CITY OF KIRKLAND
Department of Public Works
123 Fifth Avenue, Kirkland, WA 98033 425.587.3800
www.kirklandwa.gov

MEMORANDUM

To: Kurt Triplett, City Manager

From: John MacGillivray, Solid Waste Programs Lead
Marilynne Beard, Interim Public Works Director

Date: September 25, 2014

Subject: PLASTIC BAG MANAGEMENT OPTIONS

RECOMMENDATION

Staff recommends that the City Council receives a presentation on the plastic bag management policy options presented in the *Plastic Bag Staff Report (September 2013)* (or see Attachment A) and provides direction to staff.

BACKGROUND

At the March 19, 2013 City Council meeting, subsequent to moving through the Public Works, Parks, and Human Services Council Committee (March 12, 2013), staff received direction to use Solid Waste resources to draft a staff report intended to evaluate the potential of implementing a ban on single-use plastic bags in Kirkland. Staff provided updates on the status of the report on June 25, 2013 to the Public Works, Parks, and Human Services Committee and on July 8, 2013 to the Community Planning, Housing, and Economic Development Committee. In September 2013, staff published the final report on the City website and distributed copies to the City Council and interested City staff. On October 22, 2013 the final staff report was presented to the Public Works, Parks, and Human Services Committee where no action was taken.

The report used a framework called the "Sustainability Model" that evaluates a range of options for regulating plastic and paper bag use. As part of the study, staff presented three case studies from other cities and a consultant conducted two surveys, one for Kirkland residents and one for Kirkland businesses regarding their practices and attitudes toward plastic and paper bag use and regulation. The survey results are contained in the addendum to the report beginning on page 30.

On June 4, 2014, the Public Works, Parks, & Human Services Committee received a staff presentation on the variety of policy options available to manage single-use plastic bags. Members of the committee expressed potential interest in Option 2: Public Education and Outreach Campaign and Option 4: Ban Plastic Bags/Require Fee for Paper Bags but the decision on a formal Committee recommendation was deferred pending a second staff presentation at the Committee's July 2 meeting on the lifecycles of various types of shopping bags (see Attachment B) and more discussion. Subsequent to the July informational presentation, the

Committee did not reach a consensus on a recommended plastic bag management option and recommended that the issue be discussed by the full City Council at a future study session.

PLASTIC BAG MANAGEMENT OPTIONS

In the *Plastic Bag Staff Report*, several policy options for managing single-use plastic bags were presented and evaluated. Descriptions of the option, pros and cons, a sustainability rating and estimated implementation cost is provided for each of the following seven options.

OPTION 1: Take No Action
OPTION 2: Public Education and Outreach Campaign
OPTION 3: Require Plastic Bag Ban Recycling Stations
OPTION 4: Ban Plastic Bags/Require Fee for Paper Bags
OPTION 5: Tax on Plastic Bags Only
OPTION 6: Tax on Paper and Plastic Bags
OPTION 7: Ban Both Paper and Plastic Bags

The Sustainability Model was used to evaluate each option in terms of cost and overall impact upon the environment, the economy, and social equity. The seven options are shown below ranked by their sustainability rating as presented in the staff report:

1st -- OPTION 4: Ban Plastic Bags/Require Fee for Paper Bags
2nd -- OPTION 5: Tax on Plastic Bags Only (2nd)
3rd -- OPTION 2: Public Education and Outreach Campaign
4th (tied) -- OPTION 6: Tax on Paper and Plastic Bags
4th (tied) -- OPTION 7: Ban Both Paper and Plastic Bags
5th -- OPTION 3: Require Plastic Bag Ban Recycling Stations
6th -- OPTION 1: Take No Action

DISCUSSION OF PLASTIC BAG MANAGEMENT OPTIONS AND RECOMMENDATION

As shown on Page 12 of the staff report, in order to determine the one single-use plastic bag management policy option which best balances and protects the interests of the environment, the economy, and social equity, staff applied the concepts of the sustainability model to several of the most viable plastic bag policy options. The options range between taking no action to the extreme of banning both paper and plastic bags. As shown on Page 23 of the report and in the report's executive summary on Page 3, staff found that following the Seattle/Issaquah model of banning plastic bags and requiring a minimum fee for each paper bag (Option 4) is the highest rated and most balanced option when the sustainability model is used as a point of reference and filter.

Alternatively, while the sustainability model tool was intended to aid staff in finding the single most balanced option, the tool can also be used to recognize which option or options may be the best specifically for the environment and the economy. Presented below are the report's findings for Option 4, the most balanced option and alternative options which may provide the most benefit or positive impact specific to the economy and the environment.

BALANCED OPTION FINDING: OPTION 4 – PLASTIC BAG BAN/PAPER BAG FEE

As discussed on Pages 18 and 19 of the staff report and in the Evaluation Findings on Page 23, banning plastic bags and requiring all retailers to charge a minimum fee on paper bags emerged as the highest ranked and most balanced option with 28.5 sustainability points. The estimated budget required to implement this option is $46,600 in the first year and $5,000 per year thereafter. The high first year expense is for hiring a consultant to work with affected businesses to implement the change. If this option were to be preferred by the City Council, there are several key questions that, if answered, would help staff draft a policy. Staff comments for each element is included:

Question 1: How much should the minimum paper bag fee be?

STAFF COMMENT:
A minimum of five cents should be charged on a typical paper shopping bag (each "1/8 barrel") or larger paper bag. Smaller retailers who pay higher wholesale costs for paper bags are allowed to charge a higher paper bag fee to cover their costs.

Question 2: Who retains the revenue from the paper bag fee?

STAFF COMMENT:
Retailers should retain the entire fee to help cover the cost of the increased demand for paper bags.

Question 3: How would the policy be phased in?

STAFF COMMENT:
Per the Issaquah ordinance, for businesses with retail space greater than 7,500 square feet such as Safeway and Fred Meyer, the ban should be effective one year after the adoption of the ordinance. For businesses with less than 7,500 square feet of retail space, the ban should be effective two years after the adoption of the ordinance. Issaquah indicated that small retailers face the most challenges gaining compliance, and the extra year provided some relief.

Question 4: Are there any special organizations or groups that should be exempt from the ordinance such as restaurant take-out, food rescue organizations such as Hopelink, or citizens receiving public assistance?

STAFF COMMENT:
Citizens receiving public assistance who present a voucher or electronic benefits card (EBT) at checkout and food rescue organizations should be exempt from the paper bag fee. For health and safety reasons, restaurants have been vocal in their contention that plastic bags should be allowable for prepared take-out restaurant foods, and staff concurs by recommending this exemption.

With most bag bans of this type, exemptions are also provided for plastic bags used for bulk food or hardware items, frozen foods and meat/fish, newspaper and dry cleaning, and pet waste and garbage.

Question 5: Should 2.25mm plastic bags be exempt from the policy?

STAFF COMMENT:
In the cities of Issaquah and Seattle, plastic bags greater than 2.25mm in thickness are exempt due to pressure received from retail lobby groups and their definition as "reusable." Staff believes that some businesses are circumventing the spirit of their respective city's ordinances by offering their customers thicker 2.25mm plastic bags. When interviewed, both cities recommended that Kirkland should reconsider this exemption.

Question 6: Should additional Solid Waste budget and/or staffing be allocated to support implementation and education and outreach?

STAFF COMMENT:
On Page 18 of the report, staff estimated that $30,000 to $50,000 in funding will be required to successfully promote and implement a plastic bag ban policy. A provisional $51,600 service package has been drafted in the event Council adopts a bag ban policy. The budget includes $46,600 in 2015 for planning and implementation costs and $5,000 in 2016 and on for ongoing education and outreach costs and supplies. The funding would be used for additional staff or contracted consultant services, the purchase and distribution of reusable shopping bags, costs associated with education and outreach activities such as printing, mailing, and advertising, and code enforcement.

ECONOMIC OPTION FINDING: OPTION 3 - REQUIRE PLASTIC BAG RECYCLING STATIONS <u>AND/OR</u> OPTION 2 - PUBLIC EDUCATION AND OUTREACH

Besides taking no action at all, the option which would result in the lowest overall net cost to the City budget, local businesses, and the consumer is to require large retailers to have in-store plastic bag recycling stations available to their customers. When there is demand for recyclable plastic bag material, recycling stations are typically provided to retailers at little to no cost. This option would, however, be most successful when coupled with a robust and sustained public education and outreach effort designed to encourage consumers to recycle their plastic bags or to reduce or eliminate their use of single-use bags in lieu of using reusable shopping bags. A concentrated and sustained education and outreach effort that would include the purchase and distribution of reusable bags is expected to cost approximately $20,000 year.

ENVIRONMENTAL OPTION FINDING: OPTION 4 – PLASTIC BAG BAN/PAPER BAG FEE

From a purely environmental standpoint the ultimate goal is to restrict or limit the use of <u>both</u> plastic and paper bags and to steer consumers toward the most sustainable alternative – the reusable shopping bag. Accordingly, for the environmental option, staff recommends consideration of a hybrid plastic bag ban policy that includes a paper bag fee that is substantially higher than the typical five to ten cents paper bag fee to more strongly discourage the use of paper bags. The higher fee could be similar to the 28 cent tax Ireland placed on plastic bags per *Option 5* on Page 20 of the report. The Irish tax reduced the use of plastic bags by 94% and would likely result in a similar reduction in the use of paper bags.

Staff does not recommend banning both plastic and paper bags since consumers should have some option available to them in the event they forget their reusable bags. Additionally, with the higher paper bag fee option, the City could receive a portion of the fee revenue to prevent retailers from receiving a windfall profit from increased use of paper bags and to fund litter control programs, hire staff to provide education and outreach and enforcement, purchase and distribute reusable shopping bags, and to support other related environmental programs and initiatives related to minimizing the use of single-use plastic bags.

LIFECYCLE ANALYSIS OF SHOPPING BAGS

At the July 2, 2014, Public Works, Parks, and Human Services Committee meeting, members received a presentation on an analysis of the relative lifecycles of various types of disposable and reusable shopping bags. Staff reviewed several reports and determined that the UK's Environment Agency's government-funded *Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006 (Sept 2011)* provided the most-thorough and least-biased life cycle analysis (LCA) of shopping bags.

Types of Bags Analyzed
While the LCA was conducted in the UK, the report includes a review of several types of shopping bags that are also used and readily available in Western Washington to include:

- Conventional thin, lightweight HDPE (High-density Polyethylene) plastic shopping bags
- Thicker LDPE (Low-density Polyethylene) plastic shopping bags that typically exempted from bag bans (>2.25mm)
- Conventional Non-woven Polypropylene (PP) reusable shopping bags
- Paper bags
- Reusable cotton bags

Methodology
Since the sizes and volumes of each type of bag vary, the report uses the number of bags required to carry the equivalent of one month's worth of shopping as a benchmark unit to make the comparison fair. The report calculates how many times each type of bag would have to be used to reduce its global warming potential below that of a lightweight HPDE bag. The report also compares the various types of bags as to their relative performance in specific environmental impact categories to include resource depletion, detrimental impact on the soil, human, aquatic, and terrestrial toxicity, and smog formation.

The various lifecycle stages for each type of bag analyzed in the report include:

- Extraction of natural resources
- Primary packaging
- Bag manufacturing
- Transportation chain
- End-of-life processes such as landfilling, incineration, recycling, and composting
- Recycling, reuse, and avoidance of the use of virgin materials

Report Conclusions

The key conclusion of the report is that the repeated primary reuse (using again to transport groceries) of any type of bag is vital to increasing its environmental performance. In the absence of primary reuse, a secondary reuse of a bag as a can liner also improves its environmental performance. In the event that any of the non-HDPE bags are not reused and thrown away, the lightweight HDPE bag has the highest environmental performance of all the bags evaluated. However, paper, LDPE, PP, or cotton bags have a lower global warming potential than the HDPE bags if they are reused 3, 4, 11, and 131 times, respectively as shown below in *Table 1*.

In reality, few paper and some thicker LDPE bags are reused and most are instead recycled or disposed of after only one primary use which, in that case, doesn't make them necessarily a better environmental alternative to the lightweight HDPE bag. However, polypropylene reusable bags typically have a lifespan of at least 100 uses which shows that they can easily outperform the HPDE bag and that they become the best environmental option if they are reused just 11 times by the consumer.

Table 1: Shopping Bag Performance Comparison Table

Type of Bag	HDPE Bag (no reuse)	HDPE (40% reuse as liners)	HDPE (100% reuse as liners)	HDPE Bag (reused 3 times)
Paper Bag	3	4	7	9
LDPE Bag	4	5	9	12
PP Reusable	11	14	26	33
Cotton Bag	131	173	327	393

Source: Lifecycle Assessment of Supermarket Carrier Bags (Sept 2011)

ALTERNATIVE SUSTAINABILITY INITIATIVES

While consideration of a policy to better manage single-use plastic bags and encourage the use of reusable alternatives is important and consistent with the City's environmental stewardship goals, there are several other competing waste reduction, recycling, and sustainability initiatives that staff believes may result in greater diversion of waste from the landfill and that may have an overall higher positive impact on the environment in the long term. The options below may also be more effective in helping Kirkland meet its waste reduction and recycling goals (70% recycling diversion by 2020) in the regional draft Solid Waste Management Comprehensive Plan. Some of these competing interests include (in approximate order of priority):

1. Get the fiber out – increase the recycling of cardboard and mixed paper
2. Mandatory and adequate commercial and multifamily recycling service
3. Multifamily and commercial recycling disposal ban
4. Increase food diversion to food rescue and composting
5. Kirkland Green Business Program renovation
6. Product stewardship initiatives (mattresses, tires, medicine take back)
7. Every-other-week garbage service
8. Ban on expanded polystyrene food service products
9. Glass on the side – Glass out of commingled recycling

NEXT STEPS

Staff is requesting that City Council identify a preferred policy to manage single-use plastic bags and provide input on next steps which could include:

- No action
- Deferral to a future City Council meeting for more discussion with staff providing additional information as requested
- Direction to staff to draft a policy and public outreach plan based on one of the options presented in the staff report

Attachment A

PLASTIC BAG
STAFF REPORT

September 2013

CITY OF KIRKLAND WASHINGTON

Table of Contents

Purpose and City Council Goal 2
Executive Summary 3
Environmental Considerations. 5
Other Considerations 8
The Sustainability Model 9
Plastic Bag Management Options 10
Evaluation of Management Options 14
- Take No Action 15
- Public Education and Outreach. 16
- Require Bag Recycling Stations 17
- Ban Plastic/Fee on Paper 18
- Tax on Plastic Bags 20
- Tax on Plastic and Paper Bags 21
- Ban Plastic and Paper Bags. 22

Sustainability Ratings Ranking 22
Evaluation Findings. 23
Case Studies 24
- City of Issaquah. 25
- City of Seattle. 26
- City of Edmonds 26

Selected Sources and References 28
Addendum 29

Authors
John MacGillivray
Solid Waste Programs Lead

Kelly Ferron
former Recycling Programs Coordinator

Design and Layout
Romina Rivera
Environmental Education and Outreach Specialist

Purpose

Using the Kirkland City Council Goals as the guiding principle and compass, the purpose of this staff report is to present a thorough evaluation of the many issues surrounding single-use plastic bags, their impacts on our environment, and some potential management options for Kirkland's policy makers. This staff report was requested by the Kirkland City Council at its meeting on March 19, 2013.

Relevant Kirkland City Council Goal

Environment

We are commited to the protection of the natural environment through an integrated natural resource management system.

Goal: To protect and enhance our natural environment for current residents and future generations.

Executive Summary

Single-use plastic bags are a convenient way for shoppers to transport their purchases from the store to their homes. As our community survey reveals, plastic bags are popular and valued by our residents and businesses. However, there is a significant environmental trade-off for this one-time convenience, as single-use plastic bags have proven to be detrimental to our environment and a drain on our non-renewable natural resources.

Plastic bag management is not a question of diversion: plastic bags account for less than one-half of one percent of our landfilled trash. Rather, the issue is clearly one of waste reduction and sustainability and how our City government, business community, and residents can collaborate to be even better stewards of our natural environment by trading the fleeting convenience of a single-use plastic bag for the inherent recyclability of a paper bag or, even better, the relative permanence of a reusable bag.

There is a broad continuum of options available to policy makers designed to encourage residents to use reusable bags. Options range from education and outreach to a tax on plastic bags to an outright ban on both plastic and paper bags. As stated, the purpose of this report is to present and evaluate the most viable bag management options available to Kirkland policy makers to aid them in making as informed decision as possible.

North America and Western Europe account for nearly 80% of plastic bag use.

After an evaluation of the options staff finds that one management option comes the closest to achieveing the ideal of true sustainability by successfully integrating the competing economic, environmental, and social equity factors of the sustainability model while also substantially meeting the Kirkland City Council's goals to protect and enhance our natural resources and provide and maintain our naturals areas.

The so-called "Issaquah/Seattle Model" of banning plastic bags and requiring businesses to charge customers a fee on each paper bag emerges as the option that best balances and reconciles the economic impacts to the retailers and the consumer; provides a substantial benefits to the environment by restricting the use of plastic bags and driving consumers toward the more sustainable reusable bag option; and provides for a reasonable amount of fairness between the retailer, the consumer, and government. This option has also become the region's preferred alternative among retailers and has been heralded for its fairness, consistency, and predictability.

THANK YOU
NICE DAY

Environmental Considerations

Resource Conservation

Each year, Americans dispose of an incredibly high number of plastic bags. The numbers vary by study, but the WorldWatch Institute estimates 100 billion plastic bags are thrown away each year in the United States. In King County, 49,000 tons of plastic bags and film were disposed in the Cedar Hills Regional Landfill in 2010, most of which could have been recycled. This is a signficant statistic considering the average lifespan of a plastic bag is just 12 minutes.

Plastic bags are made from by-products of natural gas and sometimes oil depending on the location of manufacture. Most plastic bags in grocery stores are made of high-density polyethylene (HDPE). Although there are recycling options in Kirkland's recycling program and through plastic bag take-back programs at some local retailers, the recycling diversion rate for plastic bags is very low. The Environmental Protection Agency reports that the nationwide recycling rate for plastic bags and wraps (HDPE material) was just 4.3% in 2010. However, between 60-75% of plastic bags are reused for pet waste or garbage can liners.

According to 2012 end-of-year data as reported by Waste Management's Cascade Recycling Center, clean plastic film accounted for only 4/10 of 1% of the recyclable materials received for processing. Conversely, cardboard and kraft paper which includes paper shopping bags accounted for 26% of the recyclable materials.

Paper bags are also resource-intensive to manufacture, especially because paper bags are heavier which requires more energy to transport. However, the recycling diversion rate of paper bags is significantly higher than plastic bags and has been reported as high as 85%.

Litter and storm drains

Due to their lightweight nature, plastic bags are easily transported by air and water. In 2004, the Department of Ecology conducted a litter study in Washington and found that plastic bags were one of the ten largest components of litter by weight on Washington roadways. Plastic bag litter is easily transported by wind and rainwater to storm drains, open channels and ditches, and urban streams where they restrict proper drainage and cause localize flooding. However, according to Kirkland Surface Water Maintenance staff, plastic bag litter in Kirkland's surface water system is insignificant relative to other communities.

Marine Impacts

Worldwide and nationwide, it is becoming increasingly apparent just how much plastic is making it to our waterways and negatively impacting marine wildlife and water quality. Researchers have reported instances of garbage and plastics accumulating on the surface and in the deep sea of the ocean, photodegrading into small pieces of plastic not visible by the eye but easily ingested by marine wildlife.

Solid waste is now accumulating in ocean gyres around the planet, the largest being a "trash island" named the Great Pacific Garbage Patch that sits in the northern Pacific Ocean. There is no way to know the actual size of the garbage patch because some debris sinks or is unable to be seen by the naked eye, but scientists have collected

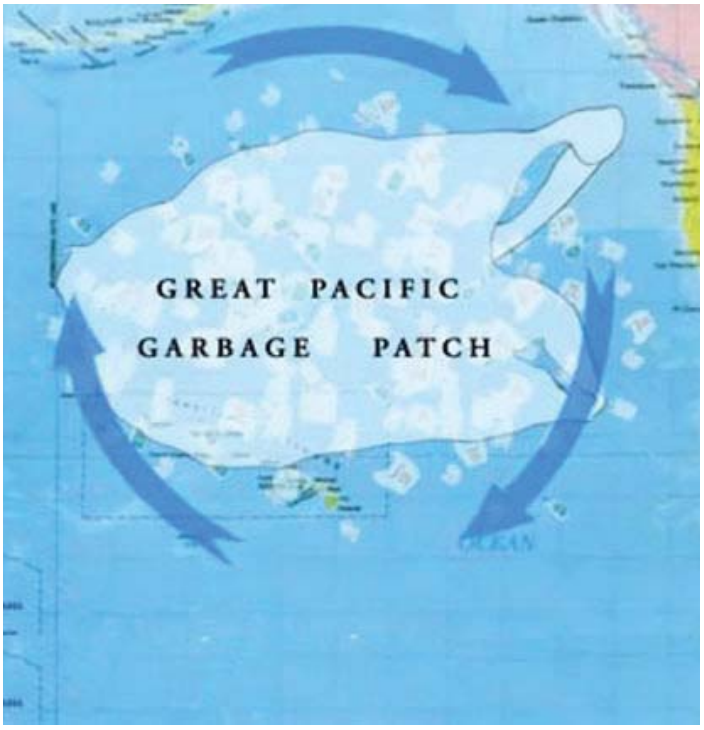
up to 750,000 pieces of plastic in one square kilometer of the Garbage Patch.

The Monterey Bay Research Institute researches garbage accumulating in the deep sea and in a recent study, they found that 1/3 of the debris in the deep sea was plastic and, of these objects, more than half were plastic bags. The increase of plastics found in the ocean is alarming due to the negative impacts plastics can have on marine life and water quality.

Ingestion

Multiple studies have shown that marine life, including seabirds, fish, marine mammals and sea turtles, often ingest plastic marine debris mistaken for food. For example, sea turtles may mistake plastic bags for jellyfish or squid. Marine animals may also inadvertently ingest marine plastics while feeding on natural food. Ingestion of marine plastics is a serious problem for marine animals - it can cause starvation or malnutrition when the debris collects in the animal's stomach, causing it to feel full.

The Great Pacific Garbage Patch is a "trash island" in the Northern Pacific Ocean. Scientists have collected up to 750,000 bits of plastic in one single square kilometer.



Credit: vimeo.com

Entanglement

Marine wildlife can become entangled in marine plastics marine debris resulting in serious health effects on the animal, including suffocation, starvation, drowning or other injury. Plastic debris can also constrict animals' movement, which can result in wounds from the material or exhaustion. The International Coastal Cleanup often finds entangled mammals and birds in their cleanup efforts (*2010, ICC Report, Ocean Conservancy*).

Pollutants

When plastics enter the marine environment, they photodegrade into smaller and smaller plastic molecules until they can no longer be seen. Although the pieces are invisible to the naked eye, the plastics do not mineralize (disappear) in the ocean and instead break down into microplastics, plastics that are less than 5mm long.

Disposal

At the Recycling Center

Plastic bags are currently accepted in Kirkland's curbside recycling program as long as they are collected and bagged together before being placed in the recycling cart. Kirkland's recycling is collected and transported to Waste Management's Cascade Recycling Center in Woodinville, where it is sorted. Single, loose plastic bags cause significant problems at recycling centers. Single bags can get stuck in the machinery and the center must stop mechanical sorting operations to remove the bags.

Plastic Bags in Machinery at Recycling Center
Credit: olympiawa.gov

At the Composting Facility

Plastics are not accepted in Kirkland's curbside yard waste or commercial and multifamily food recycling programs, but plastic bags remain a common contaminant in organic material delivered to the region's leading composting company, Cedar Grove Composting. Susan Thoman from Cedar Grove explains, "In general, plastic bags that enter the system get removed whenever possible on the front end of the process (visual), through blowers, or through screening equipment at the back end. Ultimately, they build up in our "reject" screen pile and then have to ship to the landfill. They are problematic because they tend to "float" around the equipment, and break down into very fine, wispy bits that are difficult to capture and completely remove from the system."

Take-Back Programs at Grocery Stores

Bag take-back programs are one of the best ways to recycle plastic grocery bags. Most programs also accept other types of plastic bags and film, such as newspaper bags, bread bags, and dry cleaner bags. Recycling bags at in-store recycling kiosks diverts bags away from recycling centers where bags chronically get stuck in machinery and potentially contaminate other marketable recycling commodites such as paper bales. There are currently several retailers in Kirkland that offer plastic bag recycling collection stations.

Other Important Considerations

Shoplifting/Theft

Some newspaper articles have reported an increase in shoplifting due to the increase in the use of reusable bags. Shoplifters may hide items in their reusable bags which are not counted at checkout. There is no real data to confirm or refute the accuracy of the increase in shoplifting due to reusable bags; however this is something to consider as customers shift from single-use bags to reusable bags. Cities interviewed with bag bans in Western Washington indicated that shoplifting attributable to reusable bags is not prolific nor a serious issue.

Health Issues with Reusable Bags

There have been varying reports of health issues with the increase of use in reusable bags in California and Arizona, some citing instances of E. coli and other harmful bacteria, and others reporting that the bags are perfectly safe. A 2011 study of reusable bags in California and Arizona found that 51% of the bags contained coliform bacteria. The same study also found that washing reusable bags would remove 99.9% of the harmful bacteria. Unfortunately, 97% of the people surveyed indicated that they never wash their bags.

King County has not done a private or public study on bacteria in reusable bags. It is hard to determine the actual health risk of reusable bags because it is such a case-by-case scenario. Clearly education and outreach to the public regarding reusable bags should include safety tips and reminders about their safe, long term

use. Sacramento and other cities have released statements about potential health concerns and remind their residents to periodically wash their reusable bags. For example, San Mateo County's health officer released a statement with the following advice:

- Do not transport raw foods and other food products in the same bag.
- Do not use reusable grocery bags for other purposes, such as carrying books, laundry or gym clothes.
- Wash your reusable bags often.

Community Surveys

In May 2013, Solid Waste contracted with Elway Research, Inc. in order to gain an understanding of how Kirkland residents and business feel about banning single-use plastic bags. Full copies of each scientific survey and its key findings can be found in the Addendum section of this report.

Of the 407 residents contacted by phone, 69% were opposed to banning plastic bags in Kirkland. There was general support for measures targeted on retailers such as requiring plastic bag recycling stations or encouraging retailers to voluntarily curb their use of plastic bags. Most residents surveyed claimed that they are either recycling or re-using their bags.

Also in May, 259 Kirkland businesses that regularly offer plastic bags to their customers were invited to participate in an online survey. A total of 48 businesses participated for an excellent response rate of 20%. Eight out of ten businesses were opposed to a ban or imposing a fee on plastic bags and seven of ten anticipated that a ban may have a negative impact on their business.

In 2008, Solid Waste staff conducted a non-scientific survey of 380 residents and visitors to Kirkland at several local special events. The results of the survey and a summary of the finding can be found in the Addendum section. Similar to the May 2013 survey, only 30% of respondents supported a ban or a fee of plastic bags. The majority of respondents indicated that they reuse their plastic bags for pet waste, diapers, or as garbage can liners. One-third of the respondents supported more education and outreach and distributing more reusable bags.

The Sustainability Model

To provide a measured and in-depth evaluation of each of the potential options available to manage plastic bags in the City of Kirkland, we have turned to the sustainability model to help guide us in identifying the preferred options. This model allows us to consider the social, economic, and environmental aspects of each option.

The sustainability model is a holistic approach where the "Triple Bottom Line" of the social equity (PEOPLE), economic (PROFITS), and environmental (PLANET) considerations are measured concurrently in decision-making. Ultimately, a combination of all three considerations results in true sustainability and an enhanced quality of life.

When applied to local government, the model ensures that policies includes social equity

The Sustainability Model
Credit: www.uofaweb.ualberta.ca

and fairness among the plurality of its diverse residents, businesses, and stakeholders. The economic consideration strives to ensure that policy contemplates the viability and vibrancy of the business community and the sustainability of government's budget and resources. Finally, the environmental consideration endeavors to ensure that policies respect, protect, and preserve the community's natural resources.

Plastic Bag Management Options

When evaluating plastic bag management options, staff rated each option as objectively as possible by developing an in-depth list of economic, environmental, and social equity considerations to serve as a foundational reference. For example, a public education and outreach compaign alone would likely have less of a negative economic impact than an outright ban on both plastic and paper bags. More financial resources would be needed to implement the latter over the former. The major considerations are discussed and listed below and intergrated into *Chart 1* on Page 12.

Economic Considerations

For the economy, the ratings consider the estimated net cost a given management option may have on the City budget, to local businesses, and to consumers. Some of the major considerations are presented below.

Net Cost to City Budget

- Estimated cost of City staff wages and benefits
- Education and outreach material costs
- Costs to purchase and distribute reusable shopping bags

It takes less energy to create plastic bags than paper bags; however plastic is made from fossil fuels.

- Enforcement costs to ensure compliance and tax collection

Net Cost to Businesses

- Implementation and employee training costs
- Potential diversion of consumers to other cities without bans
- Potential security and shoplifting issues
- Reusable bag health concerns/worker safety
- Cost of paper versus plastic bags
- Management of self-checkout stations
- Unused/stranded plastic bag inventory

Net Cost to Consumers

- Impact on the price of consumer goods
- The amount of a tax or fee
- Loss of convenience
- Reusable bag health concerns

Environmental Considerations

On the environmental end, the ratings include an assessment of the net effect each bag management option would have upon reducing waste going to the landfill, on diverting plastic and paper bags for recycling, and providing an overall net benefit to the Kirkland's environment and its net impact

on our use of natural resources. For example, an option that bans both paper and plastic bags would receive a higher overall environmental rating than an option that bans only plastic bags but charges a fee on paper bags. The former option does not allow the use of paper resources at all whereas the latter still makes paper bags available to consumers.

Net Effect on Recycling Diversion

- Overall amount of material diverted for recycling
- Amount of plastic bags diverted for recycling
- Amount of paper bags diverted for recycling

Net Effect on Waste Reduction

- Overall amount of material removed from the waste stream
- Amount of plastic bags removed from the waste stream
- Amount of paper bags not produced

Net Effect on the Environment

- Use of fossil fuels
- Depletion of forests and timber
- Use of energy resources in production
- Litter control
- Surface water management and water quality
- Health impacts upon land and marine wildlife

Social Equity and Fairness

This final rating category contemplates the fairness of each potential bag management option by determining if one particular option favors or provides unequal benefits to one class versus the other. The comparisons included:

- Large businesses versus small businesses
- The affluent versus the poor
- Retailers versus consumers

Chart 1: Evaluation of Plastic Bag Management Options

				Economy			Environment			Equity	
Option	Action	Type	Current Example	Net Cost to City Budget	Net Cost to Businesses	Net Cost to Consumer	Net Effect on Recycling Diversion	Net Effect on Waste Reduction	Net Effect on Environment	Social Equity and Fairness	Sustainability Grade
1	Take No Action	Status Quo	Kirkland	5	5	5	0	0	0	5	20
2	Public Education and Outreach	Voluntary	Kirkland (limited)	4	5	5	2	2	1.5	5	24.5
3	Require Plastic Bag Recycling Stations	Ordinance	None found	5	4.5	5	2	0	1	4.5	22
4	Ban Plastic Bags/Fee on Paper Bags	Ordinance - Ban and Fee	Seattle, Bellingham, Edmonds	3.5	4	4	3	5	5	4	28.5
5	Tax on Plastic Bags Only	Ordinance - Tax	Ireland, Northern Ireland	5	4.5	1	2	5	4	3.5	25
6	Tax on Paper and Plastic	Ordinance - Tax	District of Columbia	5	4	2	2	4	3	3.5	23.5
7	Ban Both Plastic and Paper Bags	Ordinance - Ban	Austin, Texas	3.5	3	3	2	5	5	2	23.5

*Ratings assigned by Solid Waste staff

Key:	Very Positive/High Impact (5)	Positive/Good Impact (4)	Neutral/Moderate Impact (3)	Negative/ Little Impact (2)	Very Negative/ Very Little Impact (1)	No Effect/No Impact (0)

Chart 1 is intended to be used as an objective tool to assist policy makers evaluate and navigate the myriad of options available to manage plastic bags. The chart is divided into the three headings of the sustainability model: the economic, the environment, and social equity. Seven options are presented ranging from taking no action to banning both paper and plastic bans. Each policy option is placed under the scrutiny of these three legs of the sustainability model and assigned a rating of 0-5 depending upon how much the option positively or negatively impacts the economy, the environment, and equity relative to taking no action at all.

Here is an example of the thought process taken to assign ratings to each option:

The economic impacts of **Option 1: Take No Action** to consumers, businesses, and the City budget are very low and thus positive. However, this option clearly provides no real positive impact on our environment. Accordingly this option received an overall sustainability rating of 20 pts.

Alternatively, **Option 5: Tax on Plastic Bags Only** received a higher overall sustainability rating of 25 pts.

On the economic side, the net cost to the City budget would be low since the tax would likely be remitted to the City to cover implementation costs and to fund environmental programs (5 pts). Businesses might incur some costs by having to cover the full cost of paper bags (4.5 pts). The impact to the consumer would likely be relatively very negative as the taxes levied on plastic bags must be fairly high and punitive to encourage the use of paper bags (1 pt).

Environmentally, the tax option has been proven to significantly reduce the use of plastic bags and waste (5 pts). It has been less effective at increasing recycling diversion since the plastic bags are still available and are typically not accepted for recycling (2 pts). In terms of its net effect upon the environment and sustainability, this option greatly reduces the use of plastic bags and natural resources but falls a little short

of perfect since plastic bags would still remain available to consumers (4 pts). This option is a little less socially equitable since the tax is relatively high and the taxes collected are not shared between the retailers and the government (3.5 pts).

An Evaluation of Potential Plastic Bag Management Options

Presented in the following pages are several options to manage plastic bags in Kirkland. Each option is given a Sustainability Rating and an estimated implementation cost to the Solid Waste Utility. It is important to note that some of the options such as Options 4 and 7 are relatively more expensive than others and are consequently more impactful upon the resources of the Solid Waste Division. These options may lead policy makers to consider adding ongoing funding for education and outreach staff or contracted consultants to ensure a successful implementation.

Each option is discussed in general detail and the positives and negatives of each option are presented. For the sake of brevity, staff selected the most viable and popular options instead of trying to capture and present the myriad of idiosyncrasies and minor differences between ordinances that have been adopted across the nation. For example, within the most popular **Option 4: Ban Plastic Bags/Fee on Paper Bags** differences exist between individual ordinances as to whether or not restaurants are exempt, if there are specifications for reusable bags, and if hardship condition exemptions are allowed.

Additionally, the pros and cons presented are not intended to represent all of the positives and negatives associated with each option; rather they are merely highlights used to distinguish one option from another. Copies of examples of ordinances for each option are presented in the Addendum section.

Option 1: Take No Action

Sustainability Rating: 20
Cost: Under $5,000/year for reusable bags and limited education and outreach

Discussion

This option would require no further action to be taken to manage the use of plastic bags in Kirkland. As it has for the last several years, Solid Waste would continue to purchase and distribute 500-1,000 reusable shopping bags to residents each year through periodic promotions and at local events. A low level of education and outreach discouraging the use of plastic bags and encouraging reusable bags would be provided.

Pros

- No additional cost to business or changes to operations
- No change from status quo for Kirkland residents and visitors
- No requirement for additional Solid Waste budget

Cons

- No reduction on the amount of plastic bags used in Kirkland
- No positive impacts on the Kirkland environment
- No positive impact on reducing litter

Option 2: Public Education and Outreach Program

Sustainability Rating: 24.5

Implementation Cost to City: Minimal: $20,000 to $30,000/year ongoing

Discussion

This action would implement a sustained, multi-year education and outreach campaign to reduce the use of single use plastic and paper bags in Kirkland. Solid Waste would purchase 1,500 to 2,000 reusable bags each year and provide them to businesses for distribution at the point of sale. The bags would also be distributed to residents at local events and upon request. Staff would work with businesses to voluntarily establish more plastic bag recycling stations. Staff would use all available forms of media to saturate the Kirkland with information to discourage the use of single-use bags in Kirkland.

Pros

- More residents will recycle single-use plastic bags or use reusable bags.
- Opportunities to recycle plastic bags would increase.
- There would be a nominal cost to businesses and no cost to the consumer.

Cons

- Education and outreach campaigns are costly and impacts and results can be marginal in some cases in the absence of a legislated mandate such as a ban to support the campaign.
- There would be a minimal positive effect upon waste reduction, recycling, and the environment.
- Additional Solid Waste staff and/or resources may be required to implement and sustain the education and outreach effort.
- Recycling stations are highly sensitive to supply and demand. If there is market demand for plastic film, collectors are willing to provide stations for free. In the absence of demand for film, collectors may charge for stations which results in many stations disappearing from retail stores.

Option 3: Require Plastic Bag Recycling Stations

Sustainability Grade: 22
Implementation Cost to City: Nominal: Under $5,000

Discussion

By ordinance, retail stores distributing over a given amount of single-use plastic bags in a month or year would be required to have convenient plastic bag recycling stations at their retail stores. This option could be coupled with the promotion and distribution of reusable bags.

Pros

- Residents would be provided with more opportunities to recycle plastic bags.
- More bags would be diverted from the recycling center where the get caught in machinery.
- There is a minimal cost to the City budget and businesses and no cost to residents.

Cons

- Many large chain stores such as Fred Meyer and Safeway already provide recycling stations but the amount of plastic bags recycled remains between 5-15%.
- Recycling stations are inconvenient and, given that Kirkland accepts plastic bags in its commercial and curbside recycling programs, unlikely to be fully utilized.
- The aformentioned recycling station sensitivity to supply and demand.

Option 4: Ban Plastic Bags/Require a Fee for Paper Bags

Sustainability Grade: 28.5

Implementation Cost to City: Moderate: $30,000 to $50,000

Discussion

The plastic bag ban coupled with a fee on paper bags is the most popular bag management action taken by cities in Western Washington. The cities of Seattle, Issaquah, Edmonds, Bellingham and many others have adopted variations of this ban. Save for Edmonds, retailers are required to charge their customers at least five cents for each large paper grocery bag to encourage customers to use reusable bags. In most cases, major exemptions include:

1. Restaurants for take-out items
2. Plastic bags over 2.25mm in thickness
3. Bags for bulk items such as nuts or candy
4. Bags used to wrap frozen foods and meat or fish
5. Bags that contain prescription drugs
6. Newspaper, door hanger, laundry/dry cleaning bags
7. Bags used for pet waste, garbage, and yard waste
8. Hardships
9. Residents receiving public assistance

This type of ban is not made effective until a grace period, typically six month to one year, has elapsed so that retailers can use up their bag inventories, develop implementation and compliance strategies, and train employees. The grace period is also designed to give cities the opportunity to provide education and outreach to its residents, purchase and distribute reusable bags, and contact and visit its businesses to provide assistance to help them achieve compliance. In some cases, the ban is phased in whereby large retailers are required to comply first after the grace period elapses and smaller retailers are given a longer time (up to a year) to comply.

Pros

- 60% of the respondents to the residential plastic bag survey indicated that they would be willing to pay five cents or less if a ban was implemented.
- A large percentage of single-use plastic bags would be eliminated from use in Kirkland which reduces waste and benefits our environment.
- About 85% of paper bags are recycled.
- This type of ban is the most popular option and is generally supported by retailers who value consistency and predictability as a means to streamline compliance between cities where they do business.

- At their discretion, retailers are able to charge more than five cents for each paper bags to cover costs.
- The exemption for restaurants builds consensus and negates opposition from the restaurant industry.

Cons

- The number of paper bags used would increase. Paper bags cost more in natural resources and energy to produce compared to plastic bags.
- Bans can be perceived negatively by the public. The results of the community surveys indicated that residents and businesses are opposed to a ban.
- The five cent fee typically does not cover the costs of paper bags for the smaller retailers.
- There is less social equity and fairness if residents on public assistance or food rescue organizations are not exempted since they may not able to afford paper bags.
- The ban would require a significant education and outreach effort on the part of Solid Waste with a likely need for more resources to include education and outreach staff/consultants, to purchase a reusable bag inventory, and to print and provide education and outreach materials.

Option 5: Tax on Plastic Bags Only

Sustainability Grade: 25

Implementation Cost to City: Minimal: $40,000 - $50,000 for education and outreach, enforcement, and tax collection. All costs offset by tax revenue.

Discussion

This tax was first passed by Ireland in 2002. Plastic bags are not banned but are heavily taxed to encourage the use of paper or reusable bags. The original tax was set at 15 Euro cents (19 US Dollar cents) and was increased in 2007 to 22 Euro cents (28 US Dollar cents). The tax reduced the use of plastic bags by about 94%. The tax collected by the retailers is remitted to the State of Ireland and is used for enforcement, education and outreach, and environmental clean-up projects. The exemptions to the tax are similar to those of ban. Exemptions include bags used for fish, meat, and poultry and items sold in bulk such as fruits, nuts, and vegetables.

Pros

- Plastic bags would remain an option for customers and retailers.
- The tax has proven to be an effective way to limit the use of plastic bags without resorting to an outright ban.
- The tax is effective at reducing waste.
- The implementation cost to businesses and the City is nominal.

Cons

- The City would need to establish its legal authority to charge a tax on plastic bags. The City must establish that the tax would be used for regulatory purposes and not imposed as a means to generate revenue.
- Requirement for enforcement and tax collection costs.
- Retailers would have to cover the entire cost of the paper bags and pass the cost on to consumers.
- New taxes are generally not well-received by the public.
- There would be less equitability as there are no provisions for exemptions for residents on public assistance.
- Plastic bags would remain an option so their use would not be entirely eliminated.
- As consumers adjust to the tax, the tax may need to be periodically increased to spur additional reductions in the use of plastic bags.

Option 6: Tax on Paper and Plastic Bags

Sustainability Grade: 23.5

Implementation Cost to City: Minimal: $40,000 - $50,000 for education and outreach, enforcement, and tax collection. All costs offset by tax revenue.

Discussion

This option would levy a tax on both plastic and paper bags. The current model for this option is Washington D.C. where a fee of five cents is charged to the consumer for each plastic and paper bag. This law provides for the same typical exemptions as other laws and bans. Restaurants with seating that provide paper carryout bags to take food away from their premises are also exempt from the tax. Taxes collected are shared between the retailer and the Anacosta River Protection Fund. The retailer retains one cent of the tax and remits four cents to the Protection Fund. A retailer participating in the Carryout Bag Credit Program may retain an additional one cent of the tax. Retailers participating in the program must credit the customer five cents for each carryout bag provided by the customer to the retailer for packaging his or her purchases regardless of the type of bag.

Pros

- The overall use of plastic and paper bags is reduced thus reducing waste.
- The City would need to establish its legal authority to charge a tax on paper and plastic bags.
- The tax is used to directly support environmental programs.
- The tax was effective at reducing the use of paper and plastic bags by 67%.

Cons

- Plastic bags would still be available to consumers.
- New taxes are generally not well-received by the public.
- The tax retained by the retailer is generally not enough to cover the cost of the paper bags.
- The tax may be too small to encourage more use of reusable bags.

Option 7: Ban Both Paper and Plastic Bags

Sustainability Grade: 23.5
Implementation Cost to City: Moderate: $30,000 to $50,000

Discussion

The best example available for this type of ban is the ordinance adopted by the City of Austin, Texas in 2012. This law prohibits retailers from providing any single-use plastic bags to consumers. Retailers are allowed to provide or sell reusable carryout bags to their customers that are defined as being made from cloth, recyclable thick plastic bags, and recyclable paper bags. This ban provides for the standard exemptions to include bags for bulk items; frozen foods, meat and fish; dry cleaning, newspaper, garbage, pet waste, and yard waste bags; paper bags for restaurants for carryout foods; and hardship cases.

Pros

- Bans all single-use plastic and paper bags.
- Provides waste reduction by completely eliminating the use of plastic bags.
- Allows retailers to charge customers for reusable bags to cover costs.

Cons

- Not a true ban of single-use paper bags since they are defined in the ordinance as "reusable".
- Not equitable for smaller businesses that have to pay and charge more for paper bags.
- May increase the use of paper bags which generally cost more energy and natural resources to produce.

Sustainability Ratings Ranking

1. Ban Plastic Bag/Fee on Paper Bags (28.5 pts)
2. Tax on Plastic Bags Only (25 pts)
3. Public Education and Outreach Campaign (24.5 pts)
4. Tax on Paper and Plastic Bags (23.5 pts)

   Ban Both Paper and Plastic Bags (23.5 pts)
5. Require Plastic Bag Recycling Stations (22 pts)
6. Take No Action (20 pts)

Evaluation Findings

Of the seven options presented, **Option 4: Ban Plastic Bags/Fee on Paper Bags** emerges with the highest overall sustainability rating of 28.5 points. The overall cost to implement this option would be somewhat higher than taking no action but its overall benefit to our environment is the highest among the options considered. **Option 4** would have a relatively larger effect upon our environment and sustainability (5 pts) and waste reduction (5 pts) and, to a lesser degree, upon recycling diversion (2 pts) as most plastic bags would be removed from the waste stream and would simply not be available to be recycled. This option is also relatively equitable, since the fee charged to customers for paper bags is nominal and businesses retain the paper bag fees to help cover their costs. Eight cities in Western Washington have adopted this type of ban and retailers favor it over other options for its fairness, predictability, and consistency.

Alternatively, the Irish model of charging a high tax on plastic bags received the second highest sustainability rating of 25 points. As noted in the evaluation, this option has also been very successful at reducing the use of plastic bags and steering customers toward the use of paper bags or reusable bags. This option provides a sustainable funding source to cover the costs of implementation, education and outreach, and environmental programs while accomplishing almost the same result as an outright ban on plastic bags.

Plastic bags are among the twelve items of debris most often found in coastal cleanups.

Case Studies

Many cities in the region have crafted and passed legislation intended to minimize the use of single-use plastic bags. Kirkland Solid Waste staff interviewed their counterparts at the cities of Edmonds, Seattle, and Issaquah about the specific provisions in their respective ordinances, how they conducted education and outreach, and to gain insights and advice on best management practices for implementing plastic bag bans. The texts of the individual ordinances are included in the Addendum section.

The City of Edmonds was the first city in Washington to pass a plastic bag ban in 2009. The Edmonds ordinance was modeled from a plastic bag ordinance in the City of Palo Alto, California. Single-use plastic carry-out bags are banned, but secondary smaller plastic bags such as for meat, produce, or bakery items are exempt. This ban is unique in that there is no fee or restriction on paper bags. Businesses were allowed a grace period of one year to liquidate their plastic bag inventory and prepare for the ban. During the waiting period, City staff offered advisory assistance to businesses and rolled out a robust "Bring Your Own Bag" campaign.

The cities of Bellingham, Seattle, Mukilteo, Bainbridge Island and Issaquah have also passed plastic bag ban ordinances. These bans, similar to Edmonds, ban single-use plastic carry-out bags, with the exemption of smaller plastic bags and an exemption for restaurants. There is also an exemption for plastic bags that are 2.25mm or thicker because these are deemed to be reusable plastic bags. Businesses must charge a minimum five cent fee on each paper bag provided to a customer. The five cent fee goes to retailers to cover the cost of the paper bags which can cost up to 12 cents each depending on the volume purchased by the retailer. These cities' bans are all based on the same model, with minor differences. For example, the City of Issaquah's ban is a phased ordinance: businesses larger than 7,500 square feet had to comply to the ban immediately when it went into effect, whereas businesses smaller than 7,500 square feet have an additional year grace period to gain compliance.

In interviews of staff from Issaquah, Edmonds and Seattle, a series of questions were asked about potential issues and concerns with plastic bag bans. The following feedback was received:

- There were no reported issues or complaints from store owners about an increase of shoplifting.
- There were no health issues reported due to an increase in the use of reusable bags.
- Cities generally received positive feedback from both businesses and residents about the ban.
- Staff noticed that compliance was easier for larger businesses than smaller businesses.

Staff also relayed the following feedback and advice about future bag bans:

- Both the cities of Issaquah and Seattle noticed that larger retailers were converting to using a thicker plastic bag (as allowed by the 2.25mm or thicker exemption) in their stores. The Cities recommended reconsidering this exemption because the goal of the ban is to completely restrict the use of all plastic bags.
- Cities interviewed recommended that consideration be given to removing the exemption for restaurants since restaurants use a significant amount of plastic bags for carryout items.

City of Issaquah Case Study
Staff Interviewed: Micah Bonkowski

The City of Issaquah passed its plastic bag ban ordinance in the spring of 2012. The ordinance is essentially the same as City of Seattle, Bellingham, Mukilteo, and Bainbridge Island. All plastic carry-out bags are banned except those used for meat, produce, and bakery items. Plastic carry-out bags used by restaurants are exempt. There is also an exemption for any plastic bags that are 2.25mm or thicker because these are considered to be reusable plastic bags.

Issaquah's ban differs slightly because it has a phased implementation provision. After the ordinance was passed, stores over 7,500 square feet had about nine months before the ordinance took effect. Businesses with less than 7,500 square feet were provided with one additional year to comply.

City staff sent out two mailings to businesses and visited each large retail store three weeks before the ban went into effect. A second visit was made right before the ban went into effect. The City provided signage to retailers to provide information about the ban at checkstands. City staff placed ads in the local newspaper and issued multiple news releases to educate the public about the upcoming ban. Reusable bags were distributed at Issaquah's solid waste hauler's storefront, at giveaway events at local grocery stores, and to low income housing residents.

Many stakeholders said they favored consistency and predictability across the region and only supported the ban since it was in the same standard format as Bellingham and Seattle. Staff noted that the ban was much easier on bigger retailers who had already had to comply with similar bans in other cities. Bigger retailers were able to train staff about the ordinance and set up and brand their own reusable bag sales areas. Overall, smaller businesses had more resistance to and more complaints about the ban. Finally, Issaquah staff had to develop communication plans for vendors at special events/farmers markets, such as their large Salmon Days event - an event comparable in size to Kirkland's Uncorked and Summerfest.

City of Seattle Case Study
Staff Interviewed: Dick Lilly

The City of Seattle passed its plastic bag ban in 2011. This bag ban closely resembles Bellingham's plastic bag ban. Single-use plastic bags are banned with the exception of restaurant take-out bags and in-store smaller plastic bags, such as for the deli or produce. Like Issaquah, plastic bags thicker than 2.25mm are exempt from the ban. There is a five cent charge for paper bags which the retailer retains to help cover the costs of paper bags.

Seattle's plastic bag ban was passed by its City Council subsequent to a tax levied on both paper and plastic bags. The tax was overturned by Seattle voters through a referendum.

In terms of education and outreach, Seattle held one stakeholder meeting and sent out two mailers to businesses, one well in advance of the ban's effective date and a second 2-3 weeks before the ban went into effect. Seattle also received generous unsolicited, but welcome, newspaper and television coverage. City staff contacted 150-200 businesses in person about the ban and spoke to another 600 businesses by phone. Staff posted free signage on their webpage for businesses to print out and use at checkstands. Reusable bags were handed out to low-income families.

There was some concern from grocers that the reusable bags would become dirty and become a health risk to store clerks, but that has not proven to be the case. Similarly, there was concern about a potential increase in shoplifting, but Seattle staff indicated that there have been no complaints from retailers about increases in theft attributable to reusable bags.

As a final word of advice, staff advised that cities considering banning plastic bags should not make a plastic bag ban any tougher than the City of Seattle's to lessen backlash from the public and retail associations. This advice includes retaining the 2.25 mm plastic bag thickness and restaurant take-out bag exemptions.

City of Edmonds Case Study
Staff Interviewed: Steve Fisher

The City of Edmonds passed its plastic bag ban in August 2010. The ordinance was modeled from a plastic bag ordinance in the City of Palo Alto, CA in which plastic bags are banned but there is no fee charged for paper bags. All businesses were given a one year grace period to comply with the ban.

To provide education to businesses and residents, City staff sent out postcards, visited businesses face-to-face to explain the ban, rolled out a "Bring Your Own Bag campaign", and coordinated a poster competition with the local school district to involve schools. Staff did not have the budget to distribute reusable bags.

Edmonds did not take any formal surveys after the ban became effective, but feedback received indicates that businesses and residents are supportive of the ban and all businesses are in compliance. Edmonds staff has not received any reports of increases in shoplifting attributable to the ban. Like Seattle and Issaquah, the ban exempts plastic bags thicker than 2.25mm and a few businesses have opted to provide these thicker bags to their customers as single-use plastic bags to circumvent the spirit of the law.

As a final piece of advice, Edmonds staff reported that talking face-to-face with businesses was helpful in education and outreach and critical to a smooth implementation.

What Kirkland Has Done In the Past

Kirkland Solid Waste staff provides recycling and waste reduction education and outreach at various events throughout the year, such as Kirkland Uncorked, the Kirkland Wednesday Market, and at schools and neighborhood association meetings. Outreach provided at these events includes information on plastic bags and the reusable bag alternative.

Staff also distributes about 500 reusable bags at events each year. In 2008, Kirkland distributed over 1,000 reusable bags made from 100% recycled plastic bottles. Today, Kirkland distributes the more compact Chico Bag which is made in part from recycled PET (polyethylene terephthalate). The cost of the reusable bags is approximately $5,000 per year.

King County also provides outreach on recycling plastic bags through their campaign, "Bag your bags, bring 'em back." The campaign seeks to educate residents on bringing their plastic bags back to the grocery stores to be recycled. Their webpage, *www.bagyourbags.com,* provides information on plastic bag recycling locations in King County, including three sites in Kirkland.

Selected Sources and References

"King County encourages plastic bag recycling through annual 'bag your bags' campaign", 2011,
www.kingcounty.gov/environment/dnrp/newsroom/newsreleases/2011/october/1005Bag-your-bags.aspx

"Store owners say plastic bag ban causes more shoplifting"
http://www.seattlepi.com/local/article/Store-owners-say-plastic-bag-ban-causes-more-4314744.php

Environmental Protection Agency, Marine Debris Impacts
http://water.epa.gov/type/oceb/marinedebris/md_impacts.cfm

Washington 2004 Litter Study. Department of Ecology
https://fortress.wa.gov/ecy/publications/publications/0507029.pdf

"New Bans on Plastic Bags May Protect Marine Life"
http://www.worldwatch.org/node/5565
(100 billion bags thrown away annually in U.S.)

Trash Travels, International Coastal Cleanup, 2010
http://act.oceanconservancy.org/images/2010ICCReportRelease_pressPhotos/2010_ICC_Report.pdf

Monterey Bay Research Institute Report
http://www.mbari.org/news/news_releases/2013/deep-debris/deep-debris-release.html

Great Pacific Garbage Patch
http://education.nationalgeographic.com/education/encyclopedia/great-pacific-garbage-patch/?ar_a=1
Assessment of the Potential for Cross-contamination of Food Products by Reusable Shopping Bags, David L. Williams, Charles P. Gerba, Sherri Maxwell, Ryan G. Sinclair Biblographic citation: Food Protection Trends, vol. 31, no. 8, pp. 508-513, August 2011, Volume 31, Issue 8

Two Years of the Washington DC Bag Tax: An Analysis
http://s3.amazonaws.com/atrfiles/files/files/BHI_Report.pdf

Addendum

2013 Community Survey: Resident Opinions of Disposable Bag Ban - May 2013

2013 Community Survey: Retail Business Survey: Disposable Shopping Bags - June 2013

2008 Plastic Bag Survey

Comments Received from Community Surveys

City Ordinances

Stakeholders List

Letter to Stakeholders

Stakeholder Comments

CITY OF KIRKLAND

Resident Opinions of Disposable Bag Ban

May 2013

ELWAY RESEARCH, INC.

CITY OF KIRKLAND

Resident Opinions of Disposable Bag Ban

May 2013

TABLE OF CONTENTS

1. Introduction 1
   - Methods 2
   - Respondent Profile 3
2. Key Findings 4
3. Major Findings 5
4. Discussion 13
5. Appendix 14
   - Questionnaire with data

ELWAY RESEARCH, INC.

CITY OF KIRKLAND

Citizen Opinions of Disposable Bag Ban

May 2013

INTRODUCTION

This report summarizes the results of a telephone survey, conducted on behalf of the City of Kirkland, to assess Kirkland residents' attitudes about a potential ban of disposable shopping bags in Kirkland.

Some 407 Kirkland adults (age 18+) were selected at random and interviewed between May 21-23. Survey respondents were asked about:

- Current behavior with regard to the use of shopping bags;
- Potential support for a ban of, or fees on, paper and plastic disposable shopping bags in Kirkland; and
- Willingness to pay if a fee were imposed.

Demographic information was also collected so as to compare and contrast answers.

The survey was administered by Elway Research, Inc. The questionnaire was designed in collaboration with representatives of the Public Works Department of the City of Kirkland.

The report includes Key Findings, followed by annotated graphs summarizing the results to each question. The full questionnaire and a complete set of cross-tabulation tables is presented in the appendix.

METHODS

SAMPLE: 407 adult residents of Kirkland, WA

TECHNIQUE: Telephone Survey.
Address-based sample frame:
Telephone numbers were looked up for addresses in the City of Kirkland.

10% of the interviews were conducted via cell phone.

FIELD DATES: May 21-23, 2013

MARGIN OF ERROR: ±5% at the 95% confidence interval. That is, in theory, had all similarly qualified voters been interviewed, there is a 95% chance the results would be within ±5% of the results in this survey.

DATA COLLECTION: Trained, professional interviewers under supervision conducted all interviews during weekday evenings. Up to four attempts were made to contact a head of household at each number in the sample. Questionnaires were edited for completeness, and a percentage of each interviewer's calls were re-called for verification.

It must be kept in mind that survey research cannot predict the future. Although great care and the most rigorous methods available were employed in the design, execution and analysis of this survey, these results can be interpreted only as representing the answers given by these respondents to these questions at the time they were interviewed.

RESPONDENT PROFILE

In interpreting these findings, it is important to keep in mind the characteristics of the people actually interviewed. This table presents a profile of the 407 respondents in the survey.

Note: Here and throughout this report, percentages may not add to 100%, due to rounding.

