HTP inf.) [kg DCB-Equiv.]	100%	35.0%	34.1%	23.5%	23.4%
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	100%	39.0%	30.0%	25.5%	24.7%
Terrestrial Ecotoxicity Potential (TETP inf.) [kg DCB-Equiv.]	100%	24.0%	13.2%	9.7%	9.5%
Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]	100%	44.0%	32.1%	30.9%	30.6%

Table 19 shows that beverage carton when compared to container glass, gives a lower environmental impact. Scenario with more recycling rates of 29% and 35% shows even lower environmental impacts.



Annex A LCI DATASET FOR BEVERAGE CARTON

Inputs:		
	Quantity:	Unit:
Grid electricity	360	MJ
Natural Gas*	114.6	MJ
Fuel oil light*	0.367	MJ
LPG*	22.7	MJ
Water	0.105	m ³
Printing ink	1.7	kg
Polyethylene	Specified by user	
Aluminium foil	Specified by user	
Liquid Packaging Board	Specified by user	
<i>Secondary Packaging Materials:</i>		
corrugated cardboard	10	kg
LDPE shrink foil	0.6	kg
Outputs:		
	Quantity:	Unit:
<i>Product:</i>		
Converted board (BC)	1000	m ²
<i>Waste:</i>		
special waste	3.08E-01	kg
<i>Emissions to air from process:</i>		
VOC	5.,93E-02	kg
<i>Emissions to air from on-site fuel use:</i>		
CO ₂ , fossil	7.60E+00	kg
N ₂ O	1.39E-04	kg
CO	2.89E-03	kg
CH ₄	6.94E-04	kg
NM VOC	6.94E-04	kg
NO _x	7.70E-03	kg
SO ₂	8.71E-05	kg
dust	1.96E-05	kg
<i>Product waste:</i>		
Product waste	7.1	%**
* lower heating value used for calculation		
**: % of input materials, thereof >96% are sent to recycling (~3% landfill/ ~1% incineration)		

Annex B DESCRIPTION OF SELECTED INVENTORIES AND IMPACT CATEGORIES

Acidification Potential

The acidification of soils and waters occurs predominantly through the transformation of air pollutants into acids. This leads to a decrease in the pH-value of rainwater and fog from 5.6 to 4 and below. Sulphur dioxide and nitrogen oxide and their respective acids (H_2SO_4 und HNO_3) produce relevant contributions. This damages ecosystems, whereby forest dieback is the most well-known impact.

Acidification has direct and indirect damaging effects (such as nutrients being washed out of soils or an increased solubility of metals into soils). But even buildings and building materials can be damaged. Examples include metals and natural stones which are corroded or disintegrated at an increased rate.

When analysing acidification, it should be considered that although it is a global problem, the regional effects of acidification can vary.

The acidification potential is given in sulphur dioxide equivalents (SO_2 -Eq.). The acidification potential is described as the ability of certain substances to build and release H^+ - ions. Certain emissions can also be considered to have an acidification potential, if the given S-, N- and halogen atoms are set in proportion to the molecular mass of the emission. The reference substance is sulphur dioxide.

