National Association for PET Container Resources
www.napcor.com

NAPCOR™

POLYETHYLENE TEREPHTHALATE

PET

When it comes down to it, the essential role of a package is to **protect** the product it contains, delivering it safely, with all of its features and benefits **intact.**
The PET package does this and much more.

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This document can be found on-line in pdf format with live links at **www.napcor.com/PET/whatispet.html**
For more about NAPCOR, its mission and members, visit **www.napcor.com**

"PET is a **transparent, lightweight, strong, safe, shatterproof** and **recyclable** packaging material with an **inherent barrier**, making it suitable for a wide array of product applications."

SUITABLE FOR VARIED USE

"PET packages are made in two ways: **blow molded** to create bottles (and other narrow mouth containers), or **thermoformed** from sheet (to create items such as clamshell produce or bakery containers)."

PET container types include:

- bottles
- cups
- take-out containers

Products packaged in PET include:

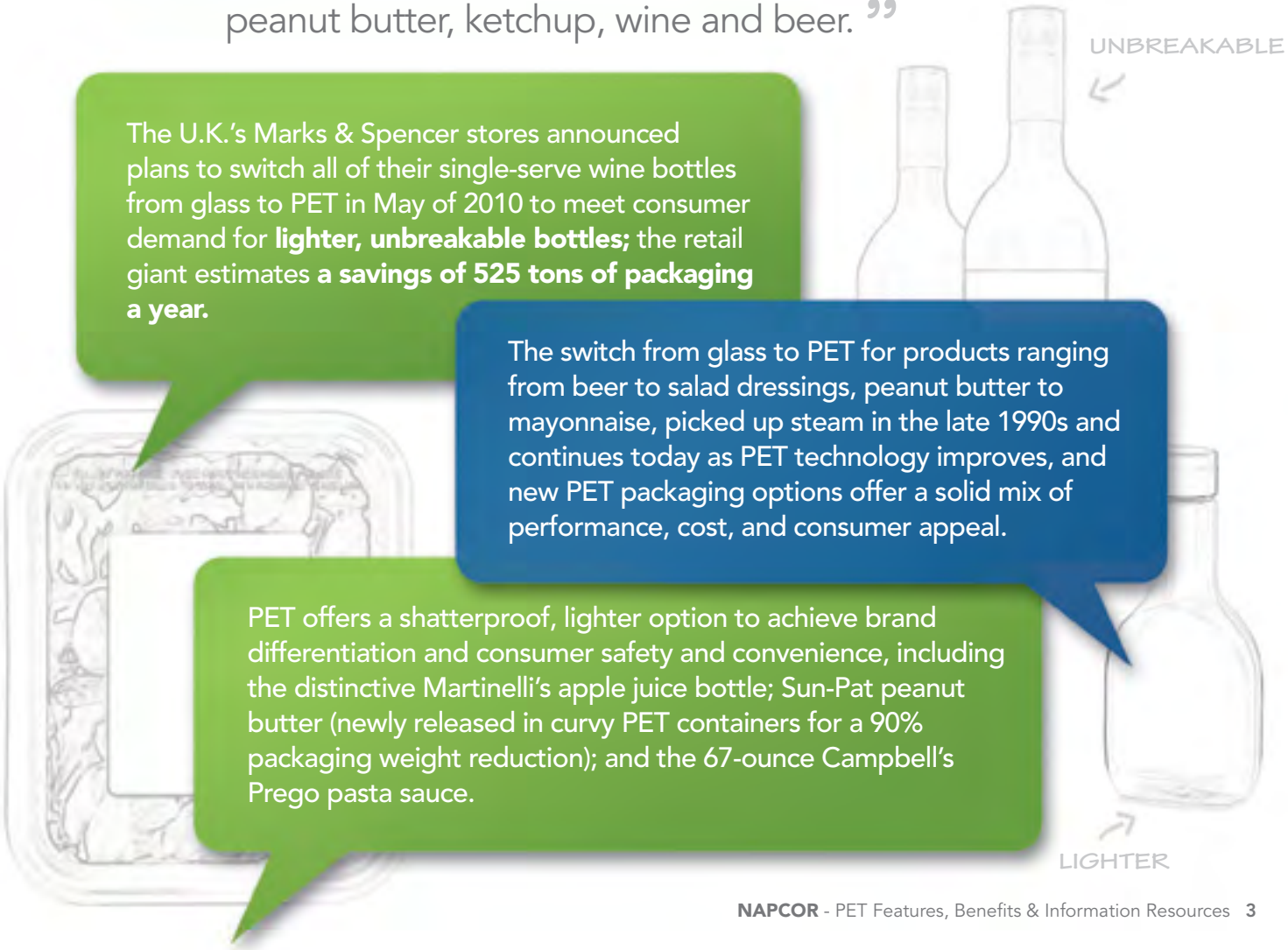
- water
- carbonated soft drinks
- juice
- ketchup
- salad dressing
- peanut butter
- fresh produce
- baked goods
- frozen foods
- beauty & household products
- beer, wine and spirits
- and many other food and non-food items