GENDER:	50%	Male
	50%	Female
AGE:	9%	18-35
	20%	36-50
	41%	51-64
	28%	65+
	2%	No Answer
EDUACTION LEVEL	12%	High School or less
	24%	Some College/Vocational
	42%	College Degree
	20%	Post Grad School
EMPLOYMENT:	14%	Self-employed/Owner
	30%	Private Business
	10%	Public Sector
	8%	Not Working
	34%	Retired
	3%	No Answer
HOUSEHOLD:	28%	Couple with children
	45%	Couple with no children
	4%	Single with children
	21%	Single with no children
	2%	No Answer
HOME TYPE	81%	Single Family House
	11%	Condominium
	6%	Apartment
	3%	Other / No answer
HOME OWNER	83%	Own
	13%	Rent
	4%	No Ans
INCOME:	13%	$50,000 or less
	18%	$50 to $75,000
	12%	$75 to $100,000
	15%	$100 to 150,000
	14%	Over $150,000
	28%	No Answer

KEY FINDINGS

- **Most Kirkland residents surveyed are currently engaging in desired behavior with paper and plastic bags**
  - 8 in 10 recycle or re-use more than one type of bag
  - Nearly half (46%) currently bring their own bags to the grocery store, including 3 in 10 (29%) who always do so

- **Voluntary measures for reducing disposable bag use have greater support than mandatory measures, and much more support than fees.**

- **Measures aimed at stores had more support than measures aimed at consumers**
  - 85% supported requiring stores to have plastic bag recycling bins
  - 80% supported encouraging stores to voluntarily reduce their use of disposable bags
  - 67% opposed charging a fee to shoppers for plastic bags
  - 76% opposed charging for any disposable bag

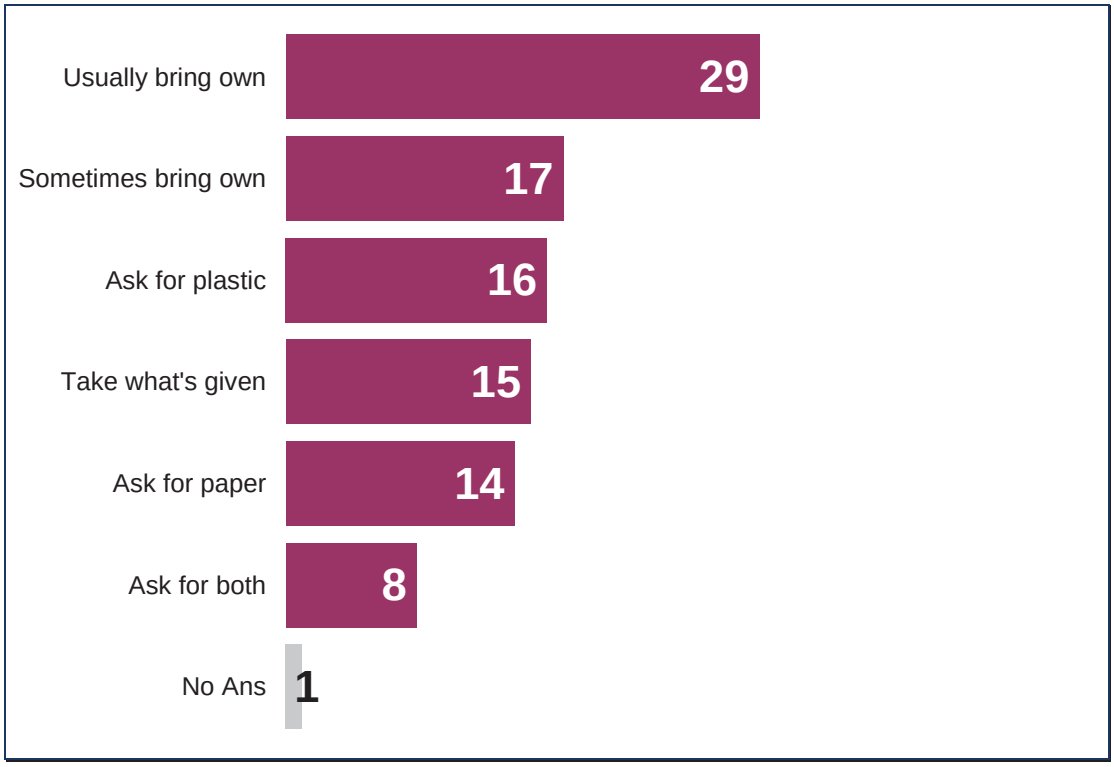
- **There was little support for, and stubborn opposition to, banning disposable shopping bags**
  - 69% opposed banning plastic shopping bags
  - 25-30% consistently stated that there should not be a ban or a fee across all questions which posed that policy as a hypothetical. This was despite the fact that the "no fee" option was not read as a possible answer; they consistently volunteered it anyway.

- **Despite the consistent lack of support for fees, most would be willing to pay something if there were a fee for disposable bags**
  - 36% would be willing to pay 5¢ or more
  - 31% would be willing to pay "less than 5¢"
  - 33% would not be willing to pay anything (an option not offered).

FINDINGS

Major findings are presented in the following section in the form of annotated graphs and bullets. The full results are appended in detailed cross-tabulations.

Nearly Half Bring Their Own Bags Grocery Shopping At Least Sometimes



Q2: When shopping for groceries, do you: 1) usually bring your own bags to carry them; 2) sometimes bring your own bags; 3) usually ask for plastic bags; 4) usually take what the clerk gives me; 5) usually ask for paper bags; 6) sometimes ask for plastic, sometimes for paper.

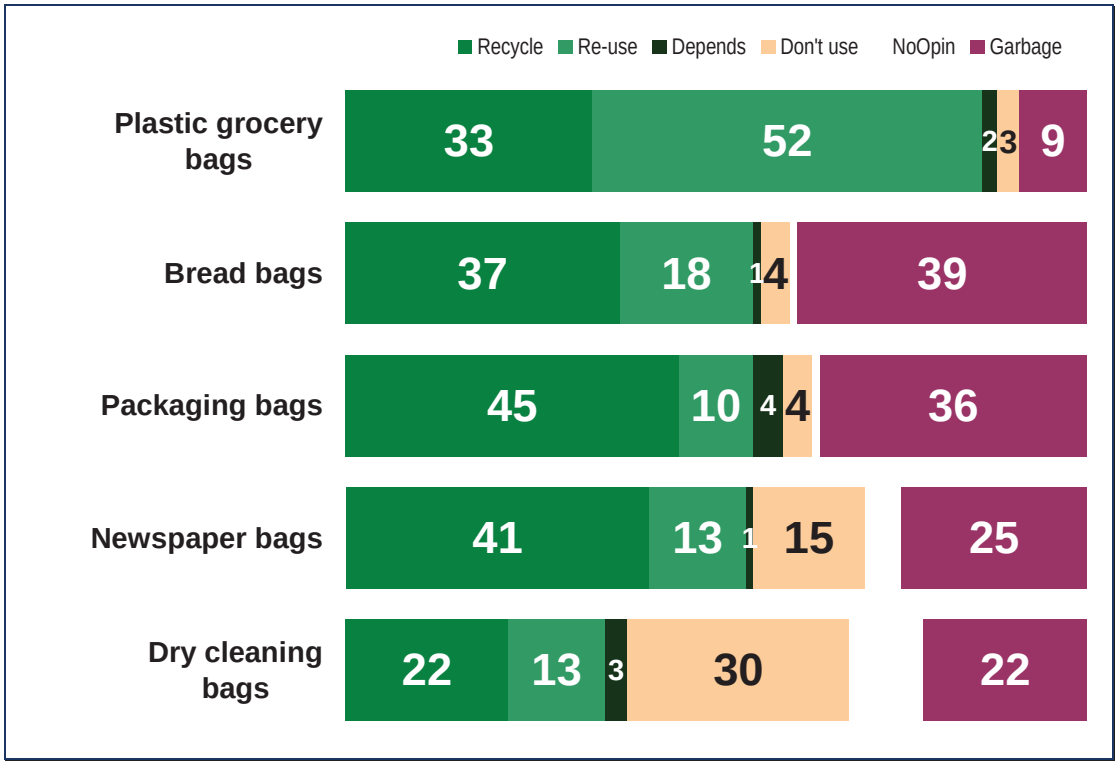
- **Education related to bringing own bags**

  The only significant demographic predictor of whether or not someone brought their own bags to the grocery store (at least sometimes) was education level:

  48% of those with a college degree did so, compared to
  44% of those with some college and
  26% of those with a high school education.

- **Other patterns, not statistically significant:**
  - 50% of those between the ages of 36-64 brought their own bags, compared to 39% of those over 65 and 37% of those under 36;
  - 49% of those in couples brought their own bags, compared to 37% of singles

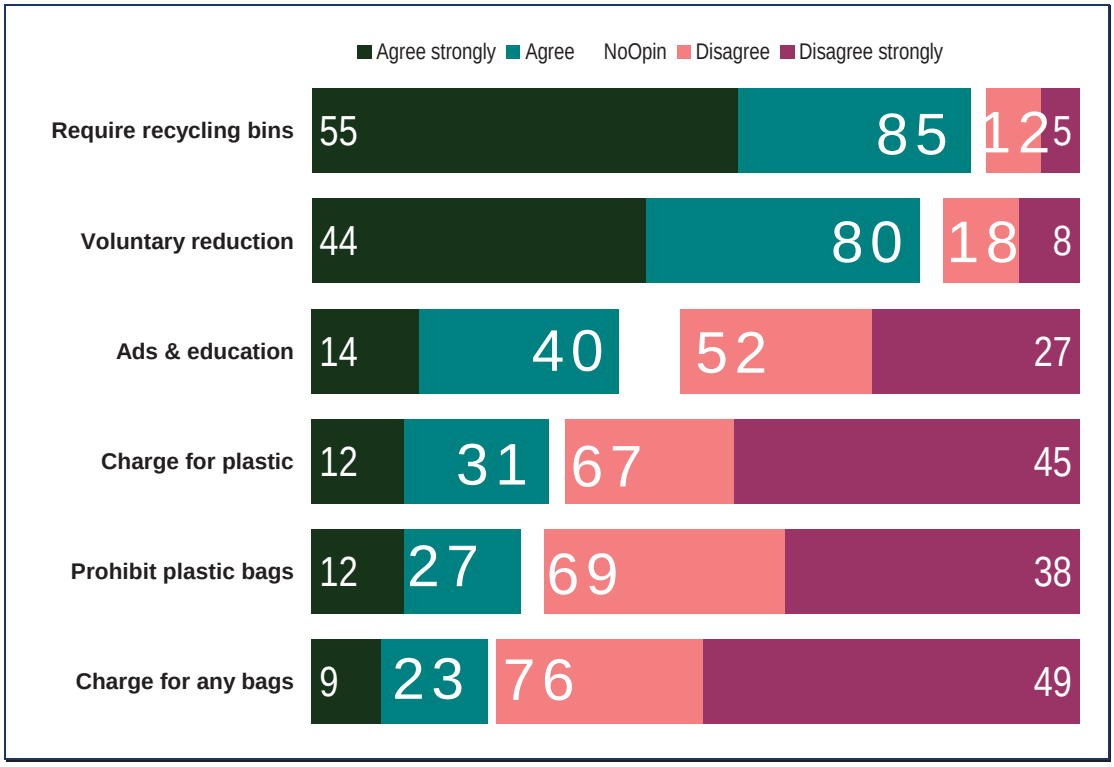
Most Recycle / Re-Use Bags



Q3 People do different things with used plastic bags. For each of following types of plastic bags, do you typically throw them in the garbage, recycle them, or re-use them? First, what do you typically do with…

- **Sizeable majorities recycled or re-used each of the type of bags they used**
  - 8 in 10 recycled or re-used more than one of these types of bags
- **Least likely to be recycled or re-used were**
  - Bread bags (39%) and
  - Packaging bags (36%)

7 in 10 Oppose Bans or Fees to Discourage Use of Disposable Bags

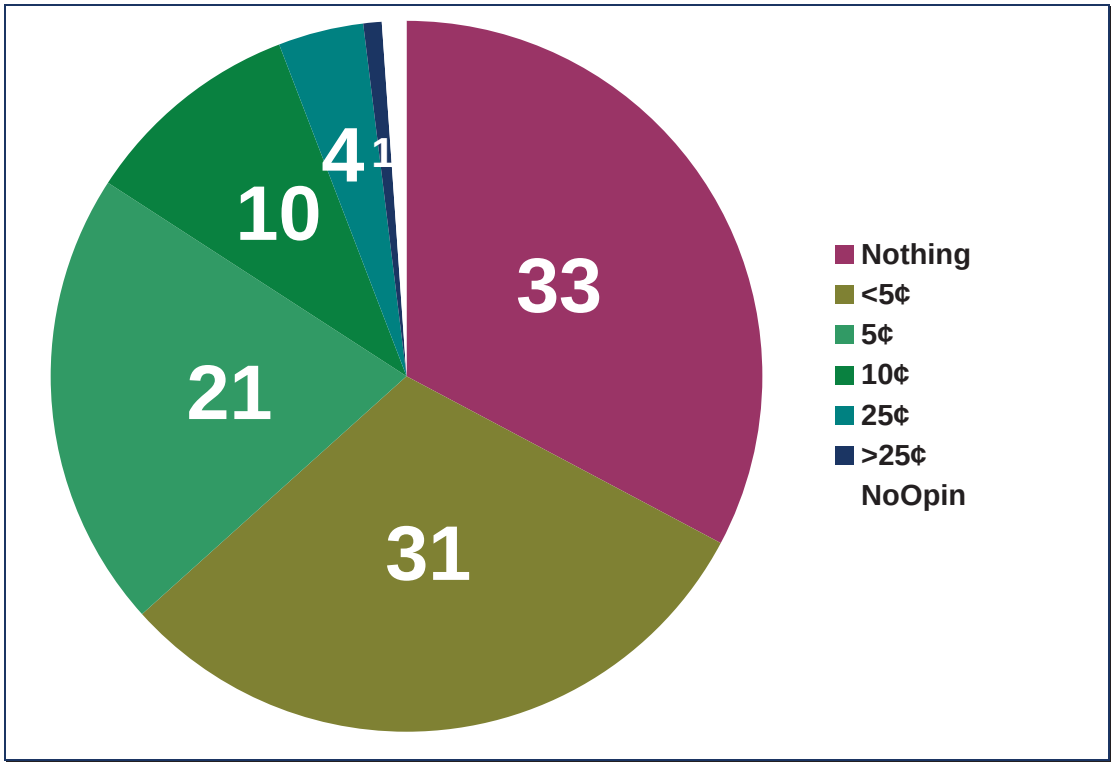


Q4 Some cities are taking measures to discourage the use of disposable shopping bags. By shopping bags, I mean the bags you get at the check stand – not the small bags for meat or vegetables. As I read some of these ideas, tell me whether you Agree, Agree Strongly, Disagree or Disagree Strongly that the City of Kirkland should do this. The first one is …

- Require stores that provide plastic shopping bags to recycle those bags by having bins where customers can return them.
- Encourage stores to voluntarily reduce their use of disposable plastic and paper shopping bags and promote reusable shopping bags.
- Use city utility money for advertising and public education to promote the use of reusable shopping bags.
- Charge a fee to shoppers for each plastic shopping bag they accept from a store at the checkout counter.
- Prohibit stores from giving out plastic shopping bags.
- Charge a fee to shoppers for <u>any</u> type of disposable shopping bag - including paper - that they accept from a store.

- **A majority even of those who bring their own bags**
  - Favored encouraging voluntarily reduction of disposable bag use (90%)
  - Favored mandatory recycling bins (87%)
  - Opposed banning plastic bags (60%)
  - Favored ads and education (52%)
  - Opposed charging for plastic bags (51%)
  - Opposed charging for all types of disposable bags (64%)

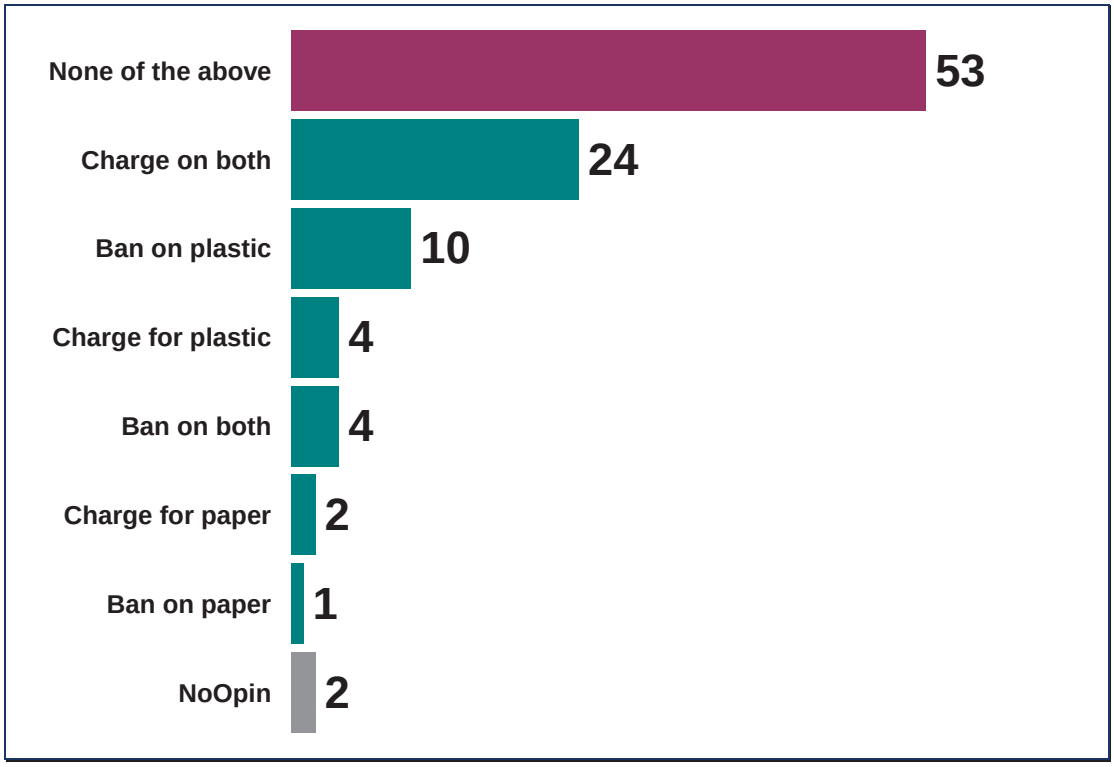
Two-thirds may be willing to pay for shopping bags



Q5 If there were a fee for paper and plastic shopping and grocery bags, how much would you personally be willing to pay for the convenience of getting plastic or paper bags to carry your purchases from the store?

- **Even most who oppose charging a fee for all bags would be willing to pay something if there were a fee:**
  - 24% would be willing to pay 5¢ or more
  - 36% would be willing to pay something less than 5¢
- **Most willing to pay something were:**
  - Age 36-50 (74%)
  - Those who bring their own bags shopping (73%)
  - Those with incomes over $75,000 (73%).
- **Least willing to pay anything were:**
  - Seniors (41%)
  - Self employed (40% unwilling to pay)
  - Those who do not bring their own bags (38%)

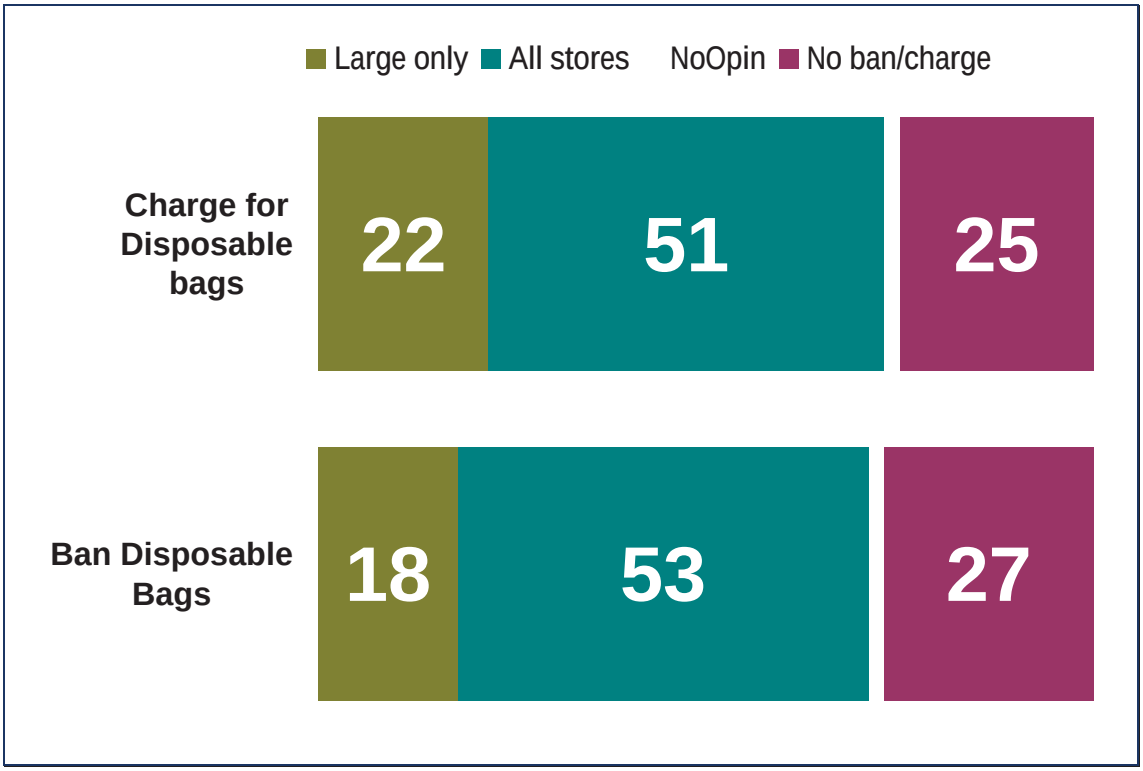
Most Do Not Support Any Change to Existing Bags Policy



Q6 The amount energy used in the production of paper shopping bags, even those with recycled paper, is significantly greater than that for plastic bags. Given that fact, which of the following actions – if any – would you support in the City of Kirkland:

- **A 53% majority would not support either charging for bags nor banning them outright – regardless of type of bag.**
- **Charging was more acceptable than banning bags:**
  - 30% supported charging for paper, plastic or both types of bag; while
  - 15% supported any ban
- **Change acceptable to small majority (54%) of those under 65**
  - Unacceptable to 61% of seniors

Any Disposable Bag Ban or Fee Should Apply to All Types of Stores

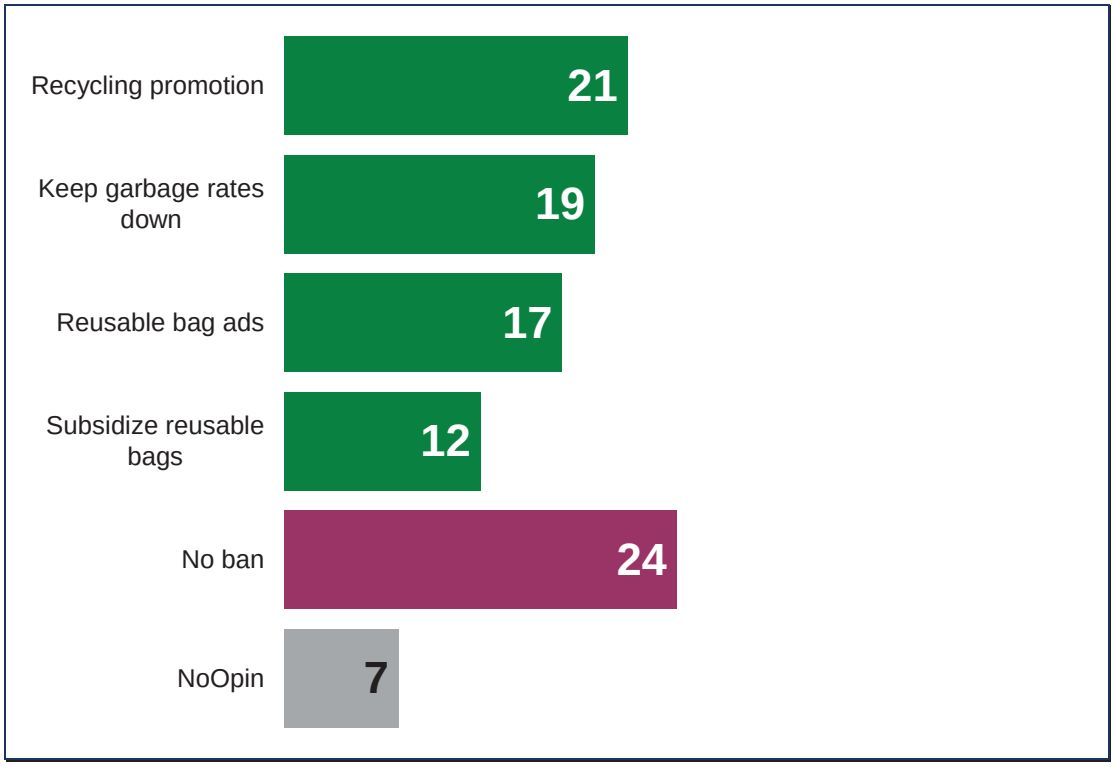


Q7 If there were a charge per bag on disposable paper and plastic bags, should it apply to:
Large grocery, drug and other chain stores only? Or
All stores of any kind that provide disposable shopping bags - including grocery and drug stores, retail and convenience stores plus small "mom and pop" grocery stores?

Q8 If there were a ban on the use of disposable plastic shopping bags, should it apply to:
Large grocery, drug and other chain stores only? Or
All stores of any kind that provide disposable shopping bags - including grocery and drug stores, retail and convenience stores plus small "mom and pop" grocery stores.

- **Just over half of all respondents said that any fee to disposable bags should apply to all types of stores, not just large chain stores**
- **The response was almost identical when the question was prohibiting disposable bags**
- **This pattern of response was consistent across all demographic categories.**

No Consensus on What to do With Bag Fee Proceeds



Q9 If the city charged a fee on each disposable shopping bag used by shoppers, how would you suggest the money be used?
To pay for city promotion of waste prevention and recycling programs.
To keep city garbage rates down, even though the effect might be small
To pay for advertising & public education to promote the use of reusable bags.
To subsidize stores for the price of reusable bags.

- **Three of four suggested uses for revenue from a bag fee each received equivalent support**
  - Taken together, promotion and advertising to promote recycling and use of re-useable bags was supported by 38%
  - One in five (19%) preferred to used the proceeds to keep garbage rates down
- **Reducing garbage rates most favored by**
  - Those making less than $50k/year (35%)
  - Renters (29%) and apartment dwellers (30%)
  - The young (24% of those under 35)

DISCUSSION

Most Kirkland residents interviewed for this survey report recycling plastic and paper bags and about half bring their own, reusable bags to the grocery store. The City of Kirkland also provides for the curbside collection of plastic bags and many retail stores offer on-site plastic bag recycling.

Perhaps because such high proportions of residents believe they, the City and many businesses are already "doing the right thing" with regard to bags, there is little support for banning or charging for disposable bags in the city.

Certainly the *mandatory* aspect of the proposals is unpopular. Support for encouraging voluntary behavior had far more support among these residents than did any of the proposals for mandatory actions. Even those who are already recycling and bringing their own bags do not support the idea of banning or charging for disposable bags.

Interestingly, however, about two-thirds of respondents were willing to pay something if a fee were imposed on disposal bags. This willingness to pay *something* suggests that real fee being contemplated is less that the amount people imagine, and that the fee in reality may not be as onerous as it is in the abstract.

Still, the overwhelming finding is this survey is the widespread opposition to banning or charging for disposable bags. Programs and policies to encourage voluntary reduction the use of disposable bags will likely be met with widespread support. Policies to mandate the same behavior will likely be met with widespread opposition.

QUESTIONNAIRE

with Data

ELWAY RESEARCH, INC.

TOPLINE DATA

SAMPLE	407 Kirkland Adults (age 18+)
MARGIN OF SAMPLING ERROR	±5% at the 95% level of confidence
FIELD DATES	May 21-23, 2013
GENDER	MALE...**50%** FEMALE...**50%**

- The data are presented here in the same order the questions were asked in the interview
- The figures in bold type are percentages of respondents who gave each answer.
- Percentages may not add to 100% due to rounding.

1. How often, if at all, do you personally shop for groceries?

57 Several times a week
30 Once a week
7 A couple of times a month
2 Once a month
1 Less than once a month
3 Never
0 [DK/NA]

2. When shopping for groceries, do you…

16 Usually ask for plastic bags to carry them
14 Usually ask for paper bags to carry them
8 Sometimes ask for paper, sometimes for plastic
15 Usually take - what the clerk gives me
29 Usually bring your own bag to carry them
17 Sometimes bring your own bag to carry them
1 [DK/NA]

3. People do different things with used plastic bags. For each of following types of plastic bags, do you typically throw them in the garbage, recycle them, or re-use them.? First, what do you typically do with…

[1=GARBAGE…2=RECYCLE…3=RE-USE…4="DEPENDS" OR "ALL"…5=DON'T USE…6=DK/NA]

ROTATED	GARB	RECYCLE	RE-USE	DEP	DONT USE	DK
A. Plastic grocery bags	9	33	52	2	3	0
B. Bread bags	39	37	18	1	4	1
C. Dry cleaning bags	22	22	13	3	30	10
D. Plastic bags that come with packaging such as electronic equipment.	36	45	10	4	4	1
E. The bags the newspaper comes in	25	41	13	1	15	5

4. Some cities are taking measures to discourage the use of disposable shopping bags. By shopping bags, I mean the bags you get at the check stand – not the small bags for meat or vegetables. As I read some of these ideas, tell me whether you Agree, Agree Strongly, Disagree or Disagree Strongly that the City of Kirkland should do this. The first one is …

ROTATED	AGSTR	AGREE	DISAG	D-STRG	DK
A. Encourage stores to voluntarily reduce their use of disposable plastic and paper shopping bags and promote reusable shopping bags.	44	36	10	8	3
B. Use city utility money for advertising and public education to promote the use of reusable shopping bags	14	26	25	27	8
C. Prohibit stores from giving out plastic shopping bags.	12	15	31	38	3
D. Require stores that provide plastic shopping bags to recycle those bags by having bins where customers can return them	55	30	7	5	2
E. Charge a fee to shoppers for each plastic shopping bag they accept from a store at the checkout counter	12	19	22	45	2
F. Charge a fee to shoppers for <u>any</u> type of disposable shopping bag - including paper - that they accept from a store.	9	14	27	49	1

5. If there were a fee for paper and plastic shopping and grocery bags, how much would you personally be willing to pay for the convenience of getting plastic or paper bags to carry your purchases from the store?

33 Would not be willing to pay anything [NOT READ]
31 Less than 5 cents per bag
21 5 cents per bag
10 10 cents per bag
4 25 cents per bag
1 More than 25 cents per bag
1 [DK/NA]

6. The amount energy used in the production of paper shopping bags, even those with recycled paper, is significantly greater than that for plastic bags. Given that fact, which of the following actions – if any – would you support in the City of Kirkland:

4 A charge for each plastic bag
10 A ban on plastic bags
2 A charge for each paper bag
1 A ban on paper shopping bags
24 A charge on BOTH paper and plastic bags
4 A ban on both paper and plastic bags
53 Would not support any of these proposals
2 [DK/NA]

7. If there were a charge per bag on disposable paper and plastic bags, should it apply to:

22 Large grocery, drug and other chain stores only?
51 All stores of any kind that provide disposable shopping bags - including grocery and drug stores, retail and convenience stores plus small "mom and pop" grocery stores
25 Should not be a charge [NOT READ]
2 [DK/NA]

8. If there were a ban on the use of disposable plastic shopping bags, should it apply to:

18 Large grocery, drug and other chain stores only?
53 All stores of any kind that provide disposable shopping bags - including grocery and drug stores, retail and convenience stores plus small "mom and pop" grocery stores
27 Should not be a charge [NOT READ]
2 [DK/NA]

9. If the city charged a fee on each disposable shopping bag used by shoppers, how would you suggest the money be used?

19 To keep city garbage rates down, even though the effect might be small
17 To pay for advertising & public education to promote the use of reusable bags.
21 To pay for city promotion of waste prevention and recycling programs.
12 To subsidize stores for the price of reusable bags.
24 Should not be a charge [NOT READ]
7 [DK/NA]

10. I have just a few last questions for our statistical analysis. How old are you?

9 18-35
20 36-50
41 51-34
28 65+
2 no ans

11. Which of these best describes your household at this time:

28 Couple with Children at Home
45 Couple with No Children at Home
4 Single with Children at Home
21 Single with No Children at Home
2 [DK/NA]

12. Do you own or rent the place in which you live?

83 OWN
13 RENT
4 [DK/NA]

13. Which of these best describes your home?

81 Single Family House
6 Apartment
11 Condominium
1 [OTHER]
2 [DK/NA]

14. What is the last year of schooling you completed?

12 HIGH SCHOOL
24 SOME COLLEGE OR VOCATIONAL SCHOOL
42 COLLEGE DEGREE
20 POST GRADUATE SCHOOL
1 DK/REF

15. Which of these the following best describes you at this time? Are you. . .

14 Self-Employed or Business Owner
30 Employed in Private Business
10 Employed in the **Public Sector**, Like a Govt Agency or Educ Institution
7 Not employed outside the home
1 Student
34 Retired
3 DK/NA

16. Finally, I am going to list four broad categories. Just stop me when I get to the category that best describes your approximate household income - before taxes - for this year.

13 $50,000 or less
18 $50 to 75,000
12 $75 to 100,000
15 $100 to 150,000
14 Over $150,000
28 [DO NOT READ: NO ANSWER]

KIRKLAND PUBLIC WORKS DEPARTMENT

Retail Business Survey

DISPOSAL SHOPPING BAGS

June 2013

ELWAY RESEARCH, INC.

KIRKLAND PUBLIC WORKS DEPARTMENT

Retail Business Survey

DISPOSAL SHOPPING BAGS

June 2013

TABLE OF CONTENTS

1. Introduction 1
   - Methods 2
2. Key Findings 3
3. Summary of Findings 4
   - Participant Profile 5
   - Current Practices 6
   - Reaction to Fee/Ban Proposals 8
   - Anticipated Impact of Fee/Ban 10
   - Preferred Use of Revenue 11
4. Discussion 12
5. APPENDIX 13
   - Questionnaire with Data
   - Invitation Letter
   - Crosstabulation Tables

KIRKLAND PUBLIC WORKS DEPARTMENT

Retail Business Survey

DISPOSAL SHOPPING BAGS

June 2013

INTRODUCTION

This report presents the responses from a survey of retail business operators in the City of Kirkland to assess their attitudes about a potential ban or fees on disposable shopping bags. This was a companion to a survey of Kirkland residents conducted in May.

Some 259 retail businesses were mailed a letter from the Kirkland Public Works Department inviting the owner/manager to take the survey on line. They received a post card one week after the initial mailing reminding them to take the survey if they had not done so. Some 48 retailers completed the questionnaire.

The business operators were asked about:

- Current practices with regard to shopping bags, both on the part of the businesses and their customers;
- Opinions of shopping bag restrictions implemented in other cities in the region;
- Reaction to the possibility of fees or a ban on reusable shopping bags in Kirkland;
- Anticipated impact on their business if fees or a ban were implemented.

The survey was administered by Elway Research, Inc. The questionnaire was designed in collaboration with representatives of the Public Works Department of the City of Kirkland.

The report includes Key Findings, followed by annotated graphs summarizing the findings for each question. The full questionnaire and a complete set of cross-tabulation tables are presented in the appendix.

METHODS

SAMPLE: 48 Retail business operators in the City of Kirkland

TECHNIQUE: Online survey

FIELD DATES: May 23 – June 10, 2013

DATA COLLECTION: Letters were mailed to 259 retail businesses in Kirkland inviting the owner/manager to take the on-line survey. 20 of the invitation letters were returned as undeliverable, resulting in a total of 239 eligible businesses.

The 20% response rate is higher than normal for this type of survey. More typical for an "external" population (vs. internal, such as employees or members) would be around 10%.

MARGIN OF ERROR For this survey, the calculated margin of error ±13% at the 95% level of confidence. That is, there is a 95% chance that the results here would be within ±13% of the results that would have been obtained by interviewing all 239 businesses.

Margin of sampling error with small populations should be interpreted with caution. Even though the respondents comprise 20% of the retail businesses in Kirkland, it is important to keep in mind that there were only 48 respondents. These results therefore should be prudently interpreted as representing only the answers given by these respondents at the time they answered.

KEY FINDINGS

- **8 in 10 retailers surveys provide carry-out shopping bags to customers. Of those**
  - 4 in 10 provide custom bags
  - 2 in 3 provide paper bags
  - 8 in 10 provide plastic bags
- **6 in 10 report that customers sometimes bring their own bags**
  - But only 6% of retailers report that as many as 25% of their customers bring their own bags
- **Only 1 in 10 retailers have recycling bins on site**
- **1 in 4 would consider offering incentives to customers to bring reusable bags**
  - One 1 respondent currently offers such incentives
- **8 in 10 opposed to fees or bans on plastic or paper bags**
- **7 in 10 anticipated a negative impact on their business if ban or fees were implemented**
  - About half said a ban of either bag type would result in a “Significant” negative impact on their business
  - 4 in 10 said a charge for either bag type would result in a “Significant” negative impact

FINDINGS

The survey results are presented on the following pages in the form of annotated graphs.

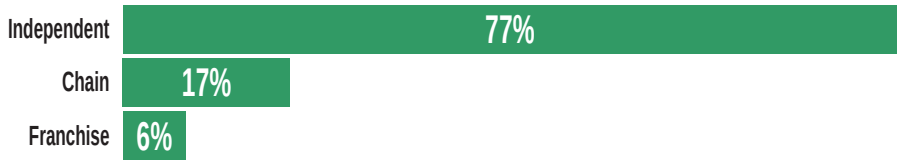
The findings are presented as percentages throughout this report, even though there were only 48 respondents. This is done for ease of comparison.

PARTICIPANT PROFILE

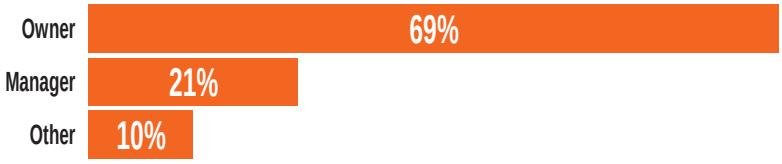
In interpreting these findings, it is important to keep in mind the characteristics of the people actually interviewed. This table presents a profile of the 48 respondents in the survey.

Note: The findings are presented as percentages throughout this report, even though there were only 48 respondents. This is done for ease of comparison. The percentages may not always add to 100%, due to rounding.

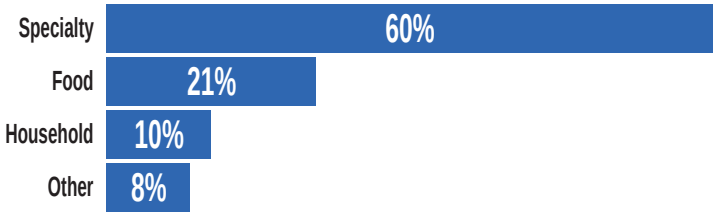
BUSINESS OWNERSHIP



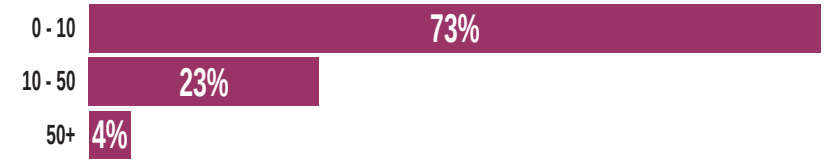
SURVEY RESPONDENT



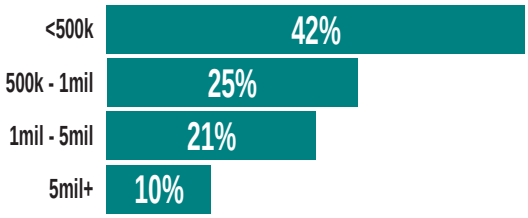
TYPE OF RETAIL*



OF EMPLOYEES



ANNUAL SALES

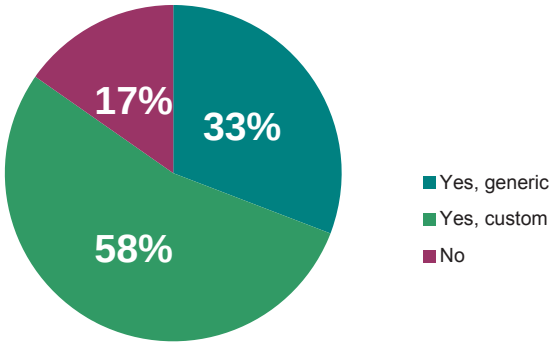


*FOOD: (Grocery / Specialty food / Convenience store / Wine, spirits, tobacco/ etc.)
HOUSEHOLD: (Home furnishings / Cookware/ Office supplies / Automotive /Appliances / Electronics / Hardware / Garden / Tools / Paint)
SPECIALTY: (Apparel / Art supplies/ / Books / Gifts / Grooming & Beauty supplies/ Guns / Jewelry / Pet supplies / Pharmacy / Sports Equipment/ etc.)

CURRENT PRACTICES

9 in 10 provide carry-out shopping bags to customers

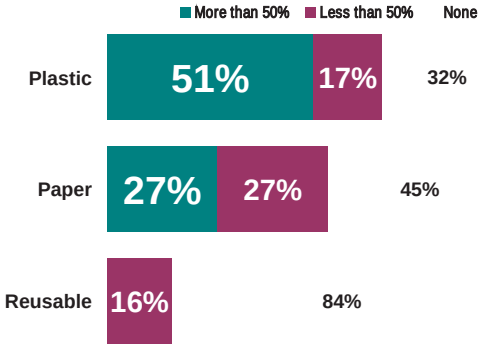
- Of those who provide bags, 4 in 10 provide custom bags
- 4 in 10 specialty stores provide custom bags
- 2 in 3 chain or franchise stores provide custom bags



Do you provide carry-out shopping bags to your customers?

Of those who provide bags, most provide plastic

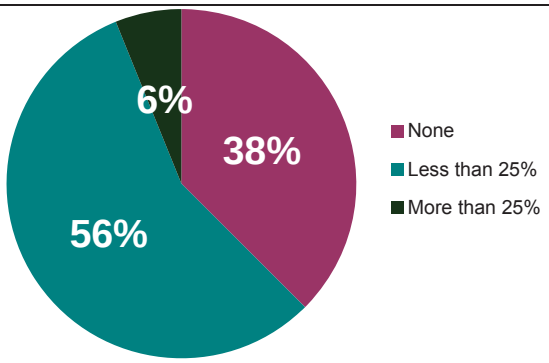
- 2/3 provide plastic bags, including half who provide plastic bags more than half of the time
- half provide paper bags, including 1/4 who provide paper bags more than half of the time



Approximately what percentage of the bags you provide to customers are:

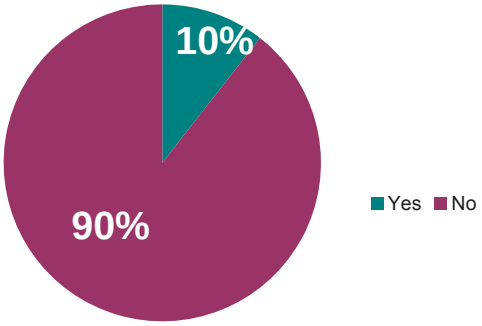
Only 6% of retailers report at least 25% of customers bring their own bags

- 4 in 10 have *some* customers who bring bags, but only 6% or retailers say that is 25% of their customers



What percentage of your customers would you estimate bring their own, reusable bags when they shop at your store?

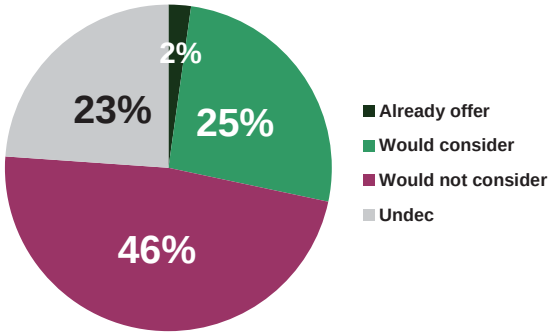
1 in 10 have recycling bins on site



Does your business have bins or stations where customers can recycle plastic bags

1 in 4 would consider offering incentives to customers to bring reusable bags

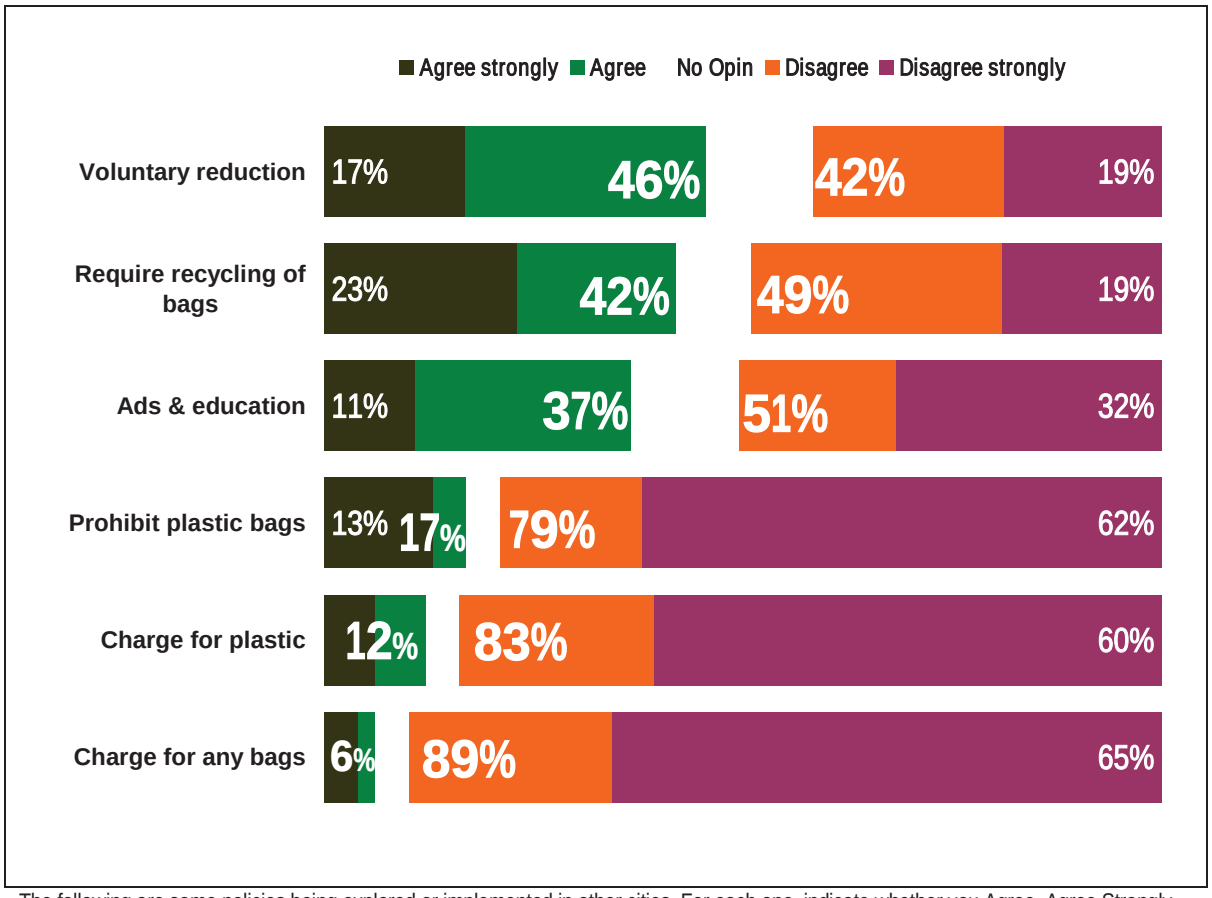
- Independent more likely than chains to offer incentives already and less likely to consider doing so, if they don't already



Would your business consider offering incentives to your customers to bring their own reusable shopping bags?

REACTION TO FEE / BAN PROPOSALS

Most disapprove of fees or bans for disposal bags



The following are some policies being explored or implemented in other cities. For each one, indicate whether you Agree, Agree Strongly, Disagree or Disagree Strongly that the City of Kirkland should do this.
The city of Kirkland should…

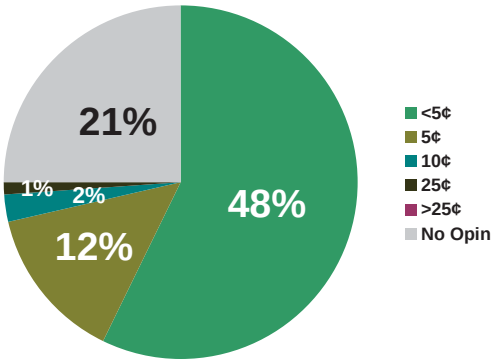
- Work with stores to help you reduce the use of disposable plastic and paper shopping bags and promote reusable shopping bags.
- Require stores that provide plastic shopping bags to recycle those bags by having bins where customers can return them
- Use city utility money for advertising and public education to promote the use of reusable shopping bags
- Prohibit stores from giving out plastic shopping bags.
- Require stores to charge a fee to shoppers for each plastic shopping bag they accept from a store at the checkout counter
- Require stores to charge a fee to shoppers for any type of disposable shopping bag - including paper - that they accept from a store.

Food stores were generally more likely to oppose fees than other retailers:

- No food store agreed with requiring recycling; charging for plastic bags or charging for any bags;
- 5 in 10 food stores agreed with voluntary reduction (same proportion as other types of store);
  4 in 10 agreed with prohibiting plastic bags (same proportion as other types of store).

If there *were* a fee, half think it should be less than 5¢

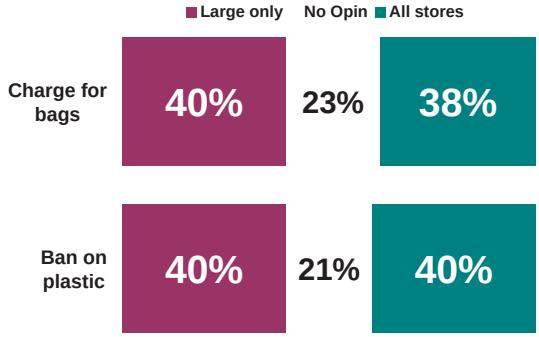
- Another 1/4 thought it should be 5¢



If there *were* a fee for paper and plastic shopping and grocery bags, how much do you think your customers should pay for the convenience of getting plastic or paper bags to carry out their purchases from your store?

Even split over whether bag restrictions should apply to large stores only, or all retailers.

- Among larger stores (10+employees): 23% said large stores only should be subject to fees;
  15% said large stores only should be subject to ban
- Among small stores (<10 employees): 46% said large stores only should be subject to fees;
  49% aid large stores only should be subject to ban

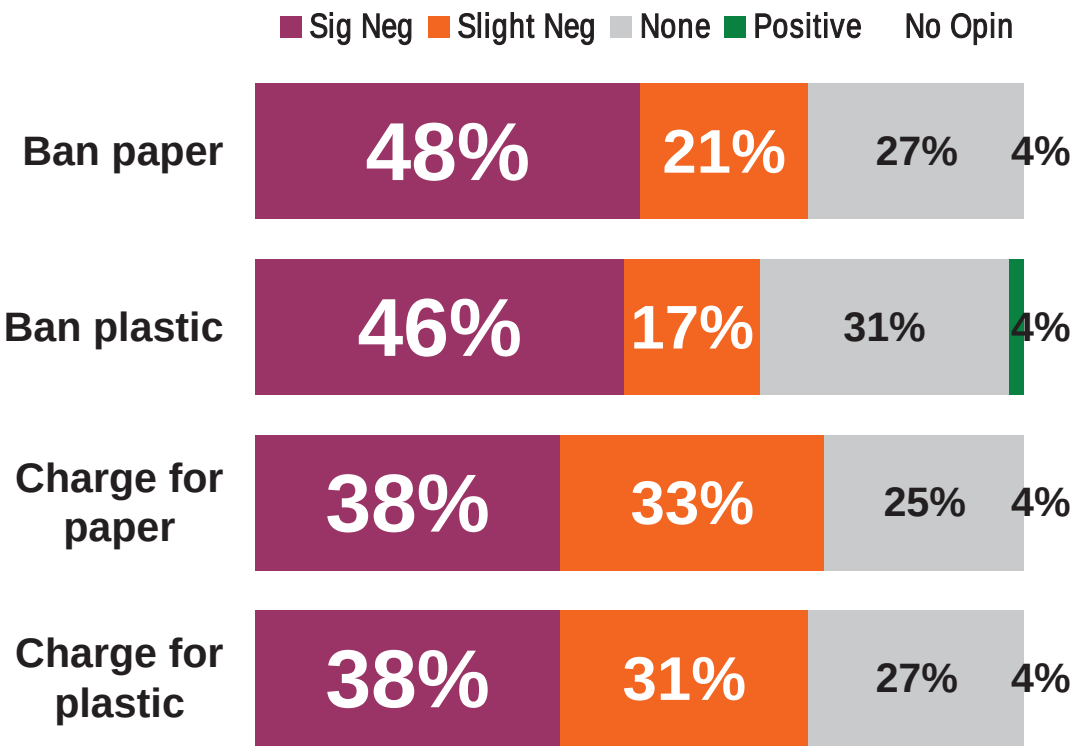


If there *were* a fee for paper and plastic shopping and grocery bags, how much do you think your customers should pay for the convenience of getting plastic or paper bags to carry out their purchases from your store?

If there *were* a fee for paper and plastic shopping and grocery bags, how much do you think your customers should pay for the convenience of getting plastic or paper bags to carry out their purchases from your store?

ANTICIPATED IMPACT OF FEE/BAN

Most believe bag fees and/or ban would have negative impact on their business

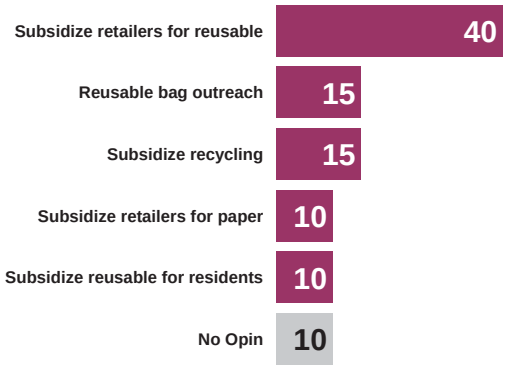


If Kirkland were to implement a fee or a ban on paper and plastic bags, what do you think world be the impact on your business?
[SIGNIFICANT NEGATIVE….SLIGHT NEGATIVE…NONE…DON'T KNOW]
Ban on paper bags
Ban on plastic bags
Fee for paper bags
Fee for plastic bags

- Larger stores were more likely to anticipate negative impact than smaller stores. Stores with 10+ employees said they would suffer "significant Negative impact" from:
  - Ban on plastic bags (62% vs. 40% of smaller stores)
  - Fee on plastic bags (62% vs. 29% of smaller stores)
  - Fee on paper bags (54% vs. 31% of smaller stores).

PREFERRED USE OF FEE REVENUE

If there were to be a fee, large plurality prefer the revenue be used to subsidize retailers



If there were a fee charged for each disposable bag provided to shoppers, how should the revenue from the fee be used?
CHECK ANY THAT APPLY

- Subsidize retailers for the price of paper bags
- Reimburse retailers for the cost of purchase and distribution of reusable bags (cloth, woven plastic, etc)
- Used by the City to pay for education and outreach programs to promote the use of reusable bags
- Used by the City to subsidize the cost of waste prevention and recycling programs
- Used by the City to purchase and distribute reusable bags to Kirkland residents

DISCUSSION

It is apparent in these findings that Kirkland retailers do not see restricting the use of disposal bags as a viable solution to a problem. On the contrary, they believe such a policy would cause significant financial problems for them.

Although only about 20% of the retailers in Kirkland, the prudent assumption is that these respondents represent the current thinking of the larger retail community.

A large majority of retailers who participated in this survey are opposed to any fees or bans of disposable shopping bags. Nearly all provide bags to customers, and for about half of them, that is a custom bag that represents advertising for them as well as a convenience to their customers, adding to the disincentive to relinquish it.

Most saw fees or a ban hitting their bottom line: 7 in 10 anticipated a negative impact on their business from the imposition of fees or a ban with nearly half thinking that negative impact would be "significant."

Other programs to reduce the use of disposable bags may meet with a more favorable reception. For example, only 1 in 10 of these retailers have recycling bins on site; only 1 in 16 report that as many as a quarter of their customers bring their own bags to their store; and 1 in 4 of these retailers would consider incentives to customers to bring reusable bags. These represent opportunities for engagement and cooperation with the retail community.

It seems likely that such incremental steps, coupled with education and incentive efforts, would be productive at reducing the use of disposable bags in Kirkland, by bringing both retailers and consumers on board.

APPENDIX

ELWAY RESEARCH, INC.

CITY OF KIRKLAND LETTERHEAD

May 20, 2013

RE: PLASTIC BAG SURVEY

Dear Kirkland Retailer:

As you may know, several cities around the region and around the country have instituted a ban on disposable shopping bags. We want to know what the business community in Kirkland thinks about this idea. We are therefore conducting a scientific survey of retail businesses in the city of Kirkland. **Your business has been selected to participate.**

The survey is on-line. To register your opinions, please log on to the website at the bottom of the page. Then simply follow the instructions on the questionnaire. The survey will only take about 10 minutes to complete.

Your answers will be completely anonymous and confidential. The survey is being conducted by Elway Research, Inc. a highly-respected independent research firm. They will compile the results and publish a summary of the findings. Identifying information will be removed from the file and no one in city government will see your individual responses.

In order for this study to be representative of Kirkland retail businesses, it is vital that your opinions be included. Time is of the essence. Please take a few minutes to complete the survey at your earliest convenience.

Thank you for taking the time to complete this survey. If you have any questions, please contact me by email at jmacgillivray@kirklandwa.gov or by phone at (425) 587-3804.

TO TAKE THE SURVEY, TYPE THIS WEB ADDRESS INTO YOUR INTERNET BROWSER:

http://sgiz.mobi/s3/kirkland

Sincerely yours
PUBLIC WORKS

John MacGillivray
Solid Waste Programs Lead

Dear Kirkland Retailer:

Last week we sent you an invitation to take part in a survey of retail businesses about disposable bags.

If you have already completed the survey, *Thank You*!

If you have not already done so, please log on to the website below and take the survey today. Your business was specifically selected to make this survey representative of Kirkland retailers, so your response is critical. It will take about 5 minutes.

Your opinions and ideas will help Kirkland City Government decide this issue. Your responses will be anonymous and confidential.

Thank you for your cooperation in this important study.

Elway Research, Inc.

TAKE THE SURVEY ON LINE TODAY

Log on at: http://sgiz.mobi/s3/Kirkland

Questions: John MacGillivray, Kirkland Public Works, (425)587-3804 or jmacgillivray@kirklandwa.gov

REVERSE SIDE:

KIRKLAND PUBLIC WORKS
123 – 5TH AVE
KIRKLAND WA 98033

QUESTIONNAIRE

with Data

ELWAY RESEARCH, INC.

TOPLINE DATA

SAMPLE	48 Kirkland Businesses
MARGIN OF SAMPLING ERROR	±13% at the 95% level of confidence
FIELD DATES	May 23-June 10, 2013

- **The data are presented here in the same order the questions were asked in the interview**
- **The figures in bold type are percentages of respondents who gave each answer.**
- **Percentages may not add to 100% due to rounding.**

1. Is this business:

6 A franchise
17 Part of a chain (2 or more locations)
77 Independent, single business

2. What is you position with this business?

69 Owner
21 Manager
10 Other

3. Which of these best describes this business:

21 Food: (e.g. Grocery / Specialty food / Convenience store / Wine, spirits, tobacco/ etc)
10 Household items (e.g. / Home furnishings / Cookware/ Office supplies / Automotive / Appliances / Electronics / Hardware / Garden / Tools / Paint)
60 Specialty retail (e.g. Apparel / Art supplies/ / Books / Gifts / Grooming & Beauty supplies Guns / Jewelry / Pet supplies / Pharmacy / Sporting Equipment// etc)
8 Other

4. How many people are employed at this location?

73 Less than 10
23 11-50
4 More than 50

5. What are the approximate annual sales at this location?

43 Under $500,000
26 $500,000 to $1,000,000
21 $1,000,000 to $5,000,000
11 More than $5,000,000

6. Do you provide carry-out shopping bags to your customers?

33 YES – custom bags unique to our store
50 YES – generic bags
17 NO

7. Approximately what percentage of the bags you provide to customers are:

AVERAGE:

28 Paper
54 Plastic
1 Reusable (cloth, woven recycled plastic, etc.)

8. What percentage of your customers would you estimate bring their own, reusable bags when they shop at your store?

AVERAGE: 6%

9. Does your business have bins or stations where customers can recycle plastic bags?

10 Yes
90 No

10. Would your business consider offering incentives to your customers to bring their own reusable shopping bags?

2 Already offer incentives
26 Would consider
48 Would not consider
24 Don't Know

11. The following are some policies being explored or implemented in other cities. For each one, indicate whether you Agree, Agree Strongly, Disagree or Disagree Strongly that the City of Kirkland should do this.

The city of Kirkland should…

ROTATE	AGSTR	AGREE	DISAG	D-STRG	NO OPIN
A. Work with stores to help you reduce the use of disposable plastic and paper shopping bags and promote reusable shopping bags	17	29	23	19	13
B. Use city utility money for advertising and public education to promote the use of reusable shopping bags	11	26	19	32	13
C. Require stores that provide plastic shopping bags to recycle those bags by having bins where customers can return them	23	19	30	19	9
D. Prohibit stores from giving out plastic shopping bags	13	4	17	62	4
E. Require stores to charge a fee to shoppers for each plastic shopping bag they accept from a store at the checkout counter	6	6	23	60	4.
F. Require stores to charge a fee to shoppers for any type of disposable shopping bag - including paper - that they accept from a store.	4	2	24	65	4

12. If there *were* a fee for paper and plastic shopping and grocery bags, how much do you think your customers should pay for the convenience of getting plastic or paper bags to carry out their purchases from your store?