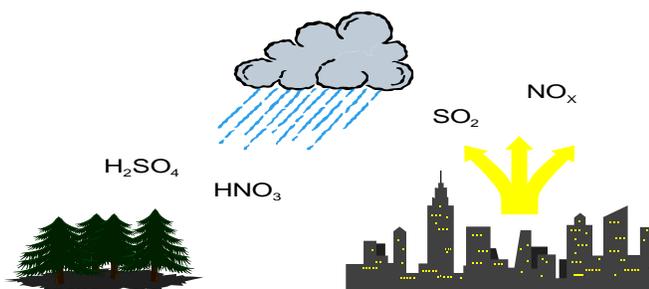


Figure 7 Acidification potential¹⁷

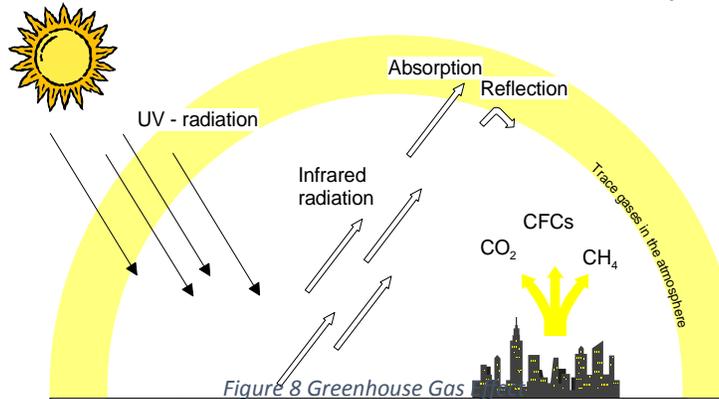
Global Warming Potential

The mechanism of the greenhouse effect can be observed on a small scale, as the name suggests, in a greenhouse. These effects are also occurring on a global scale. The occurring short-wave radiation from the sun comes into contact with the earth's surface and is partly absorbed (leading to direct warming) and partly reflected as infrared radiation. The reflected part is absorbed by so-called greenhouse gases in the troposphere and is re-radiated in all directions, including back to earth. This results in a warming effect at the earth's surface.

In addition to the natural mechanism, the greenhouse effect is enhanced by human activities. Greenhouse gases that are considered to be caused, or increased, anthropogenically are, for example, carbon dioxide, methane and CFCs. An analysis of the greenhouse effect should consider the possible long term global effects.

¹⁷ Kreißig, J.; Kümmel, J (1999): Baustoff-Ökobilanzen. Wirkungsabschätzung und Auswertung in der Steine-Erden-Industrie. Hrsg. Bundesverband Baustoffe Steine + Erden e.V

The global warming potential is calculated in carbon dioxide equivalents (CO₂-Eq.). This means that the greenhouse potential of an emission is given in relation to CO₂. Since the residence time of the gases in the atmosphere is incorporated into the calculation, a time range for the assessment must also be specified. A period of 100 years is customary.



Primary energy demand

Primary energy demand is often difficult to determine due to the various types of energy source. Primary energy demand is the quantity of energy directly withdrawn from the hydrosphere, atmosphere or geosphere or energy source without any anthropogenic change. For fossil fuels and uranium, this would be the amount of resource withdrawn expressed in its energy equivalent (i.e. the energy content of the raw material). For renewable resources, the energy-characterised amount of biomass consumed would be described. For hydropower, it would be based on the amount of energy that is gained from the change in the potential energy of the water (i.e. from the height difference). As aggregated values, the following primary energies are designated:

The total **“Primary energy from non renewable resources”**, given in MJ, essentially characterises the gain from the energy sources natural gas, crude oil, lignite, coal and uranium. Natural gas and crude oil will be used both for energy production and as material constituents e.g. in plastics. Coal will primarily be used for energy production. Uranium will only be used for electricity production in nuclear power stations.

The total **“Primary energy from renewable resources”**, given in MJ, is generally accounted separately and comprises hydropower, wind power, solar energy and biomass.

It is important that the end energy (e.g. 1 kWh of electricity) and the primary energy used are not miscalculated with each other; otherwise the efficiency for production or supply of the end energy will not be accounted for.

The energy content of the manufactured products will be considered as feedstock energy content. It will be characterized by the net calorific value of the product. It represents the still usable energy content.

Aquatic Eutrophication

Aquatic Eutrophication occurs when excessive amounts of nutrients reach freshwater systems or oceans. Algae bloom may result and fish may disappear. Whereas phosphorous is mainly responsible for eutrophication in freshwater systems, nitrogen is mainly responsible for eutrophication in ocean water bodies.



The Aquatic Eutrophication indicator based on the potential impact relative to the reference substance phosphorous, i.e. [kg P eq / FU] is recommended for freshwater eutrophication and mass of nitrogen equivalents [kg N eq] / FU] is recommended for marine eutrophication.