MODERN CONVENIENCE & INNOVATION

"PET is a **shatterproof, safe** package option for both home and away-from-home applications."

"PET is **easy to store, carry, clean up and re-seal,** making it the ideal package to accommodate active lifestyles."

"PET is easy to work with, allowing for new and **innovative package design.** Offers customer choice for a wide variety of applications, including salad dressings, pasta sauce, peanut butter, ketchup, wine and beer."



The U.K.'s Marks & Spencer stores announced plans to switch all of their single-serve wine bottles from glass to PET in May of 2010 to meet consumer demand for **lighter, unbreakable bottles;** the retail giant estimates **a savings of 525 tons of packaging a year.**

The switch from glass to PET for products ranging from beer to salad dressings, peanut butter to mayonnaise, picked up steam in the late 1990s and continues today as PET technology improves, and new PET packaging options offer a solid mix of performance, cost, and consumer appeal.

PET offers a shatterproof, lighter option to achieve brand differentiation and consumer safety and convenience, including the distinctive Martinelli's apple juice bottle; Sun-Pat peanut butter (newly released in curvy PET containers for a 90% packaging weight reduction); and the 67-ounce Campbell's Prego pasta sauce.

INHERENT BARRIER PROPERTIES

"PET has good barrier properties that **protect and preserve** the contents of its package. Different technologies can further enhance PET's inherent barrier properties and offer **greater protection** to the natural properties of packaged products against oxygen migration and carbon dioxide. These barrier enhancing technologies include oxygen scavenger additives, multi-layers, silicon oxide (glass) coatings, and carbon coatings."

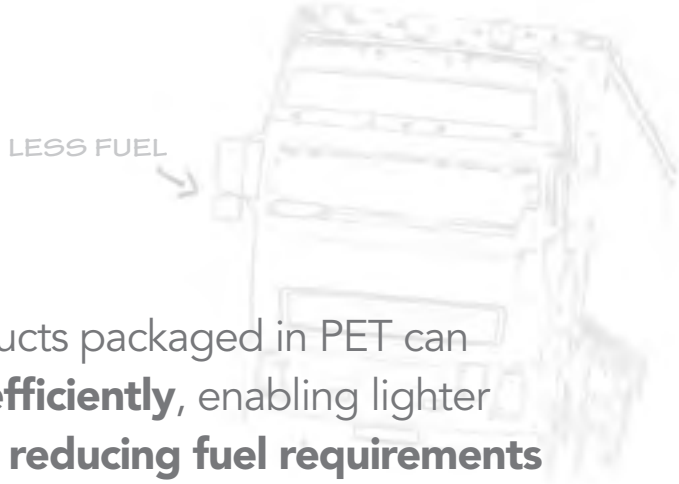
"Not all resins (including bio resins) have inherent barrier properties or the versatility to be enhanced. For example, PLA is considerably more porous than PET, allowing water vapor to escape over the course of the day at a ratio of approximately 17 to 1, as compared to PET; PLA is not suitable for many of the products packaged in PET."

"Oxygen transmission is an important factor in ensuring product shelf-life and freshness. PET provides almost nine times more protection against oxygen transmission than does PLA and over 40 times more than HDPE."

MORE FIZZ

Barriers in Packaging are Important Because Without Them.....