FEE PER BAG
48 Less than 5¢
25 5¢
4 10¢
2 25¢
0 More than 25¢
21 No Opinion

13. If there *were* a charge per bag on disposable paper and plastic bags, should it apply to:

40 Large grocery, drug and other chain stores only
38 All stores of any kind that provide disposable shopping bags
23 No Opinion

14. If there *were* a ban on disposable paper and plastic bags, should it apply to:

40 Large grocery, drug and other chain stores only
40 All stores of any kind that provide disposable shopping bags
21 No Opinion

15. If Kirkland were to implement a fee or a ban on paper and plastic bags, what do you think world be the impact on your business?

[SIGNIFICANT NEGATIVE….SLIGHT NEGATIVE…NONE…DON'T KNOW]

	SIG	SLIGHT	POS	NONE	DK
A. Ban on plastic bags	46	17	2	31	4
B. Fee for plastic bags	38	31	0	27	4
C. Ban on paper bags	48	21	0	27	4
D. Fee for paper bags	38	33	0	25	4

16. If there were a fee charged for each disposable bag provided to shoppers, how should the revenue from the fee be used?

CHECK ANY THAT APPLY

48 Subsidize retailers for the price of paper bags
41 Reimburse retailers for the cost of purchase and distribution of reusable bags (cloth, woven plastic, etc)
18 Used by the City to pay for education and outreach programs to promote the use of reusable bags
20 Used by the City to subsidize the cost of waste prevention and recycling programs
27 Used by the City to purchase and distribute reusable bags to Kirkland residents

DATA TABLES

READING THE CROSSTABULATION TABLES

The crosstabulations found in this report are presented in a "banner table" format. Categories of respondents (e.g. "Size of City", “Official Type” or "Years of Service") are listed across the top of each page (the "banner"). The questions asked in the survey are listed down the left margin. The figures in the cells are percentages based on the number of respondents in the category at the head of each.

Note that the number of respondents in several of the cells is quite small. Generally speaking, inferences should no be drawn where the number of cases is below 5 in each cell.

ELWAY RESEARCH, INC.

KIRKLAND RETAIL SURVEY

	TOTAL		LOCATIONS			ROLE					BIZ TYPE				
	(n=)		Multipl		Single		Owner		Manager		Other		Food		Spclty		Other
TOTAL (n=)	48	100	11	100	37	100	33	100	10	100	5	100	10	100	29	100	9 100
[1] BIZ SIZE																	
Franchise	3	6%	3	27%	0	0%	2	6%	1	10%	0	0%	1	10%	2	7%	0 0%
Chain	8	17%	8	73%	0	0%	0	0%	7	70%	1	20%	1	10%	6	21%	1 11%
Independent	37	77%	0	0%	37	100	31	94%	2	20%	4	80%	8	80%	21	72%	8 89%
[1A] LOCATIONS IN KIRKLAND																	
One	43	91%	9	82%	34	94%	30	94%	9	90%	4	80%	9	90%	26	93%	8 89%
Two	1	2%	0	0%	1	3%	1	3%	0	0%	0	0%	0	0%	0	0%	1 11%
Three or more	3	6%	2	18%	1	3%	1	3%	1	10%	1	20%	1	10%	2	7%	0 0%
[2] POSITION																	
Owner	33	69%	2	18%	31	84%	33	100	0	0%	0	0%	9	90%	20	69%	4 44%
Manager	10	21%	8	73%	2	5%	0	0%	10	100	0	0%	1	10%	7	24%	2 22%
Other	5	10%	1	9%	4	11%	0	0%	0	0%	5	100	0	0%	2	7%	3 33%
[3] BIZ TYPE																	
Food	10	21%	2	18%	8	22%	9	27%	1	10%	0	0%	10	100	0	0%	0 0%
Household	5	10%	1	9%	4	11%	3	9%	2	20%	0	0%	0	0%	0	0%	5 56%
Specialty	29	60%	8	73%	21	57%	20	61%	7	70%	2	40%	0	0%	29	100	0 0%
Other	4	8%	0	0%	4	11%	1	3%	0	0%	3	60%	0	0%	0	0%	4 44%
[4NET] NUM EMPLOYEES																	
<10	35	73%	5	45%	30	81%	28	85%	5	50%	2	40%	7	70%	24	83%	4 44%
10-50	11	23%	6	55%	5	14%	5	15%	4	40%	2	40%	3	30%	5	17%	3 33%
50-500	2	4%	0	0%	2	5%	0	0%	1	10%	1	20%	0	0%	0	0%	2 22%
[5] ANNUAL SALES																	
<500k	20	43%	1	9%	19	53%	17	52%	1	10%	2	50%	3	30%	14	50%	3 33%
500k-1m	12	26%	3	27%	9	25%	8	24%	3	30%	1	25%	4	40%	5	18%	3 33%
1-5m	10	21%	4	36%	6	17%	6	18%	3	30%	1	25%	1	10%	8	29%	1 11%
5m+	5	11%	3	27%	2	6%	2	6%	3	30%	0	0%	2	20%	1	4%	2 22%
[6] PROVIDE BAGS																	
Custom	16	33%	7	64%	9	24%	9	27%	6	60%	1	20%	2	20%	11	38%	3 33%
Generic	24	50%	4	36%	20	54%	21	64%	2	20%	1	20%	8	80%	14	48%	2 22%
No	8	17%	0	0%	8	22%	3	9%	2	20%	3	60%	0	0%	4	14%	4 44%

ELWAY RESEARCH, INC. May 2013

KIRKLAND RETAIL SURVEY

	TOTAL	NUM EMPLOYEES		SALES			OFFERS BAGS NOW	
	(n=)	< 10	10+	<500k	500k-1m	1m+	Yes	No
TOTAL								
(n=)	48 100	35 100	13 100	20 100	12 100	15 100	40 100	8 100
[1] BIZ SIZE								
Franchise	3 6%	2 6%	1 8%	1 5%	1 8%	1 7%	3 8%	0 0%
Chain	8 17%	3 9%	5 38%	0 0%	2 17%	6 40%	8 20%	0 0%
Independent	37 77%	30 86%	7 54%	19 95%	9 75%	8 53%	29 73%	8 100
[1A] LOCATIONS IN KIRKLAND								
One	43 91%	33 97%	10 77%	19 100	11 92%	12 80%	35 90%	8 100
Two	1 2%	1 3%	0 0%	0 0%	1 8%	0 0%	1 3%	0 0%
Three or more	3 6%	0 0%	3 23%	0 0%	0 0%	3 20%	3 8%	0 0%
[2] POSITION								
Owner	33 69%	28 80%	5 38%	17 85%	8 67%	8 53%	30 75%	3 38%
Manager	10 21%	5 14%	5 38%	1 5%	3 25%	6 40%	8 20%	2 25%
Other	5 10%	2 6%	3 23%	2 10%	1 8%	1 7%	2 5%	3 38%
[3] BIZ TYPE								
Food	10 21%	7 20%	3 23%	3 15%	4 33%	3 20%	10 25%	0 0%
Household	5 10%	2 6%	3 23%	1 5%	1 8%	3 20%	4 10%	1 13%
Specialty	29 60%	24 69%	5 38%	14 70%	5 42%	9 60%	25 63%	4 50%
Other	4 8%	2 6%	2 15%	2 10%	2 17%	0 0%	1 3%	3 38%
[4NET] NUM EMPLOYEES								
<10	35 73%	35 100	0 0%	19 95%	11 92%	4 27%	30 75%	5 63%
10-50	11 23%	0 0%	11 85%	1 5%	0 0%	10 67%	10 25%	1 13%
50-500	2 4%	0 0%	2 15%	0 0%	1 8%	1 7%	0 0%	2 25%
[5] ANNUAL SALES								
<500k	20 43%	19 56%	1 8%	20 100	0 0%	0 0%	18 45%	2 29%
500k-1m	12 26%	11 32%	1 8%	0 0%	12 100	0 0%	8 20%	4 57%
1-5m	10 21%	4 12%	6 46%	0 0%	0 0%	10 67%	10 25%	0 0%
5m+	5 11%	0 0%	5 38%	0 0%	0 0%	5 33%	4 10%	1 14%
[6] PROVIDE BAGS								
Custom	16 33%	9 26%	7 54%	4 20%	4 33%	8 53%	16 40%	0 0%
Generic	24 50%	21 60%	3 23%	14 70%	4 33%	6 40%	24 60%	0 0%
No	8 17%	5 14%	3 23%	2 10%	4 33%	1 7%	0 0%	8 100

KIRKLAND RETAIL SURVEY

	TOTAL	LOCATIONS		ROLE			BIZ TYPE		
	(n=)	Multipl	Single	Owner	Manager	Other	Food	Spclty	Other
TOTAL (n=)	48 100	11 100	37 100	33 100	10 100	5 100	10 100	29 100	9 100
[7ANET] PERCENT PAPER									
None	5 10%	1 9%	4 11%	3 9%	1 10%	1 20%	1 10%	2 7%	2 22%
<25%	12 25%	4 36%	8 22%	7 21%	3 30%	2 40%	4 40%	5 17%	3 33%
26-50%	1 2%	1 9%	0 0%	1 3%	0 0%	0 0%	0 0%	1 3%	0 0%
51-75%	3 6%	0 0%	3 8%	3 9%	0 0%	0 0%	2 20%	1 3%	0 0%
76-100%	10 21%	1 9%	9 24%	10 30%	0 0%	0 0%	2 20%	7 24%	1 11%
DKNA	17 35%	4 36%	13 35%	9 27%	6 60%	2 40%	1 10%	13 45%	3 33%
[7BNET] PERCENT PLASTIC									
None	3 6%	0 0%	3 8%	2 6%	0 0%	1 20%	0 0%	1 4%	2 22%
<25%	6 13%	1 10%	5 14%	5 15%	1 11%	0 0%	1 10%	5 18%	0 0%
26-50%	2 4%	1 10%	1 3%	2 6%	0 0%	0 0%	1 10%	1 4%	0 0%
51-75%	1 2%	0 0%	1 3%	0 0%	0 0%	1 20%	0 0%	0 0%	1 11%
76-100%	23 49%	7 70%	16 43%	16 48%	6 67%	1 20%	6 60%	14 50%	3 33%
DKNA	12 26%	1 10%	11 30%	8 24%	2 22%	2 40%	2 20%	7 25%	3 33%
[7CNET] PERCENT REUSABLE									
None	6 13%	2 18%	4 11%	3 9%	2 20%	1 20%	1 10%	2 7%	3 33%
<25%	8 17%	3 27%	5 14%	4 12%	2 20%	2 40%	1 10%	5 17%	2 22%
DKNA	34 71%	6 55%	28 76%	26 79%	6 60%	2 40%	8 80%	22 76%	4 44%
[8NET] PERCENT BRING									
None	14 29%	3 27%	11 30%	10 30%	2 20%	2 40%	4 40%	6 21%	4 44%
<25%	27 56%	8 73%	19 51%	19 58%	6 60%	2 40%	6 60%	19 66%	2 22%
26-50%	3 6%	0 0%	3 8%	3 9%	0 0%	0 0%	0 0%	2 7%	1 11%
DKNA	4 8%	0 0%	4 11%	1 3%	2 20%	1 20%	0 0%	2 7%	2 22%
[9] HAS RECYCLING									
Yes	5 10%	0 0%	5 14%	3 9%	0 0%	2 40%	1 10%	2 7%	2 22%
No	43 90%	11 100	32 86%	30 91%	10 100	3 60%	9 90%	27 93%	7 78%
[10] CONSIDER INCENTIVES									
Already	1 2%	0 0%	1 3%	1 3%	0 0%	0 0%	0 0%	1 4%	0 0%
Consider	12 26%	2 18%	10 29%	11 34%	1 11%	0 0%	2 20%	9 33%	1 11%
Would not consider	22 48%	4 36%	18 51%	15 47%	3 33%	4 80%	7 70%	11 41%	4 44%
DK	11 24%	5 45%	6 17%	5 16%	5 56%	1 20%	1 10%	6 22%	4 44%

KIRKLAND RETAIL SURVEY

	TOTAL	NUM EMPLOYEES		SALES			OFFERS BAGS NOW	
	(n=)	< 10	10+	<500k	500k-1m	1m+	Yes	No
TOTAL (n=)	48 100	35 100	13 100	20 100	12 100	15 100	40 100	8 100
[7ANET] PERCENT PAPER								
None	5 10%	4 11%	1 8%	2 10%	3 25%	0 0%	3 8%	2 25%
<25%	12 25%	6 17%	6 46%	4 20%	2 17%	6 40%	12 30%	0 0%
26-50%	1 2%	1 3%	0 0%	1 5%	0 0%	0 0%	1 3%	0 0%
51-75%	3 6%	2 6%	1 8%	2 10%	0 0%	1 7%	3 8%	0 0%
76-100%	10 21%	9 26%	1 8%	5 25%	2 17%	3 20%	10 25%	0 0%
DKNA	17 35%	13 37%	4 31%	6 30%	5 42%	5 33%	11 28%	6 75%
[7BNET] PERCENT PLASTIC								
None	3 6%	2 6%	1 8%	1 5%	2 17%	0 0%	1 3%	2 25%
<25%	6 13%	5 15%	1 8%	3 15%	1 8%	2 14%	6 15%	0 0%
26-50%	2 4%	2 6%	0 0%	2 10%	0 0%	0 0%	2 5%	0 0%
51-75%	1 2%	1 3%	0 0%	1 5%	0 0%	0 0%	1 3%	0 0%
76-100%	23 49%	15 44%	8 62%	9 45%	5 42%	9 64%	23 59%	0 0%
DKNA	12 26%	9 26%	3 23%	4 20%	4 33%	3 21%	6 15%	6 75%
[7CNET] PERCENT REUSABLE								
None	6 13%	4 11%	2 15%	2 10%	3 25%	1 7%	4 10%	2 25%
<25%	8 17%	3 9%	5 38%	3 15%	0 0%	5 33%	8 20%	0 0%
DKNA	34 71%	28 80%	6 46%	15 75%	9 75%	9 60%	28 70%	6 75%
[8NET] PERCENT BRING								
None	14 29%	9 26%	5 38%	4 20%	3 25%	6 40%	11 28%	3 38%
<25%	27 56%	21 60%	6 46%	12 60%	7 58%	8 53%	27 68%	0 0%
26-50%	3 6%	3 9%	0 0%	2 10%	1 8%	0 0%	2 5%	1 13%
DKNA	4 8%	2 6%	2 15%	2 10%	1 8%	1 7%	0 0%	4 50%
[9] HAS RECYCLING								
Yes	5 10%	3 9%	2 15%	3 15%	1 8%	1 7%	3 8%	2 25%
No	43 90%	32 91%	11 85%	17 85%	11 92%	14 93%	37 93%	6 75%
[10] CONSIDER INCENTIVES								
Already	1 2%	1 3%	0 0%	0 0%	1 9%	0 0%	0 0%	1 17%
Consider	12 26%	11 33%	1 8%	9 47%	2 18%	1 7%	12 30%	0 0%
Would not consider	22 48%	14 42%	8 62%	10 53%	4 36%	7 47%	19 48%	3 50%
DK	11 24%	7 21%	4 31%	0 0%	4 36%	7 47%	9 23%	2 33%

KIRKLAND RETAIL SURVEY

	TOTAL	LOCATIONS		ROLE			BIZ TYPE		
	(n=)	Multipl	Single	Owner	Manager	Other	Food	Spclty	Other
TOTAL (n=)	48 100	11 100	37 100	33 100	10 100	5 100	10 100	29 100	9 100
[11A] VOLUNTARY REDUCTION									
Agr str	8 17%	1 9%	7 19%	6 18%	1 10%	1 20%	0 0%	5 17%	3 33%
Agr	14 29%	3 27%	11 30%	11 33%	3 30%	0 0%	5 50%	8 28%	1 11%
Disagree	11 23%	2 18%	9 24%	9 27%	1 10%	1 20%	3 30%	6 21%	2 22%
Str disagree	9 19%	3 27%	6 16%	4 12%	3 30%	2 40%	0 0%	7 24%	2 22%
No op	6 13%	2 18%	4 11%	3 9%	2 20%	1 20%	2 20%	3 10%	1 11%
[11B] ADS AND EDUCATION									
Agr str	5 11%	2 18%	3 8%	3 9%	1 10%	1 20%	0 0%	4 14%	1 11%
Agr	12 26%	5 45%	7 19%	7 22%	5 50%	0 0%	1 11%	10 34%	1 11%
Disagree	9 19%	1 9%	8 22%	7 22%	1 10%	1 20%	2 22%	5 17%	2 22%
Str disagree	15 32%	3 27%	12 33%	10 31%	3 30%	2 40%	3 33%	9 31%	3 33%
No op	6 13%	0 0%	6 17%	5 16%	0 0%	1 20%	3 33%	1 3%	2 22%
[11C] REQUIRE RECYCLING									
Agr str	11 23%	2 18%	9 25%	7 22%	3 30%	1 20%	0 0%	7 24%	4 44%
Agr	9 19%	2 18%	7 19%	7 22%	1 10%	1 20%	4 44%	4 14%	1 11%
Disagree	14 30%	5 45%	9 25%	9 28%	3 30%	2 40%	4 44%	8 28%	2 22%
Str disagree	9 19%	2 18%	7 19%	6 19%	3 30%	0 0%	0 0%	8 28%	1 11%
No op	4 9%	0 0%	4 11%	3 9%	0 0%	1 20%	1 11%	2 7%	1 11%
[11D] PROHIBIT PLASTIC BAGS									
Agr str	6 13%	0 0%	6 17%	6 19%	0 0%	0 0%	0 0%	3 10%	3 33%
Agr	2 4%	1 9%	1 3%	1 3%	1 10%	0 0%	0 0%	2 7%	0 0%
Disagree	8 17%	1 9%	7 19%	7 22%	1 10%	0 0%	3 33%	5 17%	0 0%
Str disagree	29 62%	9 82%	20 56%	17 53%	8 80%	4 80%	6 67%	18 62%	5 56%
No op	2 4%	0 0%	2 6%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[11E] CHARGE FOR PLASTIC									
Agr str	3 6%	0 0%	3 8%	3 9%	0 0%	0 0%	0 0%	2 7%	1 11%
Agr	3 6%	1 9%	2 6%	3 9%	0 0%	0 0%	0 0%	2 7%	1 11%
Disagree	11 23%	2 18%	9 25%	8 25%	3 30%	0 0%	4 44%	7 24%	0 0%
Str disagree	28 60%	8 73%	20 56%	17 53%	7 70%	4 80%	5 56%	17 59%	6 67%
No op	2 4%	0 0%	2 6%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[11F] CHARGE FOR ALL BAGS									
Agr str	2 4%	0 0%	2 6%	2 6%	0 0%	0 0%	0 0%	2 7%	0 0%
Agr	1 2%	0 0%	1 3%	1 3%	0 0%	0 0%	0 0%	1 3%	0 0%
Disagree	11 24%	2 18%	9 26%	8 26%	3 30%	0 0%	4 44%	6 21%	1 13%
Str disagree	30 65%	9 82%	21 60%	19 61%	7 70%	4 80%	5 56%	19 66%	6 75%
No op	2 4%	0 0%	2 6%	1 3%	0 0%	1 20%	0 0%	1 3%	1 13%

KIRKLAND RETAIL SURVEY

	TOTAL	NUM EMPLOYEES		SALES			OFFERS BAGS NOW	
	(n=)	< 10	10+	<500k	500k-1m	1m+	Yes	No
TOTAL								
(n=)	48 100	35 100	13 100	20 100	12 100	15 100	40 100	8 100
[11A] VOLUNTARY REDUCTION								
Agr str	8 17%	5 14%	3 23%	3 15%	2 17%	3 20%	5 13%	3 38%
Agr	14 29%	13 37%	1 8%	5 25%	7 58%	2 13%	12 30%	2 25%
Disagree	11 23%	6 17%	5 38%	7 35%	0 0%	4 27%	10 25%	1 13%
Str disagree	9 19%	6 17%	3 23%	3 15%	1 8%	4 27%	8 20%	1 13%
No op	6 13%	5 14%	1 8%	2 10%	2 17%	2 13%	5 13%	1 13%
[11B] ADS AND EDUCATION								
Agr str	5 11%	3 9%	2 15%	1 5%	1 9%	3 20%	4 10%	1 13%
Agr	12 26%	11 32%	1 8%	5 25%	5 45%	2 13%	10 26%	2 25%
Disagree	9 19%	7 21%	2 15%	7 35%	0 0%	2 13%	8 21%	1 13%
Str disagree	15 32%	8 24%	7 54%	5 25%	1 9%	8 53%	12 31%	3 38%
No op	6 13%	5 15%	1 8%	2 10%	4 36%	0 0%	5 13%	1 13%
[11C] REQUIRE RECYCLING								
Agr str	11 23%	9 26%	2 15%	4 20%	3 27%	4 27%	7 18%	4 50%
Agr	9 19%	5 15%	4 31%	4 20%	1 9%	4 27%	9 23%	0 0%
Disagree	14 30%	11 32%	3 23%	6 30%	5 45%	2 13%	12 31%	2 25%
Str disagree	9 19%	6 18%	3 23%	5 25%	0 0%	4 27%	8 21%	1 13%
No op	4 9%	3 9%	1 8%	1 5%	2 18%	1 7%	3 8%	1 13%
[11D] PROHIBIT PLASTIC BAGS								
Agr str	6 13%	6 18%	0 0%	4 20%	2 18%	0 0%	5 13%	1 13%
Agr	2 4%	2 6%	0 0%	0 0%	2 18%	0 0%	1 3%	1 13%
Disagree	8 17%	7 21%	1 8%	5 25%	1 9%	2 13%	7 18%	1 13%
Str disagree	29 62%	18 53%	11 85%	11 55%	5 45%	12 80%	25 64%	4 50%
No op	2 4%	1 3%	1 8%	0 0%	1 9%	1 7%	1 3%	1 13%
[11E] CHARGE FOR PLASTIC								
Agr str	3 6%	3 9%	0 0%	2 10%	1 9%	0 0%	2 5%	1 13%
Agr	3 6%	3 9%	0 0%	2 10%	1 9%	0 0%	2 5%	1 13%
Disagree	11 23%	10 29%	1 8%	5 25%	4 36%	2 13%	10 26%	1 13%
Str disagree	28 60%	17 50%	11 85%	11 55%	4 36%	12 80%	24 62%	4 50%
No op	2 4%	1 3%	1 8%	0 0%	1 9%	1 7%	1 3%	1 13%
[11F] CHARGE FOR ALL BAGS								
Agr str	2 4%	2 6%	0 0%	2 10%	0 0%	0 0%	2 5%	0 0%
Agr	1 2%	1 3%	0 0%	0 0%	1 10%	0 0%	0 0%	1 14%
Disagree	11 24%	10 30%	1 8%	5 25%	4 40%	2 13%	10 26%	1 14%
Str disagree	30 65%	19 58%	11 85%	13 65%	4 40%	12 80%	26 67%	4 57%
No op	2 4%	1 3%	1 8%	0 0%	1 10%	1 7%	1 3%	1 14%

KIRKLAND RETAIL SURVEY

	TOTAL	LOCATIONS		ROLE			BIZ TYPE		
	(n=)	Multipl	Single	Owner	Manager	Other	Food	Spclty	Other
TOTAL (n=)	48 100	11 100	37 100	33 100	10 100	5 100	10 100	29 100	9 100
[12] ACCEPTABLE FEE									
<5c	23 48%	5 45%	18 49%	15 45%	6 60%	2 40%	6 60%	11 38%	6 67%
5c	12 25%	3 27%	9 24%	10 30%	1 10%	1 20%	2 20%	8 28%	2 22%
10c	2 4%	0 0%	2 5%	2 6%	0 0%	0 0%	1 10%	1 3%	0 0%
25c	1 2%	0 0%	1 3%	1 3%	0 0%	0 0%	0 0%	1 3%	0 0%
No op	10 21%	3 27%	7 19%	5 15%	3 30%	2 40%	1 10%	8 28%	1 11%
[13] STORES CHARGED									
Large stores only	19 40%	3 27%	16 43%	17 52%	1 10%	1 20%	3 30%	12 41%	4 44%
All stores	18 38%	6 55%	12 32%	10 30%	7 70%	1 20%	5 50%	10 34%	3 33%
DKNA	11 23%	2 18%	9 24%	6 18%	2 20%	3 60%	2 20%	7 24%	2 22%
[14] STORES BANNED									
Large stores only	19 40%	2 18%	17 46%	17 52%	1 10%	1 20%	3 30%	13 45%	3 33%
All stores	19 40%	8 73%	11 30%	10 30%	8 80%	1 20%	5 50%	10 34%	4 44%
DKNA	10 21%	1 9%	9 24%	6 18%	1 10%	3 60%	2 20%	6 21%	2 22%
[15A] PLASTIC BAN									
Sig neg	22 46%	5 45%	17 46%	16 48%	5 50%	1 20%	6 60%	11 38%	5 56%
Slight neg	8 17%	3 27%	5 14%	5 15%	2 20%	1 20%	3 30%	5 17%	0 0%
Positive	1 2%	1 9%	0 0%	1 3%	0 0%	0 0%	0 0%	1 3%	0 0%
None	15 31%	2 18%	13 35%	10 30%	3 30%	2 40%	1 10%	11 38%	3 33%
DK	2 4%	0 0%	2 5%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[15B] PLASTIC FEE									
Sig neg	18 38%	4 36%	14 38%	12 36%	4 40%	2 40%	5 50%	9 31%	4 44%
Slight neg	15 31%	6 55%	9 24%	11 33%	4 40%	0 0%	4 40%	10 34%	1 11%
None	13 27%	1 9%	12 32%	9 27%	2 20%	2 40%	1 10%	9 31%	3 33%
DK	2 4%	0 0%	2 5%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[15C] PAPER BAN									
Sig neg	23 48%	5 45%	18 49%	18 55%	4 40%	1 20%	7 70%	13 45%	3 33%
Slight neg	10 21%	2 18%	8 22%	8 24%	1 10%	1 20%	3 30%	6 21%	1 11%
None	13 27%	4 36%	9 24%	6 18%	5 50%	2 40%	0 0%	9 31%	4 44%
DK	2 4%	0 0%	2 5%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[15D] PAPER FEE									
Sig neg	18 38%	4 36%	14 38%	13 39%	3 30%	2 40%	4 40%	11 38%	3 33%
Slight neg	16 33%	5 45%	11 30%	12 36%	4 40%	0 0%	6 60%	8 28%	2 22%
None	12 25%	2 18%	10 27%	7 21%	3 30%	2 40%	0 0%	9 31%	3 33%
DK	2 4%	0 0%	2 5%	1 3%	0 0%	1 20%	0 0%	1 3%	1 11%
[16] USE FOR FEE									
Subsidize paper	21 48%	5 50%	16 47%	15 50%	4 44%	2 40%	4 44%	11 42%	6 67%
Reimburse reuse	18 41%	7 70%	11 32%	10 33%	5 56%	3 60%	1 11%	13 50%	4 44%
Reusable outreach	8 18%	1 10%	7 21%	7 23%	1 11%	0 0%	3 33%	4 15%	1 11%
Subsidize recycl	9 20%	2 20%	7 21%	5 17%	3 33%	1 20%	1 11%	5 19%	3 33%
Subsidize reuse	12 27%	3 30%	9 26%	9 30%	2 22%	1 20%	3 33%	7 27%	2 22%

KIRKLAND RETAIL SURVEY

	TOTAL	NUM EMPLOYEES		SALES			OFFERS BAGS NOW	
	(n=)	< 10	10+	<500k	500k-1m	1m+	Yes	No
TOTAL (n=)	48 100	35 100	13 100	20 100	12 100	15 100	40 100	8 100
[12] ACCEPTABLE FEE								
<5c	23 48%	16 46%	7 54%	12 60%	3 25%	8 53%	20 50%	3 38%
5c	12 25%	10 29%	2 15%	4 20%	5 42%	3 20%	10 25%	2 25%
10c	2 4%	2 6%	0 0%	1 5%	1 8%	0 0%	2 5%	0 0%
25c	1 2%	1 3%	0 0%	1 5%	0 0%	0 0%	1 3%	0 0%
No op	10 21%	6 17%	4 31%	2 10%	3 25%	4 27%	7 18%	3 38%
[13] STORES CHARGED								
Large stores only	19 40%	16 46%	3 23%	11 55%	4 33%	4 27%	19 48%	0 0%
All stores	18 38%	12 34%	6 46%	6 30%	5 42%	7 47%	14 35%	4 50%
DKNA	11 23%	7 20%	4 31%	3 15%	3 25%	4 27%	7 18%	4 50%
[14] STORES BANNED								
Large stores only	19 40%	17 49%	2 15%	13 65%	3 25%	3 20%	19 48%	0 0%
All stores	19 40%	12 34%	7 54%	4 20%	6 50%	9 60%	15 38%	4 50%
DKNA	10 21%	6 17%	4 31%	3 15%	3 25%	3 20%	6 15%	4 50%
[15A] PLASTIC BAN								
Sig neg	22 46%	14 40%	8 62%	10 50%	2 17%	10 67%	21 53%	1 13%
Slight neg	8 17%	6 17%	2 15%	2 10%	4 33%	2 13%	8 20%	0 0%
Positive	1 2%	1 3%	0 0%	1 5%	0 0%	0 0%	1 3%	0 0%
None	15 31%	13 37%	2 15%	6 30%	5 42%	3 20%	9 23%	6 75%
DK	2 4%	1 3%	1 8%	1 5%	1 8%	0 0%	1 3%	1 13%
[15B] PLASTIC FEE								
Sig neg	18 38%	10 29%	8 62%	6 30%	2 17%	10 67%	17 43%	1 13%
Slight neg	15 31%	12 34%	3 23%	7 35%	4 33%	4 27%	15 38%	0 0%
None	13 27%	12 34%	1 8%	6 30%	5 42%	1 7%	7 18%	6 75%
DK	2 4%	1 3%	1 8%	1 5%	1 8%	0 0%	1 3%	1 13%
[15C] PAPER BAN								
Sig neg	23 48%	17 49%	6 46%	11 55%	3 25%	9 60%	22 55%	1 13%
Slight neg	10 21%	7 20%	3 23%	3 15%	4 33%	3 20%	10 25%	0 0%
None	13 27%	10 29%	3 23%	5 25%	4 33%	3 20%	7 18%	6 75%
DK	2 4%	1 3%	1 8%	1 5%	1 8%	0 0%	1 3%	1 13%
[15D] PAPER FEE								
Sig neg	18 38%	11 31%	7 54%	8 40%	1 8%	9 60%	17 43%	1 13%
Slight neg	16 33%	12 34%	4 31%	5 25%	6 50%	5 33%	16 40%	0 0%
None	12 25%	11 31%	1 8%	6 30%	4 33%	1 7%	6 15%	6 75%
DK	2 4%	1 3%	1 8%	1 5%	1 8%	0 0%	1 3%	1 13%
[16] USE FOR FEE								
Subsidize paper	21 48%	14 42%	7 64%	10 56%	5 42%	6 46%	17 47%	4 50%
Reimburse reuse	18 41%	13 39%	5 45%	4 22%	7 58%	7 54%	14 39%	4 50%
Reusable outreach	8 18%	7 21%	1 9%	2 11%	4 33%	2 15%	7 19%	1 13%
Subsidize recycl	9 20%	7 21%	2 18%	3 17%	5 42%	1 8%	6 17%	3 38%
Subsidize reuse	12 27%	11 33%	1 9%	6 33%	3 25%	2 15%	10 28%	2 25%

City of Kirkland
2008 Plastic Bag Survey

Survey Summary

In an effort to gauge residents' opinions regarding the use of plastic bags in Kirkland, Solid Waste staff conducted a non-scientific survey of patrons at the Kirkland Wednesday Market, the Friday Market at Juanita Beach Park, Kirkland Uncorked, and at a Public Works Week booth. In exchange for completing the survey, respondents received a free reusable shopping made of 100% recycled PET soda bottles.

A total of 380 surveys were completed and four questions were posed in addition to a request for anonymous demographic information. Almost 64 percent of the respondents were women and almost 50 percent all respondents were aged 46-65 and 62 percent maintained residences in Kirkland.

Most people surveyed either use both paper and plastic bags (30%) or always use reusable shopping bags (25%). Over 60% prefer plastic bags for reuse as garbage can liners (40%) or for other uses such as disposing of pet waste or diapers. Correspondingly, most respondents claimed that the reuse the plastic bags at home (54%).

Finally, when asked "What is the best way to manage plastic bags?" no best management practice predominated over another. Thirty percent of respondents supported a mandate to either charge a tax (14%) or ban them (16%). More public education was supported by 19 percent of those surveyed along with giving away more plastic bags (16%) and recycling bags at the store (14%)

Demographic Information

Age Group

16-25	6.3%
26-35	13.7%
36-45	18.7%
46-55	23.2%
56-65	25.8%
No Response	1.8%

Gender

Female	63.9%
Male	22.4%
No Response	13.4%

Residence

Kirkland	62.6%
Other*	12.3%
Redmond	5.0%
No Response	4.0%
Bothell	3.2%
Seattle	2.9%
Bellevue	2.5%
Shoreline	1.8%
Woodinville	1.4%
Kenmore	1.4%
Mercer Island	1.4%
Federal Way	1.4%

*Other places of residence received include Auburn, Carnation, Ellensburg, Everett, Issaquah, Kelso, Lake Forest Park, Los Angeles, Lynnwood, New York, Olympia, Puyallup, and Sammamish.

Survey Questions and Results

Question 1: When you shop do you ...

Use both paper and plastic	30.9%
Always use reusable shopping bags	25.3%
Sometimes use plastic bags	14.0%
Always use plastic bags	11.7%
Always use paper bags	11.1%
Use whatever the clerks provides	6.3%
No Response	0.8%

Question 2: If you use plastic shopping bags, why do you choose them?

Use them as garbage can liners	40.8%
Other (Pet Waste/Diapers)	20.0%
Handles make them easy to carry	15.4%
Convenience	11.5%
Can carry more plastic than paper bags	6.9%
Don't Know	5.3%

Question 3: If you use plastic bags, what do you do with them at home?

Resuse them	53.9%
Return them to the store	15.8%
Put them in the recycling bin	13.6%
Throw them in the garbage	9.8%
Other	6.8%

Question 4: What is the best way to manage plastic shopping bags

More education	19.3%
Ban them	16.1%
Give away more reusable bags	15.9%
Charge a fee to use them	14.7%
Recycle them at the store	14.1%
Collect them curbside	11.8%
Don't Know - No Opinion	3.0%
Other	2.7%
No reason to limit them	2.5%

John MacGillivray

From: John MacGillivray
Sent: Friday, June 07, 2013 2:41 PM
To: John MacGillivray
Subject: FW: Last nights survey of 500 male head of households

-----Original Message-----
From: [redacted]
Sent: Thursday, May 23, 2013 4:48 AM
To: Eric Shields
Cc: toby@tobynixon.com
Subject: Last nights survey of 500 male head of households

Dear Mr. Shields:
Last night, I received a survey call seeking 500 randomly selected, male head of households. The inquiry was regarding whether Kirkland should initiate a "bag fee" for plastic and paper bags issued by stores within the city limits of Kirkland. I opposed all queries that asked whether such fees should be imposed. A series of questions asked, "so if there was such a fee" would you...It was asked if the fee should apply to all stores or just the larger ones...if you intend to apply a tax it should be uniformly applied to all businesses.

However, I oppose any such action. Meddling in buying practices is not the responsibility of any government. It imposes costs on citizens and businesses that can become onerous, albeit "a nickel a bag" does not sound onerous but over time it will increase the cost of doing business in your city and in shopping in your city.

I shop at least once a week and sometime more often for our family. This imposition of a "bag fee/tax" would cause my patterns to move into the surrounding shopping areas in which to fees are imposed leaving between $500-$1000 per month in revenue to be collected in Woodinville and other areas rather than my Totem Lake/Juanita stores. Multiply my modest purchases by 500 people and suddenly the expected revenue stream in bag fees would dry to a trickle.

I opposed the annexation, am a business owner and have found that the cost of doing business (from my home) within he city limits has cost my businesses at least $275 per year more than when I was in the unincorporated King County. I have not found the increased costs has yielded any benefits to me as a citizen or as a business owner. I am taxed and feed for the mere existence of an alarm system, and projected revenue while not increasing the amount of traffic on the roads or increased waste as I work from home and do all my business over the internet and via phone calls. As this is my experience, thus far, with annexation, additional discussions and inquiries regarding Kirkland's intrusion into my personal spending and buying patterns by way of a bag tax/fee will be vigorously opposed.

Sincerely,
[redacted]

Phone Call Transcript – [redacted]
6-8-13 – 8:08 AM

John, good morning, [redacted], I was trying to send you and email but it bounced back and I got frustrated so I thought I would just call. But I do understand the environmental concerns relative to the issue on plastic bags but banning plastic bags doesn't seem to ban them from the stores. We use them to gather our produce, wrap our fish, our meat, to case the bed to wrap paper towels. There are soda bottles … come wrapped with plastic to carry them with. The Seattle Times and the Kirkland Reporter arrive at my door … my laundry comes in plastic bags from the cleaners. Maybe the supermarkets want to be a repository for these plastic bags so that they can be recycled but maybe they do maybe they don't but I don't know that banning the plastic bag is an effective nor and efficient was to proceed. So, my name is [redacted] and thank you for your time.

John MacGillivray

From: [redacted]
Sent: Thursday, May 30, 2013 3:20 PM
To: John MacGillivray
Subject: PLASTIC BAY SURVEY

John,

Just tried to complete the survey and the address for the survey is no longer valid.

My input, this is an absurd plan that my business and I personally do not support.

Thanks,

[redacted]

Phone Message
June 6, 2013 – 4:14 pm

"Hi John. My name is [redacted], it's a few minutes after four o'clock on Thursday, June 6th, phone number 425-822-3530. Just read the article in the Kirkland Reporter regarding the investigation into the possibility of banning plastic bags or putting fees on them. I'm disappointed that the survey is listed in the article did not offer the option of not having a change whatsoever to what we do right now and I was not part of that survey but I'll tell you that I'm adamantly opposed to the banning of plastic bags in our community and I do not want to see charges put on it like other cities have done. I think that it's intrusive and frankly from what I can tell at least in our family and other people that I speak to we reuse those bags. Those bags are not just brought home and tossed into the street, thrown into the trash. They're actually used as liners for trash cans and used for other things that we would in turn be going to the store to buy a bag for. So I don't think that it's doing much besides trying to look good and it's not really doing anything for us environmentally besides just creating a big pain in the rear for everybody. I sure would appreciate a return phone call and I hope that you're willing to listen to people that have opinions like myself when you're in this consideration of moving forward with the Council. Thank you."

John MacGillivray

From: [redacted]
Sent: Thursday, June 06, 2013 2:24 PM
To: John MacGillivray
Subject: Plastic bags

I strenuously oppose a ban, or a fee for the use, of plastic bags, in Kirkland stores.

Plastic bags entering my home see multiple uses before "ending their lives" as garbage bags. Purchasing boxes of plastic bags for garbage is expensive and certainly doesn't decrease the number of bags destined for landfills or careless disposal. The bags also provide for sanitary disposal of many items that would leak through paper or cloth bags--of course, pet waste in parks, etc. immediately comes to mind.

While the environment is of great importance to all of us, we need a logical, practical balance.

Thank you for the opportunity to express my opinion.

John MacGillivray

From: [redacted]
Sent: Thursday, June 06, 2013 7:07 AM
To: John MacGillivray
Subject: Fees for Using Plastic Bags

Mr John MacGillivray,

We read with interest the survey results about plastic bags as reported in the Kirkland Reporter. We agree with the majority: leave the plastic bags alone. Also, we do not want to pay fees to the City of Kirkland for using plastic bags. Kirkland receives more than enough money from residents like us and Kirkland area shoppers. A new fee is not welcome in the least!
Thank you,

Sincerely,

[redacted]
Kirkland, WA 98034

(Evergreen Hill Area)

John MacGillivray

From: [redacted]
Sent: Thursday, June 06, 2013 8:10 PM
To: John MacGillivray
Subject: Plastic bags

I support eliminating the option to use a plastic bag completely. Thx. [redacted]

John MacGillivray

From: [redacted]
Sent: Friday, June 07, 2013 10:23 AM
To: John MacGillivray
Cc: Doreen Marchione; Amy Walen
Subject: Plastic Bag Concern?

John- In reading today's article in the Kirkland Reporter about banning plastic bags, it appears to me that the city council has handed to you task in search of a problem. Has the council defined what the problem is to the city or its citizens?
Currently, my plastic bags are recycled either in the Waste Mgmt, QFC, Freddies or Safeway containers.
In my opinion the plastic problem is those armored plastic containers that encase many of the items found in Costco, Home Depot etc. One of those hard cased shells probably equals 20 to 50 plastic bags in terms of weight and many cannot even be recycled..
For the plastic sensitive folks, there are already many options available. I do use canvas & plastic fabric bags during most of my shopping experiences. However, for those slimey and leak prone items, I continue to wrap them up in plastic supplied at the check out stand.
The City should not proceed to allow legislation banning plastic bags.
Best Regards'

[redacted]

June 7, 2013 – 10:33 AM
Phone conversation

I received phone call from an unidentified female resident expressing her support for a ban on plastic bags. She said that she's a PCC member and that she always brings her own bags and that it's easy to do. A second gentleman was put on the phone and also said that he supports a ban on plastic bags.

John MacGillivray

From: [redacted]
Sent: Saturday, June 08, 2013 5:06 PM
To: John MacGillivray
Subject: plastic bags

I would like to chime in on the plastic bags at grocery stores issue. I have cats (in case you couldn't guess by my email address), and I recycle use of the bags by using them when I clean my litter boxes. As per Waste Managements instructions, I double bag all the litter box waste, then tie the bag tightly before throwing the used litter away. Paper bags would not serve this purpose, as the moisture would cause them to break. If I don't use the paper bags that the grocery stores provide, I'd still be using another plastic bag that I'd have to purchase to store my litter box waste in. All of my cat friends use these bags for this same purpose.

I would be very sad to see the plastic bags go away and I'd be rather upset having to pay for them. I do agree that having a recycle bin for them onsite at grocery stores, for those who don't re-use the bags is a great idea!

Thanks for your consideration,
[redacted]

Chapter 8.05
RETAIL CARRYOUT BAGS

Sections:

8.05.010 Definitions.
8.05.020 Prohibition on disposable plastic carryout bags.
8.05.030 Recycled paper bag pass-through charge.
8.05.040 Enforcement and penalties.
8.05.050 Severability.
8.05.060 No conflict with federal or state law.
8.05.070 Phased implementation.

8.05.010 Definitions.

A. “Carryout bag” means a bag that is provided by a retail establishment at the check stand, cash register, point of sale or other point of departure to a customer for the purpose of transporting food, goods or merchandise out of the establishment. Carryout bags do not include: (1) bags used by customers inside stores to package bulk items such as fruit, vegetables, nuts, grains, candy, greeting cards, or small hardware items, such as nails and bolts, or to contain or wrap frozen foods, meat or fish, whether prepackaged or not, or to contain or wrap flowers or potted plants, or other items where dampness may be a problem, or to contain unwrapped prepared foods or bakery goods, or to contain prescription drugs, or to safeguard public health and safety during the transportation of prepared take-out foods intended for consumption away from the retail establishment; or (2) newspaper bags, door-hanger bags, laundry/dry cleaning bags, or bags sold in packages containing multiple bags intended for use as garbage, pet waste, or yard waste bags.

B. “Pass-through charge” means a charge to be collected by retailers from their customers when providing recyclable paper bags, and retained by retailers to offset the cost of bags and other costs related to the pass-through charge.

C. “Recyclable paper bag” means a paper carryout bag that meets the following requirements: (1) contains a minimum average of 40 percent post-consumer recycled materials, (2) the paper carryout bag is accepted for recycling in the City’s recycling and composting program and (3) displays the minimum percent of post-consumer content on the outside of the bag.

D. “Retail establishment” means any person, corporation, partnership, business venture, public sports or entertainment facilities, government agency, street vendor or vendor at public events or festivals or organizations that sell or provide merchandise, goods or materials including, without limitation, clothing, food, beverages, household goods, or personal items of any kind directly to a customer. Examples include but are not limited to department stores, clothing stores, jewelry stores, grocery stores, pharmacies, home improvement stores, liquor stores, convenience stores, gas stations, restaurants, food vending trucks, farmers markets and temporary vendors of food and merchandise at street fairs and festivals. Food banks, food assistance programs and organizations providing services specifically for low-income households are not considered to be retail establishments for the purposes of this chapter.

E. “Disposable plastic carryout bag” means any carryout bag made from plastic or bioplastic, including materials marketed or labeled “biodegradable” or “compostable,” that is not a reusable bag.

F. “Reusable bag” means a bag made of cloth, fabric or other material with handles that is specifically designed and manufactured for long-term multiple reuse and meets all of the following requirements:

1. Has a minimum lifetime of 125 uses, which, for the purposes of this section, means the capability of loading, carrying and unloading a minimum of 22 pounds over a distance of at least 175 feet a minimum of 125 times;

2. Is washable, whether by machine or hand;

3. If made of plastic, meets all of the requirements above and is a minimum of 2.25 mils thick. (Ord. 2652 § 1, 2012).

8.05.020 Prohibition on disposable plastic carryout bags.

No retail establishment in the City, or any of its employees, managers or owners, shall provide a disposable plastic carryout bag to any customer. (Ord. 2652 § 1, 2012).

8.05.030 Recycled paper bag pass-through charge.

A. No retail establishment in the City shall provide a paper carryout bag with a manufacturer's stated capacity of one-eighth barrel (882 cubic inches) or larger that is not a recyclable paper bag. All retail establishments in the City shall collect a pass-through charge of not less than $0.05 for each recyclable paper carryout bag provided to customers that has a manufacturer's stated capacity of one-eighth barrel (882 cubic inches) or larger. It shall be a violation of this section for any retail establishment to pay or otherwise reimburse a customer for any portion of the pass-through charge; provided, that retail establishments shall not charge or collect a pass-through charge from anyone with a voucher or electronic benefits card issued under the Women, Infants and Children (WIC) or Temporary Assistance to Needy Families (TANF) support programs, or the federal Supplemental Nutrition Assistance Program (SNAP, also known as Basic Food), or the Washington State Food Assistance Program (FAP).

B. All retail establishments shall indicate on the customer transaction receipt the number of recyclable paper carryout bags provided and the total amount of the pass-through charge. (Ord. 2652 § 1, 2012).

8.05.040 Enforcement and penalties.

A. Any person who violates any of the provisions of this chapter shall be cited and liable for a civil infraction as set forth in Chapter 1.36 IMC; provided, however, that the Code Enforcement Officer shall instead issue a written warning to any person he determines is violating any provision of this chapter when such violation is the first instance of noncompliance known to the Code Enforcement Officer. If after issuing a written warning, the Code Enforcement Officer becomes aware of subsequent noncompliance, he shall apply for or impose the sanctions described in this section.

B. Any person may request a temporary waiver from the requirements of this chapter by filing a request with the City Administrator or designee. The City Administrator or designee may waive any specific requirement of this chapter for a period of up to 12 months if the person seeking the waiver has shown that strict application of the specific requirement would create an undue hardship, practical difficulty or other material concern not generally applicable to other persons or retail establishments in similar circumstances. The City Administrator's or designee's decision to grant or deny a waiver shall be in writing, shall be final and not subject to appeal. (Ord. 2652 § 1, 2012).

8.05.050 Severability.

If any section, subsection, sentence, clause, or phrase of this chapter is for any reason held to be invalid, or unconstitutional by a decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this chapter. (Ord. 2652 § 1, 2012).

8.05.060 No conflict with federal or state law.

Nothing in this chapter shall be interpreted or applied so as to create any requirement, power, or duty in conflict with any federal or state law. (Ord. 2652 § 1, 2012).

8.05.070 Phased implementation.

Retail establishments with a building square footage of 7,500 square feet or larger shall have until March 1, 2013, to comply with the provisions of this chapter. All other retail establishments shall have until March 1, 2014, to comply; provided, however, that retail establishments may voluntarily implement the restrictions on retail carryout bags allowed, as described herein, and may concurrently implement a pass-through charge. (Ord. 2652 § 1, 2012).

Title 21 - UTILITIES
Subtitle III - Solid Waste
Chapter 21.36 - SOLID WASTE COLLECTION
SubChapter II - Solid Waste Collection

21.36.100 Single-use plastic and recyclable paper carryout bags

A. No retail establishment in the City shall provide a single-use plastic carryout bag to any customer.

B. Through December 31, 2016, no retail establishment in the City shall provide a paper carryout bag with a manufacturer's stated capacity of one-eighth barrel (882 cubic inches) or larger that is not a recyclable paper bag, and retail establishments shall collect a pass-through charge of not less than five-cents for each recyclable paper carryout bag provided to customers. It shall be a violation of this section for any retail establishment to pay or otherwise reimburse a customer for any portion of the pass-through charge; provided that retail establishments may not collect a pass-through charge from anyone with a voucher or electronic benefits card issued under the Women, Infants and Children (WIC) or Temporary Assistance to Needy Families (TANF) support programs, or the federal Supplemental Nutrition Assistance Program (SNAP, also known as Basic Food), or the Washington State Food Assistance Program (FAP).

C. All retail establishments shall indicate on the customer transaction receipt the number of recyclable paper carryout bags provided and the total amount of the pass-through charge.

D. For purposes of this section, the following definitions apply.

1. "Carryout bag" means a bag that is provided by a retail establishment at the check stand, cash register, point of sale or other point of departure to a customer for the purpose of transporting food or merchandise out of the establishment. Carryout bags do not include:

    (a) bags used by customers inside stores to package bulk items such as fruit, vegetables, nuts, grains, candy, greeting cards, or small hardware items, such as nails and bolts, or to contain or wrap frozen foods, meat or fish, whether prepackaged or not, or to contain or wrap flowers or potted plants, or other items where dampness may be a problem, or to contain unwrapped prepared foods or bakery goods, or to contain prescription drugs, or to safeguard public health and safety during the transportation of prepared take-out foods and prepared liquids intended for consumption away from the retail establishment; or

    (b) newspaper bags, door-hanger bags, laundry-dry cleaning bags, or bags sold in packages containing multiple bags intended for use as garbage, pet waste, or yard waste bags.

2. "Pass-through charge" means a charge to be collected by retailers from their customers when providing recyclable paper bags, and retained by retailers to offset the cost of bags and other costs related to the pass-through charge.

3. "Recyclable paper bag" means a paper carryout bag that has a manufacturer's stated capacity of one-eighth barrel (882 cubic inches) or larger and meets the following requirements:

   (a) contains a minimum average of 40 percent post-consumer recycled materials, and

   (b) displays the minimum percent of post-consumer content on the outside of the bag.

4. "Retail establishment" means any person, corporation, partnership, business venture, public sports or entertainment facilities, government agency, street vendor or vendor at public events or festivals or organizations that sell or provide merchandise, goods or materials including, without limitation, clothing, food, beverages, household goods, or personal items of any kind directly to a customer. Examples include but are not limited to department stores, clothing stores, jewelry stores, grocery stores, pharmacies, home improvement stores, liquor stores, convenience stores, gas stations, restaurants, food vending trucks, farmers markets and temporary vendors of food and merchandise at street fairs and festivals. Food banks and other food assistance programs are not considered to be retail establishments for the purposes of this section.

5. "Single-use plastic carryout bag" means any carryout bag made from plastic or any material marketed or labeled as "biodegradable" or "compostable" that is neither intended nor suitable for continuous reuse as a carryout bag or that is less than 2.25 mils thick.

City of Edmonds

Chapter 6.80
PLASTIC BAG REDUCTION

Sections:

6.80.010 Definitions.

6.80.020 Types of checkout bags permitted at retail establishments.

6.80.040 Operative date.

6.80.050 Exemptions.

6.80.060 Severability.

6.80.070 Enforcement officer and penalties.

6.80.010 Definitions.

A. “Checkout bag” means a bag that is provided by a retail establishment at the check stand, cash register, point of sale or other point of departure for the purpose of transporting food or merchandise out of the establishment. Checkout bags do not include bags provided solely for produce, bulk food or meat at a produce, bulk food or meat department within a grocery store, supermarket, produce or meat market, or other similar retail establishment, or bags provided to carry out food cooked or prepared at a restaurant or other similar food and beverage establishment.

B. “Recyclable paper bag” or “recyclable paper checkout bag” means a paper bag that meets all of the following requirements: (1) contains no old growth fiber, (2) is 100 percent recyclable overall and contains a minimum of 40 percent post-consumer recycled content, and (3) displays the word “Recyclable” on the outside of the bag.

C. “Retail establishment” means any commercial business facility engaged in the sale of goods to consumers for ultimate consumption.

D. “Reusable bag” means a bag with handles that is specifically designed and manufactured for multiple reuse and is either (1) made of cloth or other machine-

washable fabric, and/or (2) made of durable plastic that is at least 2.25 mils thick and is suitable for reuse.

E. “Single-use plastic checkout bag” means any checkout bag made from plastic, excluding reusable bags. [Ord. 3749 § 1, 2009].

6.80.020 Types of checkout bags permitted at retail establishments.

A. All retail establishments within the city of Edmonds shall provide only the following as checkout bags to customers: reusable bags and/or recyclable paper bags.

B. Nothing in this chapter shall be read to preclude retail establishments from making reusable bags available for sale to customers.

C. The city of Edmonds shall work with retailers, retail associations, unions and other organizations to create educational elements about the benefits of reusable bags. This may include signage at store locations, informational literature, and employee training and will take place before and after the operative date. All retail establishments are strongly encouraged to educate their staff to promote reusable bags as the best option for checkout bags and to post signs encouraging customers to use reusable bags. [Ord. 3749 § 1, 2009].

6.80.040 Operative date.

All retail establishments shall comply with the requirements of this chapter by the first anniversary of the effective date of the ordinance codified in this chapter, which is August 27, 2009. The purpose of this one-year implementation period is to (A) allow time for affected retailers to prepare for and adapt to the provisions of this chapter; (B) allow time for the educational program to take effect and encourage the use of reusable bags; and (C) enable the city council to work with members of the community and affected parties to evaluate alternatives or modifications needed to address issues regarding provisions or implementation of this chapter. [Ord. 3749 § 1, 2009].

6.80.050 Exemptions.

The mayor, or his or her designee, may exempt a retail establishment from the requirements of this chapter for a period of up to one additional year after the operative date of the ordinance codified in this chapter, upon sufficient showing by the applicant that the provisions of this chapter would cause undue hardship. This request must be submitted in writing to the city within 30 days of the effective date of this chapter. The phrase “undue hardship” may include, but is not limited to, the following:

A. Situations where there are no acceptable alternatives to single-use plastic checkout bags for reasons which are unique to the applicant retail establishment.

B. Situations where compliance with the requirements of this chapter would deprive a person of a legally protected right. [Ord. 3749 § 1, 2009].

6.80.060 Severability.

If any provision or clause of this chapter is held to be unconstitutional or otherwise invalid by any court of competent jurisdiction, such invalidity shall not affect other provisions of this chapter, and clauses of this chapter are declared to be severable. [Ord. 3749 § 1, 2009].

6.80.070 Enforcement officer and penalties.

A. Prior to the "comply by date" in ECC 6.80.040, the mayor shall designate an existing department in the city as the department charged with enforcing the provisions of this chapter. The head of the department and his or her designees shall be the enforcement officers with authority and powers to issue civil infractions for violations of provisions of this chapter.

B. A violation of any provision of this chapter shall constitute a Class I civil infraction pursuant to Chapter 7.80 RCW. Issuance and disposition of infractions issued for violations of this chapter shall be in accordance with Chapter 7.80 RCW. The penalty for violation of a provision of this chapter shall be $100.00. The penalty for a second or subsequent offense in violation of the provision of this chapter within two years shall be $250.00.

C. The remedies and penalties provided in this section are cumulative and not exclusive. [Ord. 3749 § 1, 2009].

Chapter 6.47
SINGLE-USE CARRYOUT BAG ORDINANCE

Sections:

6.47.010 Definitions.
6.47.020 Regulations.
6.47.030 Recycled paper bags cost pass-through.
6.47.040 Exemptions.
6.47.050 Remedies.

6.47.010 Definitions.

“Carryout bag” means any bag that is provided by a retail establishment at the point of sale to a customer for use to transport or carry away purchases, such as merchandise, goods or food, from the retail establishment. “Carryout bag” does not include:

A. Bags used by consumers inside stores to: (1) package bulk items, such as fruit, vegetables, nuts, grains, candy or small hardware items; (2) contain or wrap frozen foods, meat, fish, whether packaged or not; (3) contain or wrap flowers, potted plants, or other items where dampness may be a problem; or (4) contain unwrapped prepared foods or bakery goods; (5) pharmacy prescription bags; or

B. Newspaper bags, door-hanger bags, laundry-dry cleaning bags, or bags sold in packages containing multiple bags intended for use as garbage, pet waste, or yard waste bags.

“Food provider” means any person or establishment in the city of Bellingham, that provides prepared food for public consumption on or off its premises and includes, without limitation, any store, shop, sales outlet, restaurant, grocery store, delicatessen, or catering truck or vehicle.

“Grocery store” means any retail establishment that sells groceries, fresh, packaged, canned, dry, prepared or frozen food or beverage products and similar items, and includes, without limitation, supermarkets, convenience stores, liquor stores and gasoline stations.

“Nonprofit charitable reuser” means a charitable organization, as defined in Section 501(c)(3) of the Internal Revenue Code of 1986, or a distinct operating unit or division of the charitable organization, that reuses and recycles donated goods or materials and receives more than 50 percent of its revenues from the handling and sale of those donated goods or materials.

“Paper bag cost pass-through” means the cost which must be collected by retailers from their customers when providing a recycled paper bag.

“Pharmacy” means any retail store, where prescriptions, medications, controlled or over the counter drugs, personal care products or health supplement goods or vitamins are sold, but excluding any licensed pharmacy located within a hospital.

“Product bag” means any bag provided to a customer for use within a retail establishment to assist in the collection or transport of products to the point of sale within the retail establishment.

“Recycled paper bag” means a paper carryout bag provided by a store to a customer at the point of sale that meets all of the following requirements:

A. Except as provided in subsection (B) of this definition, the paper carryout bag contains an average of 40

percent post consumer recycled materials.

B. An eight-pound or smaller recycled paper bag shall contain a minimum of 20 percent post consumer recycled material.

C. The paper carryout bag is accepted for recycling in curbside programs in a majority of households that have access to curbside recycling programs in the city.

D. The paper carryout bag is capable of composting, consistent with the timeline and specifications of the American Society of Testing and Material (ASTM) Standard D6400, as published in Master Environmental Assessment on Single Use and Reusable Bags, March 2010.

E. Printed on the paper carryout bag is the minimum percentage of post consumer content.

“Retail establishment” means any person, including any corporation, partnership, business, facility, vendor, organization or individual that sells or provides merchandise, goods or materials, including, without limitation, clothing, food, or personal items of any kind, directly to a customer. Retail establishment includes, without limitation, any grocery store, department store, hardware store, pharmacy, liquor store, restaurant, catering truck, convenience store, and any other retail store or vendor.

“Reusable bag” means a bag made of cloth or other fabric with handles that is specifically designed and manufactured for long-term multiple reuse and meets all of the following requirements:

A. Had a minimum lifetime of 125 uses, which for purposes of this subsection, means the capability of carrying a minimum of 22 pounds 125 times over a distance of at least 175 feet;

B. Is machine washable;

C. If made of plastic, is a minimum of at least two and one-fourth mils thick.

“Single-use plastic carryout bag” means any bag that is less than two and one-fourth mils thick and is made of nonrenewable resources. [Ord. 2011-07-034].