Photochemical Ozone Creation Potential (POCP)

Definition

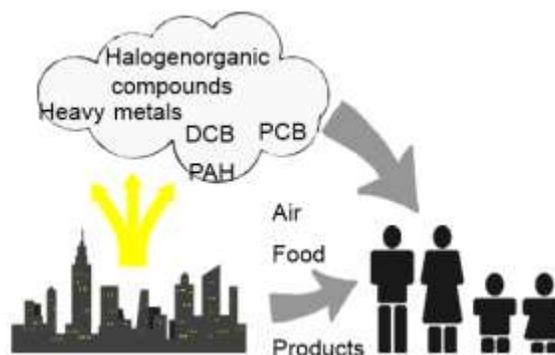
Photochemical Ozone Creation Potential (POCP) is the potential of ozone creation at ground level (i.e. tropospheric ozone) through photochemical transformation of ozone precursor emissions. The main ozone precursor compounds are nitrogen oxides (NO_x) and non-methane volatile organic compounds

(NMVOC). Mass of non-methane volatile organic compound equivalents, e.g. [kg NMVOC eq / FU] calculated using the “photochemical oxidant formation potential” indicator at a midpoint level, as described in the ReCiPe impact assessment methodology.

Freshwater Consumption

Methodologies for the measurement and assessment of life cycle impacts related to water resources are currently under development within the scientific community as well as in international initiatives, such as the UNEP/SETAC Life Cycle Initiative (<http://lcinitiative.unep.fr>), and standardization bodies such as ISO which is currently working on the international standard ISO/WD 14046 Water footprint—Requirements and guidelines. Due to the ongoing development, it is premature to recommend life cycle impact assessment methods for freshwater use. We therefore recommend to measure net water consumption (also called “consumptive use”) on an inventory level. Aggregating different measures of water, such as in-stream water use (e.g. turbined river water for hydro power generation), off-stream use (e.g. cooling water that is returned to the same watershed) or degradative use (e.g. water pollution) at an inventory level would not generate useful decision support and they are therefore excluded from this indicator awaiting the acceptance of a relevant impact assessment method.

Human Toxicity Potential (HTP): The human toxicity potential (HTP), a calculated index that reflects the potential harm of a unit of chemical released into the environment, is based on both the inherent toxicity of a compound and its potential dose. It is used to weight emissions inventoried as part of a life-cycle assessment (LCA) or in the toxics release inventory (TRI) and to aggregate emissions in terms of a reference compound. Total emissions can be evaluated in terms of benzene equivalence (carcinogens) and toluene equivalents (noncarcinogens).



USED BEVERAGE CARTON (UBC) MANAGEMENT STUDY FOR INDIA

Executive Summary

Prepared for
Tetra Pak India Pvt Ltd



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Preface

In India, Tetra Pak was among the first carton packaging companies started in the year 1987. The main focus of Tetra Pak is to provide safe food which is accessible and sustainable in nature to benefit lives of many. Tetra Pak is actively involved and has taken up various initiatives to ensure protection of food as well as future of the people (aligning its activities towards SDGs). With the sole purpose to understand the management of used beverage carton, Tetra Pak appointed The Energy and Resources Institute (TERI) to undertake this study. We laud the efforts of corporates like Tetra Pak who come forward voluntarily to commission such comprehensive studies.

Tetra Pak is consistently being proactive for safeguarding environment and has been involved in many cities to set up collection centres for Used Beverage Cartons (UBCs) as well as raising awareness among public through information, education and capacity building programs. This is a third report in the series by Tetra Pak to help understand management of UBCs and evaluate recycling rates in Indian subcontinent, after years 2011 and 2015. Every report has extended its horizon as well as number of stakeholders for interaction to assess collection and recycling of UBCs. Tetra Pak has been doing voluntary EPR for more than 15 years now and has been continuously working with recyclers across South Asian region to develop solutions, technologies and applications. Through constant interactions and tie ups with recyclers to develop solutions, technologies and applications of UBCs, Tetra Pak has always tried to bring up the level of active sorting of UBCs and reduce mixed waste recycling. Thus, making recycling of UBCs more effective, efficient and economical.

The span of this study was spread in 20 selected cities of India and 03 cities of Kathmandu, Sri Lanka and Bangladesh. This particular report specifically talks about 20 Indian cities. Compared to the earlier study conducted by TERI on UBC management (also called Post-consumer carton management) for Tetra Pak it was observed that recycling rate was about 29-35% in 2011, about 48 to 51% in 2015 and is now increased to about 54% in 2019.