- A carbonated soft drink may lose its CO2
- Juice will lose Vitamin C
- Liquid product will evaporate slowly through container
- Oxygen-sensitive foods, such as ketchup, will not retain proper color and freshness

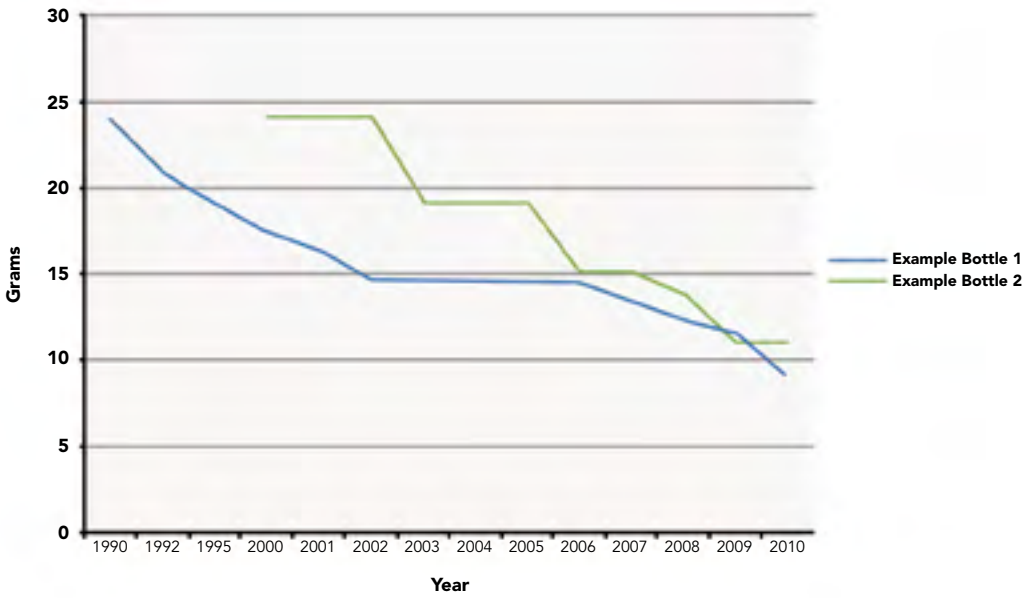


"PET is lightweight so products packaged in PET can be **packed and shipped efficiently**, enabling lighter secondary packaging, and **reducing fuel requirements and greenhouse gas emissions** during transport. PET's unique geometric properties mean there are more potential opportunities for light-weighting efficiencies."

LIGHTWEIGHT

"To maximize these efficiencies and use less plastic resin per package, PET manufacturers continue to make their packages lighter when it's possible to do so while maintaining package **strength and integrity.**"

Historical Lightweighting .5 Liter Water Bottles



Source: NAPCOR

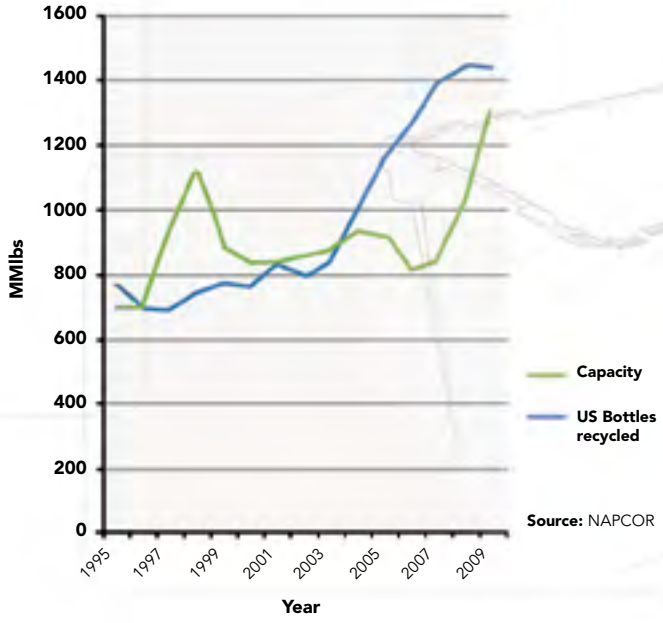
“ PET is the **most widely recycled** plastic in the world.”

RECYCLING

“ The **recycling infrastructure** for PET is **well-established,** from widespread collection and separation to further processing and end use.