6.47.020 Regulations.

A. No retail establishment in the city shall provide a single-use plastic carryout bag to a customer unless otherwise permitted pursuant to BMC 6.47.040.

B. Retail establishments in the city shall provide to a customer at the point of sale a reusable bag or a recycled paper bag unless otherwise permitted pursuant to BMC 6.47.040.

C. No person shall distribute a single-use plastic carryout bag at any city facility, city-managed concession, city sponsored event, or city permitted event unless otherwise permitted pursuant to BMC 6.47.040.

D. No person shall distribute a single-use plastic carryout bag or any paper bag at the Bellingham farmers’ markets, except eight pound or smaller recycled paper bags that may be distributed free of charge for mushrooms. [Ord. 2011-07-034].

6.47.030 Recycled paper bags cost pass-through.

A. Retail establishments may provide a customer a recycled paper bag upon request but shall charge the customer a reasonable pass-through cost, but not less than $0.05.

B. Retail establishments shall indicate on the customer transaction receipts the total amount of the paper bag pass-through charge. [Ord. 2011-07-034].

6.47.040 Exemptions.

A. Notwithstanding the regulations contained in BMC 6.47.020:

1. Single-use plastic carryout bags may be distributed to customers by food providers for the purpose of safeguarding public health and safety during the transportation of prepared take-out foods and prepared liquids intended for consumption away from the food provider's premises.

2. Retail establishments may distribute product bags and may make reusable bags available to customers whether through sale or otherwise.

3. Retail establishments whose carryout bags are for small items, such as gifts, books and nails, may offer a small paper bag for no charge.

4. Nonprofit charitable reusers who sell and promote the use of reusable bags and offer a discount when customer brings own bag.

B. Notwithstanding the requirements contained in BMC 6.47.030:

1. A store shall provide a customer participating in Washington State's low-income food assistance program with a reusable bag or a recycled paper bag at no cost at the point of sale including, but not limited to, Medicaid and Women, Infant and Children programs.

C. The mayor may exempt a retail establishment from the requirements of this chapter for up to a one-year period, upon a request by the retail establishment showing that the conditions of this chapter would cause undue hardship. An undue hardship shall only be found in:

1. Circumstances or situations unique to the particular retail establishment such that there are no reasonable alternatives to single-use plastic carryout bags or a paper bag pass-through cannot be collected; or

2. Circumstances or situations unique to the retail establishment such that compliance with the requirements of this chapter would deprive a person of a legally protected right.

D. If a retail establishment requires an exemption beyond the initial exemption period, the retail establishment must reapply prior to the end of the exemption period and must demonstrate continued undue hardship if it wishes to have the exemption extended. Extensions may only be granted for intervals not to exceed one year.

E. An exemption request shall include all information necessary for the city to make its decision, including but not limited to documentation showing the factual support for the claimed exemption. The mayor may require the applicant to provide additional information to permit the city to determine facts regarding the exemption request.

F. The mayor may approve the exemption request, in whole or in part, with or without conditions.

G. Exemption decisions are effective immediately, are final and are not appealable.

H. The city council may by resolution establish a fee for exemption requests. The fee shall be sufficient to cover the costs of processing the exemption request. [Amended during 2013 recodification; Ord. 2011-07-034].

6.47.050 Remedies.

A. The city of Bellingham shall assist retailers by referring them to the city website with information which will help retail associations, unions, and other organizations to create educational elements about the benefits of reusable bags. This may include signage at store locations, informational literature, and employee training and will take place before and after the operative date. All retail establishments are strongly encouraged to educate their staff to promote reusable bags as the best option for carryout bags and to post signs encouraging customers to use reusable bags.

B. The mayor is authorized to establish regulations and to take any and all actions reasonable and necessary to obtain compliance with this chapter, including, but not limited to, inspecting any retail establishment's premises to verify compliance.

C. Any person violating this section shall be guilty of an infraction, which shall be punishable by a fine not to exceed $250.00.

D. The city attorney may seek legal, injunctive, or other equitable relief to enforce this chapter.

E. Administrative enforcement of this chapter shall proceed pursuant to Bellingham Municipal Code with the fines to be graduated for repeat violations in amounts set forth by city council resolution.

F. Each violation of this chapter shall be considered a separate offense.

G. The remedies and penalties provided in this section are cumulative and not exclusive, and nothing in this chapter shall preclude any person from pursuing any other remedies provided by law.

H. Notwithstanding any other provision of this chapter, commencing on the date the ordinance becomes effective, this chapter may be enforced through any remedy as provided for in this section.

I. Any provision of the Bellingham Municipal Code or appendices thereto inconsistent with the provisions of this chapter, to the extent of such inconsistencies and no further, is hereby repealed or modified to that extent necessary to effect the provisions of this chapter.

J. If any section, subsection, sentence, clause, or phrase of this chapter is for any reason held to be invalid or unconstitutional by a decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this chapter. The city council hereby declares that it would have passed this chapter and each and every section, subsection, sentence, clause, or phrase not declared invalid or unconstitutional without regard to whether any portion of the ordinance would be subsequently declared invalid or unconstitutional.

K. Any provision of this chapter thereto inconsistent with Washington State law, to the extent of such inconsistencies and no further, is hereby repealed or modified to match state law.

L. Effective Date. This chapter shall become effective one year from date of enactment. [Ord. 2011-07-034].

Ireland S.I. No. 605/2001 — Waste Management (Environmental Levy) (Plastic Bag) Regulations, 2001

The Minister for the Environment and Local Government, in exercise of the powers conferred on him by sections 7 and 29 of the Waste Management Act, 1996 (No. 10 of 1996) and section 72 of that Act, as inserted by section 9 of the Waste Management (Amendment) Act, 2001 (No. 36 of 2001), and with the consent of the Government, hereby makes the following Regulations:-

Citation.

1. These Regulations may be cited as the Waste Management (Environmental Levy) (Plastic Bag) Regulations, 2001.

Interpretation.

2. (1) In these Regulations—

"the Act" means the Waste Management Act, 1996 (No. 10 of 1996) as amended by the Waste Management (Amendment) Act, 2001 (No. 36 of 2001);

"accounting period" means the period commencing on the 4th day of March, 2002 and ending on the last day of June, 2002 and thereafter each period of three months beginning on the first day of July, October, January or April,

"accountable person" means a person within the meaning of section 72(4) of the Act;

"Appeal Commissioners" has the meaning assigned to it by section 850 of the Taxes Consolidation Act, 1997 (No. 39 of 1997).

(2) In these Regulations -

(a) a reference to an article is to an article of these Regulations, unless it appears that reference to some other provision is intended;

(b) a reference to a sub-article is to the sub-article of the provision in which the reference occurs, unless it appears that reference to some other provision is intended.

(3) Subject to sub-article (1), a word or expression that is used in these Regulations and is also used in any provision of the Act has, except where the context otherwise requires, the same meaning in these Regulations as it has in that provision.

Imposition of levy, person liable, rate of levy and exceptions.

3. (1) On and from the 4th day of March 2002 there shall be charged, levied and paid a levy (which shall be known as an 'environmental levy' and is in these Regulations referred to as 'the levy') in respect of the supply to customers, at the point of sale to them of goods or products to be placed in the bags, or otherwise of plastic bags in or at any shop, supermarket, service station or other sales outlet.

(2) An accountable person shall be accountable for and liable to pay the levy.

Levy amount.

4. The amount of the levy shall be 15 cent for each plastic bag.

Excepted bags

5. The following classes of plastic bags are excepted from the definition of a plastic bag -

(a) plastic bags solely used to contain-

(i) fresh fish and fresh fish products,

(ii) fresh meat and fresh meat products, or

(iii) fresh poultry and fresh poultry products

provided that such bags are not greater in dimension than 225mm in width (exclusive of any gussets), by 345mm in depth (inclusive of any gussets), by 450mm in length, (inclusive of any handles);

(b) plastic bags solely used to contain the products referred to in paragraph (a) where such products are contained in packaging, (including a bag), provided that such plastic bags are not greater in dimension than the dimensions referred to in paragraph (a);

(c) plastic bags solely used to contain-

(i) fruit, nuts or vegetables,

(ii) confectionery,

(iii) dairy products,

(iv) cooked food, whether cold or hot, or

(v) ice

provided that such products are not otherwise contained in packaging and where such bags are not greater in dimension than the dimensions referred to in paragraph (a);

(d) plastic bags used to contain goods or products sold:

(i) on board a ship or aircraft used for carrying passengers for

reward, or

(ii) in an area of a port or airport to which intending passengers are denied access unless in possession of a valid ticket or boarding card, for the purposes of carrying the goods on board the ship or aircraft referred to in subparagraph (i);

(e) plastic bags designed for re-use, which are used to contain goods or products and which are sold to customers for a sum of not less than 70 cent each.

Charging the levy and evidence of charging.

6. An accountable person shall impose a charge equivalent to the amount of the levy on a customer in respect of the provision by him or her to the customer of a plastic bag, other than a plastic bag excepted under article 5.

Itemisation of levy.

7. Where a charge under article 6 is imposed the charge shall be itemised on any invoice, receipt or docket issued to the customer.

Exclusion of employees.

8. References in these Regulations to a person who supplies plastic bags do not include references to a person who supplies plastic bags in his or her capacity as an employee of another person but include references to a person whose employee supplies plastic bags in his or her capacity as such employee.

Collection authority.

9. (1) The Minister hereby specifies that the Revenue Commissioners shall be the collection authority to whom the levy shall be payable.

(2) An accountable person shall pay the levy to the Revenue Commissioners in accordance with article 10.

(3) The Minister hereby confers powers on the Revenue Commissioners to authorise officers of the Revenue Commissioners for the purposes of article 17.

Returns and payment.

10. (1) An accountable person or any person who has been required to do so by notice in writing from the Revenue Commissioners, shall, not later than the 19th day of the month following the end of an accounting period furnish to the Revenue Commissioners a full and true return in such form as may be specified by the Revenue Commissioners of the amount of the levy which became payable by him or her during the accounting period and he or she shall authorise the Revenue Commissioners to debit the amount payable, if any, from the account of that person in a financial institution indicated by that person on the return form.

(2) Notwithstanding the provisions of sub-article (1), the Revenue Commissioners may, from time to time, by notice in writing,

authorise an accountable person to furnish to them within 19 days of the end of a period longer than an accounting period but not exceeding a year (hereinafter referred to as the specified period), a full and true return in such form as may be specified by the Revenue Commissioners of the amount of the levy which became payable by him or her during the specified period and he or she shall authorise the Revenue Commissioners to debit the amount payable, if any, from the account of that person in a financial institution indicated by that person on the return form.

(3) The Revenue Commissioners may, by notice in writing, authorise two or more accountable persons who are closely bound by financial, economic or organisational links to submit one return in respect of the levy due by all such persons.

(4) An authorisation under sub-article (2) or (3) may be issued by the Revenue Commissioners subject to such conditions as they consider proper to ensure that there is no loss of levy and that the accountable persons will meet their obligations under the Regulations and such authorisations shall, in each case, take effect on the date specified in the notice of authorisation.

(5) The Revenue Commissioners may, by notice in writing to the accountable person or persons concerned, terminate an authorisation issued in accordance with sub-article (2) or (3) and the said termination shall take effect from the date specified in the notice of termination.

Records

11. (1) An accountable person shall keep in a permanent from a full and true record of—

(a) the number of plastic bags, other than those excepted from the definition of plastic bag by reason of article 5, in stock before the commencement of business on the 4th day of March, 2002,

(b) the number of plastic bags excepted from the definition of plastic bag by reason of paragraphs (a), (b), (c) and (d) of article 5, in stock before the commencement of business on the 4th day of March, 2002,

(c) the number of plastic bags, other than those excepted from the definition of plastic bag by reason of article 5, purchased or acquired by him or her in each accounting period,

(d) the number of plastic bags excepted from the definition of plastic bag by reason of paragraphs (a), (b), (c) and (d) of article 5, purchased or acquired by him or her in each accounting period,

(e) the number of plastic bags, other than those excepted from the definition of plastic bag by reason of article 5, supplied by him or her to customers in each accounting period.

(2). An accountable person shall retain the records referred to in sub-article (1), together with all other books and documents containing particulars on which the records are based, for a period of not less than six years.

Estimation in the case of non-payment.

12. (1) If within the time specified in article 10 a person, being an accountable person or a person who has been required to do so in writing by the Revenue Commissioners, fails to furnish a return in respect of any period, then without prejudice to any other action that may be taken, the Revenue Commissioners may estimate the amount of levy payable by that person in respect of that period and serve notice on that person of the amount estimated:

Provided that where the Revenue Commissioners are satisfied that the amount so estimated is excessive, they may amend the amount so estimated by reducing it and serve notice on the person concerned of the revised amount estimated and such notice shall supersede any previous notice issued under this sub-article.

(2) Where a notice is served under sub-article (1) on a person, the following provisions shall apply:

(a) the person may, if he or she claims that he or she is not an accountable person, by giving notice in writing to the Revenue Commissioners within the period of fourteen days from date of service of the notice, require the claim to be referred for decision of the Appeal Commissioners and their decision shall be final and conclusive,

(b) on the expiration of the said period, if no such claim is required to be referred, or, if such is required to be so referred, on final determination against the claim, the estimated levy shall be recoverable in the like manner and by the like proceedings as if the amount specified in the notice were the amount of levy which the person was liable to pay for the period referred to in the notice,

(c) if, at any time after the service of the notice the person makes the return required under article 10 and, pays the levy due, if any, together with any costs which may have been incurred in connection with the default, the notice shall stand discharged and any excess of levy which may have been paid shall be repaid.

(3) A notice given by the Revenue Commissioners under sub-article (1) may extend to two or more consecutive accounting periods.

Estimation in the case of underpayment.

13. (1) Where the Revenue Commissioners have reason to believe that the total amount of levy payable by an accountable person in relation to any period, consisting of one accounting period or of two or more consecutive accounting periods, was greater than the total amount of levy (if any) paid by him or her in relation to that period, then, without prejudice to any other action which may be taken, they may make an estimate in one sum of the total amount of levy which in their opinion should have been paid in respect of the accounting period or periods comprised in such period and may serve a notice on the person specifying—

(a) the total amount of levy so estimated,

(b) the total amount of levy (if any) paid by the person in relation to the said period, and

(c) the balance of levy remaining unpaid.

(2) Where notice is served on an accountable person under sub-article (1), the following provisions shall apply:

(a) the person may, if he or she claims that the total amount of levy or the balance of levy remaining unpaid is excessive, on giving notice in writing to the Revenue Commissioners within the period of twenty-one days from the date of the service of the notice, appeal to the Appeal Commissioners,

(b) on the expiration of the said period, if no notice of appeal is received or, if notice of appeal is received, on determination of the appeal by agreement or otherwise, the balance of levy remaining unpaid as specified in the notice or the amended balance of levy as determined in relation to the appeal shall become due and payable as if the levy were levy which the person was liable to pay for the accounting period during which the period of fourteen days from the date of the service of the notice under sub-article (1) expired or the appeal was determined by agreement or otherwise, whichever period is the later.

Proof of notice in relation to estimation.

14. For the purposes of articles 12 and 13, where any officer of the Revenue Commissioners nominated by them for the purposes of article 12 or 13, or any other officer of the Revenue Commissioners acting with the knowledge of the nominated

officer causes, for the purposes of article 12 or 13, to be issued, manually or by any electronic, photographic or other process, and to be served, a notice bearing the name of the nominated officer, the estimate to which the notice relates shall be deemed to have been made by the nominated officer.

Recovery

15. (1) Without prejudice to any other mode of recovery, the provisions of any enactment relating to the recovery of income tax and the provisions of any rule of court so relating shall apply to the recovery of any levy payable as they apply in relation to the recovery of income tax.

(2) In particular and without prejudice to the generally of sub-article (1), that sub-article applies the provisions of sections 962 , 963 , 964 (1), 966 and 1002 of the Taxes Consolidation Act, 1997 .

(3) In proceedings instituted for the recovery of any amount of levy-

(a) a certificate signed by an officer of the Revenue Commissioners which certifies that a stated amount of levy is due and payable by the defendant shall be evidence, until the contrary is proved, that that amount is so due and payable, and

(b) a certificate certifying as aforesaid and purporting to be signed by an officer of the Revenue Commissioners may be tendered in evidence without proof and shall be deemed, until the contrary is proved, to have been signed by an officer of the Revenue Commissioners.

(4) Subject to this article, the rules of the court concerned for the time being applicable to civil proceedings shall apply to proceedings by virtue of this article.

Appeals

16. The provisions of the Taxes Consolidation Act, 1997 relating to-

(a) the appointment of times and places for the hearing of appeals;

(b) the giving of notice to each person who has given notice of appeal of the time and place appointed for the hearing of his or her appeal;

(c) the determination of an appeal by agreement between the appellant and an officer appointed by the Revenue Commissioners in that behalf;

(d) the determination of an appeal by the appellant giving notice of his intention not to proceed with the appeal;

(e) the refusal of an application for an appeal hearing;

(f) the hearing and the determination of an appeal by the Appeal Commissioners including the hearing and determination of an appeal by one Appeal Commissioner;

(g) the publication of reports of determinations of the Appeal Commissioners;

(h) the determination of an appeal through the failure of a person who has given notice of an appeal to attend before the Appeal Commissioners at the time and place appointed;

(i) the refusal of an application for the adjournment of any proceedings in relation to an appeal and the dismissing of an appeal by the Appeal Commissioners;

(j) the extension of the time for giving notice of appeal and the readmission of appeals by the Appeal Commissioners;

(k) the rehearing of an appeal by a judge of the Circuit Court and the statement of a case for the opinion of the High Court on a point of law;

(l) the payment of the levy in accordance with the determination of the Appeal Commissioners notwithstanding that a case for the opinion of the High Court on a point of law has been required to be stated or is pending;

(m) the payment of levy which is agreed not to be in dispute in relation to an appeal; and

(n) the procedures for appeal,

shall, subject to any necessary modifications, apply to an estimate under articles 12 or 13 of these regulations as if the estimate or appeal were an appeal against an assessment to income tax.

Powers of officers.

17. (1) In this article, “authorised officer” means an officer of the Revenue Commissioners authorised by them in writing to exercise the powers conferred by this article.

(2) An accountable person or any person employed by the accountable person shall on request by an authorised officer

produce all records, books and documents required to be retained under article 11 and furnish the authorised officer with all reasonable assistance, including the provision of information and explanations in relation to the acquisition, supply, disposal and stocks held of plastic bags as may be required by the authorised officer.

(3) An authorised officer may, at all reasonable times, enter premises in which plastic bags in respect of which the levy is or was chargeable are reasonably believed by the officer to be kept and may inspect and carry out such search and investigation as such officer may consider to be proper and take particulars of -

(a) any such plastic bags there found, or

(b) any records, books or other documents there found and reasonably believed by the officer to relate to the acquisition and the supply of such plastic bags or, in the case of such information in a non-legible form (including such information in a computer), require the person in charge of such premises to produce it to the officer in a permanent legible form.

(4) An authorised officer may remove and retain all records, books and documents required to be retained under article 11 for such period as may be reasonable for their further examination or for the purposes of any proceedings in relation to the levy.

Obstruction.

18. A person shall not resist, obstruct or impede an officer of the Revenue Commissioners in the exercise of a power conferred on that officer by article 17.

Application of Section 14 of the Act — avoidance of doubt.

19. For the avoidance of doubt, it is hereby declared that the provisions of section 14 of the Act shall apply in relation to these Regulations.

Information to be provided by distributors etc.

20. (1) In this article “authorised officer” means an officer of the Revenue Commissioners authorised by them in writing to exercise the powers conferred by this article.

(2) A person who supplies plastic bags to a person who carries on the business of selling goods or products at any shop, supermarket, service station or other sales outlet and who has been required to do so by notice in writing from an authorised officer, shall, not later than one month after the receipt of such notice, advise the authorised officer in writing of -

(a) the number of plastic bags not greater in dimension than

225mm in width (exclusive of any gussets) by 345mm in depth (inclusive of any gussets) by 450mm in length (inclusive of any handles), and

(b) the number of plastic bags (other than those of the type referred to in paragraph (a) above or in paragraph (e) of article 5)

supplied by him or her, during the accounting period or periods specified in the notice, to each accountable person specified in the notice and shall, on request by an authorised officer, produce to the authorised officer all records, books and documents retained by him or her in relation to such supplies.

Nomination of officers.

21. The Revenue Commissioners may nominate any officer of the Revenue Commissioners to perform any acts and discharge any functions authorised by these Regulations to be performed or discharged by the Revenue Commissioners.

Government of the District of Columbia
Department of the Environment
Natural Resources Administration
Stormwater Management Division

REGULATIONS ON RETAIL ESTABLISHMENT CARRYOUT BAGS

Disclaimer:

This PDF is a user friendly version created for web view and easy reference. It should not be relied upon as the definitive authority for the Regulations on Retail Establishment Carryout Bags. Additionally, the formatting and pagination of the document may vary from the formatting and pagination of the official print edition. The official DCMR and the D.C. Register should be consulted prior to citing any provisions of the regulations as a reference. The only official version of the DCMR is certified and published by the District of Columbia Office of Documents and Administrative Issuances.

The official copy of the ***DC Municipal Regulations and Register*** can be purchased from the Office of Documents and Administrative Issuances. To order single copies of the DCMR, visit the Office of the Secretary website or contact:

The DCMR is also available for viewing at the Martin Luther King Jr. Library and some branch libraries.

The District of Columbia Office of Documents and Administrative Issuances
One Judiciary Square
441 4th Street, NW, Suite 520 South
Washington, DC 20001
Phone: 202-727-5090
http://os.dc.gov/os/cwp/view.asp?a=1207&Q=522504&osNav=|31376|

1000 PURPOSE

The purpose of this chapter is to implement the provisions of the Anacostia River Clean Up and Protection Act of 2009, effective September 23, 2009 (D.C. Law 18-55; D.C. Official Code § 2-1226.51 *et seq*.).

1001 DISPOSABLE CARRYOUT BAG FEE REQUIREMENT

1001.1 Except as provided in Section 1006, a retail establishment shall charge each customer making a purchase from the establishment a fee of five cents ($0.05) for each disposable carryout bag provided to the customer with the purchase.

1001.2 The fee imposed by Section 1001.1 shall be charged to a customer making a purchase whether the purchase is in person, through the internet, by telephone, by facsimile, electronically, or by any other means.

1001.3 The retail establishment shall indicate on the customer transaction receipt the number of disposable carryout bags provided, and the total amount of the fee charged.

1002 DISPOSABLE CARRYOUT BAG MATERIAL AND LABELING REQUIREMENTS

1002.1 Starting on April 1, 2010, each disposable carryout bag provided by a retail establishment shall meet the following requirements:

(a) All paper and plastic disposable carryout bags provided shall be one hundred percent (100%) recyclable;

(b) All paper and plastic disposable carryout bags shall display in a highly visible manner the phrase “Please Recycle This Bag”, or a substantially similar phrase. The lettering of the phrase shall meet the following requirements:

(1) The lettering of the phrase shall be at least one half of an inch (0.5″) in height or at least seventy-five percent (75%) of the width of the front panel of the bag;

(2) The lettering of the recycling statement shall appear on the exterior of either the front or back panel of the bag, and not on a gusset or the base of the bag; and

(3) The lettering of the recycling statement shall be in a boldface font.

(c) A disposable carryout bag made of paper shall contain a minimum of forty

percent (40%) post-consumer recycled content; and

(d) A disposable carryout bag made of plastic shall be made of high-density polyethylene film marked with the SPI resin identification code 2, or low-density polyethylene film marked with the SPI resin identification code 4.

1002.2 A disposable carryout bag shall meet the requirements of this section, even if the bag is biodegradable or compostable.

1002.3 A disposable carryout bag made of both plastic and paper shall meet the paper carryout bag requirements of this section for the paper components of the bag, and shall meet the plastic carryout requirements of this section for the plastic components of the bag.

1003 RETAIL ESTABLISHMENTS SUBJECT TO CARRYOUT BAG REQUIREMENTS

1003.1 For the purposes of this chapter, the term "retail establishment" means:

(a) Any business required to have a Public Health: Food Establishment Retail endorsement to a basic business license pursuant to D.C. Official Code § 47-2827; and

(b) Any business required to have an off-premises retailer's license, class A or B, pursuant to D.C. Official Code § 25-112.

1003.2 Such retail establishments include, but are not limited to, the following types of business:

(a) Bakeries;

(b) Delicatessens;

(c) Grocery stores;

(d) Convenience stores that sell food;

(e) Restaurants (subject to the exception set forth in section 1006);

(f) Food vendors;

(g) Street vendors that sell food;

(h) Liquor stores; and

(i) Any business that sells food items, whether or not the principal purpose of the business is to sell food items, including a department store or electronics store that has a Public Health: Food Establishment Retail endorsement to its basic business license.

1004 APPLICATION OF CARRYOUT BAG REQUIREMENTS TO RETAIL ESTABLISHMENTS SELLING BOTH FOOD AND NON-FOOD ITEMS

1004.1 The disposable carryout bag fee, and material and labeling requirements of this chapter, shall apply to a disposable carryout bag provided with the purchase of any item from a retail establishment subject to this chapter, even if the item is a non-food item.

1005 APPLICATION OF CARRYOUT BAG REQUIREMENTS TO RESTAURANTS

1005.1 A restaurant with seating, as described in D.C. Official Code § 47-2827(e)(2), shall comply with the fee, and material and labeling requirements of Sections 1001 and 1002, for each of the following disposable carryout bags provided to a customer to take food away from the restaurant:

(a) A plastic carryout bag;

(b) A paper carryout bag, if:

(1) The bag includes a non-food item, whether or not the bag also contains a food item; and

(2) The restaurant directly charges the customer for the non-food item.

1005.2 A retail establishment where food is prepared and sold only for consumption off the premises, such as a delicatessen without seating or a carry-out establishment, that does not qualify as a restaurant under D.C. Official Code § 47-2827(e)(2), shall comply with the fee, and material and labeling requirements of Sections 1001 and 1002, for all paper and plastic disposable carryout bags provided to a customer with his or her purchase.

1006 CARRYOUT BAGS NOT SUBJECT TO THIS CHAPTER

1006.1 For the purposes of this Chapter, the term “disposable carryout bag” shall not include:

(a) A bag used by a customer inside stores to package bulk items, such as fruit, vegetables, nuts, grains, or candy;

(b) A bag used by a customer inside a store to contain or wrap frozen foods, meat, or fish, whether or not the items are prepackaged;

(c) A bag used by a customer inside a store to contain or wrap flowers, potted plants, or other items where dampness may be a problem;

(d) A bag used by a customer inside a store to contain unwrapped prepared foods or bakery goods;

(e) A bag used by a customer by a pharmacist to contain prescription drugs;

(f) A newspaper bag, door-hanger bag, laundry-dry cleaning bag, or bags sold in a package intended for use as garbage, pet waste, or yard waste bags;

(g) A bag provided to a customer by the retail establishment for the purpose of transporting a partially consumed bottle of wine, as required by D.C. Official Code § 25-113(b)(5)(C);

(h) A paper carryout bag provided to a customer to take food away from a restaurant with seating, as described in D.C. Official Code § 47-2827(e)(2), if the bag contains only:

(1) Food items; or

(2) Food and non-food items that the restaurant does not directly charge the customer for; and

(i) A reusable carryout bag, as defined in Section 1099.

1007 RETENTION AND REMITTANCE OF THE CARRYOUT BAG FEE

1007.1 Except as provided in Section 1008, a retail establishment shall retain one cent ($0.01) of each fee of five cents ($0.05) charged pursuant to section 1001 and shall remit the remaining four cents ($0.04) of each fee of five cents ($0.05) charged pursuant to section 1001 to the Office of Tax and Revenue.

1008 CARRYOUT BAG CREDIT PROGRAM

1008.1 If a retail establishment participates in the voluntary Carryout Bag Credit Program, the establishment may retain an additional one cent ($0.01), for a total of two cents ($0.02), from each fee of five cents ($0.05) charged pursuant to Section 1001. The remaining three cents ($0.03) of each fee of five cents ($0.05) charged pursuant to Section 1001, shall be remitted to the Office of Tax and

1008.2 The voluntary Carryout Bag Credit Program means a program under which the retail establishment:

(a) Credits the customer at least five cents ($0.05) for each carryout bag provided by the customer for packaging his or her purchases, regardless of whether the bag is paper, plastic, or reusable;

(b) Prominently advertises its participation in, and the substance of, the Carryout Bag Credit Program at each of its checkout registers;

(c) Reflects the total credit amount on the receipt of the customer who provides his or her own bag or bags; and

(d) Registers its participation in the Carryout Bag Credit Program with the District Department of the Environment.

1008.3 A retail establishment shall not be required, as a prerequisite to participating in the Carryout Bag Credit Program, to provide a credit to a customer for any portion of the customer's purchase for which the customer declines the use of a carryout bag.

1008.4 The retail establishment shall credit a customer a total number of five cent ($0.05) credits that reasonably relate the amount of goods purchased to the number of carryout bags reasonably required to carry the purchased goods.

1008.5 A credit provided to a customer pursuant to a Carryout Bag Credit Program shall not reduce the amount of fees due to the Office of Tax and Revenue under Sections 1007.1 and 1008.1.

1008.6 A retail establishment that withdraws from the Carryout Bag Credit Program shall provide notice to the District Department of the Environment of its withdrawal at least ten (10) business days before its withdrawal.

1009 TAX STATUS OF FEES RETAINED BY RETAIL ESTABLISHMENT

1009.1 The fees retained by a retail establishment under this Chapter shall not be classified as revenue and shall be tax-exempt for the purposes of Chapters 18, 20, and 27B of Title 47 of the District of Columbia Official Code.

1009.2 The fees retained by the retail establishment under this section shall be excluded from the definition of a retail sale under D.C. Official Code § 47-2001(n)(2) and from the definition of gross receipts under D.C. Official Code § 47-2761(5).

1009.3 The fees to be remitted to the District under Sections 1007.1 and 1008.1 shall be added to other tax payments in determining whether the electronic payment requirement under D.C. Official Code § 47-4402(c) applies.

1010 PROHIBITION ON CERTAIN FEE-RELATED PRACTICES

1010.1 A retail establishment shall not assume or absorb, or refund to the customer, the disposable carryout bag fee.

1010.2 A retail establishment shall not advertise or hold out or state to the public or to a customer, directly or indirectly, that the reimbursement of the disposable carryout bag fee or any part of the fee to be collected by the retail establishment will be assumed or absorbed by the retail establishment or refunded to the customer.

1011 PROHIBITION ON SALE AND DISTRIBUTION OF CERTAIN DISPOSABLE CARRYOUT BAGS

1011.1 Disposable carryout bags made of plastic that is not one hundred percent (100%) recyclable shall not be sold or distributed, retail or wholesale, in the District.

1011.2 The prohibition set forth in this section applies to all disposable carryout bags sold or distributed, retail or wholesale, to or by any establishment in the District, whether or not the establishment is a retail establishment.

1012 PENALTIES FOR VIOLATIONS

1012.1 Violation of any of the requirements of this chapter, except for Sections 1007, 1008.1, 1008.5, and 1009, shall subject a retail establishment to the penalties set forth in this Chapter.

1012.2 If the Director of the District Department of the Environment ("Director") determines that a violation of this chapter covered by subsection 1012.1 has occurred, the Director shall issue a warning notice to the retail establishment for the initial violation.

1012.3 If the Director determines that an additional violation of this chapter has occurred after a warning notice has been issued for an initial violation, the Director shall issue a notice of infraction and shall impose a penalty against the retail establishment.

1012.4 The penalty imposed by the Director shall not exceed the following, for each violation that occurs after the issuance of the warning notice:

(a) One hundred dollars ($100) for the first violation in a calendar year;

(b) Two hundred dollars ($200) for the second violation in a calendar year; and

(c) Five hundred dollars ($500) for the third and each subsequent violation in a calendar year.

1012.5 No more than one (1) penalty shall be imposed upon a retail establishment within a seven (7) calendar day period.

1012.6 A retail establishment shall have fifteen (15) calendar days after the date that a notice of infraction is issued to pay the penalty.

1012.7 The penalty shall double after fifteen (15) calendars days if the retail establishment:

(a) Does not pay the penalty; or

(b) Fails to respond to a notice of infraction by either denying or objecting in writing to the infraction or penalty.

1012.8 A recipient may request a hearing pursuant to instructions contained in the notice of infraction.

1012.9 Hearings or adjudications of violations under this Chapter shall be conducted pursuant to the Office of Administrative Hearings Establishment Act of 2001, effective March 6, 2002 (D.C. Law 14-76; D.C. Official Code §§ 2-1831.01 *et seq.*).

1099 DEFINITIONS

When used in this Chapter, the following words and phrases shall have the meanings ascribed:

100 percent (100%) recyclable - capable of being collected, separated, and recovered from the solid waste stream through the District's recycling programs, and either used again or reused in the manufacture or assembly of another package or product.

Act - means the Anacostia River Clean Up and Protection Act of 2009, effective September 23, 2009 (D.C. Law 18- 0055; D.C. Official Code § 2-1226.51 *et seq.*).

Disposable carryout bag - a bag of any material, commonly plastic or kraft paper, which is provided to a customer at the point of sale to carry purchases.

Post-consumer recycled content - any material that has completed its use as a consumer item and that would otherwise have been disposed of as municipal solid waste, but that has instead been reused or reconstituted as a product or raw material.

Reusable carryout bag - a bag with handles that is specifically designed and manufactured for multiple reuse and is made of cloth, fiber, other machine-washable fabric, or durable plastic that is at least two and one-quarter millimeters (2.25 mm) thick.

ARTICLE 7. CARRYOUT BAGS.

§ 15-6-121 DEFINITIONS.

In this article:

(1) BUSINESS ESTABLISHMENT means any commercial enterprise that provides carryout bags to its customers, including sole proprietorships, joint ventures, partnerships, corporations, or any other legal entity whether for profit or not for profit and includes all employees of the business and any independent contractors associated with the business.

(2) CARRYOUT BAG means a bag provided by a business establishment to a customer typically at the point of sale for the purpose of transporting purchases.

(3) REUSABLE CARRYOUT BAG means a carryout bag that is specifically designed and manufactured for multiple reuse, and meets the following criteria:

(a) displays in a highly visible manner on the bag exterior, language describing the bag's ability to be reused and recycled, as prescribed by rule;

(b) except as provided in subsection (d) below, has a handle;

(c) is constructed out of either:

(i) Cloth, other washable fabric, or other durable materials whether woven or non-woven,

(ii) Recyclable plastic, with a minimum thickness of 4.0 mil and containing only the types of plastic resin as prescribed by rule, or

(iii) Recyclable paper; and

(d) handles are not required for carryout bags constructed out of recyclable paper with a height of less than 14 inches and width of less than 8 inches.

(4) SINGLE-USE CARRYOUT BAG means a carryout bag that is not a reusable carryout bag.

Source: Ord. 20120301-078.

§ 15-6-122 REGULATIONS.

(A) Beginning on the effective date of this ordinance, the City will engage in a public education campaign to inform business establishments and citizens of the requirements regarding carryout bags.

(B) Beginning March 1, 2013, no person may provide single-use carryout bags at any City facility, City-sponsored event, or any event held on City property.

(C) Beginning March 1, 2013, a business establishment within the City limits may not provide single-use carryout bags to its customers or to any person.

(D) Beginning March 1, 2013, a business establishment within the City limits must provide prominently displayed signage advising customers of the benefit of reducing, reusing and recycling and of the need to use reusable carryout bags. The language and placement of signs under this Section shall be as prescribed by rule.

(E) A business establishment within the City limits may provide or sell reusable carryout bags to its customers or any person. A person may provide or sell reusable carryout bags at any City facility, City-sponsored event, or any event held on City property.

Source: Ord. 20120301-078.

§ 15-6-123 EXEMPTIONS.

This article does not apply to:

(1) Laundry dry cleaning bags, door-hanger bags, newspaper bags, or packages of multiple bags intended for use as garbage, pet waste, or yard waste;

(2) Bags provided by pharmacists or veterinarians to contain prescription drugs or other medical necessities, only if the bags are recyclable within the City of Austin residential recycling program;

(3) Bags used by restaurants to take away prepared food, only if the bags are recyclable within the City of Austin residential recycling program; and

(4) Bags used by a consumer inside a business establishment to:

(a) Contain bulk items, such as produce, nuts, grains, candy, or small hardware items,

(b) Contain or wrap frozen foods, meat, or fish, whether or not prepackaged,

(c) Contain or wrap flowers, potted plants or other items to prevent moisture damage to other purchases, or

(d) Contain unwrapped prepared foods or bakery goods; and

(5) Bags used by a non-profit corporation or other hunger relief charity to distribute food, grocery products, clothing, or other household items.

Source: Ord. 20120301-078.

§ 15-6-124 HARDSHIP VARIANCE.

(A) The Director may grant a variance from a requirement of this article only after determining that:

(1) application of this article would cause undue hardship based upon unique circumstances, or

(2) application of this article would deprive a person or business enterprise of a legally protected right.

(B) The request for variance shall be submitted on a form prescribed by rule.

(C) A variance granted under this Section must be the minimum departure necessary to address the hardship.

(D) The Director shall prepare written findings to support the grant or denial of a variance request under this Section.

Source: Ord. 20120301-078.

Disclaimer:
This Code of Ordinances and/or any other documents that appear on this site may not reflect the most current legislation adopted by the Municipality. American Legal Publishing Corporation provides these documents for informational purposes only. These documents should not be relied upon as the definitive authority for local legislation. Additionally, the formatting and pagination of the posted documents varies from the formatting and pagination of the official copy. The official printed copy of a Code of Ordinances should be consulted prior to any action being taken.

For further information regarding the official version of any of this Code of Ordinances or other documents posted on this site, please contact the Municipality directly or contact American Legal Publishing toll-free at 800-445-5588.

© 2013 American Legal Publishing Corporation
techsupport@amlegal.com
1.800.445.5588.

Stake Holders List

	Contact Name	Organization
1.	Bruce Wynn	Kirkland Chamber of Commerce
2.	Jan Gee	Washington Food Industry Association
3.		American Chemistry Council
4.	Katrina Rosen	Environment Washington
5.	Vivian Weber	Sustainable Kirkland
6.		Fred Meyer (The Kroger Co.)
7.	Holly Chisa	Northwest Grocery Association
8.	Diana Crane	PCC Natural Markets (Corporate)
9.	Alison Mochizuki	Trader Joe's (Corporate)
10.	Mark Johnson	Washington Retail Association
11.	Theron Andrews	Bartell Drugs
12.	Chris Klein	Duro Bag Manufacturing
13.	Josh McDonald	Washington Restaurant Association
14.	Joe Mizrahi	United Food and Commercial Workers Union
15.	Brad Halverson	Metropolitan Market
16.		Safeway (Corporate)
17.		Hopelink
18.		Northwest Grocer's Office
19.		American Progressive Bag Alliance
20.	Susan Thoman	Cedar Grove Composting
21.		Walgreen's (Corporate)
22.		Rite Aid (Corporate)
23.		QFC (The Kroger Co)
24.	Mario Morales	Eastside Business Association
25.		Ace Hardware
26.	Jeni O'Neal	Kirkland Wednesday Market (KDA)
27.	Tina Lathia	Juanita Friday Market
28.	Bruce Wynn	Kirkland Downtown Association
29.	Mary Evans	Waste Management, Inc.
30.	Jeff Borgida	Republic Services

June 28, 2013

Bruce Wynn
Kirkland Downtown Association
328 Park Place Center
Kirkland, WA 98033

Dear Bruce Wynn,

The Kirkland City Council has established environmental goals and performance measures to increase, enhance, and gauge the sustainability of our community and protect our natural environment. To achieve these goals and measures, Kirkland has developed and implemented innovative waste reduction and recycling programs and initiatives that has made Kirkland a perennial regional leader in recycling diversion and sustainability. To set the bar even higher and improve the sustainability of our community, the Kirkland City Council is considering regulating the use of single-use plastic bags in Kirkland.

As one of the many businesses/associations holding an important stake in our community and its natural environment, we would appreciate your opinion whether the City of Kirkland should regulate the use of single-use plastic bags in our community. Please take the time to send us your thoughts by **July 31, 2013** so that they may be shared with the City Council as it considers this issue further.

Please email your comments to recycle@kirklandwa.gov or post mail them to:

John MacGillivray
City of Kirkland Public Works Department
123 5th Avenue
Kirkland, WA 98033

Your opinions will be compiled with the survey results of Kirkland residents and local businesses known to use disposal bags and presented to the Kirkland City Council early this fall.

For more information contact Mr. MacGillivray at 425-587-3804 or jmacgillivray@kirklandwa.gov.

Sincerely,
PUBLIC WORKS

Pam Bissonnette

Pam Bissonnette
Interim Public Works Director

Sustainable Kirkland

Creating an environmentally friendly Kirkland

Plastic Bag Ban

Proposal

20 February 2013

Greetings,

Members of Sustainable Kirkland would like the City of Kirkland to pass an ordinance that would ban single-use plastic carryout bags in Kirkland. Single-use plastic bags are a significant source of the plastic pollution that threatens the marine life in Puget Sound. According to the EPA, seabirds, sea turtles, fish, and marine mammals often mistake plastic debris for food. For example, whales and sea turtles often mistake clear plastic bags for squid and jellyfish, and birds mistake microplastics for fish eggs.[1]

Environment Washington, a research and policy center dedicated to protecting Washington's air, water, and open spaces, noted these examples of plastic pollution in Puget Sound:[2]

- Researchers at the University of Washington Tacoma's Center for Urban Water found that every sample they took of nearby Puget Sound water and beach debris contained some form of plastic pollution.
- In April 2010, a dead grey whale washed up on the beach in West Seattle. Its stomach was full of trash, including 20 plastic bags.
- In the Strait of Juan de Fuca, researchers from the Port Townsend Science Center found that over 10% of the gulls nesting along the shores consumed plastic—half consisting of thin-film plastic single-use bags.

Goal Ban single-use plastic carryout bags in Kirkland.

Elements of a Proposed City of Kirkland Ordinance

- Prohibit the use of single-use plastic carryout bags given to customers at point of sale. Include bags advertised as compostable, biodegradable, photodegradable, or similar.
- Impose a 5-cent fee on each recyclable paper carryout bag to encourage shoppers to bring their own reusable carryout bags. Specify that paper bags contain a minimum percentage of post-consumer recycled fiber. For example, at least 40%.
- **Exceptions**: Allows plastic bags for produce, meat, and bulk food.

Important In 2009, Edmonds was the first city in Washington to pass a local ban on plastic bags. Unfortunately, they failed to impose the 5-cent fee on paper bags. Instead of bringing their own reusable bags, some people are asking for paper bags.

Did you know?

- The U.S. uses 100 billion plastic bags annually, consuming about 12 million barrels of oil.[3]
- Every quarter second, 3000 plastic bags are used in the U.S. The average American uses about 500 bags each year.[4]
- Every year, people in Washington State use over 2 billion plastic bags. More than 95% of these bags end up in landfills or as litter.[5]

---

1 "Marine Debris Impacts". http://water.epa.gov/type/oceb/marinedebris/md_impacts.cfm. Accessed on 10 February 2013.

2 "Keeping Plastic out of Puget Sound—Why Washington Should Join the Global Movement to Reduce Plastic Bag Pollution". Environment Washington news release on November 17, 2011. http://environmentwashington.org/reports/wae/keeping-plastic-out-puget-sound. Accessed on 10 Feb 2013.

3 "Green Tips". World Wildlife Fund. http://worldwildlife.org/pages/green-tips Accessed on 10 February 2013.

4 Information learned during Sustainable Kirkland group field trip to "Plastics Unwrapped" Exhibit at the Burke Museum, Seattle, WA on 7 February 2013. http://www.burkemuseum.org/plastics.

5 Krehbiel, Robb and Emma Jornlin. "Cutting Down on Plastic—Bag Bans Prove Popular and Successful". Environment Washington. December 2012. Accessed on 4 February 2013. Copy of report in this binder.

Why ban plastic bags?[6]

- **Plastic bags pollute our water and our food supply** Plastic bags never biodegrade. When plastic bags enter the water, they break down into smaller and smaller pieces called microplastics. These tiny plastics absorb other chemicals in the water, including banned toxins DDT and PCBs, and become concentrated toxic pellets, ingested by smaller fish and thereby introduced into the food chain.[7]
- **Plastic bags litter the ocean and our coasts** Because they are so lightweight, wind and water currents easily pick them up. According to the National Marine Debris Monitoring Program, plastic bags account for more than 11% of the debris washed up on U.S. western continental coastlines. In the Pacific Ocean, currents have created the Great Pacific Garbage Patch, which contains mostly plastic swirling in an area twice the size of Texas.
- **Plastic bags are not recycled** In 2010, only 4.3% of all plastic bags in the United States were recycled. Many grocery stores offer bag collection. However, many bags turned in for recycling end up in the landfill because they are contaminated with food, receipts, etc.
- **Plastic bags contaminate the recycling process** Over 50% of the Washington's recycling facilities do not accept plastic bags because they get tangled in their separation machinery. Because they spend an estimate of 20-30% of their labor costs removing plastic bags from the machinery, over 70% of municipalities want plastic bags out of their recycling systems.

Which other communities have implemented a ban on disposable, single-use plastic bags?[8]

- **In State of Washington** Bainbridge Island, Bellingham, Edmonds, Issaquah, Mukilteo, Port Townsend, and Seattle. In addition to these 7 communities, Anacortes, Shoreline, and Thurston County are considering bans.
- **On west coast** Alameda County, Carmel, Eugene, Hawaii (every county), Laguna Beach, Los Angeles county, Monterey, Portland, San Francisco, San José, Santa Cruz county.
- **Elsewhere in U.S.** Austin, Texas; State of Massachusetts; Washington, D.C.
- **Elsewhere in the world** At least 20 countries and more than 50 local governments.

In summary, plastic bags do not belong in the ocean. Members of Sustainable Kirkland encourage the City of Kirkland to follow other Washington cities and approve a ban on single-use plastic carryout bags. Teri Thomas, Thurston County Solid Waste Reduction Coordinator, summarizes this issue well: "It has been shown over and over that education and increased bag recycling opportunities do not make a significant impact. If jurisdictions truly want to reduce the use, bans are the about the only way that is going to happen".[9] If successful, Thurston County would be the first Washington County to ban plastic bags. Next, a statewide ban on disposable plastic bags would be the best solution to preventing plastic bags from entering Washington's coastal waters and harming our marine life. We thank you for your attention to this important matter, and encourage you to visit "Plastics Unwrapped" exhibit at the Burke Museum before it ends on 27 May 2013.

Members of Sustainable Kirkland

---

[6] Ibid.

[7] For more scientific details, see Plastic Ocean, a book written by Capt. Charles Moore with Cassandra Phillips. Pages 246-257. Published by the Penguin Group. 2012.

[8] For a state-by-state list and brief description of plastic bag laws passed in the U.S., go to http://www.campaignforrecyling.org/print/191.

[9] "Other Cities Provide Insight to What Thurston Can Expect with Own Ban". Environment Washington news release on 19 December 2012. http://www.environmentwashington.org/news/wae/new-survey-plastic-bag-bans-big-success. Accessed on 14 February 2013.

John MacGillivray

From: Recycle
Sent: Monday, July 08, 2013 7:49 AM
To: John MacGillivray
Subject: FW: Kirkland, WA Bag Regulation Comments
Attachments: Sustainability_Paper v Plastic.pdf; AFPA Paper Bag Sustainability.pdf; 1 6 10 Paper vs Plastic Sustainability Comparison.pdf; Duro Sustainability Overview.pdf; US Bag Legislative Overview 053113.pdf

---

From: Christopher Klein [mailto:cklein@durobag.com]
Sent: Monday, July 08, 2013 7:47 AM
To: Recycle
Cc: Christopher Klein
Subject: Kirkland, WA Bag Regulation Comments

Dear John MacGillivray and Pam Bissonnette,

Thank you for reaching out to Duro Bag, and for the opportunity to comment on potential bag regulation.

I have personally worked with numerous cities around the U.S. on similar legislation, including Seattle, Portland, San Francisco, Los Angeles, Chicago, New York, Austin, and Washington D.C. As a representative for the world's largest producer of paper bags, I work to inform municipalities on the impacts of paper v. plastic environmental issues, and resulting regulation.

Duro supports Kirkland's effort to regulate the use of single-use plastic bags.

Although I am unaware of Kirkland's specific language, many ordinances around the country have adopted similar regulations and compliance requirements, and I would like to comment on those below:

1. 40% PCW requirement for paper bags.
    a. Duro is strongly supportive of the 40% PCW requirement. Duro advocates the use of this paper to many of our customers due to the environmental quality.

2. Fee on paper bags.
    a. In principle Duro does not support fees on paper bags, because we see paper bags as an environmentally friendly alternative on par with reusable bags, BUT we also acknowledge the need for the fee for retailer support.
    b. Therefore, in these situations Duro recommends a hybrid option. Similar to what was successful in Austin, TX, wherein the 5 cent fee is placed on standard paper bags with the 40% PCW minimum, but to create an exception (no fee) for paper bags with 100% PCW and 3rd party certification (due to strong environmental/sustainability quality) or paper bags with handles (due to reusability). This format has been widely accepted in other cities, and by retailers. This provides businesses the option as to whether they want to collect a fee or not and absorb the cost of the environmental option. This satisfies the objectives of legislatures by implementing a "market-friendly" bill that is flexible to businesses and consumers.

In addition to my comments, please see attached and consider the information in the supporting documents which outline the key aspects and benefits of paper bags, and specifically compared to plastic bags. Also attached is a U.S.

Bag Legislative Overview, which provides a snapshot of all bag legislation. This will give you a good start in comparing other regulatory efforts.

I hope this information is helpful. Please feel free to call or email me to discuss in more detail.

I am available at cklein@durobag.com or my mobile is 859-446-8506.

Thanks again for considering my comments, and best of luck in your pursuit to engage the community in sustainable practices.

Best,
Christopher Klein
Duro Bag Mfg Co.
859-446-8506
cklein@durobag.com

This email transmission contains information that is intended to be confidential and privileged. If you receive this email and you are not a named addressee you are hereby notified that you are not authorized to read, print, retain, copy, or disseminate this communication without consent of the sender and that doing so is prohibited and may be unlawful. Please notify sender immediately by email if you have received this via email and delete and otherwise erase the email and any copies or attachments from your computer system. Also, email transmission cannot be guaranteed to be secure or error free as information could be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses. The sender therefore does not accept liability for any errors or omissions in the contents of the message, which arise as a result of email transmission

American Forest & Paper Association
www.afandpa.org

Paper Bags

The American Forest & Paper Association (AF&PA) is the national trade association that advances a sustainable U.S. pulp, paper, packaging, and wood products manufacturing industry through fact-based policy and marketplace advocacy. The industry is an integral part of our nation's green job base and generates approximately 4.5 percent of the total annual U.S. manufacturing GDP and is among the top 10 manufacturing sector employees in 47 states.

AF&PA's member companies manufacture products from renewable and recyclable resources, which are relied upon in the daily lives of people across the country and around the world. Nationwide, our industry value chain employs nearly 900,000 workers — exceeding employment levels in the automotive, chemicals, and plastics industries -- in green jobs that promote recycling to reduce waste and reduce greenhouse gases by sustaining the forests that absorb carbon dioxide; making the paper and wood products that store it; and generating about two thirds of our energy needs through carbon neutral biomass renewable energy.

Renewable

Paper bags are made from a renewable resource—trees—that help reduce greenhouse gases in the atmosphere.

- U.S. forests and forest products offset 10 percent of annual U.S. carbon dioxide emissions.
- Sustainable Forestry Initiative® (SFI) participants alone plant 1.7 million trees each day in North America.
- Two-thirds of the power used to make paper comes from carbon-neutral, renewable sources.
- The fossil fuel from which plastic bags are made and the fossil fuels burned to power the manufacture of plastic bags lead to a net increase of carbon dioxide in the atmosphere.

Recyclable

The recovery rate for paper bags is four times greater than that of plastic bags.

- Paper bags' and sacks' recovery rate is 49.5 percent, which helps keep them out of landfills and extends the fiber supply, according to the EPA in 2009.
- Plastic bags' recovery rate is about 10 percent. Plastic bags are a leading cause of ocean litter and are a major threat to marine animals.
- Every ton of paper that is recovered for recycling saves 3.3 cubic yards of landfill space.
- More than 78 percent of the U.S. population has access to recycling paper bags. In 2010, 87 percent of the U.S. population had access to paper and paperboard community recycling programs.
- In 2011, 66.8 percent of paper used in the U.S. was recovered for recycling.

Compostable

- Paper bags are ideal as a container to hold compostable waste.
- Paper bags are readily compostable, as evidenced by their use throughout the country in municipal leaf mulching programs.
- Under perfect conditions, a plastic bag may take a thousand years to biodegrade. In a landfill, plastic bags decompose while presenting litter problems and threats to wildlife, especially marine life. If buried, they block the natural flow of oxygen and water through soil. If burned, they release dangerous toxins and carcinogens into the air.

Continued on p. 2

Greenhouse Gases

- Paper bags help reduce greenhouse gases in the atmosphere by requiring less energy to produce than plastic bags. On average, two-thirds of the energy used to make paper is carbon-neutral or renewable. When biomass such as wood is combusted for energy, it releases carbon dioxide that it had absorbed during growth back into the atmosphere. When harvested biomass is replanted, it once again absorbs carbon dioxide. In contrast, the combustion of fossil fuel is not carbon neutral.

January 2013

American Forest & Paper Association

www.afandpa.org

Paper vs. Plastic Sustainability Comparison

Questions and Answers

The American Forest & Paper Association (AF&PA) is the national trade association of the forest products industry and advances public policies that promote a strong and sustainable U.S. forest products industry in the global marketplace. The industry is an integral part of our nation's green job base and generates approximately 6 percent of the total annual U.S. manufacturing GDP.

AF&PA's member companies make pulp, paper, packaging and wood products, and own forest land. Our companies make essential products from renewable and recyclable resources that sustain the environment. Nationwide, the U.S. forest products industry:

- *Employs approximately one million workers — on par with the nation's automotive and plastics industries.*
- *Provides green jobs that reduce greenhouse gases by sustaining the forests that absorb carbon dioxide; making the paper and wood products that store it indefinitely; generating and using more renewable energy than anyone else—28.5 million megawatt hours annually, enough to power 2.7 million homes; and recycling paper to avoid methane emissions and reduce waste.*
- *Is among the top ten manufacturing sector employers in 48 states.*
- *Is a significant taxpayer, paying approximately $7 billion annually in federal, state, and local taxes.*

Does it take less energy to create a plastic bag?

Yes, but plastic bags are made almost entirely with fossil fuels, whereas on the average, two-thirds of the energy to make paper bags is carbon-neutral or renewable. When biomass such as wood is combusted for energy, it releases back into the atmosphere carbon dioxide that it had absorbed from the atmosphere during growth. When harvested biomass is replanted, the cycle repeats. In contrast, combustion of fossil fuel is not carbon neutral.

This contrasts with the fossil fuels used to power the manufacture of plastic. The carbon released when fossil fuel is combusted is geologic carbon that was never in the atmosphere. Therefore, its release creates a net increase of carbon in the atmosphere.

Does it take less fossil fuel to make paper bags than plastic?

Yes, because it takes three plastic bags to carry the same amount of goods as one paper bag. The LCA data conducted by AF&PA shows that paper bags are more energy efficient to produce. An LCA done by the plastic bag industry suggests that it takes 1.5 plastic bags to carry the same amount of goods as a paper bag, in which case plastic bags are made to appear more energy efficient to produce than paper bags. However, we dispute the assumption that it takes only 1.5 plastic bags to replace a single paper bag and instead use the more accurate 3:1 ratio.

The LCA conducted by the plastics industry says that it takes less potable water to make plastic bags than paper bags. Is this true?

No. Paper is not made with any potable (drinking) water at all. Papermakers practice efficient, non-consumptive reuse of water resources. Virtually all of the water that helps make our products is used, treated, and then released back into the waterways from which it was originally drawn.

The LCA conducted by the plastics industry says that the life cycle of plastic bags generates fewer greenhouse gas emissions than does that of paper. Is this true?

The paper bag manufacturing process actually generates 20 percent less greenhouse gas emissions than does that of plastic bags. Paper bags decompose, however, whereas plastic bags do not. This decomposition releases greenhouse gases and is where plastic bags claim an advantage in the life cycle. To mitigate the amount of greenhouse gases released into the atmosphere, the paper industry continues to promote paper recycling. In 2008 more than 57 percent of the paper consumed in the U.S. was recovered for recycling.

Does plastic production generate less NO2 and SO2 emissions than paper?

While minute amounts of NO_2 and SO_2 are emitted in the papermaking process, the amounts are so infinitesimal that these are not substances for which paper companies are typically even required to test or monitor.

Do paper bags generate more solid waste than plastic?

The LCA conducted by the plastics industry examines only the weight of paper and plastic bags. Plastic bags are recycled at far lower rates and wind up in landfills more often than do paper ones. Paper bags decompose and become soil, plastic bags do not decompose. As the recycling rate for paper bags increases, less solid waste and methane will be created. According to the U.S. EPA in 2008, the recovery rate of Kraft paper bags was 37.6 percent.

Are paper bags a litter issue?

No. If a paper bag ends up as litter on land, in a stream, or in the ocean, that bag will decompose and not pose a threat to wildlife and the environment.

Contrary to what the plastics industry claims, plastic's inability to decompose is actually one of its major problems, as is evidenced by the severe litter problems of plastic, the deadly toll it takes on aquatic life, and the United Nation's Environmental Programme's recent finding that 80 percent of all the plastic in the ocean is thin-film plastic.

Why are trees considered a renewable resource?

The paper bag is made from a renewable resource – managed forests – that provides habitat for animals and removes large amounts of carbon dioxide from air we breathe. In its stewardship of these lands, the U.S. forest products industry plants 1.7 million trees every day.

AF&PA requires participation in a forest certification program, like the Sustainable Forestry Initiative® (SFI), as a condition of membership. The SFI Standard requires protection of high conservation value forest as one of its forest management objectives.

The Northwest Grocery Association represents retailers and suppliers in all the counties and cities across Washington State. Our membership includes the larger grocery stores – Safeway, Albertsons, Costco Wholesale, QFC, Fred Meyer, and WinCo stores – but not the independent grocers.

Over the past several months NWGA members have worked with various municipalities that are interested in passing ordinances to ban plastic bags. NWGA supports proposed ordinances that ban plastic but ALSO requires a fee be collected by retailers for paper.

NWGA has supported specific bans on plastic bags, but only if it fits three specific criteria:

- **The legislation must apply to ALL retailers, not just grocery stores. ALL retailers use plastic bags, and ALL retailers should be held to the same standard.**
- **There should be a fee on paper bags that is required to be collected. The retailer would retain this fee. Switching to paper bags can increase costs for a retailer almost $100,000 per store site, and the nickel will help to offset those potential costs.**
- **It includes all bags, paper and plastic.**

We continue to work with local governments to pass this type of model at the local level. Ordinances that have passed in Seattle and other communities have proven to be workable for the retail community, and these ordinances treat all retail businesses the same.

We remain committed to working with local governments to draft ordinances that meet the above criteria, and which doesn't pit one retailer against another. Please contact me should you be interested in talking about our position further, and how we may assist the Council.

Contact Holly Chisa (360)791-6647

WASTE MANAGEMENT

720 Fourth Ave, Suite 400
Kirkland, WA 98033

July 30, 2013

Ms. Pam Bissonnette, Interim Public Works Director
Mr. John MacGillivray, Solid Waste Programs Manager
City of Kirkland
123 Fifth Avenue
Kirkland, WA 98033

** *Sent via Email* **

Dear Pam and John:

Thank you for inviting Waste Management to comment on Kirkland's consideration of single-use plastic bag regulation.

There are several approaches to material bans:

1. Disposal ban;
2. Collection ban;
3. Ban on use or sale; or
4. A requirement to recycle (the inverse of a disposal ban).