We hope this type of study will definitely help Tetra Pak to formulate appropriate strategies to enhance the recycling rates of UBCs and help achieve SDGs. This report will also be helpful to policy makers, urban local bodies, think tanks, NGOs and waste processors to understand the scenario of UBCs management and it's potential.



Dr Ajay Mathur

Executive Summary

Beverage cartons allow distribution of liquid & food products at ambient temperature or under refrigerated conditions by extending shelf life of foods and beverages. A beverage carton is majorly made up of 75% paperboard, 4% aluminium and 21% polymers, thus categorizing these cartons as paper-based packaging. Paperboard used in beverage carton is a valuable raw material that can be easily recycled for making new paper-based products. Aluminium present in the carton is very thin and similar to human hair. It helps in creating a barrier for oxygen, flavours and light. Polymer acts as an inner layer which seals the liquid and acts as an adhesive to aluminium, fibre and external layer as well to keep out the moisture. These paper-based cartons are fully recyclable.

In India, Tetra Pak was among the first carton packaging companies started in the year 1987. It created a lot of job opportunities. The company brought in newer technologies that were customized for Indian markets. The main focus of Tetra Pak is to provide safe food which is accessible and sustainable in nature to benefit lives of many. Tetra Pak India is way ahead of many countries and is one of the fastest growing markets globally.

Tetra Pak offers a wide variety of openings and closures for the cartons, which are bio-based caps made up of HDPE (High Density Poly-ethylene) which is derived from sugarcane. Tetra Pak is one of the first among all other companies to use bio-based HDPE. This is helping improve the environmental performance of packaging, making recycling much more convenient and therefore is economically beneficial.

In India, Tetra Pak is leading and is the first manufacturing company for beverage cartons. Over the last 30 years many packaging formats have been introduced and advanced in different sizes and these packages are kept at different prices so they could suit different consumer requirements.

Tetra Pak is actively involved to ensure that its cartons don't end up in landfill from last 15 years and has taken up various initiatives to make sure the cartons are collected, sorted and recycled and ensure protection of food as well as future of the people (aligning its activities with the SDGs). With the sole purpose to understand the management of used beverage carton, Tetra Pak appointed TERI to undertake this study and help them formulate appropriate strategies to enhance the recycling rates of UBCs.

The paper-based beverage cartons manufactured by Tetra Pak are fully recyclable and out of the overarching 161,000 Tonnes per day of Municipal Solid Waste our urban cities generate, they form only a miniscule part. Tetra Pak is consistently being proactive for safeguarding environment and has been involved in many cities to set up collection centres for Used Beverage Cartons (UBCs) as well as raising awareness among public through various information, education and capacity building programs. This is a third report of its kind within this decade by Tetra Pak to help evaluate recycling rates of UBCs, after year 2011 and year 2015. Every report has extended its horizon as well as number of stakeholders for interaction.

Tetra Pak has been fulfilling extended producer responsibility (EPR) voluntarily for more than past 15 years now and has been continuously working with recyclers across South Asian region to develop solutions, technologies and applications for UBCs. Through

constant interactions and tie ups with recyclers to develop solutions, technologies and applications of UBCs, Tetra Pak has always tried to bring up the level of active sorting of UBCs and reduce mixed waste recycling. Thus, making recycling of UBCs more effective, efficient and economical.

This study was undertaken with the overarching objective to explore the perceptions of waste generators and waste collectors on UBC management, and evaluating the quantity of UBCs collected for recycling with mixed waste paper through scrap dealers. The span of this study is spread across 20 cities of India and 03 cities of Kathmandu, Sri Lanka and Bangladesh. This particular report specifically talks about 20 Indian cities.