- PET can be **recycled multiple times.**
- Virtually **all recycling programs** in the U.S. accept PET containers
- The first PET bottle was recycled in 1977. In 2009, **PET had a U.S. recycling rate of 28%.**
- **1.4 billion pounds of PET were recycled in 2009**; 937 million pounds of recycled PET material was used in U.S. and Canadian end products. ”

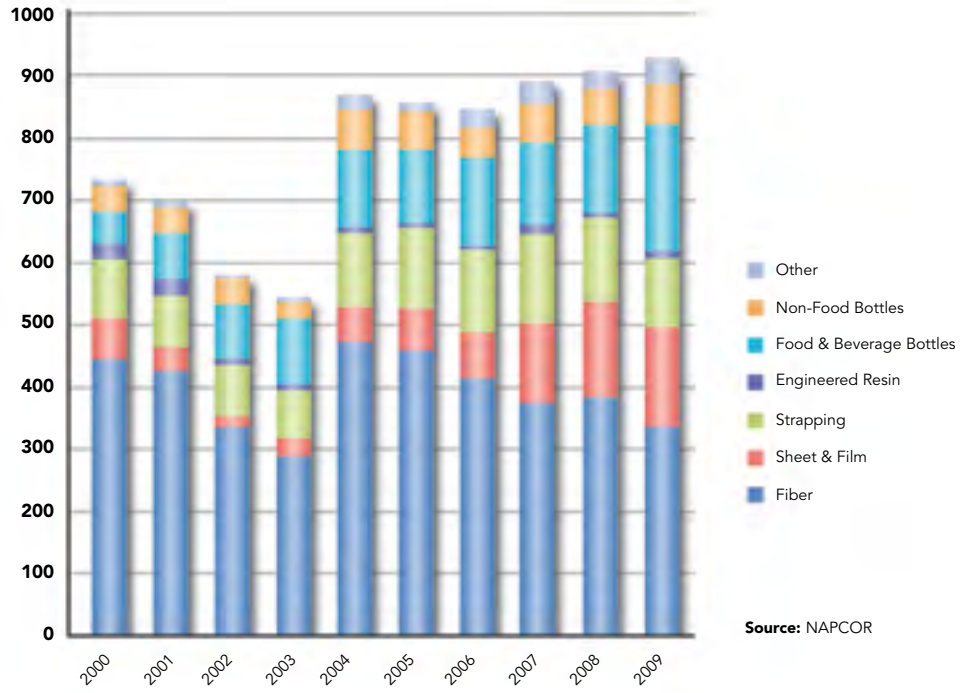
PET Reclamation Capacity and US RPET bottle supply



Investment in U.S. reclamation assets is expected to exceed $300 million over the next few years.

> NAPCOR is working actively to overcome obstacles to the recovery and reclamation of PET thermoforms. PET thermoform manufacturers are using **increasing amounts of recycled PET** in their packaging, up to 100%.

RPET Used (MMlbs) by Category (US and Canada)



Source: NAPCOR

> Demand for recycled PET is high and curtailed by supply; more content would be used in a variety of end uses if supply were available.

PET is being recycled into a wide variety of end products including: **fiber, fiberfill, carpeting, strapping, food and non-food bottles,** and thermoformed PET packaging, such as **cups and take-out containers.**

The "2009 Report on Post Consumer PET Container Recycling Activity" shows a **44% increase in use** of RPET for the Food & Beverage Bottle category over 2008; and a **22% increase overall** in packaging applications.

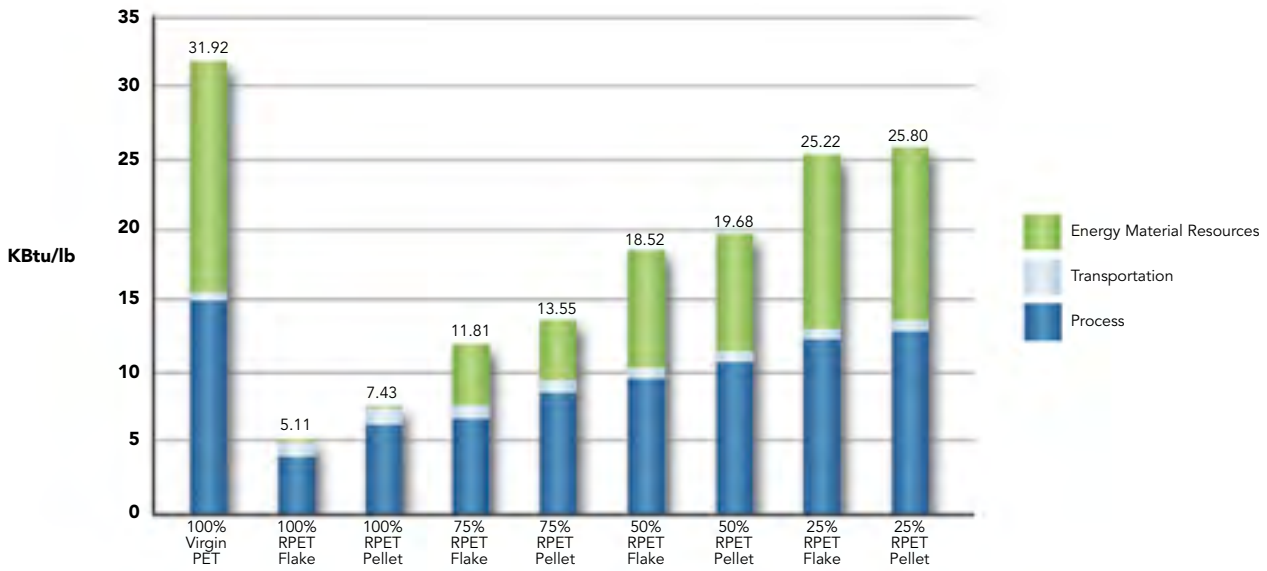
See Report at http://www.napcor.com/PET/pet_reports.html