Each approach comes with its own considerations. Generally speaking, Waste Management is neutral on sale or use bans. With regard to disposal bans, collection bans or recycling mandates, we advocate having a "plan before a ban". When well-developed collection systems, robust markets and supporting enforcement and collection systems are in place, we generally do not object to the implementation of material bans.

Effective plans require appropriate collection programs, processing infrastructure and markets for the recycled material. Our current contract includes the collection of "bagged plastic bags" in the single-stream recyclables collection at the city's request. Processing plastics bags is challenging, even when they are properly prepared (bags kept clean and dry; bagged together). Adding difficult materials – like plastic bags – to an existing processing facility, requires a deft hand at the pre-sort line to catch as many bags as possible. Left on the line, plastic bags inevitably tangle and clog the MRF equipment.

In addition to the processing challenges, the end market for this material has become problematic. China's "Operation Green Fence" initiative has banned curbside film plastics (among other types of plastics) from import. This has effectively shut-off the existing global marketplace for these materials. Sufficient domestic alternatives do not exist presently. Simply put, mixed plastics (including film plastics) collected in curbside recycling programs have no end market at this time.

Operation Green Fence is a reminder of the importance of material quality in our recycling programs. Sustainable recycling requires careful attention to quality at each point along the value chain. The type of material collected and the material quality of many types of plastics collected in curbside recycling programs have been particularly challenging to recycle effectively. We have increased labor cost at our MRFs, and are focusing on clear communication with our customers, to minimize confusion and contamination – hoping to improve material quality and recyclability of more types of plastics.

We are watching this situation closely, and hope to see a change in export market demand combined with the development of alternative domestic solutions for plastics, beyond the more stable PET and HDPE plastics. However, we anticipate that the situation may require new long-term market solutions. In the meantime, we are working with our customers to limit the types of material that we collect to those with established and stable end markets in this new environment.

We hope that this helps you in your decision making process. Please do not hesitate to contact me at 425.814.7844 or mevans4@wm.com should you have further questions.

Sincerely,

Mary S. Evans
Area Director – Public Sector Services

MSE2013103

From: Susan Thoman
To: John MacGillivray
Subject: [SPAM] Comments on plastic bag ban initiative
Date: Friday, August 09, 2013 10:04:44 AM

Greetings, John. I received a letter from Pam Bissonnette a few weeks ago, and I am so sorry that I did not respond within the prescribed timeline (July 31). With that, I hope the comments provided herein are still timely and can be integrated with your other comments to Council on the matter of regulating single-use plastic retail bags in your community.

Cedar Grove Composting is in full support of this initiative, as we see that any efforts to exclude *any amount of* film plastic from our inbound tonnage is one step closer to minimizing the potential for this material to end up in yard waste carts. We greatly appreciate the efforts of our city and county recycling partners in their efforts to educate the public on what should and should not go into composting carts. However, film plastics remain one of the most insidious, prevalent and costly contaminants to contend with. By encouraging the use of paper or durable shopping bags in Kirkland, we anticipate this will certainly create an incrementally positive effect on our feed stock quality.

We were in full support of the plastic bag bans in both the City of Seattle and the City of Issaquah. We provided public testimony for these initiatives when these ordinances were before their respective councils. We would certainly take advantage of the opportunity to do the same if this initiative matures to that stage. We admire the progressive stance of Kirkland in considering this, and it would be our privilege (and in the overall best interest of our local organics recycling program) to act in support of this consideration.

Thank you for asking for our comments. We look forward to learning more about this as it progresses.

CEDAR GROVE

Susan Thoman | Vice President, Corporate Development | Office: (206) 832-3083
Cell: (206) 755-8309 | susant@cgcompost.com
Customer Service: 1-877-764-5748 | www.cedar-grove.com

BARTELL DRUGS

Washington's Own Drugstores®

John MacGillivray
Solid Waste Coordinator, City of Kirkland
Kirkland City Hall
123 5th Avenue
Kirkland, WA 98033

Dear Mr. MacGillivray,

Bartell Drugs, from the time of my Grandfather and company founder, has been focused on serving our customers in the best way we can. An important component to our commitment to service is offering choices for our customers. This has involved, in recent years, providing environmentally sound disposal options for certain items that we sell*.

When it comes to the packaging of customer purchases, we are glad to accommodate customers who don't want their purchase bagged, those who bring their own bags, and those who want us to provide bags, both bags for purchase and "free" ones. For decades we have provided plastic bags to meet the latter need because they are inexpensive, take up less space than paper bags to stock in our warehouse and in our stores and are less expensive to transport from our warehouse to our stores. Further, they are generally more durable than paper bags, especially in our rainy environment.

Our most commonly used larger plastic bags have intentionally been of good quality and we have found that many customers re-use them, in some cases many times. But, as I pointed out earlier, our primary obligation is to respond to the needs of our customers. If customers did not want us to provide bags we wouldn't. If customers refused plastic bags we would find a way to serve their needs. Overall we appreciate the ability to run our business by offering our customers what they need.

In our limited experience with plastic bag bans we've found that making this adjustment has slowed our checkout times, caused frustration for our employees and most importantly as it pertains to my prior comments, exasperated and confused some of our customers. Overall it has been more cumbersome to manage: not our preferred way of doing business.

We urge that you support freedom of choice and allow merchants to tailor their bag offerings to the needs of their customers.

Sincerely,

George D. Bartell
Chairman and CEO, Bartell Drugs

***Existing Sustainability Programs at Bartell Drugs:**

- Free, chain-wide recycling program for CFL (compact fluorescent light bulbs).
- Recycling and disposal programs for used batteries and old cell phones.
- Leadership role in the environmentally safe disposal of unwanted prescription drugs through the "Take It Back Network" program.

The Bartell Drug Company • Trusted Since 1890
4025 Delridge Way SW, Suite 400 Seattle, WA 98106
Phone 206-763-2626 • Fax 206-763-2062 • bartelldrugs.com

PUBLIC WORKS DEPARTMENT
Solid Waste Division

www.kirklandwa.gov/recycle
(425) 587-3812
recycle@kirklandwa.gov

Attachment B

Environment Agency

Evidence

Life cycle assessment of supermarket carrier bags: a review of the bags available in 2006

Report: SC030148

The Environment Agency is the leading public body protecting and improving the environment in England and Wales.

It's our job to make sure that air, land and water are looked after by everyone in today's society, so that tomorrow's generations inherit a cleaner, healthier world.

Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

This report is the result of research commissioned and funded by the Environment Agency.

Published by:
Environment Agency, Horizon House, Deanery Road, Bristol, BS1 5AH

www.environment-agency.gov.uk

© Environment Agency

February 2011
ISBN: 978-1-84911-226-0

All rights reserved. This document may be reproduced with prior permission of the Environment Agency.

The views expressed in this document are not necessarily those of the Environment Agency.

This report is printed on Cyclus Print, a 100% recycled stock, which is 100% post consumer waste and is totally chlorine free. Water used is treated and in most cases returned to source in better condition than removed.

Further copies of this report are available from:
The Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708 506506.

Author(s):
Dr. Chris Edwards
Jonna Meyhoff Fry

Dissemination Status:
Publicly available

Keywords:
Carrier bags, life cycle assessment, LCA

Research Contractor:
Intertek Expert Services
Cleeve Road
Leatherhead, KT22 7SB

Tel 01372 370900

Environment Agency project manager:
Dr Joanna Marchant
Environment Agency
Kings Meadow House
Kings Meadow Road
Reading, RG 1 8DQ

Tel 0118 9535346
Product Code: SCHO0711BUAN-E-E

Evidence at the Environment Agency

Evidence underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us, helps us to develop tools and techniques to monitor and manage our environment as efficiently and effectively as possible. It also helps us to understand how the environment is changing and to identify what the future pressures may be.

The work of the Environment Agency's Evidence Directorate is a key ingredient in the partnership between research, guidance and operations that enables the Environment Agency to protect and restore our environment.

This report was produced by the Research, Monitoring and Innovation team within Evidence. The team focuses on four main areas of activity:

- **Setting the agenda**, by providing the evidence for decisions;
- **Maintaining scientific credibility**, by ensuring that our programmes and projects are fit for purpose and executed according to international standards;
- **Carrying out research**, either by contracting it out to research organisations and consultancies or by doing it ourselves;
- **Delivering information, advice, tools and techniques**, by making appropriate products available.

Miranda Kavanagh
Director of Evidence

Advisory Board

This project was informed and assisted by an Advisory Board set up by the Environment Agency.

Iris Anderson	Department of Energy and Climate Change (DECC)
Peter Askew	Department for Business, Innovation and skills (BIS)[1]
Jane Bickerstaffe	Industry Council for Packaging and the Environment (Incpen)
Terry Coleman (Chair)	Environment Agency
Jeff Cooper	Environment Agency[2]
Julia Faria	Local Environmental Quality Division, Department for Environment, Food and Rural Affairs (Defra)[2]
Bob Gordon	British Retail Consortium (BRC)[3]
Keith James	Waste & Resources Action Programme (WRAP)[4]
Marlene Jannink	Department for Business, Enterprise & Regulatory Reform (BERR)[5]
Charlotte Lee-Woolf	Sustainable Consumption and Production, Department for Environment, Food and Rural Affairs (Defra)[3]
Joanna Marchant	Environment Agency
Rob Mynard	Waste Strategy Division, Department for Environment, Food and Rural Affairs (Defra)[2]
Julie Osmond	Welsh Assembly Government[3]
Marc Owen	Waste Strategy, Department for Environment, Food and Rural Affairs (Defra)[3]
Gerry Newton-Cross	Environment Agency[6]
Julian Parfitt	Waste & Resources Action Programme (WRAP)[7]
Nigel Smith	British Retail Consortium (BRC)[2]

[1] From January 2007.
[2] Until April 2007.
[3] From December 2009.
[4] From December 2006.
[5] Until December 2006.
[6] Until April 2007.
[7] Until November 2006.

Stakeholder Consultation Group

In addition to the Advisory Board, a Stakeholder Consultation Group was set up to support the project. Membership of the Stakeholder Consultation Group was by invitation. The purpose of the Stakeholder Consultation Group was to provide a two-way communication platform.

Executive Summary

This study assesses the life cycle environmental impacts of the production, use and disposal of different carrier bags for the UK in 2006.

In recent years, the relative environmental impacts of lightweight carrier bags and other options has been debated. By the Spring of 2009[8] leading supermarkets had halved the number of single use carrier bags used. However, questions still remain about the environmental significance of lightweight carrier bags, especially with regard to the wider debate on global warming.

The report considers only the types of carrier available from UK supermarkets[9]. It does not examine personal bags nor carriers given out by other high street retailers. The report does not consider the introduction of a carrier bag tax, the effects of littering, the ability and willingness of consumers to change behaviour, any adverse impacts of degradable polymers in the recycling stream, nor the potential economic impacts on UK business.

The following types of carrier bag were studied:

- a conventional, lightweight carrier made from high-density polyethylene (HDPE);
- a lightweight HDPE carrier with a prodegradant additive designed to break the down the plastic into smaller pieces;
- a biodegradable carrier made from a starch-polyester (biopolymer) blend;
- a paper carrier;
- a “bag for life” made from low-density polyethylene (LDPE);
- a heavier more durable bag, often with stiffening inserts made from non woven polypropylene (PP); and
- a cotton bag.

These types of carrier bag are each designed for a different number of uses. Those intended to last longer need more resources in their production and are therefore likely to produce greater environmental impacts if compared on a bag for bag basis. To make the comparison fair, we considered the impacts from the number of bags required to carrying one month’s shopping in 2006/07.

We then calculated how many times each different type of carrier would have to be used to reduce its global warming potential to below that for conventional HDPE carrier bags where some 40 per cent were reused as bin liners. Finally the carriers were compared for other impacts: resource depletion, acidification, eutrophication, human toxicity, fresh water aquatic ecotoxicity, marine aquatic ecotoxicity, terrestrial ecotoxicity and photochemical oxidation (smog formation).

---

[8] Based on 2006 baseline figures.

[9] The study also included a paper carrier bag which are generally not available from UK supermarkets.

The study found that:

- The environmental impact of all types of carrier bag is dominated by resource use and production stages. Transport, secondary packaging and end-of-life management generally have a minimal influence on their performance.
- Whatever type of bag is used, the key to reducing the impacts is to reuse it as many times as possible and where reuse for shopping is not practicable, other reuse, e.g. to replace bin liners, is beneficial.
- The reuse of conventional HDPE and other lightweight carrier bags for shopping and/or as bin-liners is pivotal to their environmental performance and reuse as bin liners produces greater benefits than recycling bags.
- Starch-polyester blend bags have a higher global warming potential and abiotic depletion than conventional polymer bags, due both to the increased weight of material in a bag and higher material production impacts.
- The paper, LDPE, non-woven PP and cotton bags should be reused at least 3, 4, 11 and 131 times respectively to ensure that they have lower global warming potential than conventional HDPE carrier bags that are not reused. The number of times each would have to be reused when different proportions of conventional (HDPE) carrier bags are reused are shown in the table below.
- Recycling or composting generally produce only a small reduction in global warming potential and abiotic depletion.

Type of carrier	HDPE bag (No secondary reuse)	HDPE bag (40.3% reused as bin liners)	HDPE bag (100% reused as bin liners)	HDPE bag (Used 3 times)
Paper bag	3	4	7	9
LDPE bag	4	5	9	12
Non-woven PP bag	11	14	26	33
Cotton bag	131	173	327	393

The amount of primary use required to take reusable bags below the global warming potential of HDPE bags with and without secondary reuse

Contents

CONTENTS **6**

Abbreviations **10**

1 INTRODUCTION **11**

1.1 Project background **11**

1.2 The different types of carrier bags **11**
1.2.1 Supermarket carrier bags studied 12
1.2.2 Other options 13

2 GOAL DEFINITION **15**

2.1 Goal of the study **15**

2.2 Critical review **16**

2.3 Use of the study and target audience **16**

3 SCOPE **17**

3.1 Function of the product system and functional unit **17**

3.2 Reference flow **17**

3.3 System boundaries **18**
3.3.1 Excluded processes and cut-off criteria 21

3.4 Allocation and system expansion **22**

3.5 Data requirements and data quality **23**
3.5.1 Data requirements 23
3.5.2 Data quality 23

3.6 Modelling and calculation of inventories and impacts **24**

3.7 Impact assessment **24**

3.8 Sensitivity analysis **25**

3.9 Reporting **25**

4 INVENTORY ANALYSIS **26**

4.1 Extraction/production of raw materials **26**

4.2 Bag production processes 27

4.3 Transport 28

4.4 Reuse, recycling & end-of-life 30

5 IMPACT ASSESSMENT 32

5.1 Global warming potential 33

5.2 Other impact categories 35

6 SENSITIVITY ANALYSIS 46

6.1 Secondary use of lightweight bags 46

6.2 An increase in recycling and composting at end-of-life 48

6.3 Changing the impact assessment method employed 51

7 DISCUSSION 53

7.1 Comparison with other studies 53

7.2 Discussion of results 55

8 CONCLUSIONS 59

8.1 Conclusions related to individual carrier bags 59

8.2 General conclusions 60

9 REFERENCES 62

ANNEX A - A SUMMARY OF SELECTED LIFE CYCLE ASSESSMENTS OF CARRIER BAGS 62

ANNEX B - A STUDY OF CARRIER BAG WEIGHT, VOLUME AND ITEM CAPACITY 77

ANNEX C - DESCRIPTION OF INVENTORY DATA 85

ANNEX D - DESCRIPTION OF IMPACT CATEGORIES 102

ANNEX E – PEER REVIEW COMMENTS 105

Abbreviations

BRC	British Retail Consortium
DEFRA	Department for the Environment, Food and Rural Affairs
GWP	Global Warming Potential
HDPE	High density polyethylene
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LCA	Life cycle assessment
LCI	Life cycle inventory
LCIA	Life cycle impact assessment
LDPE	Low density polyethylene
LLDPE	Linear low density polyethylene
PA	Polyamide
PE	Polyethylene
PET	Polyethylene terephthalate
PLA	Polylactic Acid
PP	Polypropylene
PVC	Polyvinyl chloride
EfW	Energy from Waste
WRAP	Waste and Resources Action Programme
WRATE	Waste and Resources Assessment Tool for the Environment

1 Introduction

1.1 Project background

This study was commissioned by the Environment Agency and assesses the life cycle environmental impacts of the production, use and disposal of different carrier bags for the UK in 2006.

In 2008, approximately 10 billion lightweight carrier bags were given away in the UK which equates to around 10 bags a week per household (DEFRA 2009). In recent years, a debate about the relative environmental impacts of these lightweight carrier bags and their alternatives has emerged. This debate has arisen due to a combination of public, media and legislative pressure to reduce the environmental and social impacts of food packaging. In response the UK government, the British Retail Consortium (BRC) and leading supermarkets agreed to cut the number of single use carrier bags used by 50% by the spring of 2009 based on 2006 baseline figures. In July 2009, the Waste and Resources Action Programme (WRAP) announced that this initiative had achieved a reduction of 48% across the UK (WRAP 2009). However, lightweight carrier bags are still seen as an important media and legislative issue and questions still remain on their environmental significance, especially to the wider debate on global warming.

Life Cycle Assessment (LCA) is a standard method for comparing the environmental impacts of providing, using and disposing of a product or providing a service throughout its life cycle (ISO 2006). In other words, LCA identifies the material and energy usage, emissions and waste flows of a product, process or service over its entire life cycle to determine its environmental performance.

Previous studies in several countries have looked at the environmental impacts of different carrier bag options. Their findings are interesting but are not directly applicable to the UK because of their geographical coverage and the assumptions made about the use and disposal of carrier bags by consumers.

This report considers only carriers available from UK supermarkets. It does not examine personal bags nor carriers given out by other high street retailers. The report does not consider the consequences of introducing a carrier bag tax, the effects of littering, the ability to and willingness of consumers to change behaviour, any adverse impacts of degradable polymers in the recycling stream, nor the potential economic impacts on UK industry.

New types of bags have been introduced since the data was collected for this study and these may have different environmental performance.

1.2 The different types of carrier bags

The main function of a carrier bag is to carry groceries and goods from the shop to the home. The bag therefore needs to be robust enough to hold a certain quantity of shopping, but at the same time provide a convenient option for the consumer to carry or transport the shopping home. The scope and findings of recent LCA studies of carrier bags are summarised in Annex A.

1.2.1 Supermarket carrier bags studied

Supermarket carrier bags used in the UK have generally been categorised as disposable (i.e. single use) or reusable. However, these descriptions are increasingly becoming blurred as 'disposable' plastic carrier bags are now encouraged to be reused both as carrier bags (primary reuse) and also to replace other products such as bin liners (secondary reuse).

Most UK supermarkets offer several types of carrier bag, generally including a conventional, lightweight, HDPE[9] carrier bag (often termed disposable) and a heavy duty LDPE[10] plastic bag often referred to as a 'bag for life'. These carrier bags vary in terms of weight, capacity and recycled content. Supermarkets now also offer other, more durable, carrier bags, generally made from woven, natural fibres, such as hemp or cotton. Carrier bags recorded as being used in the main UK supermarkets and included in this study are shown in Table 1.1 and are described below. Several of these were not available in UK supermarkets during the reference period of the study but were included because of their potential future use.

Conventional High-density polyethylene (HDPE) bags
This is the lightweight, plastic, carrier bag used in almost all UK supermarkets and often provided free of charge. It is a vest-shaped bag and has the advantage of being thin-gauged and lightweight. It has been termed "disposable" and "single use"

High-density polyethylene (HDPE) bags with a prodegradant additive
This type of lightweight, plastic, carrier bag is made from HDPE with a prodegradant additive that accelerates the degradation process. These polymers undergo accelerated oxidative degradation initiated by natural daylight, heat and/or mechanical stress, and embrittle in the environment and erode under the influence of weathering. The bag looks like the conventional HDPE bag being vest-shaped and thin-gauged.

Low-density polyethylene (LDPE) bags
These are thick-gauged or heavy duty plastic bags, commonly known as 'bags-for-life', and are available in most UK supermarkets. The initial bag must be purchased from the retailer but can be replaced free of charge when returned. The old bags are recycled by the retailer.

Non-woven polypropylene (PP) bags
This type of bag is made from spunbonded non-woven polypropylene. The non-woven PP bag is stronger and more durable than a bag for life and is intended to be reused many times. To provide stability to the base of the bag, the bag comes with a semi-rigid insert.

Cotton bags
This type of bag is woven from cotton, often calico, an unbleached cotton with less processing, and is designed to be reused many times.

[9] HDPE is high density polyethylene.
[10] LDPE is low density polyethylene.

Table 1.1 Carrier bag types used in UK supermarkets included in this study.

Bag type	Picture example	Weight* [g]	Volume capacity* [litres]
Conventional HDPE bag		**7.5 – 12.6**	**17.9 – 21.8**
HDPE with prodegradant additive		**5.9 – 8.2**	**16 – 19.6**
Heavy duty LDPE bag ('bag for life')		**27.5 – 42.5**	**19.1 – 23.9**
Non-woven PP bag		**107.6 - 124.1**	**17.7 – 21.8**
Paper bag		**55.2**	**20.1**
Biopolymer bag		**15.8**	**18.3**
Cotton bag		**78.7 – 229.1**	**17 – 33.4**

* Some supermarkets have supplied data, others are based on measurements by the authors (see annex B).

Paper bags
These are generally no longer used in UK supermarkets, although they are available from other retail shops. The paper bag was in effect the first "disposable" carrier bag, but was superseded in the 1970s by plastic carrier bags which were seen as the perfect alternative, as they did not tear when wet.

Biopolymer bags
Biopolymer carrier bags are a relatively recent development. They are only available in a few UK supermarkets. The biopolymers are usually composed of either polylactic acid (PLA), made from the polymerisation of lactic acids derived from plant-based starch, or starch polyester blends, which combine starch made from renewable sources such as corn, potato, tapioca or wheat with polyesters manufactured from hydrocarbons (Murphy *et al* 2008). These biodegradable polymers decompose to carbon dioxide, methane, water, inorganic compounds or biomass (Nolan-ITU 2003).

1.2.2 Other options

There are several other types of carrier, none of which have been considered in this study. These include woven polypropylene bags, jute or hemp bags and plastic boxes. Figure 1.1 below shows some examples.

Figure 1.1 Examples of a vacuum formed box, a woven PP bag, a hemp bag, and a jute bag.

Polypropylene (PP) vacuum formed boxes
An alternative to the carrier bag is a rigid box made from vacuum formed polypropylene with separate detachable rigid handles. This is used by one supermarket in store but by many for home deliveries. It is intended to be reused many times.

Woven polypropylene (PP) bags
This type of bag is produced from woven polypropylene "fibres". Similarly to the non-woven PP and LDPE bags, it is strong and durable and intended to be reused many times. To provide stability to the base of the bag, the bag comes with a semi-rigid insert.

Jute bags
Jute bags are made from jute fibres spun into coarse strong strands making a strong and durable carrier bag. The jute bag is intended to be reused many times.

2 Goal definition

The international standard on lifecycle assessment ISO 14040 (ISO 2006) requires that the goal of an LCA study states the intended application, the reasons for carrying out the study, the intended audience, and whether the results are intended to be used in comparative assertions intended to be disclosed to the public.

2.1 Goal of the study

The goal of this study is to assess the potential life cycle environmental impacts of various current and potential supermarket carrier bags in the UK.

The goal of the study has been split into the following objectives:

- To compile a detailed life cycle inventory of the environmental burdens associated with the production, use and disposal of lightweight plastic carrier bags and three to five other options;
- To use the life cycle inventory data to compare the environmental impacts arising from lightweight plastic carrier bags and the alternatives under the various scenarios considered; and
- To compare the results of this study with other key life cycle studies in this area and identify the main reasons for any significant differences.

The types of carrier bag studied were agreed by the project board, based partly on the market representation in supermarkets, and partly on new materials that were receiving increased attention. A carrier bag is defined in this study as a bag with a capacity of over 15 litres, that could be used at a supermarket checkout. Therefore, this does not include other bags available in supermarkets such as ‘deli’ bags.

The following types of carrier bag were studied:

- conventional high-density polyethylene (HDPE);
- high-density polyethylene (HDPE) with a prodegradant additive;
- starch-polyester (biopolymer) blend;
- paper;
- low-density polyethylene (LDPE);
- non woven polypropylene (PP); and
- cotton.

2.2 Critical review

The study has been critically reviewed in accordance with ISO 14040. The review panel consisted of:

- Mark Goedkoop (chairman), PRé Consultants, Amersfoort, the Netherlands.
- Keith Elstob (co-reviewer), Bunzl Retail, Manchester.
- Jane Bickerstaffe (co-reviewer), INCPEN, Reading.

The chairman of the review panel has been involved in the project from the start by reviewing and commenting on the goal and scope. The co-reviewers were involved at the end of the project. The panel's report as well as the consultants' responses to the reviewers' comments are included in Annex E.

In addition to the critical review, the project was also followed by a Project Advisory Board and a Stakeholder Consultation Group. Membership of both groups was by invitation. The members of the board and the stakeholder group were kept informed about the project at regular intervals and were invited to comment and provide information.

2.3 Use of the study and target audience

The results of this life cycle study are intended to provide an independent, unbiased, objective assessment of the environmental impacts of various carrier bags. It should provide evidence for government and supermarkets in devising policies to reduce the environmental impacts of carrier bags. The study also provides a potential baseline to measure the degree of success by supermarkets in reducing the environmental impacts of supermarket carriers.

The target audience for the report is:

- Interested parties such as supermarkets and other retailers, environmental organisations, consumer organisations as well as consumers themselves.
- Public authorities, in particular the Department for Environment, Food and Rural Affairs (DEFRA) responsible for national, environmental policy in England, the Welsh Assembly Government (WAG) who have parallel responsibilities for Wales and WRAP, the Waste and Resources Action Programme.

3 Scope

3.1 Function of the product system and functional unit

A comparison of life cycle environmental impacts should be based on a comparable function (or 'functional unit') to allow a fair comparison of the results. The carrier bags studied are of different volumes, weights and qualities. The Environment Agency commissioned a survey[11] which found that, over a 4 weeks period, supermarket shoppers purchased an average of 446 items. The functional unit has therefore been defined as:

Carrying one month's shopping (483 items) from the supermarket to the home in the UK in 2006/07.

3.2 Reference flow

The reference flow is the number of carrier bags required to fulfil the functional unit (as described in section 3.1). This depends on the volume of the bag, its strength and consumer behaviour when filling and using the bags. Consumer behaviour determines how many items are put into each bag, the number of times a bag is reused (primary reuse), whether the bag is subsequently used to perform an alternative function (secondary reuse), and in part the way they are managed as waste.

The primary[12] reuse of carrier bags was excluded from the reference flow due to a lack of independent data available on the reuse of each type of bag. However, as several types are designed to be reused, we have calculated the primary reuse required to reduce the global warming potential of each reusable bag to below that of the conventional, lightweight HDPE bag The inclusion of primary reuse is detailed in section 3.7

The number of bags required to carry one month's shopping (483 items) depends whether weight or volume is the limiting factor in carrier bag use, Pira International compared the volume and weight capacity of several carrier bags (detailed in Annex B). We found that the weight capacity of the bags studied was 18 to 19 kg., which is more than an average person can carry. Therefore, volume was selected as the limiting factor for bag use. The average volume of a conventional lightweight (HDPE) carrier bag was 19.1 litres and the average volume of a "bag for life" (LDPE) carrier bag was 21.5 litres.

The consumer survey commissioned by the Environment Agency[13] provided data on the number of items purchased and the number of bags required to carry those items. All the major supermarkets co-operated with the survey which showed that shoppers put an

[11] Based on a 2007 survey by TNS Market Research specialists
[12] *Primary* reuse in this study means reuse for the original purpose – to carry shopping from the supermarkrt to the home. This is distinct from *secondary* reuse which here meansd reuse to replace another product, e.g. a bin liner.
[13] *ibid*

average 5.88 items in the conventional HDPE carrier bag and an average 7.96 items into the heavy duty LDPE carrier bag

The average weight, volume and item capacity for each carrier bag type included in this study was then calculated. The material weights of the HDPE prodegradant and starch-polyester bags were adjusted pro-rata to match the average volume of the conventional lightweight HDPE bag (19.1 litres carrying 5.88 items). For the paper, LDPE, non-woven PP and cotton bags, the item capacities were adjusted according to their volumes.

These revised bag capacities were then used to calculate the reference flow[14] for each type of bag as shown in table 3.1. The initial reference flows shown do not include any primary reuse of carrier bags.

Table 3.1 The assumed volume, weight, items per bag and required reference flow for each carrier bag (excluding primary reuse).

Bag type	Volume per bag (litres)	Weight per bag (g)	Items per bag	Refflow – No. bags
Conventional high-density polyethylene (HDPE) bag	19.1	8.12	5.88	82.14
High-density polyethylene (HDPE) bag with a prodegradant additive	19.1	8.27	5.88	82.14
Starch-polyester blend bag	19.1	16.49	5.88	82.14
Paper bag	20.1	55.20	7.43	64.98
Low-density polyethylene (LDPE) bag	21.52	34.94	7.96	60.68
Non-woven polypropylene (PP) bag	19.75	115.83	7.30	66.13
Cotton bag	28.65	183.11	10.59	45.59

Supermarket policies and consumer behaviour have changed since the reference period (2006/07) but there is no evidence to suggest the capacities of HDPE and LDPE bags have changed significantly. However, while data used for starch polyester blend bags were provided by the manufacturer, since the reference period the weight of some of these bags may have been reduced and the effect of this is discussed in section 7.2

3.3 System boundaries

The study is a ‘cradle to grave’ life cycle assessment. Therefore, the carrier bag systems investigated include all significant life cycle stages from raw material extraction, through manufacture, distribution use and reuse to the final management of the carrier bag as waste. The system boundaries are defined so that all inputs and outputs from the system

[14] The reference flow is the number of each type of bag required to fulfil the functional unit (483 items of shopping in one month).

are either elemental flows[15] or materials or energy entering another product life cycle through recycling or energy recovery respectively. Therefore, the study quantifies all energy and materials used, traced back to the extraction of resources, and the emissions from each life cycle stage, including waste management. Recycled content and recycling and composting at end-of-life were excluded from the system boundaries. This was due to the large proportion of bags that contained no recycled content and the wide variation in the amount of bag recycling and composting. The recycled content in carrier bags has increased since the reference period and therefore the results of this study may be worse than the current practice. The inclusion of recycling and composting at end-of-life is considered during the sensitivity analysis. Figure 3.1 shows a simple flow diagram which defines the system boundaries for the study.

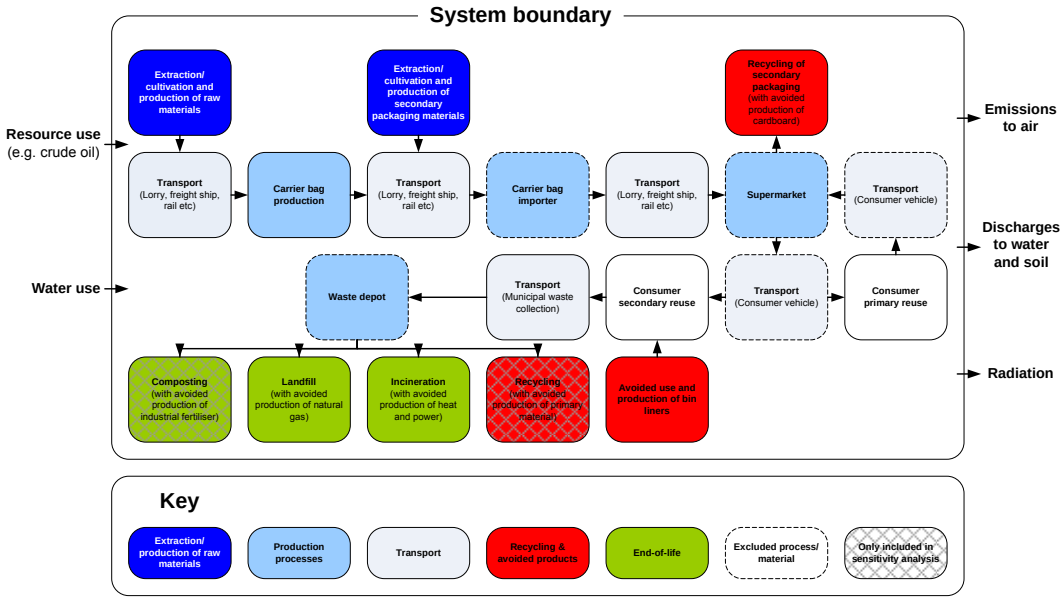


Figure 3.1 System boundaries applied in this study (simplified flow diagram).

The study includes the following life cycle stages:

Extraction/production of raw materials

The extraction of resources, as well as any forestry, agriculture and the processing of resources to produce materials such as HDPE, LDPE, PP, paper, cotton and starch-polyester blend included in the study. The study covers material and energy resources, emissions and waste. Where production data were not available, flows were estimated from similar products.

Packaging

Primary packaging is included. Some secondary packaging (used for the distribution of the bags from the importer to the supermarket distribution centre) has been excluded due to consignments generally being a mix of different supplies depending on the needs of the supermarket. Pallets have also been excluded due to lack of precise data about

[15] An elemental flow is material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation (ISO 14040).

their material and reuse rates. However, due to their high reuse, this is not considered to have any significant effect on the results.

Bag production processes
The conversion of the raw materials into carrier bags is included in the study.

Transport
The transport of materials from their producer to the carrier bag manufacturer, and the distribution of the finished carrier bag from the manufacturer to the importer and then to supermarket is included. Transportation by a municipal waste collection vehicle to a waste management facility has also been included.

End-of-life
The management of wastes is included in the study. The choice of end-of-life process reflects the realistic options for each type of bag. The options considered for each bag are shown in table 3.2. Recycling and composting are considered in the sensitivity analysis. The recycling of cotton bags has not been included as no evidence was found to support this. The recycling of HDPE bags with a prodegradant additive has also been excluded due to their negative impact on the quality of recycled HDPE.

Table 3.2 End-of-life processes considered for the different carrier bags investigated.

Bag type	Landfill	Incineration	Mechanical recycling	Composting
Conventional high-density polyethylene (HDPE) bag	✓	✓	✓	
High-density polyethylene (HDPE) bag with a prodegradant additive	✓	✓		
Starch-polyester blend bag	✓	✓		✓
Paper bag	✓	✓	✓	✓
Low-density polyethylene (LDPE) bag	✓	✓	✓	
Non-woven polypropylene (PP) bag	✓	✓	✓	
Cotton bag	✓	✓		

Recycling, reuse & avoided products
Composting at the end of life has been excluded from the system boundaries. The expansion of the system boundaries of the study to include avoided products (described in section 3.4) has been used to model both recycling and secondary reuse. If a material is recycled or reused in another application it can avoid the production of virgin materials. Therefore the benefit of this process is shown by subtracting from the lifecycle inventory the burdens associated with the amount of this product that is avoided by that recycling or reuse.

Avoided products have been included for materials that are recycled during production. Recycling and composting at end-of-life has been included in the sensitivity analysis. It has

also been assumed that 40 per cent of the lightweight carrier bags (i.e. the HDPE, HDPE prodegradant and starch-polyester bags) are reused in secondary applications as bin liners and therefore avoids their production. Paper bags were assumed not to be reused as bin liners, as there was no evidence that they could successfully be reused for this purpose.

During the reference period of the study there was no evidence of paper carrier bag use in the main UK supermarkets but we have included them because of interest in their use as a “green” alternative to conventional HDPE carrier bags.

The primary reuse of paper carrier bags was considered alongside other bags such as LDPE, non-woven PP and cotton that are regularly reused to carry shopping. However, the inclusion of reuse for paper carrier bags is intended to illustrate how many times a paper carrier bag would have to be reused to perform better than other bags, it is not a statement that this reuse occurs or that it is feasible. In fact information related to primary reuse for paper bags in the Republic of Ireland indicates that supermarket paper carriers are not reused for shopping[16].. When the primary reuse of any carriers as shopping bags has been included in the study, the required reference flow (as described in section 3.2) has correspondingly reduced.

The primary and secondary data used to model the systems considered in this study are further described in Chapter 4.

3.3.1 Excluded processes and cut-off criteria

Certain elements of the lifecycle have been excluded to ensure the scope of the study remains feasible, although no specific cut-off criteria have been applied. The following materials and processes have been excluded:

Inks and dyes
These materials are used to print the design/brand on each carrier and have been excluded from the study due to a lack of information about the inks and dyes used and the small quantities required.

Retail storage of the carrier bags
Any environmental impacts associated with storage activities at the bag importers and supermarkets have been excluded.

Transport from the supermarket to the consumer
Consumer transportation to and from the supermarket with the carrier bags has been excluded from the study, because the weight of a carrier bag would have little or no effect on vehicle emissions and fuel efficiency.

Capital equipment

[16] Personal communication from Marks & Spencer plc to the Environment Agency showing an increase in the number of carrier bags used in M&S in Ireland when HDPE carrier bags were replaced by paper bags.

The environmental impacts linked with the construction and demolition of buildings and the manufacture of machines, equipment and vehicles should in effect be depreciated over the whole of their period of use. These annualised impacts are negligible when compared to the operational burden. Therefore, the construction, maintenance and demolition of industrial buildings and the manufacture of machines, equipment and vehicles have been excluded from the primary data used in this study.

3.4 Allocation and system expansion

Product life cycle systems occasionally yield other products or services as well as the functional unit. The international standard ISO 14044 (ISO, 2006) gives a stepwise procedure for the allocation of material and energy flows as well as environmental releases when this occurs. Allocation should preferably be avoided either through an increase in system detail or through system expansion, where the product system is credited with the avoided burdens delivered by its co-products. Where the system is not expanded, mass should be used to allocate the burdens of shared processes and materials to the product and co-products.

We have used system expansion to show the potential benefits of secondary reuse, recycling, landfill and incineration in this study. System expansion is therefore used for the following processes:

- The avoided production of primary materials when HDPE based materials, LDPE, PP, cardboard and paper are recycled.
- The avoided production of any energy produced from incinerating or landfilling any of the carrier bags.
- The avoided production of bin liners when lightweight carrier bags (i.e. HDPE, HDPE prodegradant and starch polyester bags) are reused in other applications.

We have assumed the recycling of material waste from production and at end-of-life avoids the use of virgin material, which is subtracted from the system. We have also assumed that the avoided material is the same as the input material, although in practice this is not always the case. For example, Schmidt and Strömberg (2006) state that demand and not supply determines the recycling rate of plastics. Therefore, due to the oversupply of post-consumer plastics, recycled material is used in low grade applications which avoid the use of other materials such as wood or concrete. The amount of avoided material included is dependent on performance loss from the recycling process, which is detailed in section 4.5. In the case of post-consumer plastic recycling, the performance loss is greater than post industrial recycling and this is reflected in the study.

Due to the lack of reliable data on recycled content and because of the use of the avoided burden approach to recycling, no recycled content was included in any of the bag types to avoid the double counting of recycling benefits. Although some bags contained recycled content during the reference period, this was not a significant proportion of the carrier bag market.

The generation of electricity from both landfill and incineration are accounted for through the avoided production of grid electricity. None of the bags considered were produced using UK grid electricity and therefore no double counting of the energy benefits of incineration or landfill occurred.

The avoided production of bin liners was also used to reflect the benefits that result from secondary reuse. It was assumed that 40 per cent of the lightweight carrier bags (i.e. the HDPE, HDPE prodegradant and starch-polyester bags) are reused as bin liners and therefore avoid their production and disposal.

In some cases where secondary data are used, allocation has been applied and these are highlighted in the text.

3.5 Data requirements and data quality

3.5.1 Data requirements

A detailed product LCA requires primary data on the materials, energy, waste and emissions specific to the production, use and disposal of the product. The primary data used in this project include the material types and weights to produce carrier bags and primary packaging, the production of carrier bags, transport modes and distances and waste management operations. Secondary data were used for the production of raw materials and waste process emissions (where specific data were not available), electricity generation, fuel production, vehicle emissions and other more minor processes. The data used in this study are described in Chapter 4 and Annex C.

3.5.2 Data quality

Data sources
Most data used in this study are from ecoinvent™ v2. Any other sources are described in the text.

Geographical coverage
The goal of this study is to assess the life cycle environmental impacts of carrier bags used in the UK. In most cases carrier bags are imported from Asia: conventional HDPE, HDPE prodegradant, LDPE and PP bags are produced in China, Indonesia, Malaysia or Turkey. The production of polymers for these bags normally occurs in the same region. However, no datasets were identified for Asia-specific polymer production and European average data have been used instead for all plastic carrier bag systems by adapting the electricity production to the country of origin. However, the amount of electricity used and the efficiency of these production processes is still based on European data.

The paper fibres and the paper bags are assumed to be produced in Europe, due to the high cost of importation from further afield. These are modelled using a European average dataset for paper production. The material used for the biopolymer bags is produced in Italy. The majority of the conversion of biopolymer material into carrier bags

takes place in Norway, and the data used also reflect this. Data for cotton grown conventionally[17] in China have been used for the production of cotton. This is considered appropriate as most cotton bags available in supermarkets are generally produced in China, India or other Far East countries.

Data used to model transportation methods are based on European transport efficiencies.

Time-related coverage
At the start of the project a time-related coverage of the year 2005/2006 was set for core datasets and assumptions and a reference period of 10 years for literature datasets.

The literature datasets covering polymer production date from the late 1990s to the early part of this decade. The dataset for Kraft paper production represents the production processes in 2003. The dataset for starch-polyester blend production represent the production processes in 2006. The dataset for cotton represents the period from 2000 to 2005. The datasets used for the production of carrier bags are from 2003 to 2006.

The datasets for transport are representative of the year 2005 for road transport and 2000 for all other forms of transport. The datasets for energy generation represent the period 2004/2005. The datasets for recycling, composting, landfill and incineration have been taken from the WRATE© database and are representative of the current UK waste management options, generally for the period 2003 to 2006.

Technology coverage
The specific data collected for this study reflect current process configurations, operation and performance. The generic data used reflect process configurations, operation and performance at the time of data collection. However, much of the generic data used represent European rather than region-specific technologies.

3.6 Modelling and calculation of inventories and impacts

For the modelling, generation of inventories and calculation of environmental impacts the LCA software tools SimaPro and WRATE© have been used. SimaPro is a software tool specifically designed for LCA (SimaPro 2009). WRATE (Waste and Resources Assessment Tool for the Environment) is a software tool designed for the life cycle assessment of waste management options (WRATE 2009).

3.7 Impact assessment

The impact assessment is divided into two stages:

1. In the first stage we used the IPCC 2007 characterisation factors over a 100 year time horizon (IPCC, 2007) to calculate the global warming potential (GWP) for each carrier bag without any primary reuse, but including secondary reuse as bin

[17] That is, not organically grown

liners for lightweight bags. The IPCC method used excludes the impact of biogenic carbon dioxide. Therefore, a zero characterisation factor is assigned to the GWP of biogenic carbon dioxide and carbon dioxide absorbed from the air.

The GWP of the conventional HDPE bag was then used as a baseline and the number of times each heavy duty bag would have to be used for their respective GWPs to drop below this baseline was calculated.

2. For the second stage we used the CML 2 baseline 2000 method (CML, 2001) to calculate the following environmental impact categories:

   - Depletion of abiotic resources
   - Photo-oxidant formation;
   - Eutrophication;
   - Acidification;
   - Human toxicity; and
   - Aquatic and terrestrial toxicity.

The impact categories included are further described in Annex D.

3.8 Sensitivity analysis

A sensitivity analysis allows key variables and assumptions to be changed to test their influence on the results of the impact assessment. We assessed:

- Changing the secondary reuse of the bags;
- an increase in recycling and composting at end-of-life and;
- Using a different impact assessment method.

3.9 Reporting

This report fulfils the requirements of the ISO standard for a third party report supporting comparative assertions intended for publication.

4 Inventory analysis

The following sections outline the data and assumptions used to model the materials, production, transport and end-of-life of the carrier bags considered. Unless otherwise stated, inventory data were taken from the ecoinvent™ database version 2. The lifecycles of each carrier bag system are described in Annex C together with a detailed description of the secondary data used.

4.1 Extraction/production of raw materials

The weight and raw material composition of carrier bags vary depending on the requirements set by the supermarkets and the processing methods used by the producer. The bag weight used here for each carrier bag type is an average based on individual supermarket bag weights and market share (see Annex B) and table 4.1.

Table 4.1 The assumed volume, weight, items per bag and required reference flow for each carrier bag.

Bag type	Volume per bag (litres)	Weight per bag (g)
Conventional high-density polyethylene (HDPE) bag	19.1	8.12
High-density polyethylene (HDPE) bag with a prodegradant additive	19.1	8.27
Starch-polyester blend bag	19.1	16.49
Paper bag	20.1	55.20
Low-density polyethylene (LDPE) bag	21.52	34.94
Non-woven polypropylene (PP) bag	19.75	115.83
Cotton bag	28.65	183.11

The materials used for each carrier bag and its packaging are detailed in Annex C. The material composition of all oil-based polymer bags is based on a combination of data provided by the bag producers and estimates provided by Bunzl Retail[18]. The material composition of the paper bag is based on CEPI Eurokraft & Eurosac data for paper sacks (Weström & Löfgren 2005). The material composition of the starch-polyester blend bag is based on data provided by the bag producer. Inventory data for the starch-polyester blend was collected and compiled by technical experts from the manufacturers, Novamont S.p.A.

[18] Bunzl plc is a multinational distribution and outsourcing business. Bunzl Retail, a division of Bunzl plc, is one of the largest suppliers of carrier bags to the UK.

Several substitute materials were also used when existing data on bag materials were not available. For example, limestone data were substituted for those of chalk and the prodegradant additive was assumed to be cobalt stearate with the impacts of 10 per cent cobalt and 90 per cent stearic acid.

Carrier bags are generally supplied in corrugated boxes or, for conventional HDPE bags, in either corrugated boxes or vacuum packed film. It was estimated that approximately 50 per cent of conventional HDPE bags are supplied in corrugated boxes and 50 per cent in vacuum packed film (Elstob 2007). The film is assumed to be composed of two-thirds polyethylene (PE) and one third polyamide (PA). The weights of the corrugated boxes reported by bag producers fluctuated widely, with some producers reporting the box to be heavier than its content. Consequently, we have estimated the weight of corrugated packaging based on discussions with Bunzl Retail and Simpac (Elstob 2007 and Young 2006). For the starch-polyester blend bag, the corrugated box weight reported by the producer was used, although this was heavier than conventional carrier bag packaging.

4.2 Bag production processes

All plastic bags are produced from plastic melt. This is generally blown and sealed to form a bag, except for the non-woven PP bag which is produced from a molten filament using a spun bonded process. The energy demand for these processes is mainly met by grid electricity and this energy consumption depends on the polymer type, density, production equipment and capacity. The energy consumption and waste generated by the production of 1000 bags is shown in table 4.2.

Based on conversations with industry experts we have estimated that 90 per cent of LDPE bags are produced in Turkey and Germany and 10 per cent in China and Malaysia (Elstob 2007) and that all conventional HDPE, HDPE prodegradant and PP bags are imported from the Far East. Therefore, data on conversion of HDPE, HDPE prodegradant, PP and LDPE into carrier bags was provided by bag producers in China and Turkey and modelled based on production in these locations. Data on the production of starch-polyester blend into carrier bags was provided by a bag producer in Norway. All grid electricity use was modelled according to the relevant country (China, Turkey and Norway).

The heat used to produce the LDPE bags was assumed to be generated by natural gas in a non-modulating boiler. The heat used to produce the PP bags was assumed to be generated from burning heavy fuel oil in an industrial furnace based on supplier information. Waste generated during the production of the HDPE, HDPE prodegradant, starch-polyester, LDPE and PP bags is recycled and was in most cases based on data from bag producers. The modelling of the recycling process is discussed in section 4.5. None of the cotton bag producers contacted provided any data on cotton bag production and data on conversion of cotton fabric into carrier bags were estimated. We assumed that the bags were produced in China, using electric sewing machines, and the electricity use was therefore based on previous projects (ERM 2009) and was modelled using Ecoinvent data. All production waste was assumed to be landfilled.

Table 4.2 Energy consumption and waste generation for film and cotton bags (per 1000 bags)

Bag type	Electricity	Heat (from natural gas)	Heat (from heavy fuel oil)	Waste
Conventional high-density polyethylene (HDPE) bag	6.151 kWh (22.144 MJ) (0.758 kWh/kg)			418.4 g
High-density polyethylene (HDPE) bag with a prodegradant additive	6.392 kWh (23.011 MJ) (0.773 kWh/kg)			426.1 g
Starch-polyester blend bag	17.24 kWh (62.064 MJ) (1.045 kWh/kg)			94.8 g
Low-density polyethylene (LDPE) bag	32.58 kWh (117.288 MJ) (0.932 kWh/kg)	13.953 kWh (50.23 MJ) (0.399 kWh/kg)		171.2 g*
Non-woven polypropylene (PP) bag			87.75 kWh (315.9 MJ) (0.758 kWh/kg)	5,850 g
Cotton bag	11 kWh (39.6 MJ) (0.06 kWh/kg) *			1,800 g*

Data used for the conversion of Kraft paper into carrier bags were part of paper sack inventory data published by CEPI Eurokraft and Eurosac (Weström & Löfgren 2005). The data for the production of Kraft paper and the production of paper sacks were aggregated and could not be separated.

4.3 Transport

The transport of raw materials to each bag production site and the delivery of the finished bag from those sites to the UK supermarkets are shown in tables 4.3 and 4.4.

Transport distances were based on estimated production locations from industry experts (Elstob 2007). More than 98 per cent of HDPE and PP bags imported into the UK are produced in Far East countries such as China, Indonesia and Malaysia. Approximately 90 per cent of LDPE bags are produced in Turkey and Germany with the remainder being produced in the Far East. For this study, we assumed that all HDPE and PP bags were produced in the Far East and 90 per cent of the LDPE bags were produced in Turkey and the remainder in China. Transportation by lorry was based on a 16-32 tonne vehicle.

* These figures are based on industry estimates due to lack of data.

Table 4.3 The transport scenarios for carrier bags.

Bag type	From	To	Transport modes	Distance
Conventional high-density polyethylene (HDPE) bag	Polymer resin producer in Far East	Bag producer in Far East	Lorry Sea freight	100 km 500 km
	Titanium oxide and chalk producer in Far East	Bag producer in Far East	Lorry Sea freight	200 km 500 km
	Bag producer in Far East	Bag importer in UK	Lorry Sea freight Rail	100 km 15,000 km 280 km
	Bag importer	Supermarket	Lorry	200 km
High-density polyethylene (HDPE) bag with a prodegradant additive	Polymer resin producer in Far East	Bag producer in Far East	Lorry Sea freight	65 km 500 km
	Titanium oxide and chalk producer in Far East	Bag producer in Far East	Lorry Sea freight	200 km 500 km
	Bag producer in Far East	Bag importer in UK	Lorry Sea freight Rail	100 km 15,000 km 280 km
	Bag importer	Supermarket	Lorry	200 km
Starch-polyester blend bag	Polymer resin producer in Italy	Bag producer in Norway	Lorry	3,500 km
	Titanium oxide producer in Europe	Bag producer in Norway	Lorry	200 km
	Bag producer in Norway	Bag importer in UK	Lorry Sea freight Rail	100 km 1,200 km 200 km
	Bag importer	Supermarket	Lorry	200 km

Bag type	From	To	Transport modes	Distance
Paper bag	Bag producer in Europe	Bag importer in UK	Lorry	1,000 km
	Bag importer	Supermarket	Lorry	200 km
Low-density polyethylene (LDPE) bag	Polymer resin producer in Europe	Bag producer in Turkey	Lorry	300 km
	Bag producer in Turkey	Bag importer in UK	Sea freight Rail	5,000 km 280 km
	Polymer resin producer in Far East	Bag producer in Far East	Lorry Sea freight	100 km 500 km
	Titanium oxide producer in Far East	Bag producer in Far East	Lorry Sea freight	200 km 500 km
	Bag producer in Far East	Bag importer in UK	Lorry Sea freight Rail	100 km 15,000 km 280 km

	Bag importer	Supermarket	Lorry	200 km
Non-woven polypropylene (PP) bag	Polymer resin producer in Far East	Bag producer in Far East	Lorry	100 km
	Bag producer in Far East	Bag importer in UK	Lorry Sea freight Rail	100 km 15,000 km 280 km
	Bag importer	Supermarket	Lorry	200 km
Cotton bag	Textile producer in China	Bag producer in China	Lorry	100 km
	Bag producer in China	Bag importer in UK	Lorry Sea freight Lorry	100 km 15,000 km 280 km
	Bag importer	Supermarket	Lorry	200 km

4.4 Reuse, recycling & end-of-life

The secondary use of lightweight plastic carrier bags (i.e. the conventional HDPE bag, the prodegradant HDPE bag and the starch-polyester bag) was modelled using the avoided production of bin liners. A study on lightweight carrier bag usage (WRAP 2005) found that 59 per cent of respondents reused all carrier bags, 16 per cent reused most of them, 7 per cent reused around half of them and 7 per cent reused some of them. Overall it was estimated that 76 per cent of single use carrier bags were reused. The study also asked respondents how they reused carrier bags and found that 53 per cent of respondents said that they used carrier bags as a replacement for kitchen bin liners, as shown in table 4.5.

Table 4.5 The reuse of lightweight carrier bags (WRAP 2005).

Reuse applications	Percentage of respondents that reuse single use carrier bags in each application
Use as a bin liner in kitchen	53%
Use as a bin liner in other rooms	26%
Put rubbish into it then throw it away	43%
For dog / cat / pet mess	11%
Garden refuse	1%
Reuse for supermarket shopping	8%
Reuse for other shopping	10%
To store things at home	14%
For packed lunches	8%
Carry other things in when going out	4%
Put football / Wellington boots in	1%
Give to charity shops	1%
Keep bottles / cans in for recycling	1%
Other uses	2%
Do not have a use / discard	11%

We therefore calculated that 40.3 per cent (53 per cent of 76 per cent) of all lightweight carrier bags avoided the use of bin liners. The volume and weight of an average HDPE bin liner was calculated to be 29.3 litres and 9.3 grams, using the same measurement methods applied to the carrier bags in this study (see annex B). Therefore, for every 19.1 litre lightweight plastic carrier bag that was reused, an avoided burden of 6.1grams of HDPE bin liner was subtracted from the system.

The avoided production of virgin materials through recycling during production was also included in the study, adjusted for any loss in material performance due to the recycling process[19]. In practice, performance loss is often compensated for by the use of an extra amount of recycled material in a product, making it heavier than one produced only from virgin materials. This means that the virgin material avoided is less than the amount of waste material entering the recycling process. The performance loss for recycled production waste was estimated to be 10 per cent for plastic and 20 per cent for paper. Therefore, 90 per cent of the plastic and 80 per cent of the cardboard entering the recycling process is included as avoided product and subtracted from the system. Waste recycled during the production of HDPE, LDPE and PP was estimated to consume 0.6kWh of grid electricity per kilogram recycled. Primary packaging cardboard was assumed to be processed to produce recycled board.

The waste collection and end-of-life scenarios for the all carrier bags (including recycling and composting) were modelled using the Environment Agency LCA software tool WRATE. The assumptions made for end-of-life processing are given in Annex C. At the end-of-life 86 per cent of all bags were assumed to be landfilled and 14 per cent incinerated (DEFRA 2008). Statistics for paper recycling in England (DEFRA 2007) were also used to model the recovery of primary packaging cardboard in supermarkets with 77.3 per cent of cardboard assumed to be recycled. The remaining card was assumed to be split between landfill and incineration as for the carrier bags. Since the reference period (2006/07), in-house supermarket recycling has increased significantly. However, the recycling figures for that period were provided by DEFRA and were not substantially different to general in-house recycling figures reported by supermarket corporate social responsibility reports at that time.

The inclusion of recycling and composting (for the paper and starch-polyester bags) at end-of-life were also studied in a sensitivity analysis which is detailed in section 5.3.2.

When bag recycling at end-of-life was included, it was assumed that all the plastic carrier bags collected at end-of-life for recycling were exported for recycling to China. In the UK in 2005, 65 per cent of plastic film collected for recycling was exported overseas, mainly to China and other Far East countries (BPI 2007). However, carrier bags, whose main recycling route is currently through in-store collection, are likely to end up as back-of-store supermarket waste, of which more than 95 per cent is exported (Maxwell 2007). The inclusion of HDPE bags with prodegradant additive in the HDPE recycling stream is recognised by industry as potentially reducing recyclate quality. Although prodegradant additives were a small proportion of the polyethylene film being recycled, their separation from conventional HDPE is viewed as highly desirable and the recycling of HDPE prodegradant bags at end-of-life has been excluded from the study.

[19] This is loss of physical properties (strength or other function) due to the use, collection and recycling of a material.

5 Impact assessment

The first stage of this impact assessment uses IPCC 2007 characterisation factors to provide the Global Warming Potential (GWP or 'carbon footprint') for each carrier bag option. This assesses the GWP impact of the lifecycles detailed in the inventory analysis and includes secondary reuse (i.e. reuse of lightweight bags as a bin liner) but excludes the primary reuse for any bag. The number of times each heavy duty bag has to be used for its GWP to drop below this baseline figure for the conventional HDPE bag was then calculated. As discussed in section 3.2, apart from the secondary reuse of conventional HDPE carrier bags, there were no reliable data on the primary reuse of bags. This approach only shows the number of times each heavy duty bag would hypothetically have to be used to reduce its GWP below that of the conventional carrier bag. Actual reuse is governed by consumer use, bag strength and durability. Therefore, some reuse figures are unrealistic. For example, information on the use of paper bags at a major food retailer in the Republic of Ireland, shows no evidence of any reuse[20].

The second stage of the impact assessment calculates impacts for each carrier bag using the CML baseline method and is based on the hypothetical use calculated in stage one. All results and charts shown refer to the functional unit, i.e. the carrier bags required to carry one month's shopping (483 items) from the supermarket to the home in the UK in 2006/07. The majority of the bar charts show the contribution of each lifecycle stage for each type of carrier bag to an impact category. These lifecycle stages include:

- **The extraction/production of raw materials** (HDPE, LDPE, PP, paper, starch-polyester blend, etc)
- **The production processes** (Energy use during the production of the carrier bag)
- **Transport** (The movement of raw materials to the production site and the finished carrier bag to the supermarket)
- **End-of-life** (Including collection, landfill and incineration)
- **Avoided products and recycling** (The avoidance of virgin materials through secondary reuse or recycling)

Positive values represent an adverse impact. Negative values resulting from 'recycling & avoided products' lifecycle stages represent a benefit and reduce the overall impact by the amount shown

A sensitivity analysis is also included in chapter 6 to determine the influence of key variables on the results of the impact assessment. The variables assessed in the sensitivity analysis are:

- Changing consumer behaviour with regards to secondary use of the bags;
- An increase in recycling and composting at end-of-life and;
- Using a different impact assessment method.

[20] Personal communication from Marks & Spencer plc to the Environment Agency

5.1 Global warming potential

The GWP (excluding primary reuse) for each lifecycle stage of each carrier bag is shown in figure 5.1. The cotton carrier bag is not shown in figure 5.1, because its GWP is more than ten times that of any other carrier bag. Figure 5.2 includes the cotton bag and shows the results based on the number of times each heavy duty bag would have to be used to reduce its GWP below that for the conventional HDPE bag. In round numbers these are: paper bag - 4 times, LDPE bag - 5 times, non-woven PP bag - 14 times and the cotton bag - 173 times.