Methodology consists of selecting cities with highest beverage carton sales and spread across South, North, East and West regions of the country and conducting primary field surveys with various stakeholders as Waste generators (10/city), Waste collectors (20/city), Small scale scrap dealers (14/city), Large scale waste dealers (07/city), Dumpsite (03/city), Paper Mill (1/region). Local survey agencies were identified in each of the project city to carry out on ground data collection and survey. Reputed NGOs/ agencies active in the field of solid waste management were selected for the study with help from Tetra Pak India Pvt Ltd (TPIPL)

Sub Objectives of this study:

- Study the current quantum of UBC getting procured/ retrieved at the waste dealers' level for further recycling with mixed waste paper.
- Understand the value chain and economics involved in UBC collection and recycling.
- Assess the actual quantum of UBC reaching the paper mills which recycle paper from low grade paper waste.
- Understanding the composition of paper waste and quantity of UBC reaching dumpsites in the surveyed cities.
- Gauge, what critical stakeholders (low grade paper waste dealers and recycling paper mills) believe, is needed to upscale collection and recycling.

For the selected study area i.e. the selected city, detailed secondary data collection in relevance to waste management and waste characterization was carried out. Under the guidance and monitoring of TERI research staff, primary survey was conducted through questionnaire seeking information from all the major stakeholders involved in the management of the UBC including the consumers (from different socio-economic backgrounds), waste collectors, different levels of waste / scrap dealers (small and large scale waste paper dealers) spread across the city. This study also included surveys at recyclers / paper mills using mixed waste paper as raw material to understand the fate of UBCs getting mixed with it. Survey also involved evaluation of UBC reaching the disposal site (Landfill) in the selected city.

The key findings of the study are as follows:

The study revealed that UBCs are being collected by rag pickers, small scale waste paper dealers, and large scale dealers and are then sent to recycling units. The outcomes of the study revealed the percentage of dealers dealing with UBCs and are depicted in figure below.

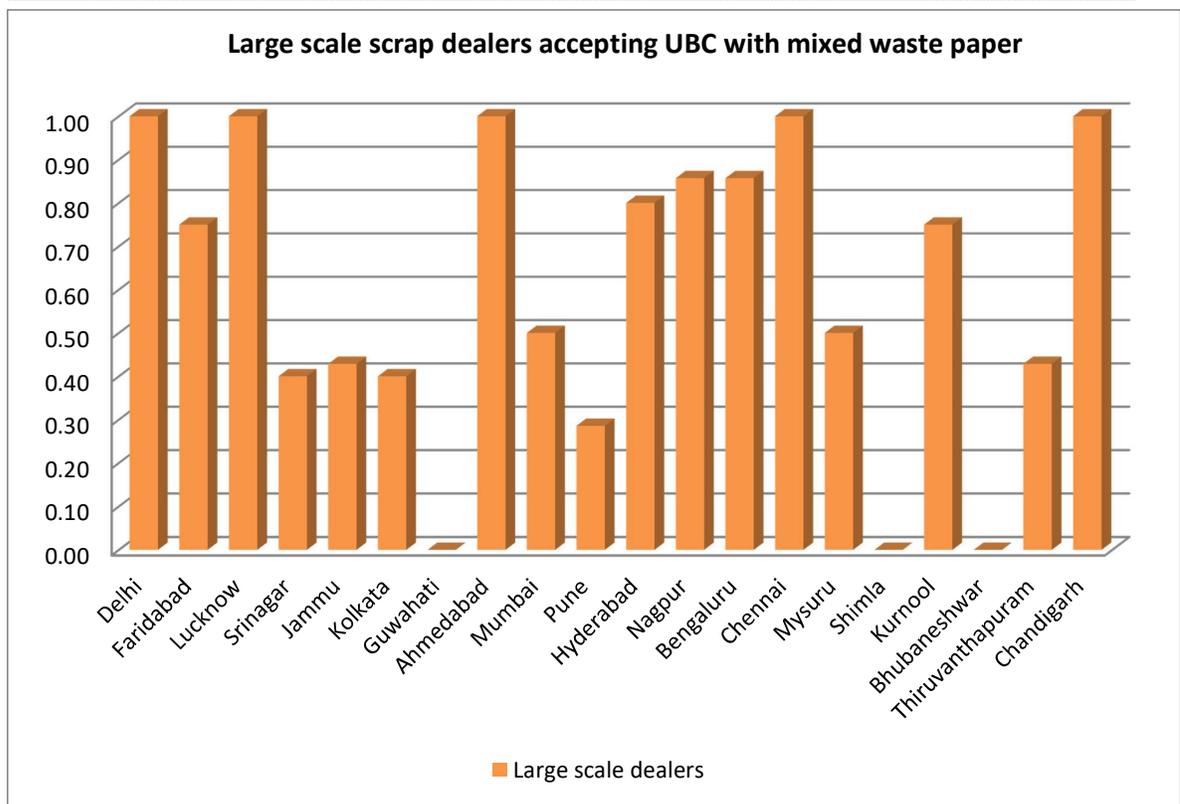


Figure 1 Fraction of Large scale scrap dealers accepting UBCs in the survey cities
 It was found that in cities like Ahmedabad, Chandigarh, Chennai, Delhi and Lucknow 100% of dealers were accepting UBCs.