Life Cycle Inventory Study (2010) results show that for every pound of recycled PET flake used, **energy use is reduced by 84%; greenhouse gas emissions by 71%.**

"The recycling of PET results in the following **advantages:**

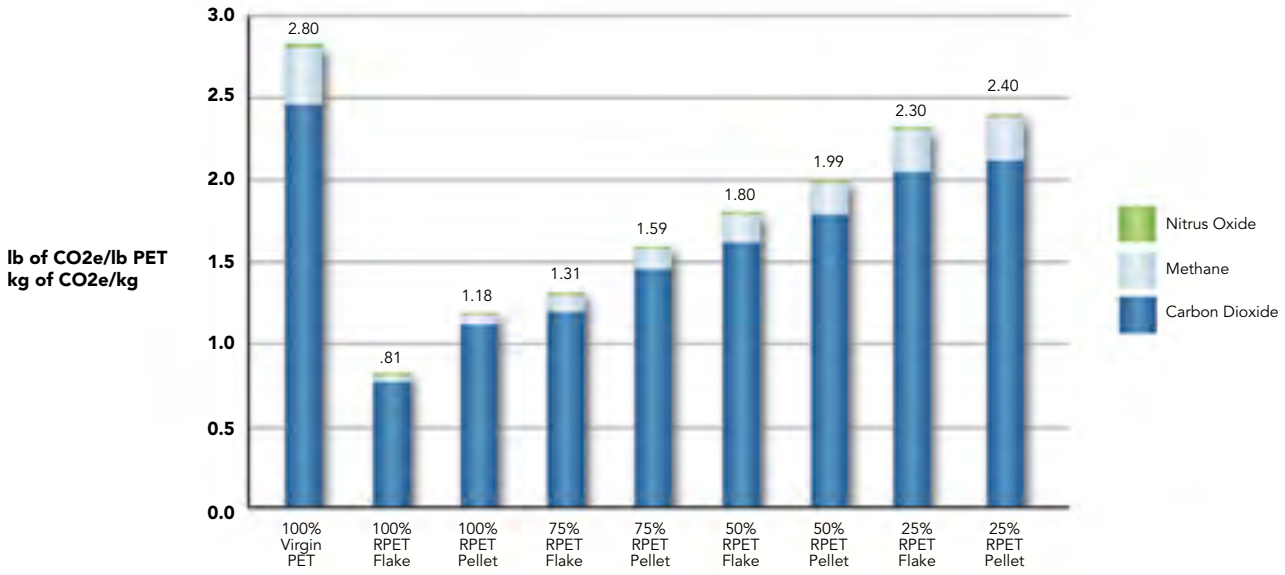
- **Conservation of raw materials** – reduces the need for virgin petrochemical feedstock
- **Less energy** is required when converting recycled PET to a virgin equivalent, whether flake or pellet.
- Less energy use results in **less greenhouse gas emissions**"

Comparison of Virgin PET to Varying Levels of Recycled PET: Energy



Source: Final Report LCI of 100% Postconsumer HDPE and PET Recycled Resin From Postconsumer Containers and Packaging April 7, 2010. GWP for Methane is 25, for N2O is 298, PER IPCC 2007

Comparison of Virgin PET to Varying Levels of Recycled PET: GHG Emissions



Source: Final Report LCI of 100% Postconsumer HDPE and PET Recycled Resin From Postconsumer Containers and Packaging April 7, 2010. GWP for Methane is 25, for N2O is 298, PER IPCC 2007

For more information and full scope of the LCI study – **http://www.napcor.com/pdf/FinalReport_LCI_Postconsumer_PETandHDPE.pdf**

For additional charts showing energy use and GHG impacts for pellet and different measurements – **http://www.napcor.com/pdf/NAPCOR_LCIcharts.pdf**

(For additional Life Cycle Study links, go to page 12.)