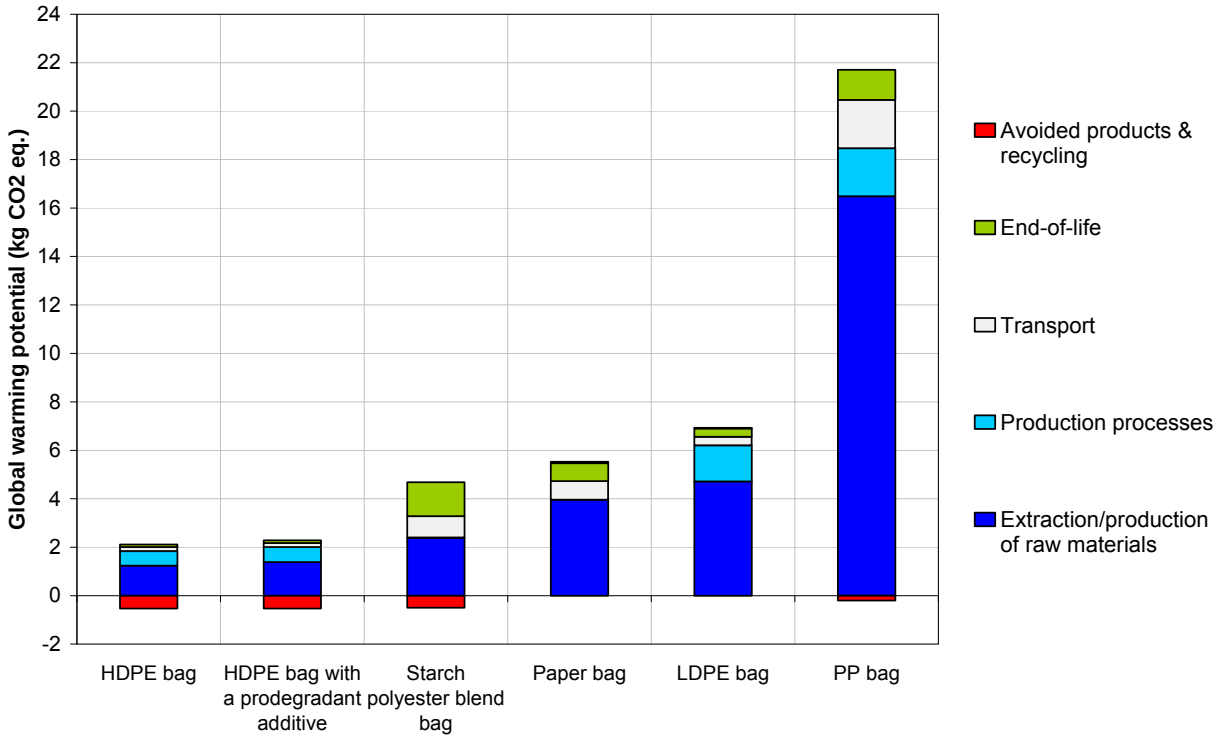


Figure 5.1 The lifecycle impacts of each carrier bag on global warming potential (excluding primary reuse).

The GWP of all of the carrier bags studied is dominated by raw material extraction and production which ranges from 57 per cent of the impact for the starch polyester bag to 99 per cent for the cotton bag. This impact is normally due to the production of the most prevalent material with 64 per cent of the HDPE bag impact generated directly from the extraction and production of HDPE. .

The avoided production of virgin material due to the recycling of post-production waste and primary packaging has a relatively small net effect due to the low proportion of scrap material reprocessed and due to the impacts of cardboard recycling being of similar size to the benefits of avoided production.

Packaging materials generally contribute between 0.4 per cent and 4 per cent of the overall global warming impact for each type of carrier. The GWP from grid electricity used to produce carrier bags varies from 38 per cent of the overall impact for HDPE bags to

0.4 per cent for the starch polyester bag, although the proportion was influenced by the impact of other lifecycle stages such as raw material extraction and production as well as the electricity mix in the country of origin: the HDPE bag is assumed to be produced in China, which relies heavily on electricity generated from burning coal, whereas the starch polyester blend bag is assumed to be produced in Norway where 99 per cent of the grid electricity is generated through hydropower.

The impact of transportation on the total GWP is generally between 0.8 per cent and 14 per cent and is heavily dependent on the road transport distance. The transportation of the starch polyester bag has the highest impact of all carrier transport and transport is also more significant in its lifecycle (21 per cent of total impact) because the starch-polyester blend is carried by road from Italy to Norway and the finished product by road/sea to the UK. In the case of the HDPE, HDPE prodegradant, PP and cotton bags, where bags are shipped from the Far East, the impact of that shipping is between 60-70 per cent of the transport impact.

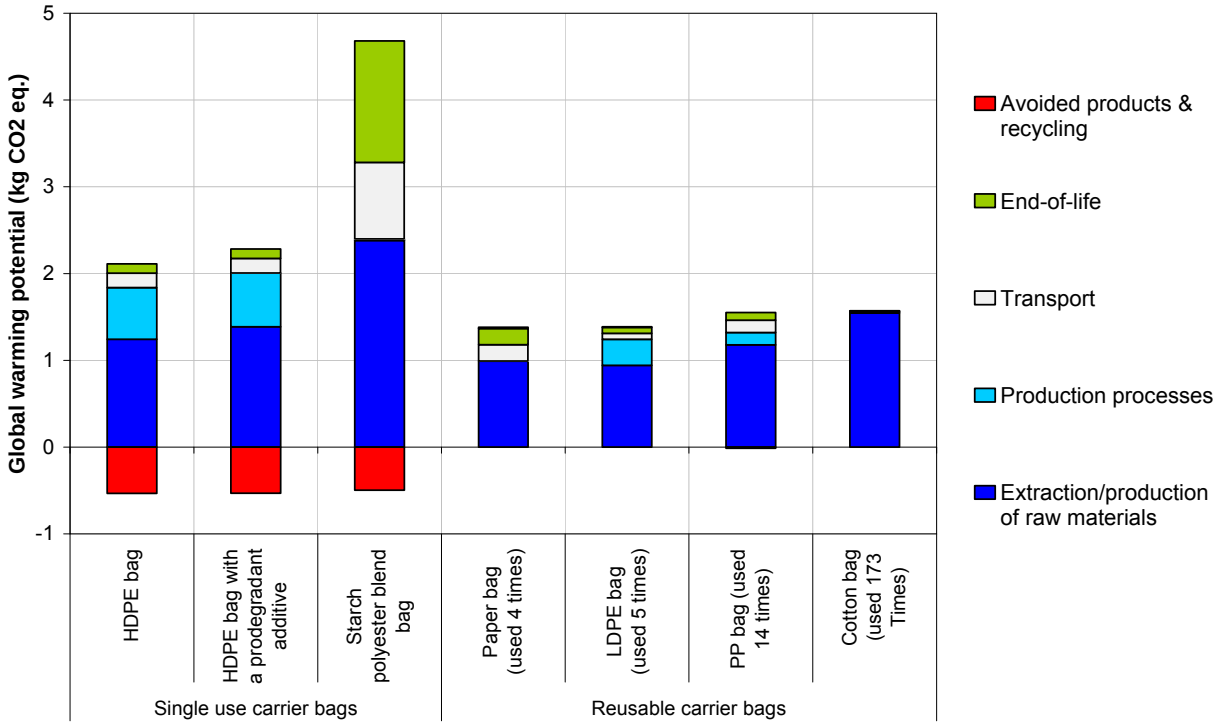


Figure 5.2 The global warming potential impacts of each type of carrier bag assuming each is reused to outperform a conventional HDPE bag with no reuse).

The end-of-life impacts of all bags contribute between 0.2 per cent and 33 per cent to overall GWPs. The end-of-life of the plastic carrier bags (the conventional HDPE, HDPE prodegradant, LDPE and PP bags) is generally between 5 per cent and 7 per cent and is dominated by the GWP of plastic incineration. However, the end-of-life of the paper bag and the starch polyester bag is dominated by landfill which contributes over 18 per cent and 29 per cent respectively to the overall impact. Incineration does provide a 5 per cent

reduction in the GWP of the paper bag due to the energy from waste incineration which offsets the direct global warming impact .

The influence of the secondary reuse of 40.3 per cent of the lightweight bags is shown in the large reduction created by the avoided products lifecycle stage in both figures. This reuse generates a reduction of 12 per cent for the starch polyester blend bag, 29 per cent for the HDPE prodegradant bag and 32 per cent for the conventional HDPE bag. The exclusion of any primary reuse from figure 5.1 unsurprisingly shows that reusable carrier bags, without primary reuse, have a higher global warming potential than conventional HDPE carrier bags. However, the required reuse shown in figure 5.2 shows that this level is practicable for reusable plastic bags, although for paper bags it remains hypothetical.

5.2 Other impact categories

The CML 2 baseline 2000 method was used to calculate other environmental impacts for each carrier bag, which are considered in turn. The results in each of the following sections show the 8 impact categories considered as well as the GWP results described in section 5.1. These results are presented in bar charts showing the percentage contribution of each life cycle stage to each impact. In some cases the ‘end-of-life’ and ‘recycling & avoided products’ lifecycle stages also reduce the impact. These are therefore shown as negative percentages on the bar charts.

5.2.1 Conventional HDPE carrier bag

The impact assessment results for the conventional HDPE bag are shown in table 5.1 and the relative contributions from each stage of the life cycle are shown in figure 5.3.

In five of the eight impact categories, including acidification, human, aquatic and terrestrial toxicity, the bag production process has the largest lifecycle impact. This results from the use of Chinese grid electricity assumed and/or the disposal of ash from coal burning. However, International Energy Agency statistics (IEA, 2007), show some bag producing countries, such as Malaysia, have a lower reliance on coal and therefore bags produced there would have a lower impact in these categories. The impact of the building, maintenance and use of the transmission network used to deliver grid electricity also influences the terrestrial ecotoxicity of the HDPE bag.

The extraction and production of materials has the largest impact in the other three of the eight impact categories and is influential in a number of others. For toxicity and ecotoxicity, where resource use in not the main influence, the use of titanium dioxide has a significant impact on the material lifecycle stage despite being only 2 per cent of the bags’ weight. For example, the release of vanadium during the extraction and production of titanium dioxide contributes over 19 per cent to the HDPE bags fresh water ecotoxicity. It is important to note that titanium dioxide is only used in opaque bags and therefore clear bags of the same weight would have a lower impact in these categories.

Table 5.1 The environmental impact of the HDPE bag

Method	Impact category	Unit	Total
IPCC 2007	**Global warming potential**	kg CO2 eq	1.578
CML 2 baseline	**Abiotic depletion**	g Sb eq	16.227
	Acidification	g SO2 eq	11.399
	Eutrophication	g PO4--- eq	0.775
	Human toxicity	kg 1,4-DB eq	0.211
	Fresh water aquatic ecotox.	g 1,4-DB eq	66.880
	Marine aquatic ecotoxicity	kg 1,4-DB eq	126.475
	Terrestrial ecotoxicity	g 1,4-DB eq	1.690
	Photochemical oxidation	g C2H4	0.531

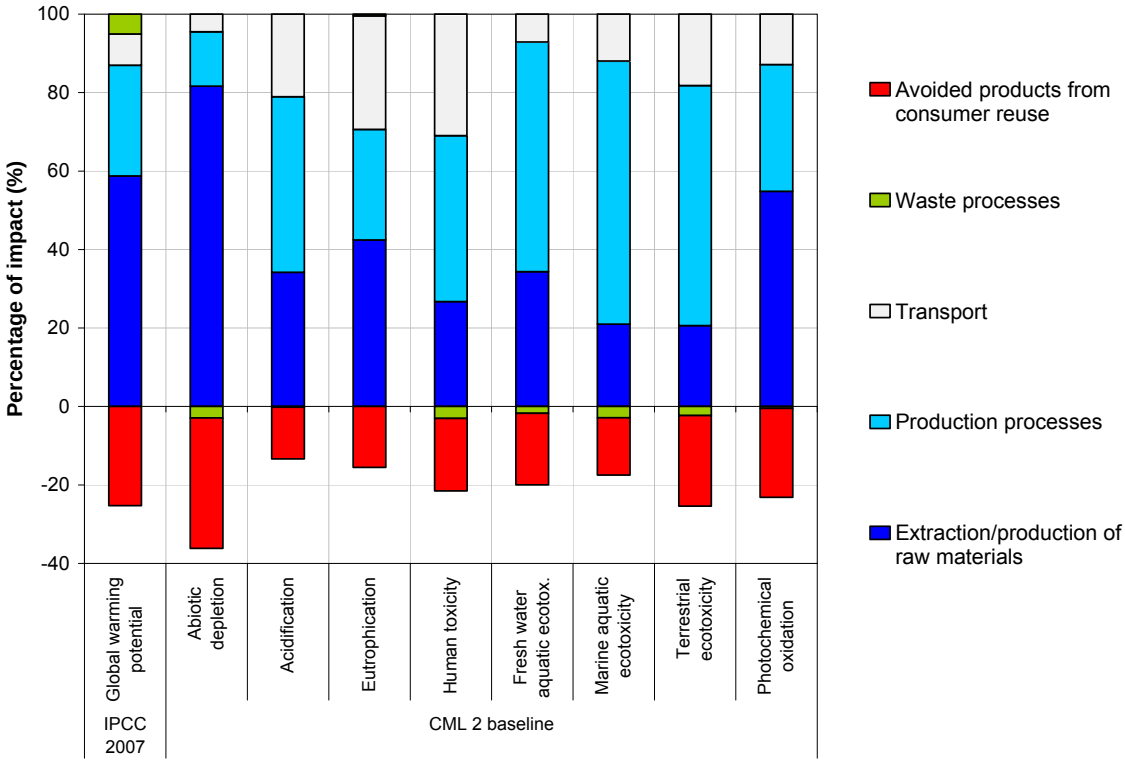


Figure 5.3 The relative contribution of different lifecycle stages to the environmental impacts of HDPE bags.

The distance and mode of transport of the HDPE bags from China to the UK contributes significantly to the impacts of eutrophication and human toxicity due to the emission of nitrogen oxides and polycyclic aromatic hydrocarbons respectively from shipping. The road transport of the raw materials to the carrier bag producer and from the UK importer to the supermarkets has little influence on the results due to the relatively short transport distances assumed (between 100km and 200km). In five of the eight categories, the end-of-life stage reduces the overall impact mainly because the impacts of incineration are outweighed by the impacts avoided from the production of electricity through waste to energy.

The reuse of HDPE carrier bags as bin liners reduces environmental impacts by between 13 per cent and 33 per cent. The reduction in impact from avoided bin liners is greatest in categories where raw material use is the dominant influence. However, in some categories such as human, aquatic and terrestrial ecotoxicity, the benefit of this avoided product is due to the avoided extrusion process rather than avoided resource use.

5.2.2 HDPE carrier bag with a prodegradant additive

The environmental impacts of the HDPE prodegradant bags are shown in table 5.2 and in figure 5.4. The impacts for the HDPE prodegradant bag are very similar to the HDPE bag. The percentage contribution of each lifecycle stage on each impact category is almost identical to the HDPE bag because of their similarity in material content, production, transportation, secondary reuse and end-of-life. In general, the material extraction and production lifecycle stage has a larger impact because the HDPE prodegradant bag is heavier. The reuse of HDPE prodegradant bags as bin liners reduces their overall environmental impact in a similar way to the HDPE bag, although the relative effect of secondary reuse is marginally smaller. The production of the bag is the largest contributor in five of the eight impact categories due to the emissions from the Chinese grid electricity used. Raw material extraction and production is an important stage in categories where energy generation is less influential, such as photochemical oxidation and abiotic depletion.

The production of the prodegradant additive has a minimal impact on most lifecycle categories, although the additive does contribute 4 per cent to the abiotic depletion of the bag due to the impact of the stearic acid used. The impact of transportation on the HDPE prodegradant bag lifecycle is only marginally greater than the HDPE bag (due to the heavier bag). Although the bag contains a prodegradant additive, the end-of-life impacts through incineration and landfill were modelled in the same way as the HDPE bag and are therefore identical. However, there is no evidence to suggest that the disposal of HDPE bags with prodegradant additive has a lower environmental impact than the conventional HDPE bag disposal and the prodegradant additive could actually increase some impacts.

Table 5.2 The environmental impact of HDPE bag with a prodegradant additive

Assessment method	Impact category	Unit	Total
IPCC 2007	**Global warming potential**	kg CO2 eq	1.750
CML 2 baseline	**Abiotic depletion**	g Sb eq	19.331
	Acidification	g SO2 eq	12.276
	Eutrophication	g PO4--- eq	0.839
	Human toxicity	kg 1,4-DB eq	0.228
	Fresh water aquatic ecotox.	g 1,4-DB eq	72.146
	Marine aquatic ecotoxicity	kg 1,4-DB eq	134.264
	Terrestrial ecotoxicity	g 1,4-DB eq	1.797
	Photochemical oxidation	g C2H4	0.581

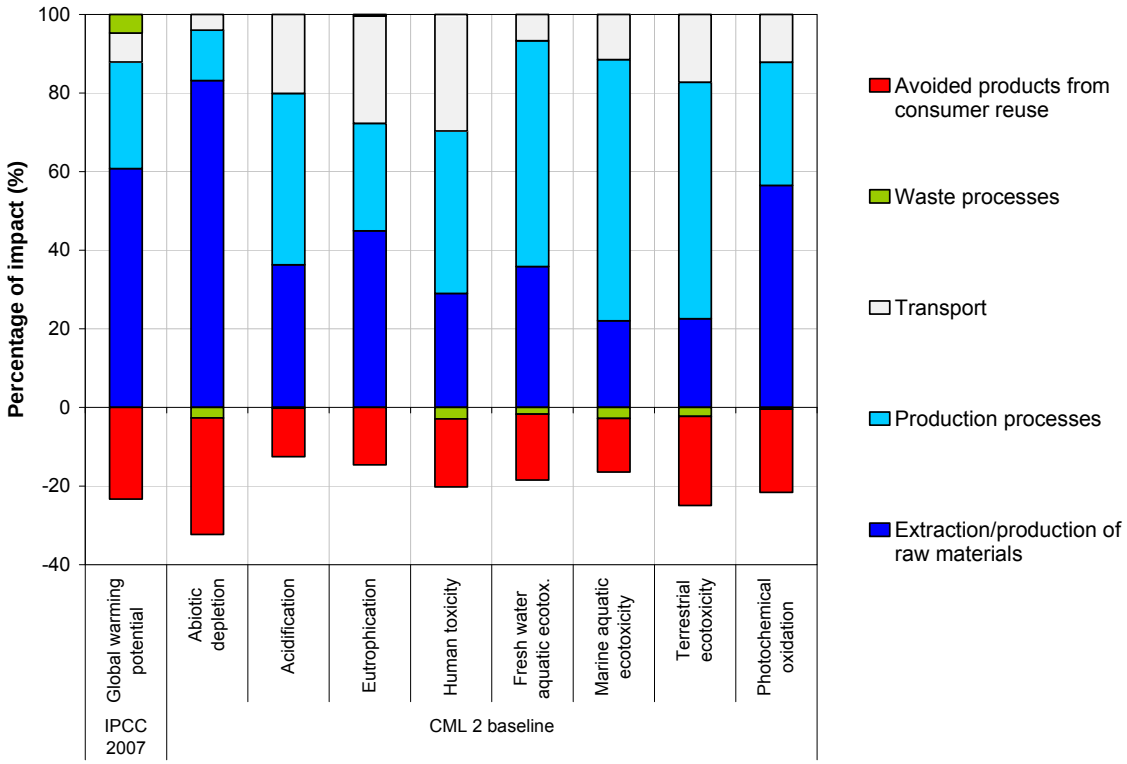


Figure 5.4 The lifecycle impacts of HDPE bag with a prodegradant additive.

5.2.3 Starch-polyester blend carrier bag

The environmental impacts of the starch-polyester blend bags are shown in table 5.3. and in figure 5.5.

Table 5.3 The environmental impact of starch-polyester blend bags.

Assessment method	Impact category	Unit	Total
IPCC 2007	**Global warming potential**	kg CO2 eq	4.184
CML 2 baseline	**Abiotic depletion**	g Sb eq	15.734
	Acidification	g SO2 eq	18.064
	Eutrophication	g PO4--- eq	7.240
	Human toxicity	kg 1,4-DB eq	1.151
	Fresh water aquatic ecotox.	g 1,4-DB eq	199.955
	Marine aquatic ecotoxicity	kg 1,4-DB eq	282.754
	Terrestrial ecotoxicity	g 1,4-DB eq	8.173
	Photochemical oxidation	g C2H4	1.232

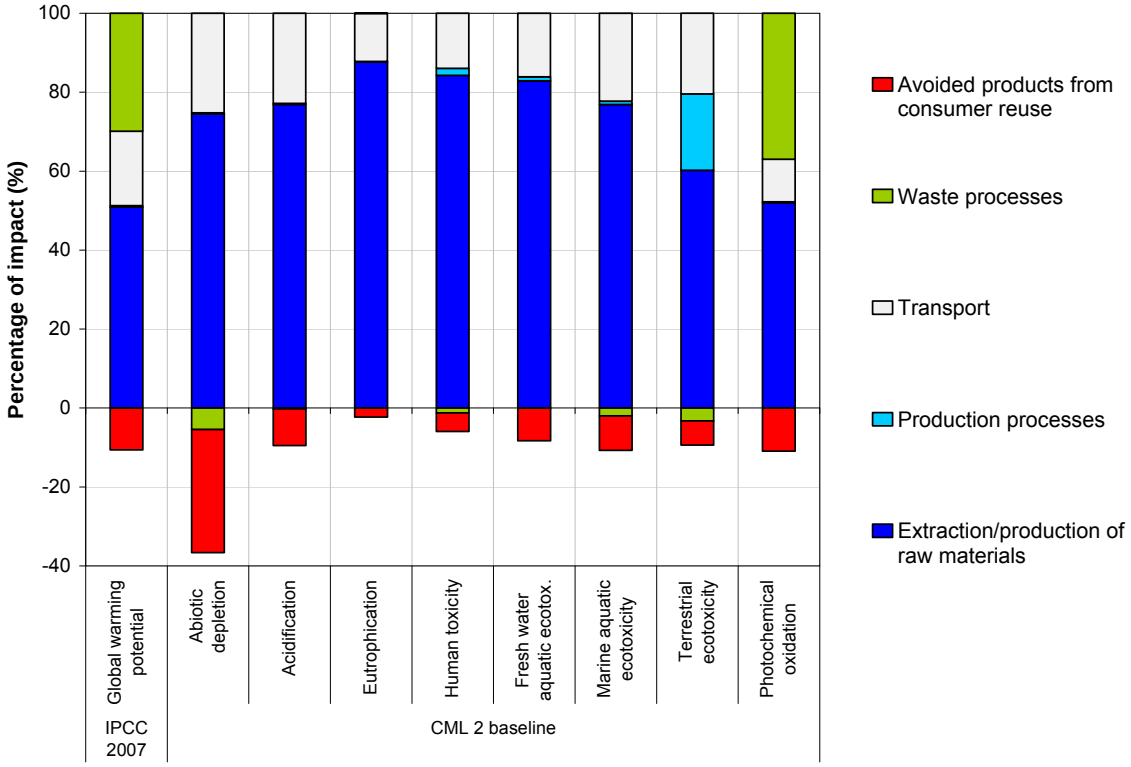


Figure 5.5 The lifecycle impacts of starch-polyester blend bags.

Raw material production is the highest contribution in all of the eight impact categories. However, no specific material or process can be identified other than the production of the starch-polyester due to the aggregated nature of the data provided by Novamont. More information on the origins of this data is available in annex C.

The influence of the transport of raw materials is very similar to that for the conventional HDPE bag. Although the distance is not as great, the materials are transported by lorry from Italy to the north of Norway and this produces a larger impact than sea transport in many categories. The end-of-life of the starch polyester bag only significantly influences its global warming potential and photochemical oxidation due to its degradation in landfill to release methane. This contributes approximately 29 per cent to the GWP impact.

Although bag production requires more energy than the conventional HDPE bag, the production has lower impacts because of the use of Norwegian grid electricity, which has very low impacts. The reuse of carrier bags as bin liners and the benefit of waste to energy at end of life reduce the overall environmental impacts of the starch-polyester blend bags by a similar amount to the other lightweight plastic bags.

5.2.4 Paper carrier bag

The CML 2 baseline impact assessment results for the paper bag are shown in table 5.4 and in figure 5.6. The results in the table include no reuse and the hypothetical four uses calculated in section 5.1. Few supermarkets use paper carriers in the UK, nor are they reused as bin liners (secondary use) as they are not as durable as HDPE bags, being

liable to split or tear easily. Currently the only evidence available suggests even where they have been introduced, there is no significant reuse of paper bags.

Table 5.4 The environmental impact of the paper bag.

Assessment method	Impact category	Unit	Total (no reuse)	Total (used 4 times)
IPCC 2007	**Global warming potential**	kg CO2 eq	5.523	1.381
CML 2 baseline	**Abiotic depletion**	g Sb eq	26.697	6.674
	Acidification	g SO2 eq	37.470	9.367
	Eutrophication	g PO4--- eq	5.039	1.260
	Human toxicity	kg 1,4-DB eq	3.247	0.812
	Fresh water aquatic ecotox.	g 1,4-DB eq	150.204	37.551
	Marine aquatic ecotoxicity	kg 1,4-DB eq	244.657	61.164
	Terrestrial ecotoxicity	g 1,4-DB eq	24.719	6.180
	Photochemical oxidation	g C2H4	1.955	0.489

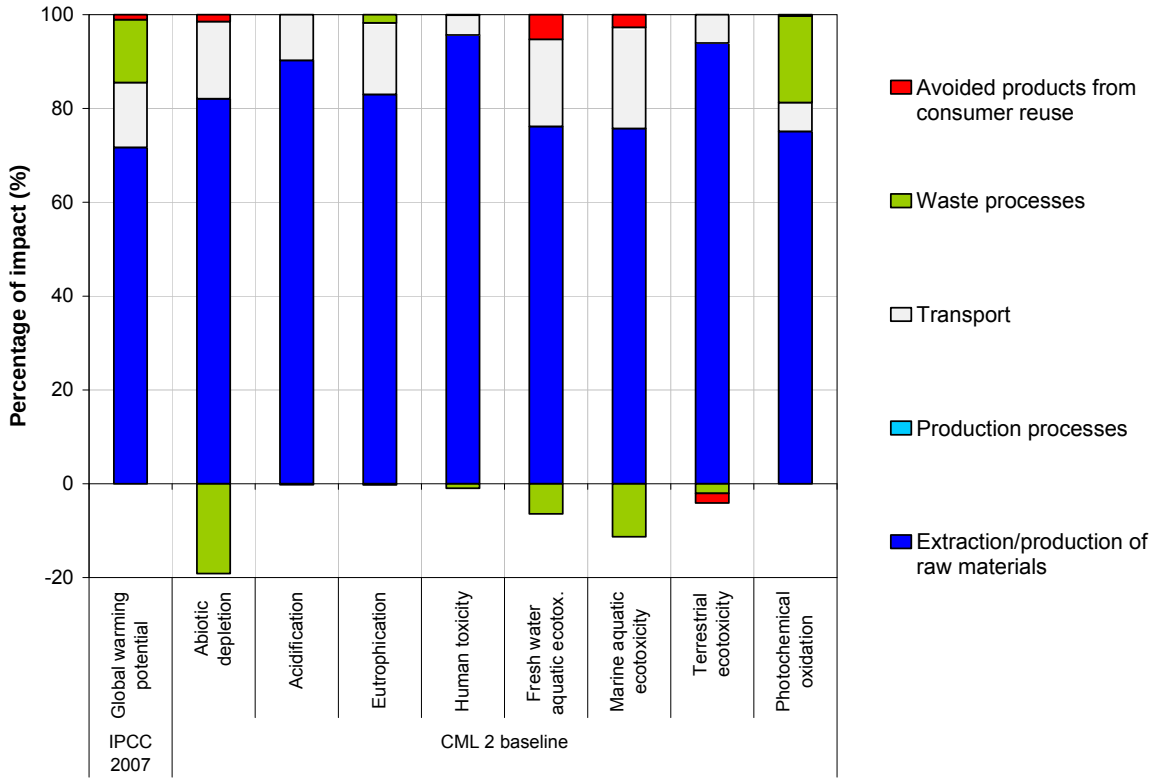


Figure 5.6 The lifecycle impacts of the paper bag.

The lifecycle impacts of the paper bag are dominated by the material extraction and production stages. As the data could not be separated, this combined stage contributes over 70 per cent of the impact in all eight categories. Due to the aggregated nature of the data, it is difficult to identify the processes or materials that contribute to these impacts. More detail on the data used is provided in annex C. However, we analysed the production of similar forms of paper and found the energy required from grid electricity

contributed significantly to all impacts. The disposal of ash from paper production also has an impact on eutrophication and fresh water aquatic ecotoxicity. The production of palm oil for use in paper manufacture affects terrestrial ecotoxicity. Although the bags are produced in Europe, the distribution of the bags from the bag producers in to the supermarkets via the UK importer is still noticeable in most impact categories. This is because of the impacts of road transport emissions on acidification, eutrophication, terrestrial ecotoxicity and photochemical oxidation, and the impacts of oil production for diesel on abiotic depletion, human toxicity and aquatic ecotoxicity.

In many cases, the recycling and avoided products stage also produces a net burden (unlike the lightweight plastic bags) because the paper bag is not reused as a bin liner and therefore this stage only represents the recycling of primary packaging at end of life. In this case, the impact of the recycling process is greater than the avoided production of card, creating a net increase. A reduction in impact from end-of-life processing is seen in abiotic depletion and aquatic ecotoxicity, due to the avoided production of electricity through energy from waste incineration. However, waste processing does contribute 18 per cent of photochemical oxidation due to the impact of landfill in that category.

5.2.5 LDPE carrier bag

The environmental impacts of the LDPE bag are shown in table 5.5 and the contribution of each lifecycle stage to each impact in figure 5.7. Raw material production dominates the environmental impacts of the LDPE carrier bag system contributing at least 65 per cent to five of the seven categories. The production of polyethylene contributes most to impacts such as abiotic depletion, GWP and photochemical oxidation. However, the production of titanium dioxide is an important factor for human toxicity and aquatic ecotoxicity impacts.

The burdens from the conversion of LDPE pellets into carrier bags are an important factor in several impact categories. In the case of terrestrial ecotoxicity this impact is due to the effects of the electricity transmission network, but for most impacts it is due to emissions and waste ash produced by coal fired power stations in both of the production locations (assumed to be China and Turkey).

Table 5.5 The environmental impact of the LDPE bag.

Assessment method	Impact category	Unit	Total (no reuse)	Total (used 5 times)
IPCC 2007	**Global warming potential**	kg CO2 eq	6.924	1.385
CML 2 baseline	**Abiotic depletion**	g Sb eq	82.711	16.542
	Acidification	g SO2 eq	29.340	5.868
	Eutrophication	g PO4--- eq	2.576	0.515
	Human toxicity	kg 1,4-DB eq	0.701	0.140
	Fresh water aquatic ecotox.	g 1,4-DB eq	186.726	37.345
	Marine aquatic ecotoxicity	kg 1,4-DB eq	311.810	62.362
	Terrestrial ecotoxicity	g 1,4-DB eq	7.323	1.465
	Photochemical oxidation	g C2H4	1.391	0.278

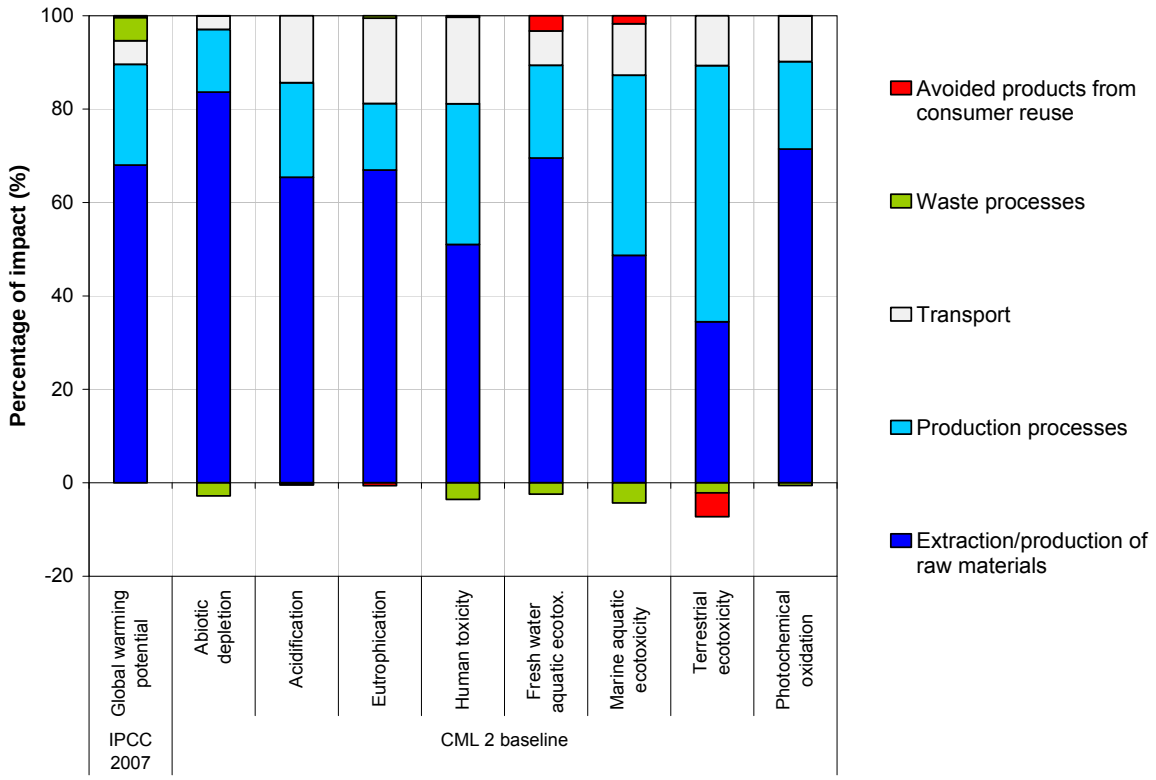


Figure 5.7 The lifecycle impacts of the LDPE bag.

The transport of materials to the carrier bag manufacturer and the distribution of the bag to the supermarket contributes considerably to the human toxicity, acidification and eutrophication impacts. However, these are proportionally smaller than the impact of transport on the HDPE bag due to 90 per cent of the bags being produced in Turkey rather than China. For eutrophication, the impact of transport is evenly split between road and sea transport due to the emission of nitrogen oxides from road vehicles, but for most impacts the contribution of transport is dominated by sea transport mainly due to emissions of nitrogen oxides.

The recycling & avoided products stage covers the recycling of primary packaging including cardboard and, similar to the paper bag, gives a net reduction in terrestrial ecotoxicity and a slight impact in aquatic ecotoxicity. The influence of end-of-life processing is very similar to the HDPE bag having been modelled in the same way.

5.2.6 Non-woven PP carrier bag

The environmental impacts of the non-woven PP bag are shown in table 5.6 and in figure 5.8.

Table 5.6 The environmental impact of the non-woven PP bag.

Assessment method	Impact category	Unit	Total (no reuse)	Total (used 14 times)
IPCC 2007	Global warming potential	kg CO2 eq	21.510	1.536
CML 2 baseline	Abiotic depletion	g Sb eq	274.764	19.626
	Acidification	g SO2 eq	101.314	7.237
	Eutrophication	g PO4--- eq	14.579	1.041
	Human toxicity	kg 1,4-DB eq	3.046	0.218
	Fresh water aquatic ecotox.	g 1,4-DB eq	467.717	33.408
	Marine aquatic ecotoxicity	kg 1,4-DB eq	1411.312	100.808
	Terrestrial ecotoxicity	g 1,4-DB eq	50.812	3.629
	Photochemical oxidation	g C2H4	5.247	0.375

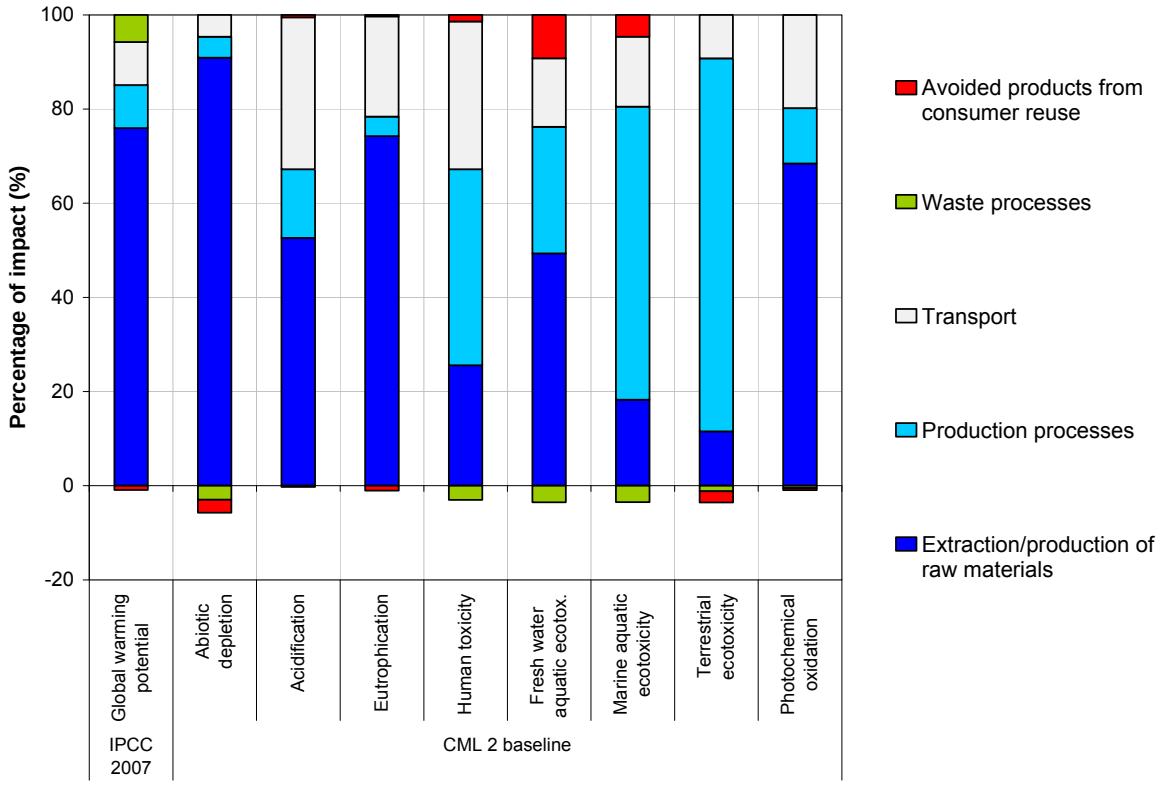


Figure 5.8 The lifecycle impacts of the non-woven PP bag.

The results for the non-woven PP bag are similar to the impacts for both types of polyethylene bags. Material extraction and production for the non-woven PP bag contributes more than half of the impacts for abiotic depletion, acidification, fresh water aquatic ecotoxicity, photochemical oxidation and eutrophication. For abiotic depletion, the contribution of resource use and material production is greater than bag production. The production of cotton fibre used in the non-woven bag contributes almost one third of the eutrophication impacts due to the release of nitrogen from cotton cultivation. Primary packaging also contributes more to the human toxicity and fresh water ecotoxicity impacts when compared to other bags, because of the amount of corrugated board used

and the impact of its production on these categories. The influence of raw materials on toxicity and ecotoxicity is limited due to the greater burdens created from emissions of nickel and vanadium from burning heavy fuel oil in an industrial furnace, which is uniquely used for the production of this type of bag.

The importance of the recycling & avoided products lifecycle stage is reduced, because it only includes the recycling of primary packaging (similar to the same stage of the paper and LDPE bags). The recycling process does have a greater impact on categories such as fresh water ecotoxicity because of the large impact of card recycling and production on those catagories and the greater amount of primary packaging for the non-woven PP bag,

The effects of the transport of the bag and the end-of-life processing of its materials are also in similar proportions to the HDPE bag due to similar distances and transport methods plus the use of the same data for the end-of-life scenarios. The road transport distances are almost identical and, although the PP bag does have lower pre-production shipping distances, this has a limited impact on most impact categories. Therefore, the only substantial differences are due to the different weight of material used.

5.2.7 Cotton carrier bag

The environmental impacts of the cotton bag (used 173 times) are shown in table 5.9. The impact category results for the cotton bag show material extraction and production contributes more than 98 per cent to all the impact categories. This contribution is partly due to the assumption that the raw material is woven cotton textile. The energy required to process cotton into cotton yarn is the main contributor to abiotic resource depletion, acidification, human toxicity, freshwater and marine ecotoxicity, and photochemical oxidation. For eutrophication, cotton growing is the main contributor, from the use and production of fertilizer. Cotton growing and the energy consumed during cotton processing contribute almost equally to terrestrial ecotoxicity.

Table 5.9 The environmental impact of the cotton bag (used 173 times).

Assessment method	Impact category	Unit	Total (no reuse)	Total (used 173 times)
IPCC 2007	**Global warming potential**	kg CO2 eq	271.533	1.570
CML 2 baseline	**Abiotic depletion**	g Sb eq	1519.838	8.785
	Acidification	g SO2 eq	2787.681	16.114
	Eutrophication	g PO4--- eq	304.486	1.760
	Human toxicity	kg 1,4-DB eq	66.254	0.383
	Fresh water aquatic ecotox.	g 1,4-DB eq	23477.073	135.706
	Marine aquatic ecotoxicity	kg 1,4-DB eq	44716.601	258.477
	Terrestrial ecotoxicity	g 1,4-DB eq	3208.855	18.548
	Photochemical oxidation	g C2H4	95.114	0.550

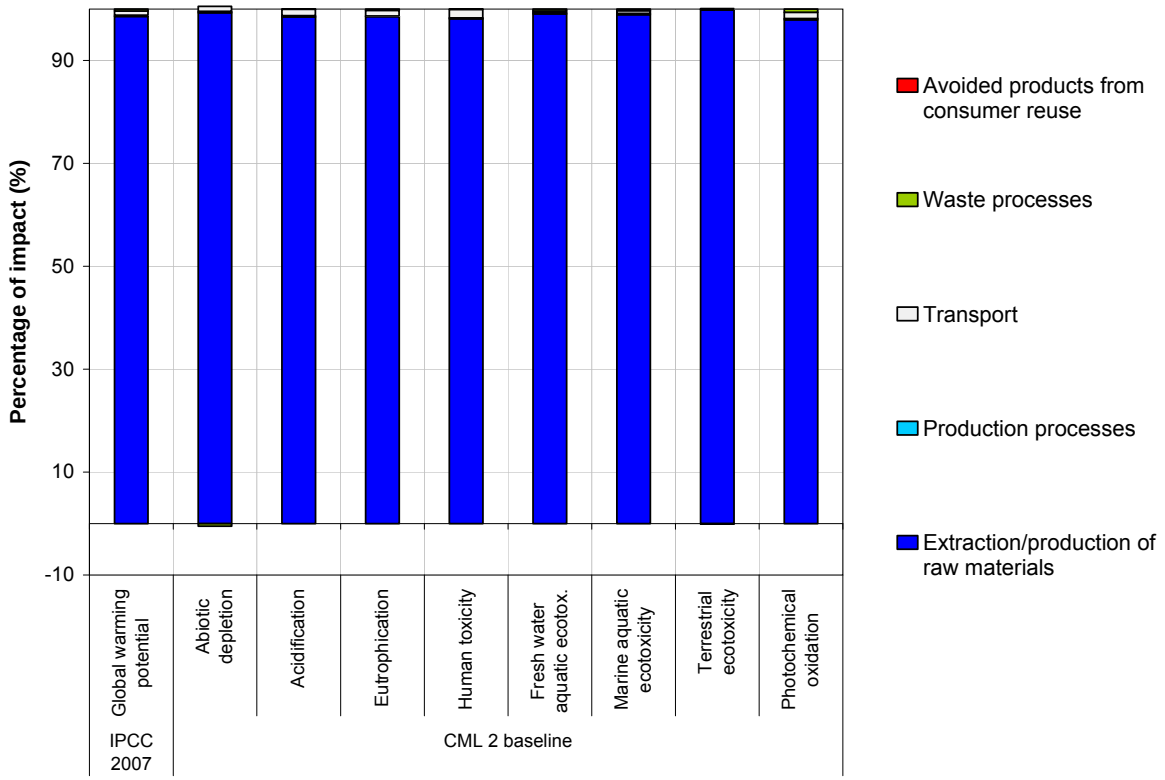


Figure 5.8 The lifecycle impacts of the cotton bag.

6 Sensitivity Analysis

The sensitivity analysis on the results focuses on three key areas:

- the secondary use of the bags by consumers;
- increasing recycling and composting at end-of-life; and
- using an alternative impact assessment method.

The reuse of conventional HDPE bags for shopping and its effect on the relative impacts is discussed in section 7.2

6.1 Secondary use of lightweight bags

We investigated the effects of changes in the secondary use of lightweight bags on all of the impact categories. Secondary use is the reuse of carrier bags in alternative applications replacing the need for other products. This was modelled in the study through the avoided production of bin liners for approximately 40 per cent of the bags used. Generally only lightweight carrier bags (i.e. the HDPE, HDPE prodegradant and starch-polyester blend bags) are reused in this way. In this sensitivity analysis, secondary use was applied to zero and 100 per cent of the bags

Table 6.1 shows the GWP for the lightweight carrier bag required to achieve the reference flow (as stated in section 3.2) with secondary use levels of zero, the original 40.3 per cent and 100 per cent. Figure 6.1 shows the influence of these changes in secondary use on all of the impacts for the conventional HDPE bag

Table 6.1 The effect of secondary reuse on the global warming potential of single use carrier bags.

Bag type	Sensitivity changes	IPCC 2007 Global warming potential (kg CO2 eq)
HDPE bag	No secondary use	2.082
	40.28% secondary use	1.578
	100% secondary use	0.830
HDPE prodegradant bag	No secondary use	2.254
	40.28% secondary use	1.750
	100% secondary use	1.003
Starch-polyester bag	No secondary use	4.691
	40.28% secondary use	4.184
	100% secondary use	3.433

The abiotic depletion of all lightweight carrier bags was reduced by between 70 per cent (for the HDPE prodegradant bag) and 81 per cent (for the starch-polyester blend bag) with a change from no reuse to 100 per cent reuse. The larger reduction in the impact of

the starch-polyester bag is because this bag has a lower abiotic depletion impact compared to the other lightweight options and the amount of resource avoided is the same for each bag. Secondary use of bags is also highly influential on other impact categories such as GWP, toxicity, ecotoxicity and photochemical oxidation for both the conventional HDPE and HDPE prodegradant bags. A change from no reuse to 100 per cent reuse reduces these impacts by between 41 per cent and 60 per cent. The change in these impacts is much lower for the starch-polyester blend bag due to the higher contribution of the rest of its lifecycle on these categories.

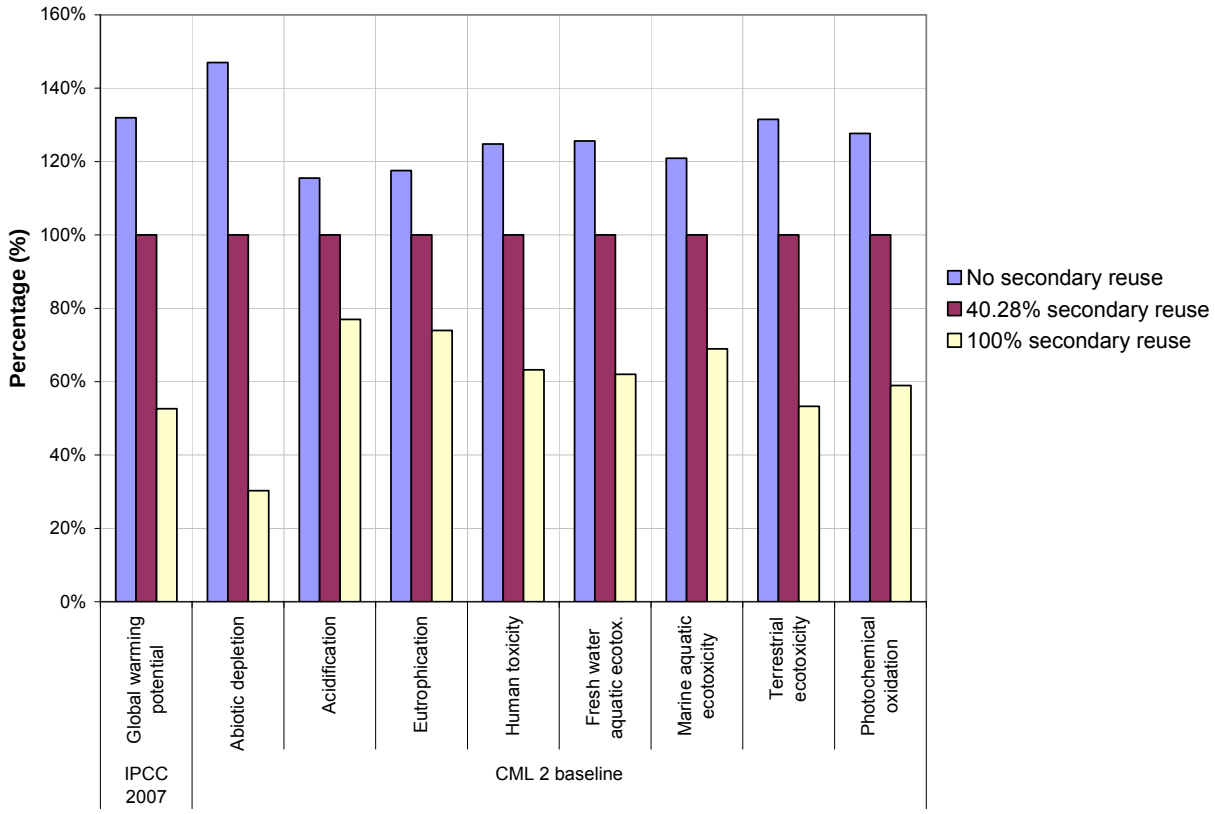


Figure 6.1 The influence of secondary reuse on the lifecycle impacts of the conventional HDPE bag.

The more bags that are reused, the greater the reduction in all the environmental impacts considered.

The number of times each of the heavy duty bags (i.e. all other bag types) had to be used for shopping to reduce the GWP below that of the HDPE bag was also considered for both low and high secondary reuse of the HDPE bag. Without secondary use the global warming potential of the conventional HDPE bags required to achieve the reference flow increased to 2.08 kg CO2 eq. This reduced the number of times the heavier bags needed to be used to drop below this baseline to 3 uses for the paper bag, 4 uses for the LDPE bag, 11 uses for the PP bag and 131 uses for the cotton bag. However, if all conventional HDPE bags were reused as bin liners the number of uses would rise to 7 for the paper bag, 9 for the LDPE bag, 26 for the PP bag and 327 for the cotton bag.

6.2 An increase in recycling and composting at end-of-life

We investigated the effect of increased recycling and composting at end-of-life on all the impact categories considered. All of the lightweight carrier bags were considered with and without secondary reuse. The 40 per cent of lightweight carrier bags that are reused as bin liners are therefore managed as residual municipal waste, leaving almost 60 per cent to go to recycling or composting. When secondary reuse is excluded we have assumed all bags are recycled or composted. The inclusion of HDPE bags with prodegradant additive in the HDPE recycling stream is recognised by industry as a potential problem for recyclate quality.and the recycling of HDPE prodegradant bags at end-of-life has not been considered. Table 6.2 shows the GWP for the different carrier bags (for the reference flow stated in section 3.2) with different levels of recycling and composting.

Table 6.2 The effect of recycling and composting on the global warming potential of carrier bags.

Bag type	Sensitivity changes	IPCC 2007 Global warming potential (kg CO2 eq)
HDPE bag	Baseline	1.578
	Recycling	1.400
	Recycling (no reuse)	1.785
HDPE prodegradant bag	Baseline	1.750
Starch-polyester bag	Baseline	4.184
	Composting	2.895
	Composting (no reuse)	3.329
Paper bag (4 uses)	Baseline	1.381
	Recycling	1.090
	Composting	1.256
LDPE bag (5 uses)	Baseline	1.385
	100% Recycling	1.196
PP bag (14 uses)	Baseline	1.536
	100% Recycling	1.292
Cotton bag (172 uses)	Baseline	1.579

The baseline figure for each carrier bag on table 6.2 represent the GWP described in section 5.1 which for all carriers includes average residual municipal waste processing for England (86 per cent to landfill, 14 per cent to incineration). Figure 6.2 shows how

these changes alter the impacts of the conventional HDPE bag relative to the baseline results set to 100 per cent.

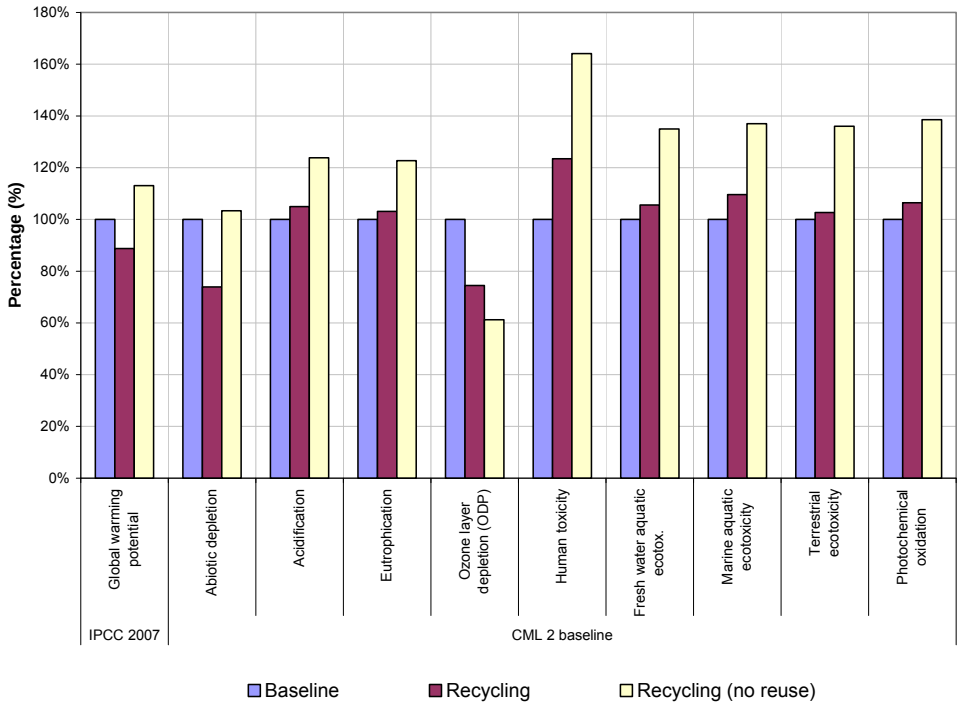


Figure 6.2 The influence of recycling on the lifecycle impacts of the HDPE bag.

Recycling conventional HDPE bags which are not reused as bin liners instead of disposing of them reduces GWP and abiotic depletion but substantially increases human toxicity and marginally increases all other impact categories. The large increase in potential human toxicity is due to the reduction in incineration which means more electricity has to be generated from coal and gas, and also an increased contribution from transport due to the shipping of the waste plastic to the Far East for recycling. If all HDPE bags are recycled, there is no benefit from avoided bin liners resulting in a rise in all impact categories. The results for all plastic carrier bags including the HDPE prodegradant bag, the LDPE bag and the PP bag are similar.

Figure 6.3 shows the influence of composting on the results for the starch-polyester blend bag. The use of composting at the end of the life for the 59.7 per cent of starch-polyester bag that are not reused changes most impact categories by less than 5 per cent. However, unlike the recycling of the conventional HDPE bag where an avoided product is created, composting the starch-polyester blend bags produces only carbon dioxide and water. The production of compost has been excluded because the amount of compost produced would have little or no effect on the results. Therefore, there is no reduction in resource use and a slight increase in abiotic depletion. Global warming potential and photochemical oxidation are both substantially reduced because composting avoids the impact of landfill, which has a considerable effect on these categories.

When no starch-polyester bags are reused as bin liners and all bags are composted, seven of the nine impacts are increased. This is more significant for abiotic depletion and photochemical oxidation where the avoided production of bin liners was particularly important.

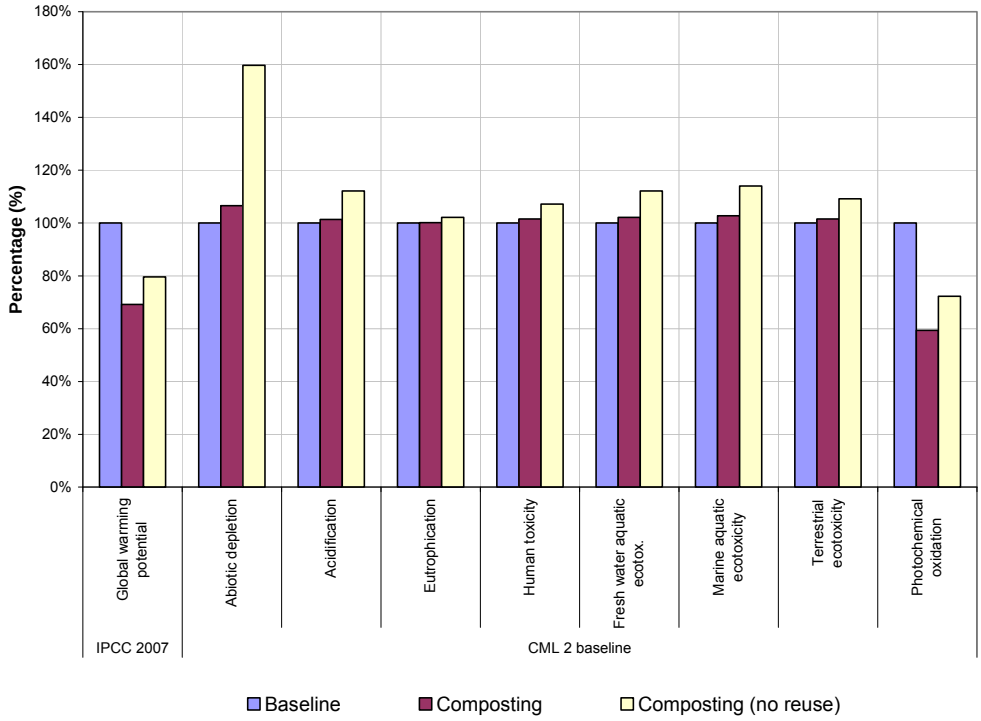


Figure 6.3 The influence of composting on the lifecycle impacts of the starch-polyester blend bag.

Figure 6.4 shows the effect of increased recycling and composting on the impacts of the paper bag. The recycling of the paper bag reduces the impact in six of the impact categories considered, including a 21 per cent reduction in GWP.

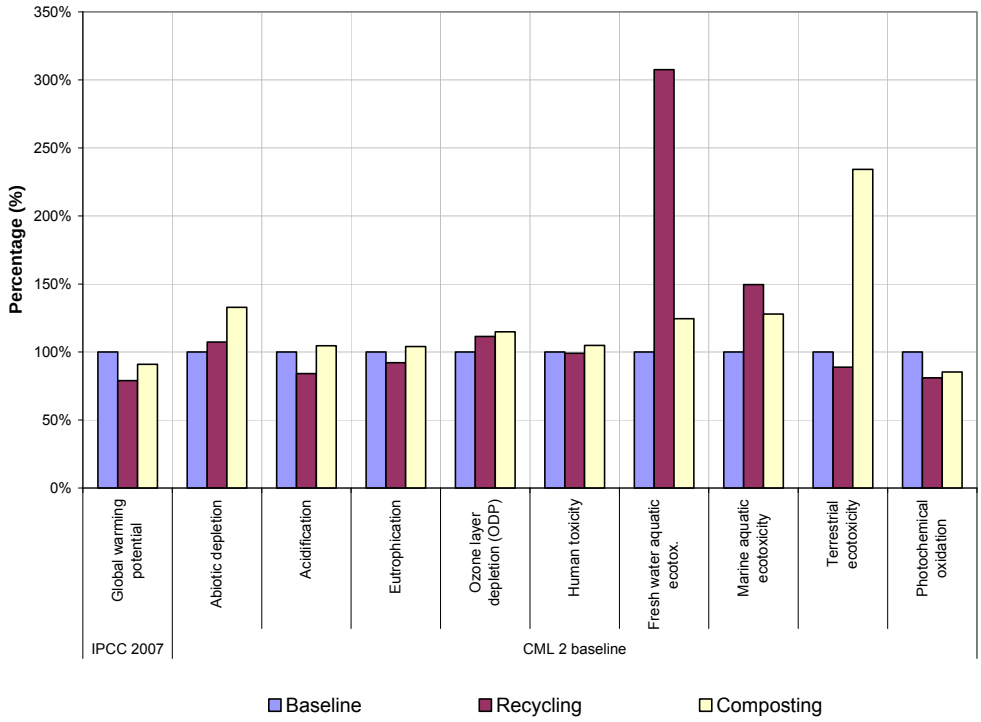


Figure 6.4 The influence of composting and recycling on the lifecycle impacts of the paper bag.