Figure2 depicts average UBCs found with mixed waste paper bales at respective cities.

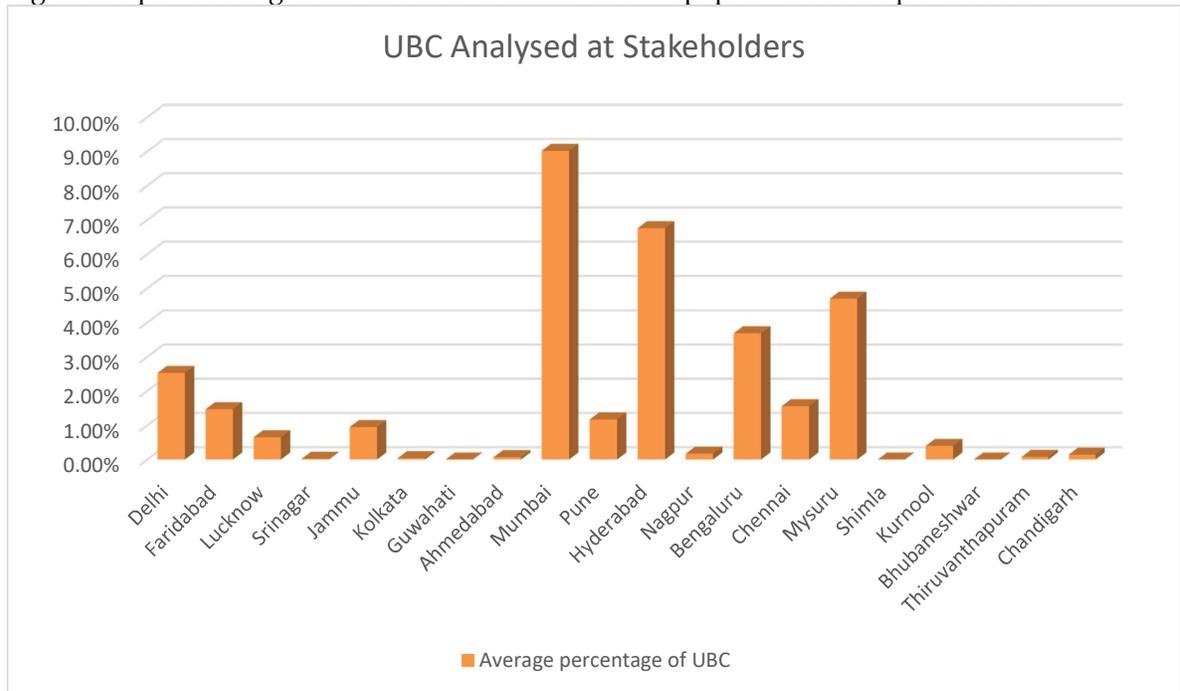


Figure 2 UBC found with mixed waste paper at dealers in the survey cities

The figure 3 depicts recycling rate with limitation of 100% recycling revealed after surveying various cities.