The term "Recyclable" is defined in the context of environmental marketing claims by the Federal Trade Commission. For the FTC "Green Guides" on this and other issues, visit **http://ftc.gov/bcp/grnrule/guides980427.htm** For NAPCOR's position on recyclability, see **http://www.napcor.com/PET/positions.html**

"**Contaminants** in the PET recycling stream:

- PET with non-compatible materials
- Other resins, including OPS, PVC and PETG
- Polylactic acid (PLA) and other bio-based resins
- Non-compatible packaging components, e.g., PVC caps and labels"

POTENTIAL OBSTACLES TO PET RECYCLING

Degradable additives are added to a primary resin such as PET. Manufacturers using degradable additives in their packaging have not provided adequate data to support claims that these additives do not negatively impact PET recycling, or the life-span and performance of products made from recycled PET, nor is there sufficient evidence of actual package degradability. For NAPCOR's positions on degradable additives and PLA mixed in with PET recycling stream, visit **http://www.napcor.com/PET/positions.html**

For further information on degradable additives:

APR - http://www.plasticsrecycling.org/images/stories/doc/documents/DegradableProtocolRelease.pdf

EPA - http://www.epa.gov/osw/wycd/catbook/debate.htm

Coca-Cola's Dasani water "PlantBottle" is not a contaminant to PET. The PlantBottle is PET, but 30% of the raw material used to make the PET molecule is derived from plant material; in its final form, the PlantBottle is no different from a traditionally manfactured PET container and can be successfully recycled along with all other PET bottles. Other brand companies are exploring similar technologies.

http://www.thecoca-colacompany.com/citizenship/plantbottle.html

Design for Recycling Guidelines:
Developed for PET and HDPE by The Association of Postconsumer Plastic Recyclers (APR) to provide guidance on recycling compatibility for new packaging innovations; guidance documents include both containers and peripherals such as closures and labels.

"Critical Guidance" and "Applications Guidance" documents are available on the APR web site.

http://www.plasticsrecycling.org/technical-resources/design-for-recyclability-guidelines

"PET is approved as **safe for food and beverage** contact by the FDA and similar regulating agencies throughout the world and has been for over 30 years."

"PET itself is **biologically inert** if ingested, is dermally safe during handling, and is not a hazard if inhaled, according to the International Life Sciences Institute Report "Packaging Materials 1. Polyethylene Terephthalate PET for Food Packaging Applications" (2000)."

http://www.napcor.com/pdf/ILSI_Report.pdf

SAFETY

"PET **does not use Bisphenol A** in its manufacturing and does not contain endocrine disruptors, ortho phthalates (sometimes referred to as plasticizers), or dioxins."

"PET does not contain heavy metals (Mercury, Lead, Cadmium, Hexavalent Chromium). Antimony oxide, not metallic antimony, is often used as a catalyst in the manufacture of PET. Antimony oxide's low toxicity, combined with its very low occurrence in PET manufacture, means **very, very low risk.** Its use in PET does not endanger workers, consumers or the environment."

For additional information on antimony, BPA, benzene and other PET safety topics, **http://www.napcor.com/PET/pet_faqs.html**

Other Studies and Resources

Cradle-To-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors
http://www.napcor.com/pdf/LCI9Resins2010.pdf

Life Cycle Inventory of Three Single Serve Soft Drink Containers
http://www.petresin.org/pdf/FranklinLCISodaContainers2009.pdf

LCI Study for PLA and PET 12-ounce Water Bottles
http://www.petresin.org/pdf/FranklinPETPLAlifecycleanal_12-oz.pdf

Husky Injection Molding Systems CSD and Wine Packaging Comparison Study
http://www.napcor.com/pdf/HuskySummaryCSDWineNPE.pdf

Plastics Europe Eco-profiles Report (PET)
http://www.napcor.com/pdf/PlasticsEuropeEco-profilePET.pdf