However, recycling increases fresh water ecotoxicity due to the release of copper to the water during recycling and terrestrial ecotoxicity from composting due to the release of metallic contaminants to soil and water.

Generally, when secondary reuse is reduced and replaced by recycling, impacts such as GWP and abiotic depletion are increased. Impact catagoires such as human toxicity are also affected by increases in recycling because of reduced incineration and the energy recovered resulting in an increase in electricity generated by coal and gas combustion. The composting of the starch-polyester and paper bags also increases many of the impacts of these carrier bags, although the recycling and composting of the paper bag and the composting of the starch polyester bag reduced GWP by avoiding the generation of methane associated with landfill.

6.3 Changing the impact assessment method employed

We conducted an alternative impact assessment using the eco-indicator 99 method and the results were compared to the original impact assessment discussed in chapter 5. These are shown in figure 6.5 and the eco-indicator 99 method results are shown over 10 impact categories in figure 6.6. Several of the impact categories are the same but a number of other impact categories such as land use are considered. One of the key differences is the inclusion of biogenic carbon dioxide in the calculation of global warming potential by assigning a characterisation factor of 1 to the GWP of biogenic carbon dioxide and a characterisation factor of -1 to carbon dioxide absorbed from the air by biomass (such as trees). This method therefore includes biogenic carbon dioxide that is absorbed and released during the natural carbon cycle.

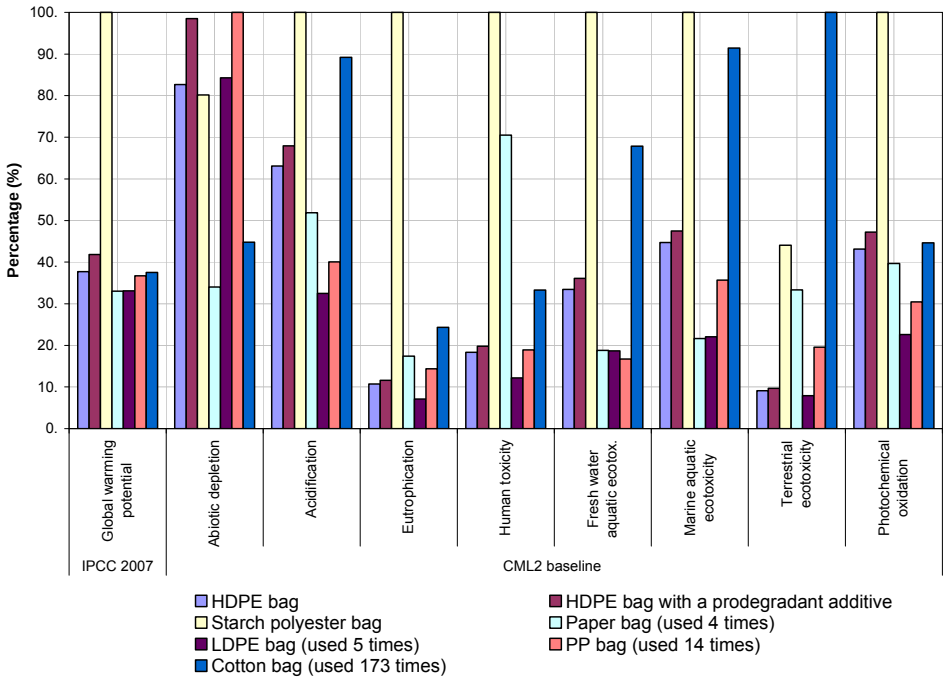


Figure 6.5 The results of the impact assessment when the IPCC 2007 and CML 2 baseline methods were used.

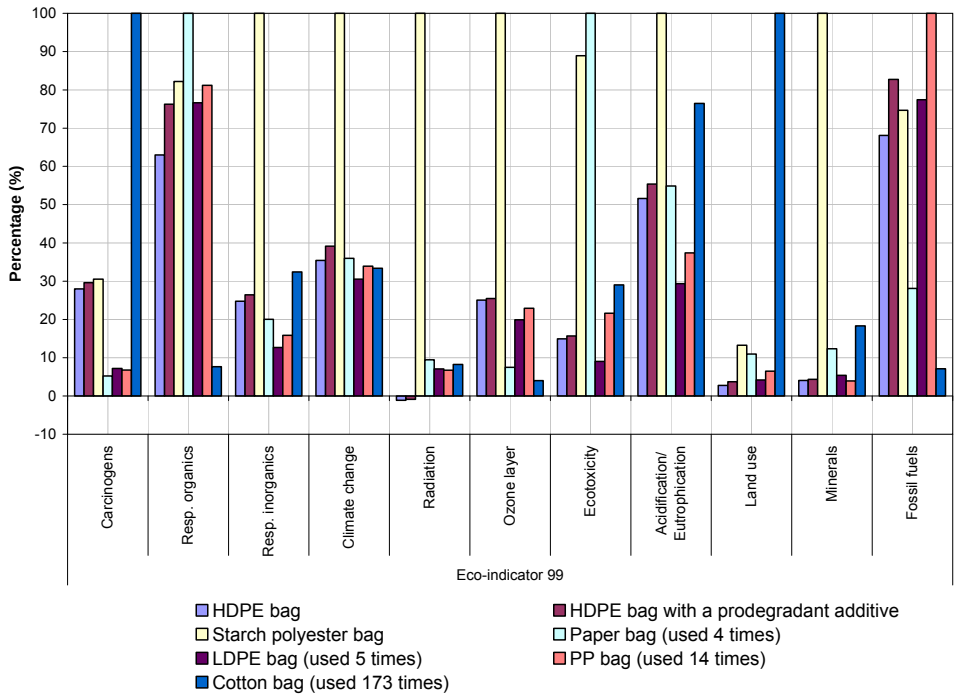


Figure 6.6 The results of the impact assessment when the eco-indicator 99 method was used.

The inclusion of biogenic carbon dioxide in the eco-indicator results increases the impact of the starch-polyester blend bag and the paper bag in comparison to the other carrier bag options. The amount of biogenic carbon dioxide equivalents emitted at the end-of-life of these bag lifecycle is greater than the biogenic carbon dioxide equivalents absorbed during production, therefore providing a marginal net increase in the GWP impact.

For the starch-polyester bags it was estimated that 0.59 kilograms of carbon dioxide is absorbed from the atmosphere for every kilogram of mater-bi produced. This value is specific to one type of bag; other starch-polyester bags could have values that give results that are better or worse.

The starch-polyester bag degrades fully to methane and carbon dioxide in landfill, producing a higher global warming impact from the end-of-life than the paper bag, which does not fully degrade in landfill.

The results for fossil fuel, abiotic depletion and acidification are very similar to the CML method. The impacts from radiation are related to the life cycle of nuclear fuel used to contribute to the grid electricity used to produce each bag type. The comparatively high radiation impact of the starch-polyester blend bag is due to the higher proportion of nuclear produced electricity used in the manufacture of the starch polyester. The reduction in radiation for the conventional HDPE and HDPE prodegradant bags is due to the reduced energy required from the extrusion of bin liners that are avoided.

The cotton, starch-polyester blend and paper bags have the highest land use due to the land required for the growth of raw materials, although the impact of land use on starch-polyester bag is dominated by the use of corrugated board for packaging with only 20 per cent of the land use impact from the production of the starch polyester.

7 Discussion

7.1 Comparison with other studies

To check the results of this study we compared the impact assessment to other LCA studies of carrier bags, some of which are described in annex A. It is difficult to make detailed comparisons between the studies due to differences in system boundaries, functional unit and impact assessment methods. However, a common feature in all the studies is the inclusion of GWP as an impact category and therefore a basic data comparison can be made by dividing the global warming potential of each bag by its reference flow weight. This should remove any difference due to bag capacities and reuse and highlight any disparities in the data used. Figure 7.1 shows the results of this and three other studies based on the weight of CO2 equivalents generated per kg of each bag. The results for each study are relative to the baseline of the HDPE carrier bag in that study which is set at 100 per cent.

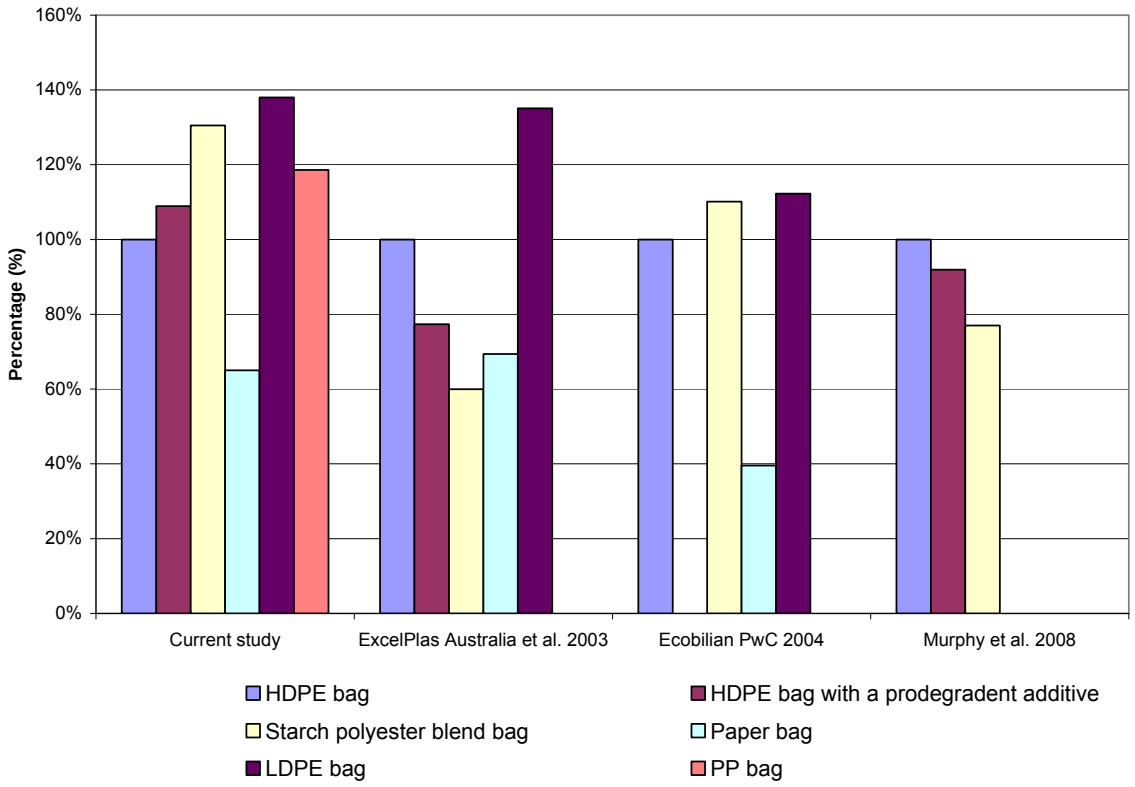


Figure 7.1 A comparison of the global warming potential of each bag type in each report based on the kg CO2 eq. produced per kg of bag weight.

Each report provides only a limited amount of information regarding the assumptions made and there are differences in material content, production, transport and end-of-life processing, so it is difficult to identify the sources of difference between each study. Generally, other studies have found that the impact of HDPE bags with prodegradant have a lower global warming potential when compared to conventional HDPE bags. This may be due to differences in the material content of the bags. Murphy et al (2008)

assumed that the HDPE bag was produced using only HDPE, whilst the HDPE prodegradant bag contained 96 per cent HDPE and 4 per cent catalyst. The prodegradant additive was modelled as an organic chemical with a lower GWP impact than HDPE from the ETH database. This study used a more complex combination of materials, including chalk and titanium oxide, and used a surrogate for the prodegradant additive (90% stearic acid, 10% cobalt) which had a larger impact when compared to HDPE.

The global warming potential of the paper bag was lower than the HDPE bag in three of the four studies when compared by material weight. The LDPE reusable bag had a higher global warming potential than the baseline HDPE bag in the three studies. The results of this study generally lie between the results of the other studies for these formats.

The impact of the starch polyester blend varies considerably between studies. Both ExcelPlas Australia et al. (2003) and Murphy et al. (2008) show a lower gram for gram impact of the starch polyester bag than HDPE. However, the Ecobilian PwC (2004) and this study both show a higher impact by weight from the starch polyester bag. This is partially due to the impact of the material in landfill at the end-of-life

Figure 7.2 compares the grams of material used per litre for each bag type relative to the HDPE bag which was set at 1 for each study.

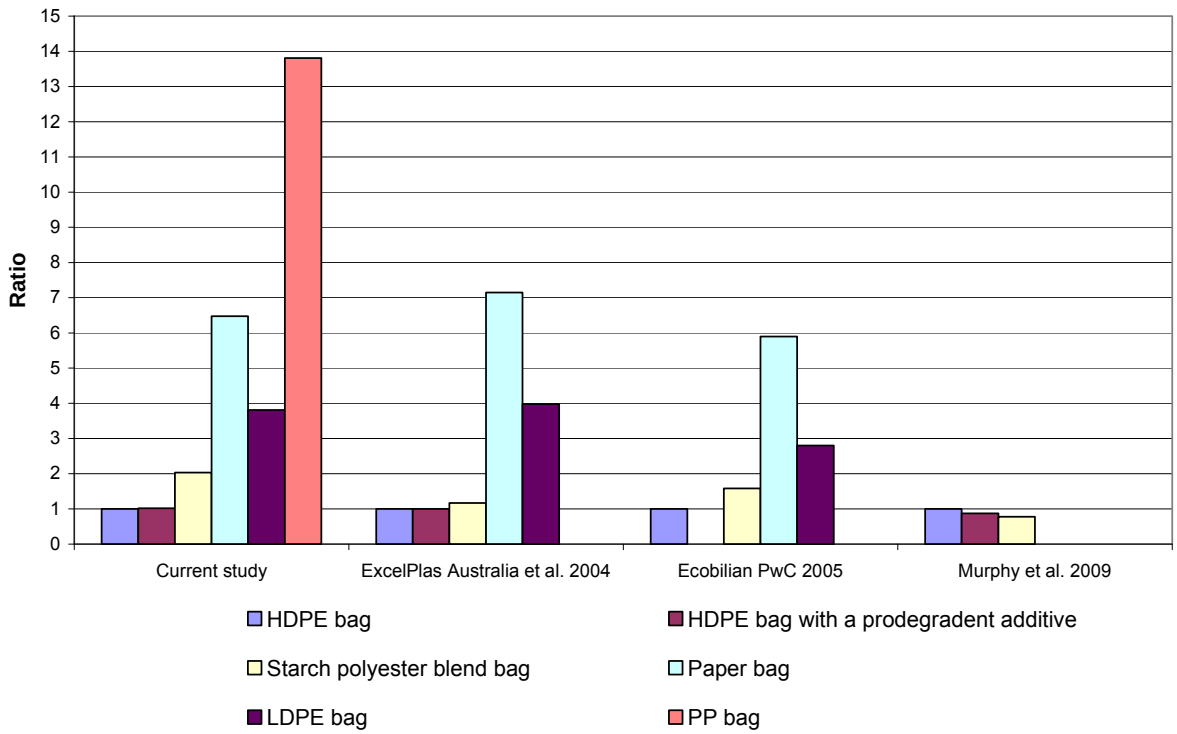


Figure 7.2 A comparison of the grams of material used per litre in each report based on a baseline of 1 for single use HDPE bags.

The ratios of material per litre capacity for the HDPE prodegradant bag, the paper bag and the LDPE bag relative to the HDPE bag in each report are comparable. However, there are differences between the grams per litre used for starch-polyester blend bags. Murphy et al. (2008) is the only study which assumes that both the prodegradant bag and the starch-polyester bag require less material per unit volume than the HDPE bag. The difference is almost certainly linked to the different samples used to generate the weight and capacity data. Although the data used here was supplied by manufacturers the results of this report only represent the reference period, 2007. There is evidence that biopolymer materials have improved since that period and weights have been reduced[21]. The current products on the market are based on new polyesters with much higher perfromace at lower grade.

All the reports agree that the extraction and production of raw materials has the greatest effect on the environmental performance of the carrier bags studied. Ecobilan PwC (2004) found that improvements were seen when secondary reuse was considered for conventional HDPE bags and that reducing weight and reuse were the best options for improving the environmental performance of the carrier bags. The level of reuse required for LDPE bag to be superior to the conventional HDPE bag was also found to be similar to this study. Nolan-ITU (2003) reported that reusable bags had a lower environmental impact, although they assumed reuse was significantly higher than the other studies at 10 uses for the LDPE bag. Nolan-ITU also found that degradable bags have a similar environmental impact to conventional lightweight HDPE bags and that starch-polyester blend bags have higher eutrophication and acidification impacts. Like this study, Murphy et al. (2008) reported that the recycling of HDPE bag reduces both abiotic depletion and global warming potential and the composting of starch-polyester bags increases the impact in those categories. However, this study shows that recycling greater effects on both eutrophication and acidification. This is probably due to the transport of recyclates to China included in this report which increases the impact in these categories.

7.2 Discussion of results

The goal of this study was to investigate and compare the environmental impact of carrier bags made from HDPE, LDPE, non-woven PP, HDPE with prodegradant additives, paper, a starch-polyester blend and cotton using life cycle assessment (LCA). The assessment used the IPCC 2007 and CML 2 baseline method to provide the environmental impacts of these carrier bag systems in nine environmental categories.

Each type of carrier bag is designed for a different number of uses. Those intended to last longer need more resources in their production. To make the comparison fair, the environmental impacts of the carriers bags were considered in relation to carrying the same amount of shopping over a period based on studies of their volumes and the number of items consumers put into them. Resource use, primary and secondary reuse and end-of-life recovery play a pivotal role in the environmental performance of the carrier bags studied. The analysis showed that the environmental impacts of each type are significantly affected by the number of times a carrier is used.

[21] Personal communication from the Co-op to the Environment Agency.

When each bag was compared with no primary reuse (i.e. no reuse as a carrier bag), the conventional HDPE bag had the lowest environmental impacts of in eight of the nine impact categories, because it was the lightest bag considered. The HDPE prodegradant bag had a larger impact than the HDPE bag in all categories considered. Although the bags were very similar, the prodegradant bag weighed slightly more and therefore used slightly more energy and resources during production and distribution. The lifecycle impact of both these types of carrier bags was dominated by raw material extraction and the production of the carrier bags, with the use of Chinese grid electricity produced from coal burning significantly affecting the acidification and ecotoxicity impacts of the bag.

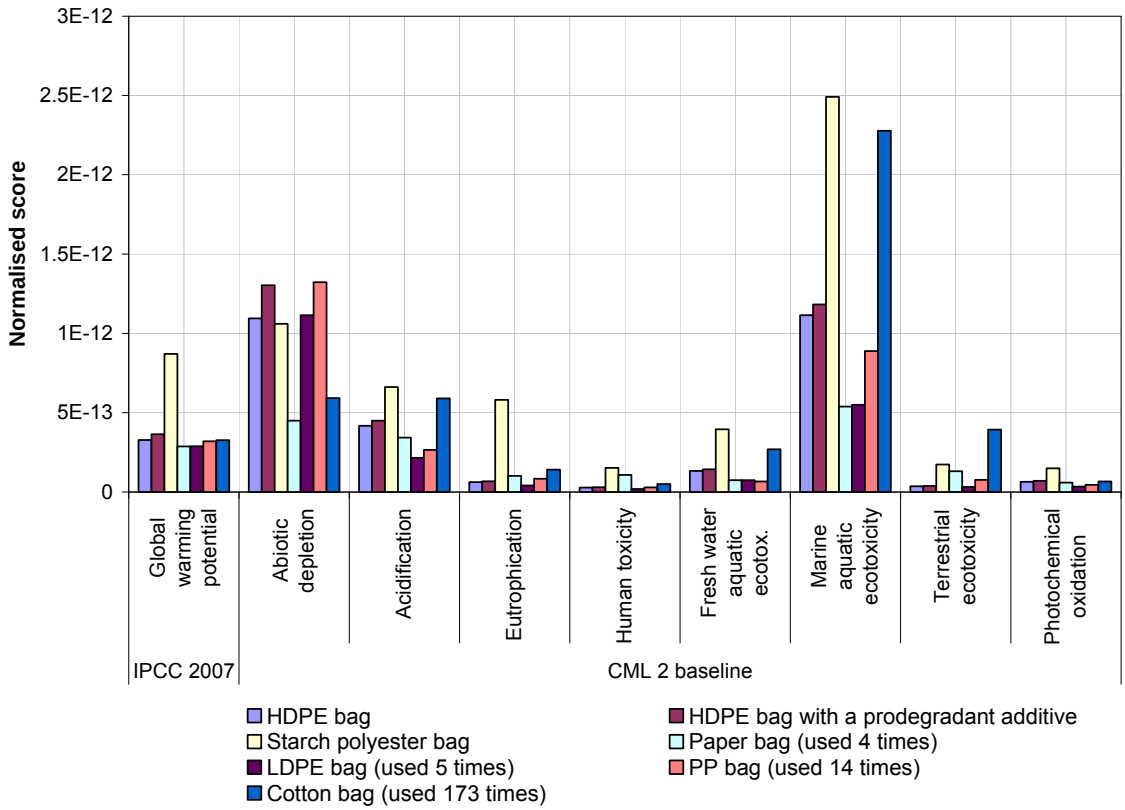


Figure 7.1 The normalised results of the impact assessment when the IPCC 2007 and CML 2 baseline methods were used.

The normalised results of the impact assessment are shown in figure 7.1. Normalisation divides the results in each category by a reference value to provide a measure of their relative important. The figure shows the relative importance of global warming potential, abiotic depletion, acidification and marine aquatic ecotoxicity. However, some impact categories, particularly human toxicity and aquatic and terrestrial ecotoxicity, are difficult to quantify with LCA because their local impacts makes them difficult to aggregate with the traditional global impact categories used. However, the impact categories are still widely used, and have therefore been included in the assessment as issues of interest.

We have avoided calling lightweight bags “single use” or “disposable”, because consumers are increasingly reusing lightweight carriers for shopping. Additionally a high proportion were used during the reference period as a genuine replacement for another product and the secondary reuse of these bags plays an important part in reducing their global warming potential.

This study does not compare the real functionality of the bags, which is partially dependent on consumer use. This would require a large survey to establish average primary reuse rates for each bag. Instead, we have calculated the 'required reuse' to reduce the global warming potential of each type of bag to below that of the conventional bag, which will be unrealistic for some bag types. This provides a better and more practical understanding of the consumers' role in the environmental impact of reusable bags.

The results show that durable carrier bags have to be reused several times to have a lower global warming potential than the conventional HDPE carrier bags. Whether this reuse is achieved depends both on the physical properties of the bag and consumer behaviour.

Most of the impacts were related to the extraction and production of the raw materials and analysis of the results shows that there are three key factors in the assessment of the impacts of different types of carrier bag:

- the amount of material necessary to carry a fixed amount of shopping;
- the way they are used (number of reuses or secondary use); and
- to a lesser extent, the way they are managed at the end-of-life.

The manufacturing of the bags is normally the most significant stage of the life cycle, due to both the material and energy requirements. The impact of the energy used is often exacerbated by their manufacture in countries where the electricity is produced from coal-fired power stations. Generally, bags that are designed to be used many times are heavier and contain more raw materials and require more energy in their production than lightweight carrier bags. For any carrier bag, including lightweight bags, the impacts of manufacture can be reduced by using a carrier bag several times – for example, if a carrier is used three times, the impacts will be one-third of a similar bag which is used only once.

Therefore if conventional HDPE carrier bags are reused as carrier bags three times followed by reusing 40 per cent as bin liners, an LDPE "bag for life" would have to be reused some 14 times and a cotton bag more than 500 times to reduce their GWP to below the level of the conventional bag with this reuse. This is quite feasible for the LDPE bag but less likely for the cotton bag.

When the lightweight carrier bags are compared, the starch polyester bag has the largest impact on GWP due to:

- its greater weight in comparison with the conventional HDPE and HDPE prodegradant bags
- the large transport distance by road; and
- the impacts from its landfil.

The starch-polyester carrier bags considered were based on manufacturer's data and weighed almost twice as much as conventional HDPE carrier bags. They had the highest

impacts of the lightweight carrier bags in every category apart from abiotic resource depletion.

Since the reference period, the weight of starch polyester bags has been reduced by manufacturers to similar to that of the conventional HDPE bag. On a weight for weight basis this suggests that the global warming potential, acidification and photochemical oxidation impacts of the starch-polyester bag would be similar to conventional HDPE carrier bags, as indicated in other reports on the subject. However, the impacts of global warming potential, eutrophication, toxicity and ecotoxicity for the starch-polyester blend bag studied would still be worse than conventional plastic bags due to the high impacts of raw material production, transport and landfill on those categories.

The sensitivity analysis showed that, not counting primary reuse, the secondary reuse of lightweight carrier bags was fundamental to their environmental performance, particularly in terms of abiotic depletion, global warming potential, toxicity, ecotoxicity and photochemical oxidation. In the case of the HDPE bag, a change from no reuse to 100 per cent reuse decreased these impacts by between 43 per cent and 79 per cent. The environmental benefit of recycling HDPE and HDPE prodegradant bags was also affected by secondary reuse. The recycling of these bags was found to be beneficial to global warming potential and abiotic depletion in combination with secondary reuse. However, when HDPE bags are recycled instead of being reused it increases most of their environmental impacts.

The sensitivity study also found that composting starch polyester bags reduce only their global warming potential. Recycling and composting reduced the global warming potential of the paper bag by 21 per cent and nine per cent respectively, but could also cause significant rises in aquatic and terrestrial ecotoxicity.

8 Conclusions

8.1 Conclusions related to individual carrier bags

The following sections outline the results shown in figure 7.1 for each of the bag types considered in this study. The comparisons include the secondary reuse of 40 per cent of lightweight bags (HDPE, HDPE prodegradant and starch-polyester) as bin liners.

8.1.1 Conventional HDPE bag

The conventional HDPE bag had the lowest environmental impacts of the lightweight bags in eight of the nine impact categories. The bag performed well because it was the lightest bag considered. The lifecycle impact of the bag was dictated by raw material extraction and bag production, with the use of Chinese grid electricity significantly affecting the acidification and ecotoxicity of the bag.

8.1.2 HDPE bag with prodegradant additive

The HDPE prodegradant bag had a larger impact than the HDPE bag in all categories considered. Although the bags were very similar, the prodegradant bag weighed slightly more and therefore used more energy during production and distribution.

8.1.3 Starch-polyester bag

The starch-polyester bag had the highest impact in seven of the nine impact categories considered. This was partially due to it weighing approximately twice that of the conventional HDPE bags but also due to the high impacts of raw material production, transport and the generation of methane from landfill.

8.1.4 LDPE bag

The LDPE bag has to be used five times to reduce its GWP to below that of the conventional HPDE bag. When used five times, its impacts were lower in eight of nine of the impact categories. The impact was also substantially lower than the HDPE bag in terms of acidification, aquatic ecotoxicity and photochemical oxidation due to lower shipping distances and the use of grid electricity which is less reliant on coal.

8.1.5 Non-woven PP bag

The non-woven PP bag had to be used fourteen times to reduce its GWP to below that of the conventional bag. With this level of reuse it was also superior to the conventional HDPE bag in five of the nine categories. However, the PP bag was significantly worse than the baseline in terms of terrestrial ecotoxicity due to the emissions associated with use of a heavy fuel oil in an industrial furnace. When recycling was considered global warming potential and abiotic depletion impacts were reduced similar to the HDPE bag.

8.1.6 Paper bag

The paper bag has to be used four or more times to reduce its global warming potential to below that of the conventional HDPE bag, but was significantly worse than the conventional HDPE bag for human toxicity and terrestrial ecotoxicity due to the effect of

paper production. However, it is unlikely the paper bag can be regularly reused the required number of times due to its low durability.

8.1.7 Cotton bag

The cotton bag has a greater impact than the conventional HDPE bag in seven of the nine impact categories even when used 173 times (i.e. the number of uses required to reduce the GWP of the cotton bag to that of the conventional HDPE bag with average secondary reuse). The impact was considerably larger in categories such as acidification and aquatic & terrestrial ecotoxicity due to the energy used to produce cotton yarn and the fertilisers used during the growth of the cotton.

8.2 General conclusions

The following bullet points provide general conclusions to the study.

- The environmental impact of carrier bags is dominated by resource use and production. Transport, secondary packaging and end-of-life processing generally have a minimal influence on their environmental performance.

- The key to reducing the impact of all carrier bags is to reuse them as much as possible and where reuse for shopping is not practical, secondary reuse in application such as bin liners is beneficial.

- The reuse of conventional HDPE and other lightweight carrier bags for shopping and/or as bin-liners can substantially improve their environmental performance.

- Reusing lightweight carrier bags as bin liners produces greater benefits than recycling bags due to the benefits of avoiding the production of the bin liners they replace.

- For the impacts categories considered, the HDPE bag with prodegradant additives increased the environmental impacts from those of the conventional HDPE bag.

- Starch-polyester blend bags have a higher global warming potential than conventional polymer bags, due to the increased weight of material in a bag, higher material production impacts and a higher end-of-life impact in landfill.

- Recycling or composting generally produces only a small reduction in global warming potential and abiotic depletion. The reduction is greatest for the biodegradable bags – paper and starch-polyester. Composting of starch-polyester bags significantly reduces the contribution of the end-of-life stage to global warming.

- The paper, LDPE, non-woven PP and cotton bags should be reused at least four, five, 14 and 173 times respectively to ensure that they have lower global warming potential than conventional HDPE carrier bags. The number of times each would have to be reused when the conventional carrier bag is reused in different ways is shown in table 8.1.

Table 8.1 The amount of primary use required to take reusable bags below the global warming potential of HDPE bags with and without secondary reuse.

	HDPE bag (No secondary reuse)	HDPE bag (40.3% reused as bin liners)	HDPE bag (100% reused as bin liners)	HDPE bag (Used 3 times)
Paper bag	3	4	7	9
LDPE bag	4	5	9	12
Non-woven PP bag	11	14	26	33
Cotton bag	131	173	327	393

9 References

British Polythene Industries (BPI), 2007. *Environmental Facts,* Retrieved 17th August 2009, from, http://www.bpipoly.co.uk/downloads/bpi_enviro2.pdf

Centre for Environmental Studies (CML), 2001. *CML Impact Assessment Characterisation Factors*, University of Leiden, More information on http://www.leidenuniv.nl/interfac/cml/ssp/lca2/index.html

Department for Environment Food and Rural Affairs (DEFRA), 2007. *Packaging Waste Recovery and Recycling achieved in 2006*, 29th March 2007.

Department for Environment Food and Rural Affairs (DEFRA), 2008. *Municipal Waste Statistics*. Retrieved 17th August 2009, from, http://www.defra.gov.uk/environment/statistics/wastats/bulletin08.htm

Department for Environment Food and Rural Affairs (DEFRA), 2009. *Local environmental quality: carrier bags*. Retrieved 17th August 2009, from, http://www.defra.gov.uk/ENVIRONMENT/localenv/litter/bags/

EcoBilan PwC, 2004. Évaluation des impacts environnementaux des sacs de caise Carrefour – Analyse du cycle de vie de sacs de caise en plastique, papier et matériau biodegradable (Evaluation of the environmental impacts of Carrefour supermarket carrier bags – Analysis of the life cycle of plastic, paper and biodegradable carrier bags), Carrefour, France.

Elstob, K., 2007. *Personal communication,* Bunzl Retail Supplies Ltd.

ERM, 2009. *Personnal communication*, Environmental Resource Management Ltd.

Intergovernmental Panel on Climate Change (IPPC), 2007. *IPCC Fourth Assessment Report. The Physical Science Basis.* More information on http://www.ipcc.ch/ipccreports/ar4-wg1.htm

International Energy Agency (IEA), 2007. Electricity/heat in Malaysia in 2007. Retrieved 4th February 2010, from http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=MY

International Organization for Standardization (ISO), 2006. *ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework.*

Maxwell, M., 2007. *Personal communication,* British Polythene Industries PLC.

Murphy. R.J. Davis. G. Payne. M., 2008. Life Cycle Assessment (LCA) of Biopolymers for single-use carrier bags. A research report for the National Non-Food Crops Centre (NNFCC), Imperial College London, September 2008.

Nolan-ITU. 2003. The impacts of degradable plastic bags in Australia, Final report to Department of the Environment and Heritage. Nolan-ITU, Centre for Design at RMIT, ExcelPlas Australia. September 2003.

Schmidt, A. and K. Strömberg, 2006. *Genanvendelse I LCA – systemudvidelse* [Recycling in LCA – system expansion], Miljønyt No. 81 2006, Danish Environmental Protection Agency, Denmark.

SimaPro, 2009. *SimaPro LCA software, version 7.1.4*, Pré Consultants.

Waste and Resources Action Programme (WRAP), 2005. *Carrier Bag Usage and Attitudes. Benchmark and Target Market Study*.

Waste and Resources Action Programme (WRAP), 2006. *Choose to Reuse.* Retrieved 17th August 2009, from http://www.wrap.org.uk/downloads/Choose_to_Reuse_Report_-_June_2006.74570e05.2998.pdf

Waste and Resources Action Programme (WRAP), 2009. *New figures show single use carrier bags cut by 48%*, 17th July 2009. Retrieved 17th August 2009, from http://www.wrap.org.uk/wrap_coporate/news/new_figures_show.html

Weström, P. and Löfgren, C., 2005. *Life Cycle Inventory for paper sacks*, CEPI Eurokraft and Eurosac, Sweden.

WRATE, 2009. *Waste and Resources Assessment Tool for the Environment, version 1.0.1.0,* Environment Agency.

Young, N., 2006. *personal communication,* Simpac Ltd.

Annex A - A summary of selected life cycle assessments of carrier bags

A.1 Introduction

Life cycle assessments of carrier bags have been carried out in several countries and regions to aid the local debate on carrier bag use. Recent LCA studies on carrier bags have been streamlined and their scope has therefore been limited. For most of them this has included limiting the environmental impacts assessed. Yet in addition to the environmental impacts, several of the studies have also included various social impacts, such as potential impacts on littering, industry, recycling, and consumers.

Generally, these LCA studies found that reusable bags have a lower environmental impact when compared to single use bags, including both conventional HDPE and prodegradent bags (Ecobilan PwC 2004). Degradable bags were shown to have similar global warming potential to conventional HDPE bags, and tended to have much higher eutrophication potential related to fertilizing the crops used as the basis for the polymer. Conversely, bags produced from conventional oil based polymers have higher abiotic resource depletion potential. Where degradable materials are composted and thereby kept out of landfill, the impacts are slightly reduced. The global warming potential of biodegradable bags was attributed to their starch content which resulted in higher methane emissions during landfill degradation.

The main issues identified in previous studies as having a significant influence on the results were:

- The weight/volume of groceries to be held by each type of carrier bag;
- The number of uses; and
- The alternative uses for lightweight carrier bags.

The following sections outline each of the reports considered in more detail.

A.2 Évaluation des impacts environnementaux des sacs de caisse Carrefaux. Analyse du cycle de vie de sacs de caisse en plastique, papier, et matériau biodegradable* (Ecobilan PwC 2004)

* Evaluation of the environmental impacts of Carrefour supermarket carrier bags. Analysis of the life cycle of plastic, paper and biodegradable carrier bags.

Description of the study

This 2004 study was conducted by Ecobilan for the French supermarket chain Carrefour. The aim of the study was to quantify the environmental impacts associated with Carrefour carrier bags in the different countries where Carrefour is represented (mainly France, Belgium, Spain and Italy). The results were intended for use in Carrefour policy development. The study was carried out in conformance with ISO 14040 and included a crital review conducted by the French Environment Agency (ADEME). The carrier bags involved in the study are shown in table A.2.1 which includes bag weight and usable volume.

Table A.2.1 The carrier bags included in the study.

	HDPE bag	LDPE bag	Paper bag	Biodegradable bag
Materials	HDPE, virgin LLDPE TiO2 Ink Adhesive	LDPE, virgin TiO2 Ink	Paper, recycled Ink Adhesive	50% starch 50% PCL Ink
Weight	6.04 g	44 g	52 g	17 g
Useable volume	14 ltr	37 ltr	20.48 ltr	25 ltr
Country of manufacture	Malaysia, France, Spain	France	Italy	Italy
Re-use scenarios	No Yes, in sensitivity analysis (re-used as bin liner)	Yes (reuse rates of 1, 2, 3, 4 and 20 investigated)	Generally no. Yes, in sensitivity analysis	No

The functional unit for the study was the carrier bags required for the packing of 9,000 litres of purchases. This was based on the typical annual volume of purchased goods per customer. The study is representative of France and primary data was collected from suppliers of bags to Carrefour and supplemented using secondary data from the Ecobilan database. The modelling of end-of-life activities was based French household waste processing which was split between landfill (51%) and incineration (49%). A recycling rate of 45% was included for waste paper.

The Impact categories/indicators considered were the consumption of non-renewable energy resources, water, the emission of greenhouse gases, atmospheric acidification,

the formation of photochemical oxidants, eutrophication, residual solid waste and littering. A sensitivity analysis was also carried out on the following parameters:

- Re-use of 32.5% and 65%, respectively, of HDPE bags as bin liners;
- Re-use of paper bags once;
- 100% landfill of used bags;
- 100% incineration of used bags, with an without energy recovery; and
- Recycling of 30% of used LDPE bags.

Results

The relative performances of the different carrier bags against the environmental indicators assessed are shown in table A.2.2.

Table A.2.2. The results of the study over 8 indicators (>1 equals worse than HDPE bag, <1 equals superior to HDPE bag)

Impact categories	HDPE bag	LDPE bag			Paper bag	Bio-degradable bag
		Used 2x	Used 4x	Used 20x		
Consumption of non-renewable energy sources	1	1.4	0.7	0.1	1.1	0.9
Consumption of water	1	1.3	0.6	0.1	4	1
Emission of greenhouse gases	1	1.3	0.6	0.1	3.3	1.5
Atmospheric acidification	1	1.5	0.7	0.1	1.9	1.8
Formation of photochemical oxidants	1	0.7	0.3	0.1	1.3	0.5
Eutrophication of water	1	1.4	0.7	0.1	14	12
Production of solid waste	1	1.4	0.7	0.1	2.7	1.1
Risk of littering	High	Average to low			Low	Average to low

The study found that when the LDPE bag was reused a minimum of four times it offered the best environmental performance compared to the other bags studied. The HDPE bag was found to be better than the paper and biodegradable bags for most indicators,

except photochemical oxidant formation and the risk of littering. In relation to the HDPE bag, the paper bag performed better with regards to the risk of littering, equivalent with regards to the consumption of non-renewable energy resources and the formation of photochemical oxidants, and worse by at least 80 per cent for the other five indicators studied. In relation to the HDPE bag, the biodegradable bag performed better with regards to the risk of littering and the formation of photochemical oxidants, equivalent for three indicators, and worse for the emission of greenhouse gases, atmospheric acidification and eutrophication.

In the sensitivity analysis, results were not found to change significantly although improvements were seen when the HDPE bag was reused as bin liner and when the paper bag was reused. However, the LDPE bag remained the best option against all indicators when reused between four to seven times.

The dominant source of environmental impacts for all the bag types studied and most indicators was the extraction and production of the materials (polyethylene, paper, starch, etc.). Overall transport contributed very little to the environmental impacts and the production of the bags generally resulted in smaller impacts than those associated with the production of the materials used. However, production of the bags may nevertheless be an important source of photochemical oxidants when the inks used are solvent-based. The end-of-life stages contributed to the impacts of risk of littering, production of solid waste and emission of greenhouse gases and dioxins.

Based on these results, it was concluded that the best options for improving the performance of carrier bags was to minimise weight (while maintaining technical properties) and reuse the bags.

A.3 Plastic Shopping Bags – Analysis of Levies and Environmental Impacts (Nolan-ITU *et al* 2002)

Description of the study

A 2002 streamlined LCA study carried out by Nolan-ITU in association with the RMIT Centre for Design and Eunomia Research and Consulting Ltd aimed to explore various shopping bag options and their associated potential environmental and economic impacts for the Australian Department of the Environment and Heritage. The results were intended to inform policy decisions with regards to plastic bags and enable decision making. The carrier bags studied are shown in table A.3.1.

Table A.3.1 The carrier bags included in the study with specification and major assumptions.

Bag material	Composition	Weight	Relative capacity	Expected life	Production location
HDPE, singlet	HDPE	6 g	1	Single use	67% southeast Asia, 33% locally
50% recycled HDPE, singlet	HDPE (50% post-consumer content)	6 g	1	Single use	67% southeast Asia, 33% locally
Boutique LDPE (single use)	LDPE	18.1 g	0.8	Single use	34% southeast Asia, 66% locally
Reusable LDPE	LDPE	35.8 g	1.5	12 trips	34% southeast Asia, 66% locally
Coles calico	Cotton	125.4 g	1.1	52 trips	100% Pakistan
Woven HDPE swag	HDPE	130.7 g	3	104 trips	100 % Taiwan
PP fibre 'Green Bag'	PP	PP 65.6 g Nylon base 50.3 g	1.2	104 trips	n/a
Kraft paper – Coles handled	Kraft virgin paper	42.6 g	1	Single use	n/a
Solid PP 'Smart Box'	PP	250 g	2	156 trips	100% Scotland
Biodegradable – starch based (Mater-Bi)	Starch based biodegradable polycaprolactone (PCL)	7 g	1	Single trip	100% Italy

The functional unit for the study was the carrying of approximately 70 grocery items home from a supermarket each week for 52 weeks. The study was representative of Australia and the data used was from publicly available life cycle inventory datasets. The study also took into account the carrying capacity and expected life of the bags as well as the avoided impact created by using less virgin material and by using the carrier bags as bin liners in the home. The impact categories/indicators considered were material consumption, Litter (reported as mass of material finding its way into the litter stream,

area of ground covered by litter, and the persistence of litter), global warming and primary energy use.

Results

The results of the study are shown in table A.3.2.

Table A.3.2. The results of the study over 6 impact categories.

Bag type	Material consumption (kg)	Litter (g)	Litter (m^2)	Litter (m^2/y)	Greenhouse (CO_2 eqv.)	Primary energy use (MJ)
HDPE, singlet	3.12	15.6	0.144	0.72	6.08	210
50% recycled HDPE, singlet	3.12	15.6	0.144	0.72	4.79	117
Boutique LDPE (single use)	11.77	58.8	0.195	0.975	29.8	957
Reusable LDPE	0.96	4.8	0.0121	0.0603	2.43	78
Calico	1.14	5.7	0.0041	0.0819	2.52	160
Woven HDPE swag	0.22	1.1	0.00148	0.00743	0.628	18.6
PP fibre 'Green Bag'	0.48	2.4	0.00187	0.00934	1.96	46.3
Kraft paper – handled	22.15	111	0.156	0.078	11.8	721
Solid PP 'Smart Box'	0.42	NA	NA	NA	1.1	38.8
Biodegradable – starch based (Mater-Bi)	6.5	32.5	0.156	0.078	6.61*	61.3

* Assumed to break down into carbon dioxide

The results showed that the heavy duty reusable plastic bags with a long usable life achieved the greatest environmental benefits. Of the heavy duty reusable plastic bags, the woven HDPE bag was the preferred option although no significant difference was identified for the reusable bags. The woven HDPE bag performed better for the impact categories material consumption, embodied energy, global warming, litter (using persistence as the measure), and primary energy use.

The environmental benefits from reusable bags were closely linked to the life expectancy of the bags, their weight-to-capacity ratio and their final destination. The woven HDPE bag assessed had a capacity three times that of the HDPE singlet bag. With a smaller capacity, the environmental impact of the woven HDPE bag came much closer to, and was in some cases exceeded by, the PP box and the PP bag.

When single use bags were compared, the biodegradable and paper bags performed better than conventional HDPE and LDPE bags on litter persistence. The biodegradable bag has a lower contribution to global warming and lower embodied energy than the paper bag.

The biodegradable bag was also found to consume less energy than the conventional HDPE bag, and was roughly equivalent in global warming potential. It used more material because the reference bag used was double the weight of the single-use HDPE bag, and it had a lower impact on litter due to the faster rate of degradation. However, It

must be highlighted that due to the limited LCA work done on starch based plastics, the data used for the modelling of biodegradable plastic bag was the least reliable of all the inventory data used in the analysis.

A.4 The Impacts of Degradable Plastic Bags in Australia (Nolan-ITU 2003)

Description of the study

A 2003 streamlined LCA study carried out by ExcelPlas Australia, the Centre for Design at RMIT and Nolan-ITU for the Australian Department of the Environment and Heritage investigated the impacts of introducing degradable plastic bags into the Australian market. In particular, it aimed to examine the effects on national recycling efforts, local manufacturing, and landfills. The LCA considered six bags manufactured from degradable polymers. These were compared with the streamlined LCA results for lightweight HDPE bags, paper bags, reusable plastic bags and calico bags from a previous Australian study (Nolan *et al* 2002). The carrier bags studied are shown in table A.4.1.

Table A.4.1 The carrier bags included in the study with specification and major assumptions.

Bag material	Composition	Weight	Relative capacity	Expected life	Production location
Starch polybutylene succinate / adipate (PBS/A)	50% starch from maize 25% 1,4-butanediol 12.5% succinic acid 12.5% adipic acid	6 g	1	Single use	Japan
Starch with polybutylene adipate terephthalate (PBAT)	50% starch from maize 25% 1,4-butanediol 12.5% adipic acid 12.5% terephthalate acid	6 g	1	Single use	50% Germany, 50% USA
Starch-polyester blend	50% starch from maize 50% polycaprolactone (PCL)	8.1 g	1	Single use	Italy
Starch-polyethylene blend	30% starch from cassava (tapioca) 70% HDPE	6 g	1	Single use	Malaysia
Polyethylene and prodegradant	97% HDPE 3% additive	6 g	1	Single use	Additive from Canada, 50% of bag from Malaysia
Polylactic acid (PLA)	100% PLA	8.1 g	1	Single use	50% USA, 50% Japan
Lightweight HDPE	HDPE	6 g	1	Single use	Hong Kong
Kraft paper (with handle)	Kraft virgin pulp	42.6 g	1	Single use	n/a
PP fibre “green bag”	PP Nylon base	65.6 g 50.3 g	1.2	104 uses	n/a
Woven HDPE “swag bag”	HDPE	130.7 g	3	104 uses	Taiwan
Calico	Cotton	125.4 g	1.1	52 uses	Pakistan
LDPE	LDPE	40 g	2	10 uses	Hong Kong

The functional unit for the study was the carrying of approximately 70 grocery items home from a supermarket each week for 52 weeks. The study was representative of Australia and the data used was from publicly available life cycle inventory datasets. The end-of-life waste management options modelled in the baseline scenario were 70.5% to landfill (anaerobic environment), 10% to composting with source separated organics, 19% reused as bin liners and 0.5% as litter.

The Impact categories considered included the greenhouse effect, (Abiotic) resource depletion, eutrophication, litter aesthetics and litter marine biodiversity.

Results

The results of the study are shown in table A.4.2.

Table A.4.2. The results of the study over 6 impact categories.

Bag type	Material use (kg)	Greenhouse gases (kg CO_2 eq.)	Abiotic depletion (kg Sb eq.)	Eutrophication (kg PO_4^{3-} eq.)	Litter marine biodiversity (kg*yr)	Litter aeshetics (m^2*yr)
Starch-PBS/A	3.12	2.5	0.00487	0.00273	4.26E-05	0.078
Starch-PBAT	3.12	2.88	0.023	0.00406	4.26E-05	0.078
Starch-polyester	4.21	4.96	0.0409	0.00494	5.75E-05	0.078
Starch-PE	3.12	4.74	0.0694	0.00258	0.0078	0.078
HDPE & additive	3.12	6.31	0.101	0.00236	0.0039	0.078
PLA	4.212	16.7	0.0776	0.00911	5.75E-05	0.078
Lightweight HDPE	3.12	6.13	0.102	0.00246	0.0078	0.312
Kraft paper	22.152	30.2	0.285	0.0266	0.000302	0.078
PP fibre	0.209	1.95	0.023	0.00126	0.000241	0.00187
Woven HDPE	0.216	0.216	0.00934	0.000231	0.000107	0.00148
Calico	1.141	6.42	0.0177	0.00795	3.09E-06	0.00164
LDPE	1.04	2.76	0.0422	0.00114	0.00257	0.00746

The overall conclusion was that reusable bags have lower environmental impacts than all the single-use bags, including both lightweight HDPE bags and degradable bags. This supported the findings of Nolan-ITU *et al* 2002. The study found that degradable bags generally had similar greenhouse effect impacts to lightweight HDPE bags, and depending on the source of the raw material may have much higher eutrophication impacts from farming activities. On the other hand, the conventional polymers have higher resource depletion impacts (abiotic depletion).

Degradable polymers with starch content had higher greenhouse effect impacts due to methane emissions from the degradation of the materials in landfills (i.e. anaerobic conditions) and nitrous oxide emissions from fertilizer application to crops. Degradable polymers manufactured from renewable resources (e.g. crops) also had a greater impact upon eutrophication due to the application of fertilizer to land.

The benefits of degradable bags were found to be the lower consumption of non-renewable resources (abiotic resource depletion) and faster rate of degradation in the litter stream (with potential benefits for wildlife as less plastics are ingested by fish and marine mammals).

A.5 Life Cycle Assessment (LCA) of Biopolymers for single use carrier bags (Murphy *et al* 2008)

Description of the study

A full peer reviewed LCA study comparing the environmental impacts of bioplastic carrier bags to conventional bags was conducted by Imperial College London on behalf of the National Non-Food Crops Centre (NNFCC) from 2006 to September 2008. The LCA considered four single use bags; a lightweight HDPE bag, an oxo-degradable HDPE bag, a starch polyester biopolymer bag and a PLA/Ecofoil biopolymer bag. The carrier bags studied are shown in table A.5.1.

Table A.5.1 The carrier bags included in the study with specification.

Bag type	Material	Weight (g)	Capacity (75% full) (l)	Quantitiy of bags for FU	Mass of material (kg)
HDPE	HDPE	8.6	11.7	855	7.35
Mater-bi	Starch (corn) 50%, Polycaprolactone	9.15	16	625	5.72
Octopus (prototype 1)	PLA 60%, Ecofoil 40%	9	11.7	855	7.7
Oxo-degradable	HDPE, Catalyst	7.5	11.7	855	6.41

The functional unit for the study was the carrying of 10,000 litres of grocery items from a supermarket to the home in carrier bags filled to 75% of the nominal bag volume. The study was representative of the production and use of these bags in the UK . Primary data concerning the processing of the polymers and their transportation and distribution was obtained from the manufacturers and distributor websites. Raw material production data was obtained from the BUWAL 250 and APME databases with surrogate materials used to represent Ecofoil, Polycaprolactone and the oxo-degradable bags catalyst material.

Use and reuse of bags, ink production, secondary packaging, anti-slip agents and transportation from the supermarket to the home were all excluded from the study. End-of-life scenarios included the consideration of 100% landfill, 100% incineration with energy from waste, 100% material recycled (for the HDPE bag only) and 100% municipal composting (for the biopolymer bags only) to facilitate the identification of the most appropriate disposal route for each bag type. The recycling process assumed the avoided production of 90% of the material entering the process.

The Impact assessment used the CML baseline 2002 methodology alongside the eco-indicator 99 method (providing a single score using a heirarchist/average perspective.

Results

The results of the study are shown in table A.5.2.

Table A.5.2. The results of the study over 4 impact categories.

Bag type	End-of-life processing	Global warming (kg CO_2 eq.)	Abiotic depletion (kg Sb eq.)	Acidification (kg SO_2 eq.)	Eutrophication (kg PO_4 eq.)
HDPE	EfW	31.7	0.258	0.111	0.0115
	Landfill	22.7	0.28	0.131	0.0121
	Recycling	19.1	0.175	0.129	0.00841
Oxo-degradable	EfW	26.1	0.0704	0.114	0.00473
	Landfill	18.2	0.0903	0.131	0.00519
Mater-bi	EfW	21.1	0.179	0.116	0.0236
	Landfill	13.6	0.195	0.13	0.0391
	Compost	24.3	0.197	0.13	0.0239
Octopus	EfW	23.1	0.238	0.207	0.0464
	Landfill	13.7	0.258	0.225	0.0672
	Compost	27.4	0.262	0.224	0.0466

The overall conclusion was that the results indicated that there is scope to gain environmental benefits, especially in terms of resource efficiency, from the use of biopolymer bags when compared with fossil based equivalents. However, these benefits will only be achieved through the use of effective disposal routes such as energy from waste or municipal composting. The study found that the environmental impacts were dominated by the extraction and production of raw materials and that the waste management scenario had a significant influence on the environmental profile of different materials. Energy from waste offered the best solution, especially for biopolymer bags, but the recycling of HPDE bags showed promise if it resulted in the avoidance of virgin polymer production.

In terms of global warming potential, the starch polyester blend bag provided the best alternative when landfilled. However, this assumed a low degradation rate of 30% resulting in the sequestration of the majority of carbon held within the bag. The study also found that the composting of biodegradable bags was subject to major uncertainty due to the use of a composting framework that was estimated from published data. Thee results of the eco-indicator 99 single score method indicated that the recycled HDPE bag offered the best option followed by the starch polyester biopolymer and oxo-degradable bags respectively.

Annex B - A study of carrier bag weight, volume and item capacity

B.1 Introduction

In January 2008 Test Research conducted a survey of supermarket carrier bag use. The data derived from this study was used in conjunction with a study on carrier bag weight and volume conducted by Pira International in March 2008 to ascertain the average weight, volume and item capacity for 7 carrier bag types which are listed below.

The following carriers were studied:

- A high-density polyethylene (HDPE) bag;
- A high-density polyethylene (HDPE) bag with a prodegradent additive; and
- A starch-polyester (biopolymer) blend bag.
- A paper bag;
- A low-density polyethylene (LDPE) bag;
- A non woven polypropylene (PP) bag; and
- A cotton bag.

The weight and volume of an average bin liner was also calculated during the study. The following report outlines how this study was conducted.

B.2 Test Research Study: January 2008

Test Research interviewed 1,149 shoppers in-store at 30 major supermarkets throughout the country between the 21st November and 9th December 2007. Table B.2.1 shows the structure of the sample.

Table B.2.1 The structure of the Test Research sampling

Supermarket	Interviews	Day	Interviews/day
Asda (6 stores)	246	Monday	181
Co-op (5 stores)	203	Tuesday	225
Morrisons (4 stores)	171	Wednesday	170
Sainsbury's (6 stores)	195	Thursday	120
Somerfield (2 stores)	57	Friday	110
Tesco (5 stores)	168	Saturday	238
Waitrose (2 stores)	109	Sunday	145
Total	1,149	Total	1,149

Four questions were asked during the survey:

- How many bags have you used to do your shopping and what types are they?
- How many items have you purchased?
- Is this a main food shopping trip or a smaller "top-up" shopping trip?

How will you transport your shopping home from the supermarket today?

The findings of the study provided a sample profile of shoppers and an analysis of the usage of different types of bags. This analysis found that the average number of items per bag for all bag types was 20.7 items, as shown in table B.2.2. The study found that 2,490 single use carrier bags were used to carry 14,651 items by the shopper surveyed providing an average of 5.88 items per bag. 72 LDPE 'bags for life' were also used to carry 573 items providing an average of 7.96 items.

Table B.2.2 The number of items per bag

	Total	Asda	Co-op	Morrisons	Sainsbury's	Somerfield	Tesco	Waitrose
Base: All respondents	**1149**	**246**	**203**	**171**	**195**	**57**	**168**	**109**
Average number of items	20.7	32	7.6	31.1	7.6	10.3	26.5	22.8
Average number of bags	3.1	4.8	1.5	4.3	1.5	2.4	3.6	3
Average number of items per bag	6.6	6.7	5.2	7.3	5	4.3	7.3	7.5

B.3 Pira International study: March 2008

The study conducted by Pira International in March 2008 measured the weight, volume and weight capacity of a number of sample carrier bags to understand whether weight capacity or volume capacity was the limited factor in carrier bag use. Carrier bags were collected from major retails and bag producers during the reference period of the study. Table B.3.1 shows the carrier bags sampled from UK supermarkets. Starch-polyester blend and paper bags were sourced from producers. Due to the variety of different capacities available for these bags, a single paper bag and starch-polyester bag were selected based on their similarity, in terms of volume and strength, to the other bags considered. In addition premium, handled and value bin liners were sourced from supermarkets.

Table B.3.1 The supermarket carrier bags sampled

Bag type	Supermarket samples
High-density polyethylene (HDPE) bag	Sainsbury's, Waitrose, Asda, Iceland, Morrisons
High-density polyethylene (HDPE) bag with a prodegradant additive	Tesco, Somerfield, Co-op
Low-density polyethylene (LDPE) bag	Tesco, Sainsbury's, Waitrose, Asda, Iceland, Morrisons, Somerfield
Non woven polyproylene (PP) bag	Asda, Greengocer
Cotton bag	Sainsbury's, Asda, Co-op, Marks & Spencer

Volume testing

The study used expanded polystyrene beads (as shown in figure B.3.1) to measure the volume of the HDPE, HDPE prodegradant and LDPE carrier bags. The use of these low weight beads above other mediums such as sand reduced any potential damage to the sample bags before weight capacity testing. Each bag was filled to capacity (up to in line with its handles) and then the volume of beads used was measured. The test found that an average single use bag (i.e. HDPE and HDPE prodegradent bags) had a capacity of 20.7 litres whilst the average LDPE bag had a capacity of 21.3 litres.

Figure B.3.1 Expanded polystyrene beads

Weight testing

The study used a jog testing machine to measure the weight capacity of the HDPE, HDPE prodegradant and LDPE carrier bags. The machine accurately simulates the movement of walking by moving the bag up and down in a walking motion. The study began by jog testing the sample bag for 4 minutes with a 5 kg load. An additional weight of 1 kg was then added every minute until the bag failed. The final weight and time were then logged. The study found that an average single use bag (i.e. HDPE and HDPE

prodegradant bags) had a capacity of 18.22 kilograms and lasted for 17 minutes and 32 seconds. The average LDPE bag had a capacity of 19 kilograms and lasted 18 minutes and 30 seconds.

Analysis of the volume and weight capacity results

The results of the volume and weight testing showed that there were only slight differences in the volume and weight capacity of conventional single use bags and reusable bags. However, the average weight capacity of both bag types was found to be significantly higher than the weight an average person could comfortably carry. Therefore, volume was selected as the limiting factor for bag use.

B.4 The calculation of bag weight, volume and number of items

Based on the findings of the two studies, the average weights and volumes of each bag type was calculated using market share data. This was then related to the average number of items found in conventional HDPE carrier bags and LDPE bags for life.

The average volume of conventional HDPE and HDPE prodegradant bags was calculated using market share data (TNS Global 2006) and the carrier bag volumes measured during the Pira International study. The market share of the top 8 supermarkets was calculated and then combined with the relevant bag volume to give an average volume of 19.1 litres, as shown in table B.4.1. Although the Sainsbury sample contained recycled content, the bag was included due to the importance of Sainsburys market share. However, this did not significantly affect the average weight and volume calculated.