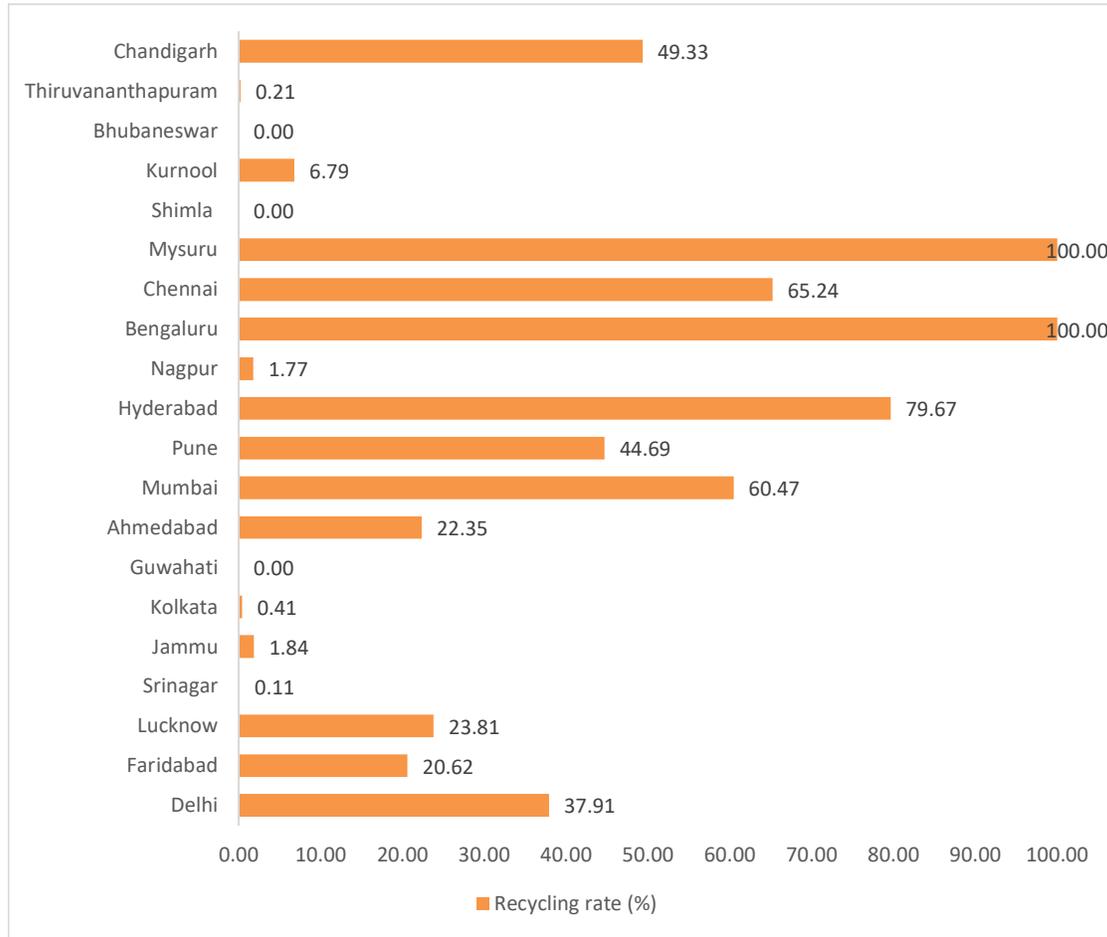


Figure 3 Recycling rates of UBCs in the survey cities by informal sector

The study also showed that 60% of the paper mills surveyed were involved in collecting UBCs from dealers but none of them dealt with UBCs separately. Compared to the earlier study conducted by TERI on Post-consumer carton (also called UBCs now) management for Tetra Pak it was observed that

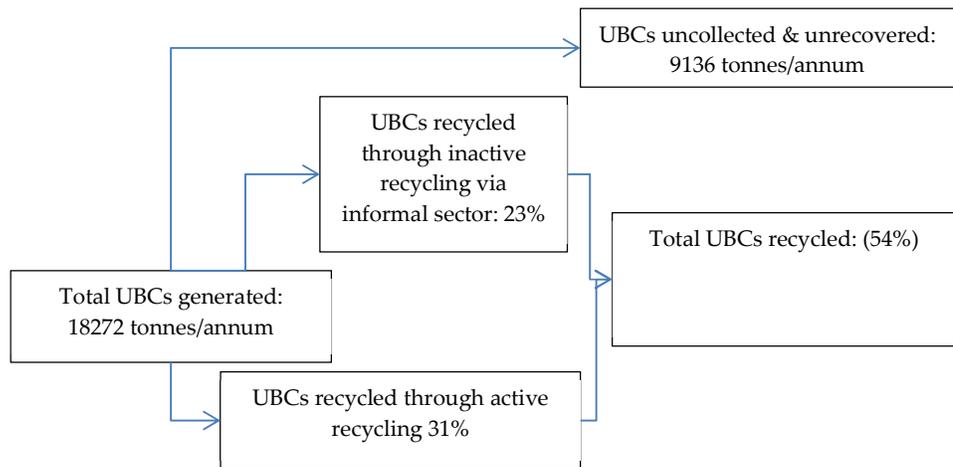


Figure 4: UBC management in India

recycling rate was about 29-35% in 2011, about 48 to 51% in 2015 and is now increased to **about 54% in 2019.**

It was thus clear that recycling rates have increased due to interventions of Tetra Pak, by virtue of working with numerous recyclers and associations to develop solutions, technologies and applications of UBCs. Due to these interventions, the quantity of UBCs going along with mixed paper has reduced and separate collection and recycling of UBCs have been achieved especially in cities like Delhi, Ahmedabad, Mumbai, Pune, Hyderabad, Bengaluru, Chennai, Chandigarh, Mysuru, and Faridabad.

Few of the key recommendations of the study which can be beneficial and help in further improving the recycling rate of UBCs are as follows:

1. As compared to the 2015 study, UBCs collected by informal sector in cities of Ahmedabad, Hyderabad and Bengaluru has reduced and viz a viz UBCs entering into formal active recycling has increased. This indicates the impact of interventions by Tetra Pak to make UBCs sustainable. There is a further need to get the UBCs into active recycling chain as this will not only increase the market potential but will also reduce the number of stakeholders involved in recycling chain. This will increase the price value for those on the front end of the recycling value chain i.e. waste collectors.
2. In cities of Jammu, Kolkata and Guwahati; an urgent attention is required, as due to the lack of acceptance of UBCs by paper mills, the amount of UBCs collected by informal sector has substantially reduced. Active UBC collection and tie ups with recycling units can help push UBCs collection and recycling in these cities again.
3. Pertaining to other surveyed cities, acceptability of UBCs via paper mills is the first key imperative that can help improve the UBCs acceptability among waste dealers. This will require information, education and capacity building activities with paper mills along with a strong business case depicting profitability scenarios through fibrous contents of paper based UBCs.
4. A separate collection centre for UBCs should be made which should be linked with material recovery facilities (existing/coming up under the Solid Waste management rules 2016) to facilitate active recycling of UBCs
5. More awareness among waste generators, waste collectors, small and large scale waste dealers can help in segregation of UBCs at source along with straws, however this should be a concerted effort by each stakeholder in the value chain i.e. government, NGOs, industry, etc
6. Higher prices of UBCs can effectively drive the informal recycling and increase recycling rates. Higher prices can be achieved in two ways a) by reducing the chain for collection and recycling and b) Upcycling UBCs through different products and interventions like sheets being used for making mobile toilets/ material recovery facilities etc.
7. The management of UBCs should be further studied and successful lessons should be replicated at other places
8. Such an exercise (to study the management of UBCs in major cities and identify the recycling rates) may be repeated in every 03 years to reassess the improvement in recycling rates and plan interventions and strategies.

About TERI

TERI is an independent, multi-dimensional organization, with capabilities in research, policy, consultancy and implementation. We are innovators and agents of change in the energy, environment, climate change and sustainability space, having pioneered conversations and action in these areas for over four decades.

We believe that resource efficiency and waste management are the keys to smart, sustainable and inclusive development. Our work across sectors is focused on;

- a) Promoting efficient use of resources,
- b) Increasing access and uptake of sustainable inputs and practices, and
- c) Reducing the impact on environment and climate.

Our research, and research based solutions have had a transformative impact on industry as well as communities. We have fostered international collaboration on sustainability action by creating a number of platforms and forums. We do this by translating our research into technology products, technical services, as well as policy advisory and outreach.

Headquartered in New Delhi, we have regional centres and campuses in Gurugram, Bengaluru, Guwahati, Mumbai, Panaji, and Nainital. Our 1200-plus team of scientists, sociologists, economists and engineers delivers insightful, high quality action-oriented research and transformative solutions supported by state-of-the-art infrastructure.



The Energy and Resources Institute

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