Table B.4.1 The calculation of the average volume of single use carrier bags

Supermarket source	Market share	HDPE & HDPE prodegradent bag volume (litres)
Sainsbury	17.98%	17.90
Waitrose	4.22%	20.80
Asda	18.42%	19.60
Iceland	2.00%	32.20
Morrisons	12.43%	21.80
Tesco	33.74%	17.90
Somerfield	5.99%	16.00
Co-op	5.22%	19.60
Average		19.1

The volume and item capacity for all single use carrier bags (HDPE, HDPE prodegradent and starch polyester bags) was therefore assumed to be 19.1 litres and 5.88 items respectively. To ensure that the correct bag weight was used to model each of these carriers, the average volume and weight of each carrier bag type was measured and an average ‘grams per litre’ ratio calculated. This figure was then multiplied by the average single use carrier bag volume (19.1 litres) to give an accurate weight for each bag type.

The calculated ratios are shown in table B.4.2. The average ratio for a HDPE bag, a HDPE prodegradant bag and a starch polyester blend bag gave bag weights of 8.116 grams, 8.266 grams and 16.491 grams respectively for a 19.1 litre bag of each type.

Table B.4.2 The calculation of an average grams per litre ratio for each single use bag type.

Bag type	Supermarket source	Market share	Share for bag type	Volume (litres)	Weight (grams)	Grams per litre
High-density polyethylene (HDPE) bag	Sainsbury	17.98%	32.66%	17.90	8.830	0.49
	Waitrose	4.22%	7.66%	20.80	8.670	0.42
	Asda	18.42%	33.47%	19.60	7.480	0.38
	Iceland	2.00%	3.63%	32.20	12.620	0.39
	Morrisons	12.43%	22.58%	21.80	8.980	0.41
	Total	55.05%	100%			
	Average			**20.09**	**8.537**	**0.42**
High-density polyethylene (HDPE) bag with a prodegradent additive	Tesco	33.74%	75.06%	17.90	8.240	0.46
	Somerfield	5.99%	13.33%	16.00	5.890	0.37
	Co-op	5.22%	11.60%	19.60	6.480	0.33
	Total	44.95%	100%			
	Average			**17.84**	**7.722**	**0.43**
Starch polyester blend bag	**Supplier**			**18.30**	**15.800**	**0.86**

The average volume of an LDPE bag was calculated using market share data (TNS Global 2006) and the carrier bag volumes measured during the Pira International study. The market share of the 7 supermarkets that provided LDPE carrier bags for the study was calculated and then combined with the relevant bag volume to give an average volume of 21.52 litres, as shown in table B.4.3.

Table B.4.3 The calculation of the average volume of LDPE carrier bags

Supermarket source	Market share	LDPE bag volume (litres)
Sainsbury	18.97%	20.20
Tesco	35.60%	23.90
Waitrose	4.45%	23.90
Iceland	2.11%	20.60
Somerfield	6.32%	21.70
Morrisons	13.12%	19.10
Asda	19.44%	19.60
Average		21.52

The volume and item capacity for an average LDPE bag was therefore assumed to be 21.52 litres and 7.96 items respectively. Unlike the calculation used for the single use carrier bags, where the same volume and number of items were assumed for all bag types, the volume and number of items for all reusable bags was varied. This was due to the Test Research data which defined reusable bags by type but did not identify single

use bag as prodegradant or non prodegradant. It was therefore assumed that, whilst the single use bag data represented all single use bag types, the reusable bag data specifically represented the use of LDPE bags. To adapt the LDPE bag data for other reusable bag types, the number of items per litre was calculated (0.37 items per litre). The volume and weight of all other reusable bags considered was then measured (as shown in table B.4.4) and, based on the items per litre ratio, a number of items per bag type was calculated. This was found to be 7.43 items for the paper bag, 7.3 items for the non woven PP bag and 10.59 items for the cotton bag. The volume, weight and items per bag for every bag type are shown in table B.4.5.

Table B.4.4 The volume and weight of all other reusable bag types

Bag type	Supermarket source	Volume (litres)	Weight (grams)	Grams per litre
Paper bag	**Supplier**	**20.10**	**55.200**	**2.75**
Non woven polyproylene (PP) bag	Asda	17.7	124.080	7.01
	Greengrocer	21.8	107.580	4.93
	Average	**19.75**	**115.830**	**5.86**
Cotton bag	Sainsbury	17.00	195.680	11.51
	Asda	32.10	229.050	7.14
	Co-op	33.40	78.660	2.36
	M&S	32.10	229.050	7.14
	Average	**28.65**	**183.11**	**7.03**

Table B.4.5 The volume, weight and items per bag for all bag types

Bag type	Volume (litres)	Weight (grams)	Items per bag
High-density polyethylene (HDPE) bag	19.10	8.116	5.88
High-density polyethylene (HDPE) bag with a prodegradent additive	19.10	8.266	5.88
Starch polyester blend bag	19.10	16.491	5.88
Paper bag	20.10	55.200	7.43
Low-density polyethylene (LDPE) bag	21.52	34.945	7.96
Non woven polyproylene (PP) bag	19.75	115.830	7.30
Cotton bag	28.65	183.110	10.59

The average volume, weight and ‘grams per litre’ ratio was also calculated for bin liners using the same methods. Three liners were measured; a premium liner, a liner with handles and a value liner. The liners selected had similar volumes to the carrier bags investigated within this study and were smaller than conventional black bin liners used for household refuse. The calculated weights and volumes are shown in table B.4.6.

Table B.4.6 The volume and weight of bin liners.

Liner type	Volume (litres)	Weight (grams)	Grams per litre
Premium bin Liner	37.07	15.820	0.43
Bin liner with handles	30.13	8.490	0.28
Value bin liner	20.70	3.490	0.17
Average	**29.3**	**9.3**	**0.32**

Annex C - Description of inventory data

C.1 Extraction and production of raw materials

The materials and weights shown in table C.1.1 are used for the carrier bag systems outlined in the study.

Table C.1.1 The material specification and primary packaging of each carrier bag.

Bag type	Bag specifications		Primary packaging	
High-density polyethylene (HDPE) bag	HDPE, virgin	6.09 g	Corrugated box	390 g/1000 bags
	LLDPE, virgin	0.89 g	Or	
	Titanium dioxide	0.16 g	Vacuum film	55 g/1000 bags
	Chalk	0.81 g		
	Ink	*<0.16 g*		
	TOTAL	8.12 g		
High-density polyethylene (HDPE) bag with a prodegradant additive	HDPE, virgin	6.45 g	Corrugated box	600 g/2000 bags
	LDPE, virgin	0.83 g		
	LLDPE, virgin	0.5 g		
	Titanium dioxide	0.17 g		
	Chalk	0.25 g		
	Prodegradant	0.002 g		
	Ink	<0.07 g		
	TOTAL	8.27 g		
Starch-polyester blend bag	Mater-Bi	16.08 g	Corrugated box	434 g/500 bags
	Titanium dioxide	0.33 g	Vacuum film	8.5 g/500 bags
	Ink	*0.08 g*	*Pallet*	*360 g/500 bags*
	TOTAL	16.49 g		
Paper bag	Kraft virgin paper	52.99 g	Corrugated box	620 g/200 bags
	Glue	1.44 g	Stretch film	17 g/250 bags
	Ink	*0.66 g*	*Pallet*	*525 g/250 bags*
	Dye	*0.11 g*		
	TOTAL	55.20 g		
Low-density polyethylene (LDPE) bag	LDPE, virgin	32.85 g	Corrugated box	640 g/250 bags
	LLDPE, virgin	0.7 g	*Pallet*	*525 g/250 bags*
	Titanium dioxide	1.05 g		
	Ink	*<0.35 g*		
	TOTAL	34.94 g		
Non-woven polypropylene (PP) bag*	PP, virgin	114.9 g	Corrugated box	564 g/50 bags
	PP/cotton thread	0.93 g	Paper lining	10.44 g/50 bags
	TOTAL	115.83 g		
Cotton bag*	Cotton textile	181.81 g	Corrugated box	1000 g/50 bags
	Cotton thread	1.3 g		
	TOTAL	183.11 g		

*Ink content data was not available for these bag types

Specific data for polymer production in the Far East was sought but no such data were identified. As a consequence, inventory datasets (eco-profiles) for HDPE, LDPE, LLDPE and PP published by Plastics*Europe* have been used (Boustead 2005a-c). The datasets were compiled by Ian Boustead by collating data collected directly from the European plastics industry. The Plastics*Europe* eco-profile versions in the ecoinvent database were used. The PlasticsEurope dataset cover the production of HDPE from the cradle to the polymer factory gate. The polymerisation data refer to the year 1999 and were acquired from 24 polymerisation plants producing 3.87 million tonnes of HDPE annually. This represents 89.7 per cent of all Western European production.

The PlasticsEurope dataset cover the production of LDPE from the cradle to the polymer factory gate. The polymerisation data refer to the year 1999 and were acquired from 27 polymerisation plants producing 4.48 million tonnes of LDPE annually. This represents 93.5 per cent of all Western European production. The Plastics*Europe* dataset covers the production of PP from the cradle to the polymer factory gate. The polymerisation data refer to the year 1999 and were acquired from 28 polymerisation plants producing 5.69 million tonnes of PP annually. This represents 76.9 per cent of all Western European production.

The Kraft paper bag is produced from chemical pulp using the sulphate process. Wood chips are cooked with chemicals in a digester at high pressure and temperature to remove the lignin and break up the wood into cellulose fibres. The sulphate process uses caustic soda and sodium sulphide to cook the wood chips. The pulp is washed and screened and the cooking liquor is drained off, concentrated and burnt off for steam production. The wet pulp is adjusted with auxiliary chemicals and additives and fed into the paper machine, where the pulp is squirted as a thin film across the machine width onto a moving wire section. In the wire section the paper is shaped and dewatered, after which it passes through a series of presses to dewater the paper further. Final drying is done in the dryer section, where the paper passes around a series of heated cylinders. At the bag producer's the kraft paper is then printed, formed, glued, cut and pressed into individual bags.

The unbleached uncoated paper sack inventory dataset has been extracted by STFI-Packforsk specifically for this study from the paper sack inventory dataset published by CEPI Eurokraft and Eurosac (Weström & Löfgren 2005). The data were compiled by STFI-Packforsk by combining data collected directly from European pulp and paper mills. The overall quality of the inventory data has been assured by internal review. No independent third party review has been conducted. Although the data refers to paper sacks excluding refuse sacks and carrier / shopping bags, CEPI Eurokraft has confirmed that it can be considered representative of these types of bags as well (Hill 2006).

The CEPI Eurokraft and Eurosac dataset covers the production of paper sacks from the cradle to the paper sack mill gate. The dataset covers the production of kraft paper and the production of paper sacks, and it is not possible to separate the two processes. The collected data is based on plant production data for the year 2003 and is estimated to be valid for about 5-6 years ahead.

The data about sack paper and paper sack production was acquired from a total of 13 pulp and paper plants in seven different European countries and five paper sack plants in

four different European countries, respectively. It is not known how many of these cover unbleached uncoated kraft sack paper. The five paper sack plants contributing with data only account for a small proportion of European production.

For the CEPI Eurokraft & Eurosac data, the production of a number of chemicals and additives where the quantities used account of less than 1-2 per cent of the total material in the sack paper is excluded (Weström and Löfgren 2005). Instead, these flows are simply reported as non-elementary inputs[22]. The amount of non-elementary inputs is less than 4 per cent of the total input weight (excluding water).

For some of the chemicals and additives reported as non-elementary inputs in the kraft paper sack inventory data, LCI data was identified in the ecoinvent database. Where this was the case, these were used.

The starch-polyester blend inventory dataset has been provided by Novamont S.p.A. The data were collected and compiled by technical experts from Novamont. The overall quality of the inventory data has been assured by Novamont, however it is not known if there has been any independent third party review of the dataset.

The Novamont dataset covers the production of the starch-polyester blend granulates from the cradle to the Novamont gate. The dataset covers the production of the fossil oil monomers i.e. oil extraction and refining, conversion into monomers, and production of the vegetable oil monomers i.e. the growing of corn and oil-seed crops, milling and extraction, and finally the polymerisation with addition of the fossil monomer. It has been estimated that 0.59 kilograms of carbon dioxide is absorbed from the atmosphere for every kilogram of mater-bi produced based on Novamont (2008).

The data refers to the year 2006 and relates to one production site in Terni, Italy. As a consequence, Italian electricity has been used.

Inventory data for the production of titanium dioxide is derived from the ecoinvent database. The titanium dioxide is manufactured by processing titanium-containing rutile and ilmenite minerals, based on confidential data. There is no information about the geographical or time-related coverage of the data.

The cotton fibres used in the non-woven PP bag was modelled using data from the IDEMAT 2001 database. This data is based on the production of cotton in the United States and was recorded in 1992.

Substitute materials were used to model the production of chalk, glue and the prodegradant additive. For chalk, the SimaPro substance of calcite has been used. Chalk was modelled as Limestone using ecoinvent data based on the production of limestone at one Swiss company during 2001. The process includes mining, mineral preparation, calcination, hydration and packaging and loading.

[22] A non-elementary input is an input from the technosphere which has been processed in some way. Thus, it has not been followed back to the cradle.

The production of glue for the paper bag lifecycle was based on inhouse data and consisted of 32% ABS, 48% phenolic resin and 20% paraffin. The glue was assumed to be produced in Germany and used 0.42 kg of steam per kg, 0.25kwh of grid electricity per kg and generated 0.26kg of waste per kg which was assumed to be incinerated. All of these processes and materials were modelled using ecoinvent data.

Due to lack of information, the prodegradant additive was assumed to be cobalt stearate and consists of 10 per cent cobalt and 90 per cent stearic acid. The ecoinvent process for Cobalt was used whilst data for stearic acid was sourced from the IVAM LCA 4.04 dataset, based on Western European production in the period of 1995-99.

The cotton bag was modelled using data from the ecoinvent database as described in the Ecoinvent Report No. 21 (Althaus et al 2007). The ecoinvent dataset is collated from a number of sources, with the main sources being two reports, one by the Öko-Institute (Wiegmann, 2002) and another by the Wageningen University (Kooistra et al, 2006). The ecoinvent dataset is for conventional production with an average net yield of 1100 kg fibres / ha for Chinese cotton production and represent data for the time period of 2000 to 2007. The dataset includes the processes of soil cultivation, fertilisation, application of pesticides, irrigation, harvesting, ginning and related transport. Further processing include yarn production, textile refinement and weaving.

Ecoinvent data for the production of cardboard was used to model any cardboard boxes used as secondary packaging. This was based on the production of fresh fibre, single walled corrugated board. The main source of raw material data within Ecoinvent is the European database for corrugated board life cycle studies from FEFCO, Groupment Ondule and Kraft Institute (2006).

Vacuum film was modelled using ecoinvent data based on a combination of 70% LDPE and 30% Nylon and the extrusion of plastic. Similarly, stretch film was modelled using ecoinvent data based on LDPE and the extrusion of plastic The ecoinvent data on the extrusion of films was based on a Swiss packaging study representing one Swiss company in 1993 (Habbersatter et al. 1998) and a PlasticsEurope conversion report representing averages of upto 8 companies (Boustead, 1997). Wastage from this process was 2.4% and all waste was incinerated.

C.2 Bag production processes

Plastic film bags, such as the HDPE and HDPE prodegradant carrier bags, are produced through the blown film extrusion or co-extrusion process. Plastic melt is extruded through a vertical circular die and air is introduced to create a “bubble-like” expansion forming a thin walled tube. The film tube is cooled and passed through nip rolls to flatten the film. The film is then heat sealed and cut or perforated to make each bag. This is done either in line with the blown film process or at a later stage.

The non-woven PP bag is produced using a spun bonded process. Plastic melt is extruded through a coat hanger die, feeding the spinneret which forms a curtain of

filaments. The filaments are cooled by air and then deposited on the wire mesh belt as a random non-woven material. This is transferred to the heat bonding calendar, which by heat and pressure determines the physical properties of the material, and then cooled by water-cooled rolls and wound up. The material is then folded and cut to size, and sewn into bags. The bags have a semi-rigid base insert for stabilisation generally made from PET, PP or PVC.

Data on conversion of HDPE with prodegradant into carrier bags was provided by a bag producer in China. This process was adapted for the conversion of HDPE bags based on the weight of material processed. Information on the conversion processes refer to the year 2006.

Data used for the conversion of kraft paper into carrier bags were paper sack inventory data published by CEPI Eurokraft and Eurosac (Weström & Löfgren 2005). Kraft sack paper is converted into sacks by the processes of forming, gluing, cutting and pressing. The energy demand is met partly by electricity and partly by various fuel types. As described in section 4.2, the dataset covers the production of kraft paper and the production of paper sacks, and it is not possible to separate the two processes.

Data on conversion of LDPE, PP and starch-polyester blend into carrier bags was provided by bag producers in Turkey, China and Norway respectively. Information on the conversion processes refer to the time period 2006/07.

Due to a lack of information from bag producers, data on conversion of cotton textile into carrier bags was estimated based on in-house confidential data.

Table C.2.1 Overview of conversion data used in this LCA study

Polymer / paper	Publication date	Reference year	Number of plants included
Anonymous bag producers			
HDPE bag	Not publicly available	2006	1
LDPE bag	Not publicly available	2006	1
HDPE bag with prodegradant	Not publicly available	2006	1
PP bag	Not publicly available	2006/07	1
CEPI Eurokraft & Eurosac			
Paper bag	2005	2003	5
Biobag International AS			
Starch-polyester bag	Not publicly available	2006/07	1

Due to confidentiality, the conversion data used are not shown in the report. The energy mix for grid electricity at each production location is shown in table C.2.2. The generation of energy from coal, oil, natural gas, hydropower, biomass and nuclear in China and Turkey was based on existing Ecoinvent processes representing average European production. The generation of heat from natural gas for the production of the LDPE bag was based on the Ecoinvent process for a <100kw non modulating fan burner boiler. The

generation of heat from heavy fuel oil for the non-woven PP bag was based on the Ecoinvent process for a 1MW industrial furnace.

Table C.2.2 Overview of grid electricity mix in production locations.

	Production location		
Energy type	**Norway**	**Turkey**	**China**
Coal		23.0%	78.0%
Oil		5.0%	3.0%
Natural gas	0.3%	41.0%	0.5%
Hydropower	99.1%	31.0%	16.0%
Wind power	0.3%		
Cogen	0.3%		
Biomass			0.5%
Nuclear			2.0%

C.3 Transport

The eco-invent datasets for European transport have been used in this study. Due to the lack of representative data, the European transport data has been used for all transport scenarios.

The transport modes considered are road, rail and sea transport. The vehicle operation data refer to the year 2000 and excludes any return trips.

The eco-invent dataset for heavy good vehicle transport in Europe is based on the European research project Copert III. The datasets are a function of the direct process of vehicle operation and the indirect processes of vehicle fleet (fleet production, maintenance, and disposal) and road infrastructure. The transportation method was assumed to be by a 16 – 32 tonne Euro 3 efficiency lorry with an average load of 10 tonnes. Based on parameters on lorry size, load and road category, the fuel consumption and emissions as a function of the distance are then calculated.

The eco-invent dataset for rail transport in Europe is based on several rail transport studies. The datasets are a function of the direct process of rail operation and the indirect processes of rail equipment (train production, maintenance, and disposal) and rail infrastructure.

The ecoinvent dataset for sea transport is based on a number of sea transport studies. The datasets are a function of the direct process of vessel operation and the indirect processes of vessel fleet (vessel production, maintenance, and disposal) and port infrastructure.

Table C3.1 Eco-invent transoceanic freight ship description and fuel assumptions

Vessel category	Engine	Average load assumed	Fuel consumption assumed	
Transoceanic freight ship, dry bulk carrier	Average of slow speed engine and steam turbine propulsion	~50,000 dwt	2.5 g/tkm	Heavy fuel oil

dwt = dry weight tonnes

C.4 End-of-life

The end of life processes were modelled using WRATE (Waste and Resources Assessment Tool for the Environment) which is the Environment Agency software that compares the environmental impacts of different municipal waste management systems. WRATE uses life cycle assessment to include the resources used, waste transportation and operation of a whole range of waste management processes with their environmental costs and benefits. The assumptions used when modeling the end of life processes in WRATE for this LCA are detailed below.

C.4.1 Landfill

Collection - 140 litre wheeled bin for household waste and 500kg of household waste/inhabitant per year. Assumes bag waste constitutes 0.5% of waste stream over year.

Waste transport - 25km one way road transport direct to site using Refuse Collection Vehicle – ultra-low sulphur diesel fuel refuse collection vehicle (6 x 4 RCV) using with waste compaction.

Landfill description - Landfill with a clay liner and clay cap with a 25000 tonne per annum capacity. Well engineered, Landfill Directive compliant landfill. It is based on modelling from LandSim v2.5 and GasSim 1.5, supplemented with other information concerning capital and operational burdens. The modelling periods were 20,000 years for leachate using LandSim and 150 years for landfill gas. The model includes landfill treatment and landfill gas capture (equivalent 75% over its lifetime) for landfill gas recovery and landfill gas burned in engines generating electricity which offsets the marginal mix for electricity production of 50 per cent coal and 50 per cent natural gas.

Waste is deposited either at the top or base of the waste face depending upon direction of tipping at the time. A steel-wheeled landfill compactor is used on the operational areas to level and compact the waste. A suitable machine is used in the construction of cell walls, the placement of daily cover and as a back-up in the event of breakdown of the compactor. A number of passes are made over the waste by the compactor, or other suitable equipment, to achieve satisfactory compaction of the wastes.

The surface of the landfill area is covered progressively with inert materials, including imported waste materials free from biodegradable waste, so that at the end of the working day the surface, face and flanks of the area are free from uncovered biodegradable and loose paper or other similar materials which may be wind blown.

The modelling of leachate emissions has been undertaken using LandSim Version 2.5, which was developed for use by the Environment Agency to provide probabilistic quantitative risk assessments of specific landfill site performance in relation to groundwater protection. The models have been run for a 20,000 year period, during which time the degradation of both the engineered liner and the low permeability cap have been incorporated.

Groundwater flow from the base of the engineered barrier through the unsaturated zone to the water table has been modelled assuming that the leaking fluid displaces the existing pore water, changing neither volume nor properties of the soil water. The discharge of leachate to a leachate treatment plant has also been included in the assessment of the overall environmental burdens. The total loading to the environment resulting from the production of leachate is represented as the sum of the total mass loading to groundwater and the total mass loading to sewer following treatment over the life of the landfill, for each contaminant

Modelling of gaseous emissions has been undertaken using GasSim v1.5. GasSim is a probabilistic performance assessment model that includes a gas generation, partitioning between collection, migration, surface emissions and biological methane oxidation as well as incorporating combustion plant and atmospheric dispersion and impact.

Biological methane oxidation was assumed for 10% of the emissions that passed directly through the cap. Flare capacity was provided to account for gas generation down to a maximum of 250 m3/h. Filling rates were selected to allow each of the landfill sizes to be filled in a 20 year period. Progressive capping of the site was assumed so that gas collection was optimised to a level consistent with current industry practice. As well as the emission of bulk and trace gases through the landfill surface, gases collected and passed through the combustion plant will be partially destroyed and converted to appropriate combustion products (with the exception of carbon dioxide) and certain new gases will be created.

C.4.2 Incineration

Collection - 140 litre wheeled bin for household waste and 500kg of household waste/inhabitant per year. Assumes bag waste constitutes 0.5% of waste stream over year.

Waste transport - 50km to regional plant (one way trip) using ultra-low sulphur diesel fuel refuse collection vehicle (6 x 4 RCV) with waste compaction.

Description - 225ktpa moving grate incinerator with electricity generation. It is assumed that integrated bottom ash is recycled for road aggregate and that there is 50km one way down stream transport by Roll-on-off for Air Pollution Control residues to landfill. Incoming municipal waste vehicles discharge their loads into the municipal waste storage bunker, kept under negative pressure to avoid the release of dust and odour.

Waste is mixed and moved by means of grabs mounted on two travelling cranes. The

crane and grab have been designed to transfer the plant's daily waste burning capacity into the feed hopper and to carry out moving, mixing and stacking of waste in the storage bunker. Municipal waste is fed by the crane into the feed hopper and feed chute. Combustion conditions are continuously monitored and controlled to avoid the release of dioxins and furans. Dry urea is injected into the furnace for NOx abatement.

The ERF has an inclined reverse-acting grate capable of burning a broad range of waste calorific values without the need for any auxiliary fuel. The bottom ash is quenched and ferrous metals recovered by an overband magnet. After this the residues can be recycled for construction with the non-ferrous metals recovered for recycling.

Flue gas from the combustion process passes to a boiler which converts the energy from the hot gases into steam at 45bar, 400°C. The steam from the boiler feeds a steam turbine which generates around 8MWs of electricity at 11,000volts (overall electrical efficiency is approximately 21 per cent). Following the turbine, the steam is condensed using an air cooled condenser and the condensate returned to the boiler.

The flue gas treatment system uses semi-dry design that neutralises the acid gases, ie hydrochloric acid, hydrogen fluoride, sulphur dioxide and sulphur trioxide. The plant is designed to be upgraded if required to meet future emissions standards. Lime injected into the flue gases as a suspension in water. The flue gases are therefore both cooled and treated. Powdered activated carbon is injected into the flue gas to adsorb residual dioxins, cadmium and mercury.

Particulate material is removed from flue gas with bag house filter. The bags are held vertically, with the gas flow through the bags being from the outside with the resultant clean gases emerging from within. FGT residues are recovered at the bottom of the gas scrubber vessel and the bag house filter and transported by screw conveyors to storage in a silo.

During normal operations, wastewater is routed to a wastewater treatment plant which is designed to allow the water to be recycled within the process.

C.4.3 Composting

Collection -140 litre bring bank located at supermarket

Waste transport - 25km one way road transport using ultra-low sulphur diesel fuel refuse collection vehicle (6 x 4 RCV) with waste compaction.

Description - In vessel composting of 50% green and 50% food waste with feedstock assumed to degrade to PAS100 standard compost. The process comprises aerated high temperature phase composting (21 days), agitation and windrow composting (63 days). For the compost offset a soil conditioning and inorganic fertiliser benefit are accounted for based on physico-chemical characteristics of typical PAS100 compost (e.g. bulk density characteristics and nutrient properties) and the typical UK soil conditioner market. Emissions to soil and ground water are estimated from elemental limit values for PAS 100 composts, and the carbon content of the compost assuming carbon dioxide air

emissions over 150 years and species specific assumptions concerning the compartmentalisation of minerals after 150 years.

This composting system provides for the rapid high temperature composting of organic wastes in a continuous flow plant. The insulated silos, each with a capacity of 32 m^3, are suspended above a concrete base in a large steel structure. A single silo-cage bank consists of between 8 and 28 silos, depending on the annual input or output requirements. For larger operations, multiple silo-cage banks are run in parallel. A silo-cage bank has a front-end mixer and loading system. An unloading system and side conveyor remove the composted material from the silo-cage. The back end of the silo-cage can be equipped with a screen and bagging line or the composted material can be collected and taken to a maturation barn to fully mature.

Feedstock Delivery
The organic waste is mixed with selected amendments in a predetermined ratio to give a feedstock that is ideal for composting. The amendment may need to be nitrogen-rich (e.g. manure) or carbon-rich (e.g. wood shavings) depending on the chemical composition of the waste. Amendment selection is crucial to ensuring that the feedstock material is bulky with sufficient airspace to support the aerobic microbial activity in all parts of the organic material. Each silo receives an amount appropriate to operation's requirements – typically about 3 m^3 per silo per day. The feedstock material is 'sprinkled' on top of the previous day's load. The material drops no more than about half a metre into the silo and so its open structure is maintained.

Composting Silos
The feedstock material sits on the hotter lower layers. It quickly warms, accelerating microbial activity and is rapidly colonised by micro-organisms from the already composting organic material below. As the silo is unloaded, the composting organic material gradually and evenly descends the silo and passes through a series of temperature bands. To monitor the progress of the process, the temperature in each silo is continuously measured by temperature probes and recorded on a pc-based data logger. The hottest layers in the silo tend to be between one and two metres from the top. As well as air in the bulky organic material, the vertical temperature gradient in the organic material creates a chimney effect and air is drawn up into the material from the open base of the silo. There is therefore no need for costly forced aeration, turning or agitation of the organic material. The feedstock characteristics and the end-product specifications determine the residence time in the silos, which can vary between 10 and 21 days.

Unloading Composting Silos
An unloading mechanism traverses beneath the silo-cage and extracts the bottom layer of composted organic material from the silos. The material is still warm (about 45°C) and side conveyors carry it to the end collection points. From here it may be dispatched straight to land or it may go to storage for maturation and further stabilisation in static piles before bagging.

C.5 Avoided products & recycling

The processing of recycled waste during the production of plastic is based on an estimate of 0.6kwh of grid electricity and was model using the grid electricity mix of the

country of production. The performance loss was estimated to be 10 per cent for plastic and 20 per cent for paper and the avoided products were modelled using ecoinvent data on for the production and extraction of the recycled material.

The recycling of bag materials at end-of-life was based on data generated through the WRATE software tool. The following sections outline the assumptions made.

Collection -140 litre bring bank at supermarket.

Waste transport -, 25 km one way trip from supermarket to transfer station using ultra-low sulphur diesel fuel refuse collection vehicle (6 x 4 RCV) with waste compaction., then 250 km one-way trip using intermodal road transport for onward transport to recycling facility.

Description – plastic film Mechanical recycling - Plastic film recycling. The process relates to the operations of the BPI recycled products process in Dumfries accepting agricultural plastic film (75% of feedstock) and commercial LDPE (25%). According to Danish LCA methodology 10% by weight are material rejects (that are sent to Landfill) and a 20% performance loss is also assumed for the offset of LLDPE granulate. The plastic film is recycled into Plaswood, a sustainable wood substitute.

Description – paper Mechanical recycling - Bag made from recycled paper in first instance ("paper, recycling at plant process") replacing corrugated board packaging from mixed fibre ("corrugated board, mixed fibre, single wall at plant"). A 14.5% material loss is assumed with a mixed residual waste material disposed to landill 10km away and a 10% performance loss is assumed over new corrugated board, based on Danish LCA methodology.

It is assumed that all the plastic carrier bags collected at end-of-life for recycling are exported for recycling to China. This was modelled using the ecoinvent transoceanic freight ship data describe in section C.3.

The avoided production of bin liners was modelled using ecoinvent data on the production of HDPE and the use of an average European extrusion process. The data was subtracted from the model to represent the avoided production of the bin liner.

C.6 Lifecycle diagrams

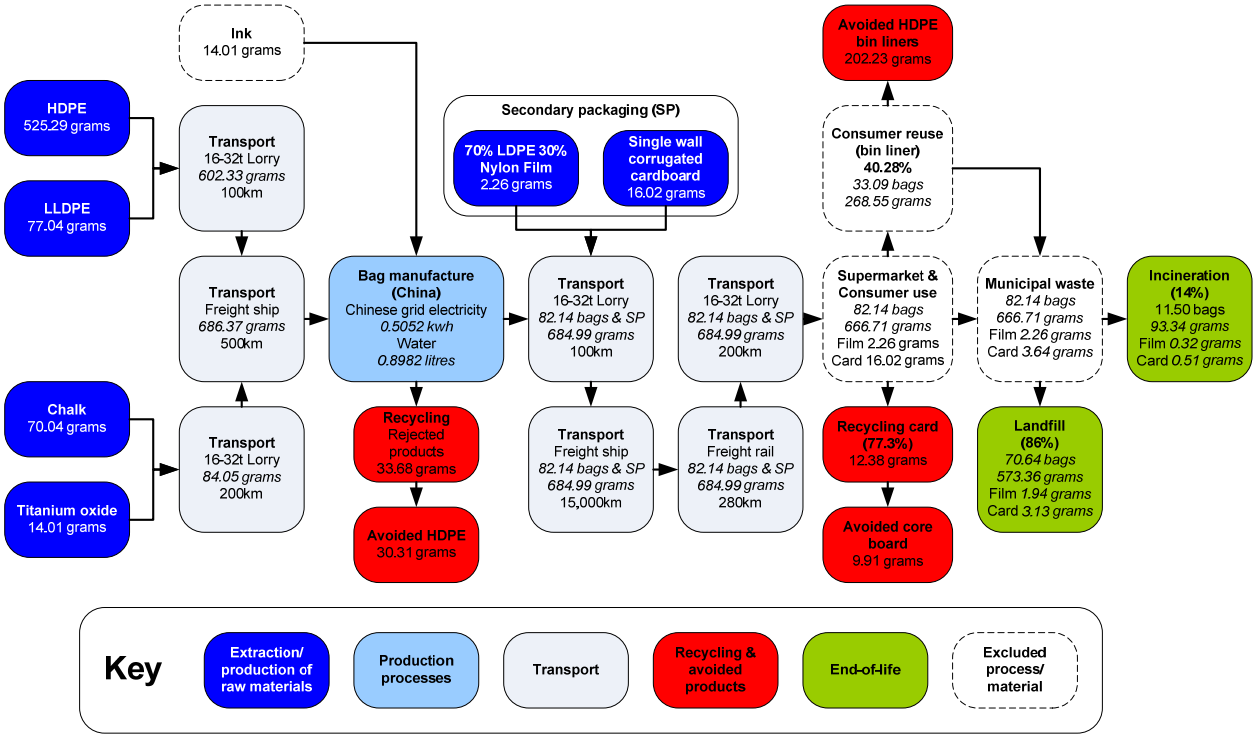


Figure C.6.1 The lifecycle of the HDPE bag.

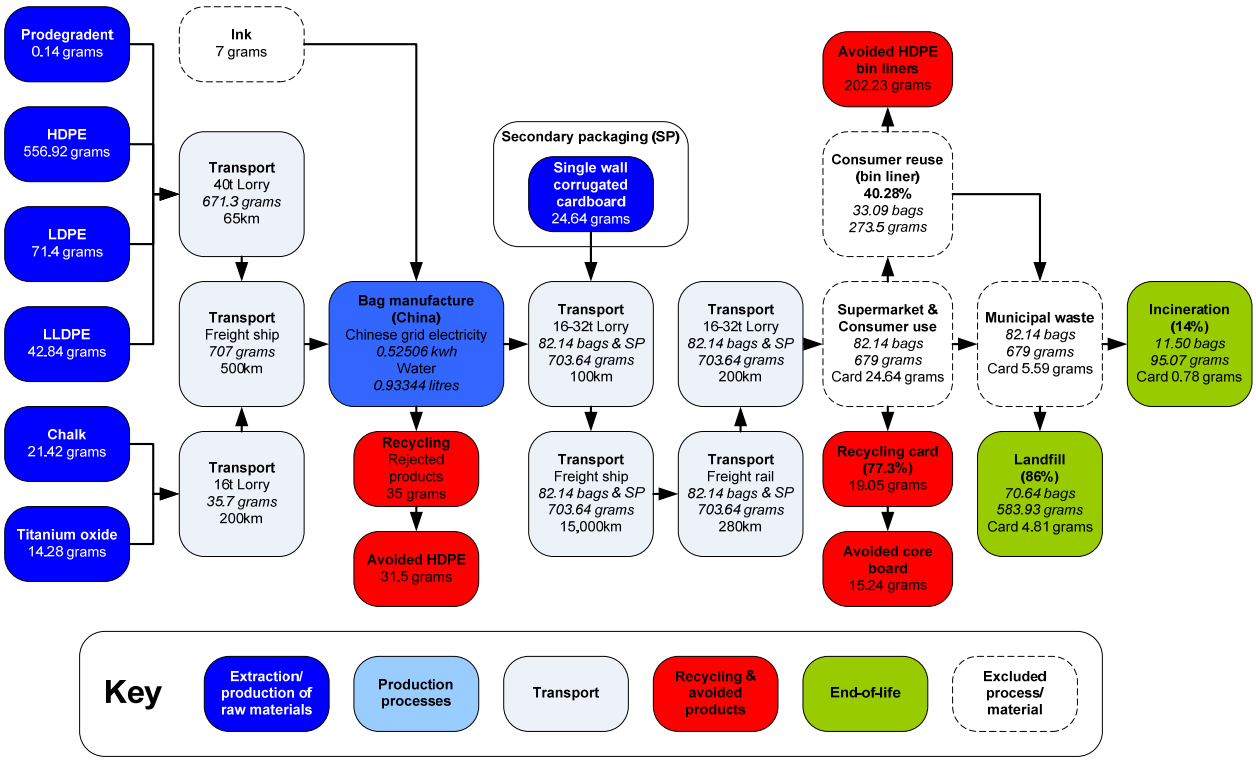


Figure C.6.2 The lifecycle of the HDPE bag with a prodegradant additive.

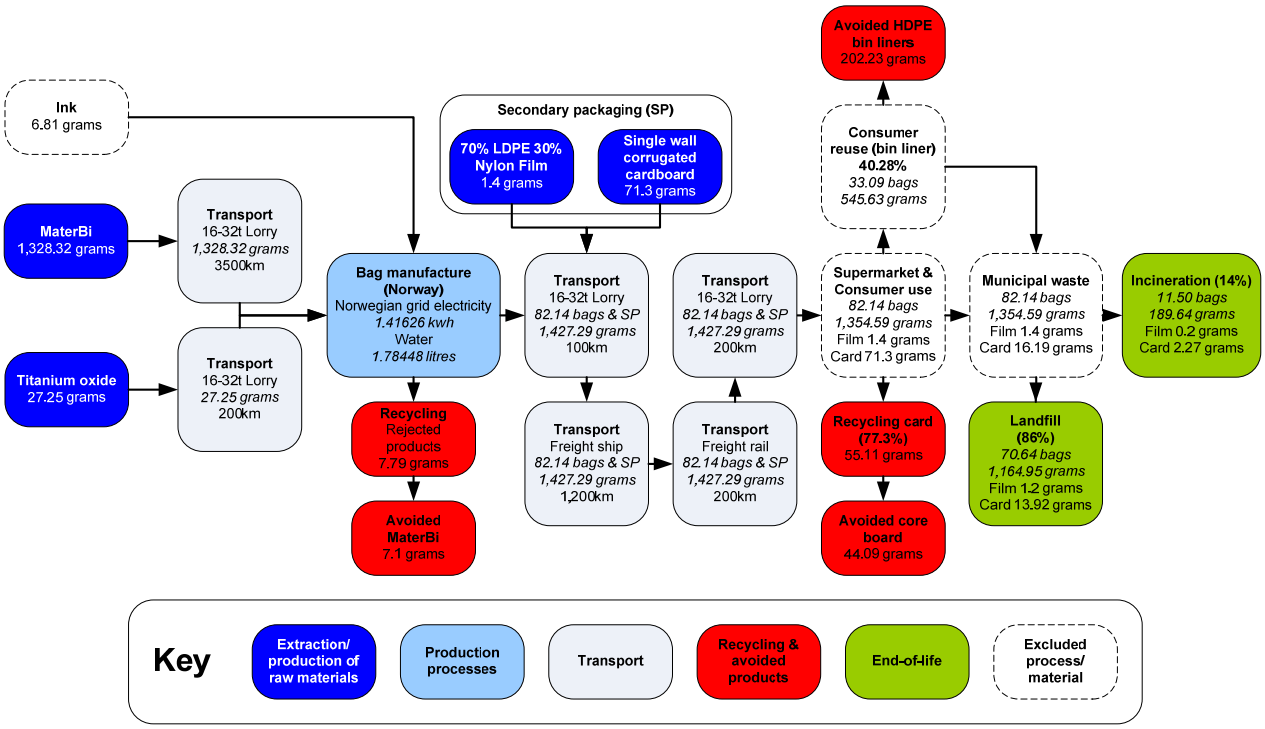


Figure C.6.3 The lifecycle of the starch-polyester blend bag.

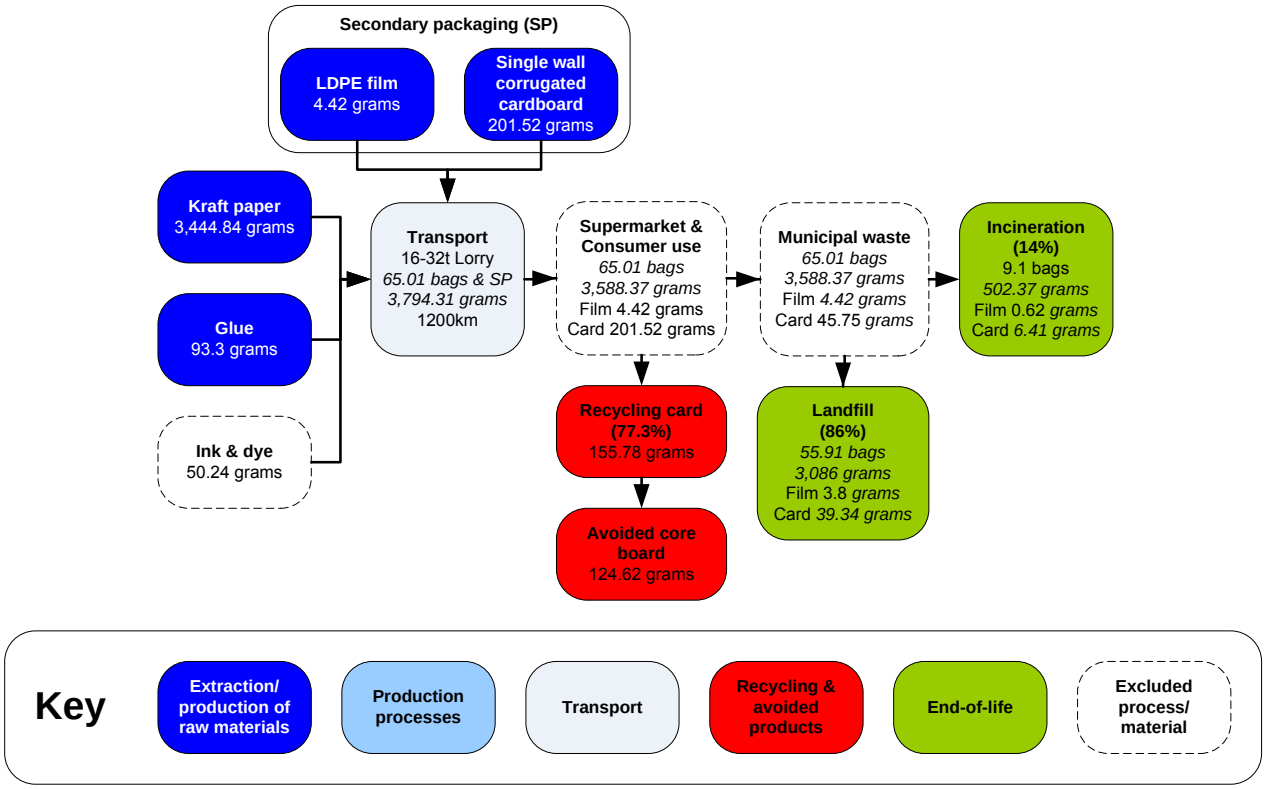


Figure C.6.4 The lifecycle of the paper bag.

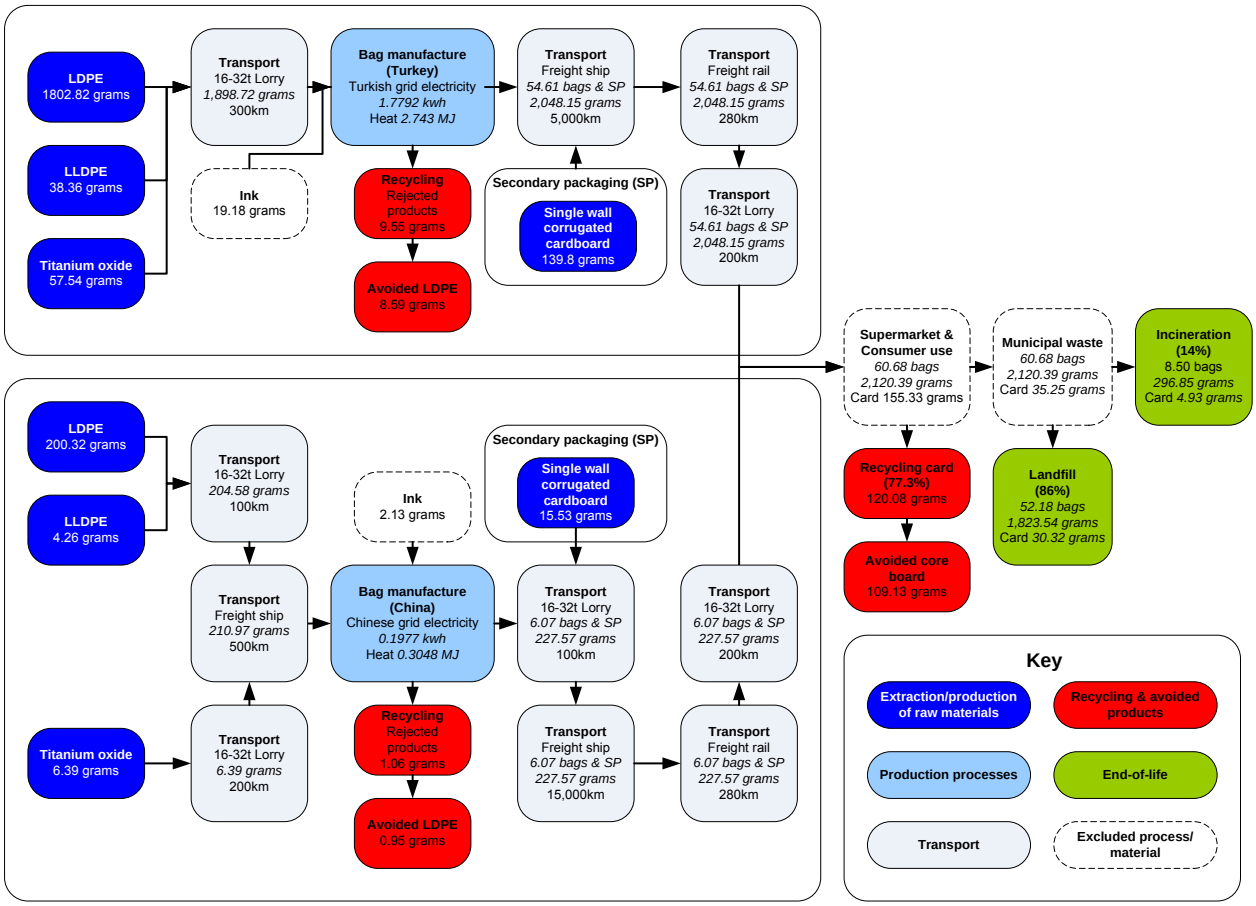


Figure C.6.5 The lifecycle of the LDPE bag.

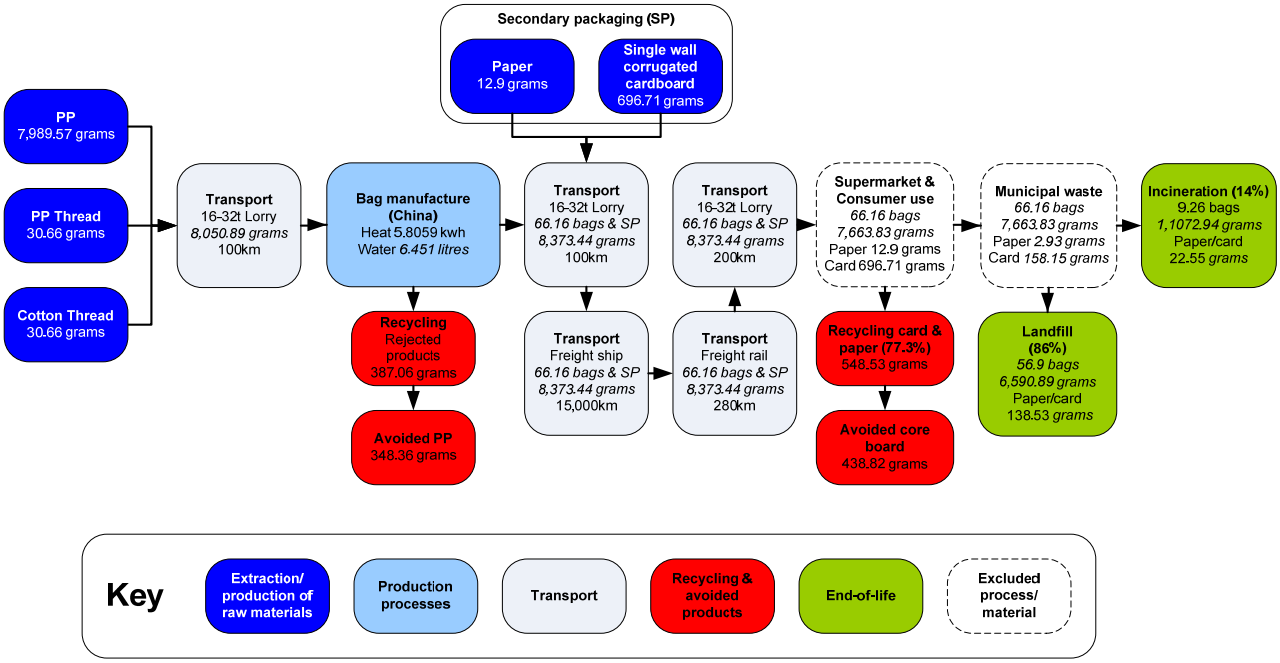


Figure C.6.6 The lifecycle of the non-woven PP bag.

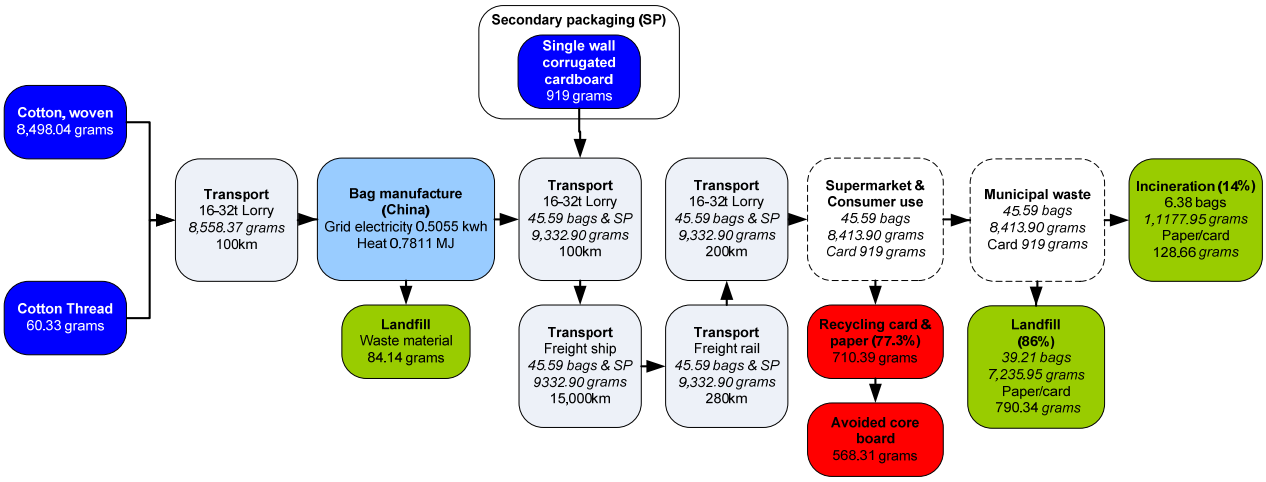


Figure C.6.7 The lifecycle of the cotton bag.

C.7 References

Althaus H.-J., Werner F., Stettler C., and Dinkel F. (2007) *Life Cycle Inventories of Renewable Materials*, v2.0, Ecoinvent Report No. 21, Switzerland.

Boustead, I. (1997) *Eco-profiles of the European Plastics Industry.* Polymer Conversion. Report 10, Brussels.

Boustead, I. (2005) *Eco-profiles of the European Plastics Industry,* Plastics*Europe*, Belgium.

Hill, U., CEPI Eurokraft, *personal email communication* (July 2006 and April 2007).

FEFCO, Groupment Ondule and Kraft Institute (2006) *European database for corrugated board life cycle studies, Paris.*

Habersatter et al. (1998) *Okoinventare fur Verpackungen.* BUWAL Schriftenreihe Umwelt Nr. 250, BUWAL, Bern.

Kooistra K.J., Pyburn R., Termorshuizen A.J. (2006) *The sustainability of cotton, consequences for man and environment*, Wageningen University Report 223, The Netherlands.

Novamont (2008) Environmental Product Declaration of Mater-Bi NF07U (EPD Validated) Retrieved from http://bio4eu.jrc.ec.europa.eu/documents/e_epd102.pdf

Weström, P. and Löfgren, C., 2005. *Life Cycle Inventory for paper sacks*, CEPI Eurokraft and Eurosac, Sweden.

Wiegmann K. (2002) *Anbau und Verarbeitung von Baumwolle – Dokumentation der GEMIS Daten*, Öko-Institut e.V., Germany.

Annex D - Description of impact categories

Abiotic depletion

What is it? This impact category refers to the depletion of non living (abiotic) resources such as fossil fuels, minerals, clay and peat.

How is it measured? Abiotic depletion is measured in kilograms of Antimony (Sb) equivalents.

Global warming potential

What is it? Global warming potential is a measure of how much of a given mass of a green house gas (for example, CO_2, methane, nitrous oxide) is estimated to contribute to global warming. Global warming occurs due to an increase in the atmospheric concentration of greenhouse gases which changes the absorption of infra red radiation in the atmosphere, known as radiative forcing leading to changes in climatic patterns and higher global average temperatures.

How is it measured? Global warming potential is measured in terms of CO_2 equivalents.

Photochemical oxidation

What is it? The formation of photochemical oxidant smog is the result of complex reactions between NOx and VOCs under the action of sunlight (UV radiation) which leads to the formation of ozone in the troposphere. The smog phenomenon is very dependent on meteorological conditions and the background concentrations of pollutants.

How is it measured? It is measured using photo-oxidant creation potential (POCP) which is normally expressed in ethylene equivalents.

Eutrophication

What is it? This is caused by the addition of nutrients to a soil or water system which leads to an increase in biomass, damaging other lifeforms. Nitrogen and phosphorus are the two nutrients most implicated in eutrophication.

How is it measured? Eutrophication is measured in terms of phosphate (PO_4^{3-}) equivalents.

Acidification

What is it? This results from the deposition of acids which leads to a decrease in the pH, a decrease in the mineral content of soil and increased concentrations of potentially toxic elements in the soil solution. The major acidifying pollutants are SO_2, NOx, HCL and NH_3.

How is it measured? Acidification is measured in terms of SO2 equivalents.

Toxicity

What is it? Toxicity is the degree to which something is able to produce illness or damage to an exposed organism. There are 4 different types of toxicity; human toxicity, terrestrial ecotoxicity, marine aquatic ecotoxicity and fresh water aquatic ecotoxicity.

How is it measured? Toxicity is measured in terms of dichlorobenzene equivalents.

Annex E – Peer review comments

E.1 General comments

We believe this is a very well presented and clear study, conducted in a very professional way; the results are presented in a balanced way. We have found a few major issues, relating to:

- The assumptions on recycling, and especially how the benefits of recycling are taken into account
- The lack of the consideration of land use and water consumption

E.2 Comments per chapter

The following sections outline the specific comments made in the peer review. The response of the authors is shown in red.

E.2.1 Chapter 1 Introduction

Comment 2.1.1 - Selection of alternatives.

Why wasn't a HDPE bag with recycled content included? The Sainsbury's bag sampled in the report would have been a 33% recycled bag (it was launched in Sept 06 and went nation wide early 2007). This coincides with the timing when the reference flow was defined (Paragraph 3.1), so this may be the reason, but it should be explained. However, upon further analysing we found that according to pages 77 & 78 – the "structure of the test research sampling' was done between 21st November and 9th December 2007. In B.3 it says the measuring of bags by Pira was in March 2008 – this would indicate the actual Sainsbury's bag should have been a recycled one.

The aim of the study was to provide an analysis of an average HDPE carrier bag during the reference period. The structure of the report aims to provide an accurate analysis of 2006/07 carrier bags and a theoretical idea of how recycling would affect those results. Therefore, no recycled contents has been included in any of the bags considered but the avoidance of like for like materials during recycling at end-of-life has been included to show both the implications of recycling and recycled content. It is clear that this required greater clarification within the report and therefore we have stated that the aim of the sensitivity analysis was to show the effect of recycling at both the start and end of life. A comment has also been added to state that recycled content was not included in the inventory and why.

Comment 2.1.2 - Market shares, and representativity

It is unclear from the report if the product studied are "real" alternatives. Some, like the paper or starch bag seem to have a very low (if any) real market share. This makes us wonder how realistic the data are regarding user behavior and some of the data representing production and logistics. It would add value if the real market shares can be added, and discussed.

Both the paper bag and the starch bag were not used in UK supermarkets during the reference period. The report acknowledged that these bag types have played or could

play a role in carrier bag use and therefore required attention. Their inclusion was not influenced by current use or market share and this has been made more explicit within the report. Due to their low use it was also difficult to find accurate samples. The samples used were selected based on the similarity of their capacity to current supermarket carrier bags and therefore represent the most accurate reference possible. This information has also been added to the report.

Comment 2.1.3 - Other bags

There is no mention of produce / deli bags; we are not sure if they are worthy of mention? A consequence of not mentioning them could lead to "supermarket carrier bags" being an all encompassing definition. Obviously the very thin gauge bags are used to avoid cross contamination from meat, cheese, and fish – the HDPE type bag is infinitely less weight than other options. They are also used to pack fresh fruit to avoid the need to have only pre-packed products in trays and flow-wraps or blister cartons. In Ireland for their carrier bag tax they differentiated these by means of dimensions of the bag. In a report meant to be used as a basis of policymaking, it would be very useful to make explicit that this study is not relevant for other types of bags.

The report has been amended to clarify the difference between carrier bags and produce/deli bags.

E.2.2 Chapter 2 Goal definition

Comment 2.2.1 – Critical review process (section 2.2)

Please clarify the term integrated in the last sentence of 2.2; I think it is better to simply state the chairman reviewed and commented the goal and scope.

The report has been amended to include this change.

E.2.3 Chapter 3 Scope

Comment 2.3.1 - Reference flow (section 3.2)

The reference flow refers to the situation 4 years ago, which we understand is due to the long time needed for the study. It would be good to make a generic comment describing to what extend this is still representative for now.

A generic comment has been added to state that although bag compositions have changed in the recent years, the reference flows for common bag types will not have significantly changed. Bag use may have reduced since the reference period but this is due to bag reuse rather than changes in other consumer habits (e.g. buying less). A comment has also been added to mention the large development in biopolymers which could have resulted in the most significant change.

Comment 2.3.2 - Items per bag (Table 3.1)

We do not understand how the data for this table was collected. The text and annex B show a very detailed study on HDP and LDPE bag (which is really unique in itself), but how the number of items in a paper or starch based bag was determined is unclear. This is of course important as this is the basis for comparison.

A reference has been made in this section to annex B and more detail has been added to the annex regarding the calculation of the paper and starch bag capacities and weights. This states that, as neither the paper or starch polyester bag were available in UK supermarkets and both were used in a variety of different applications and therefore had a wide range of weight and volume characteristics, a single bag was selected with similar physical attributes to the other bags considered to represent each of these bag types.

Comment 2.3.3 – Allocation (section 3.4)

The text in this section is not really representative of what is actually done in the study, as described in 4.5, in which much more detail and specificity is provided; we recommend to bring these in line. Or at least refer to 4.5

The report has been amended to ensure that section 4.5 is reference in section 3.4 and more detail is provided on the allocation methods used.

Comment 2.3.4 – Allocation (section 3.4)

The primary reuse is not discussed for HDPE/Starch bags, but in 4.5 this seems to be taken into account.

The third bullet point in this section states that system expansion is included for "The avoided production of bin liners when carrier bags are reused in other applications". Within the report this is defined as secondary reuse (i.e. reuse in another application) and therefore an additional sentence has been added stating this with reference to the HDPE and starch bags.

Comment 2.3.5 – Allocation (section 3.4)

The choice to assume a one to one avoidance of primary production when plastic is recycled, is highly optimistic. For several reasons:

- The paper of Schmidt and Stömberg mentioned in the text, refers to the problem that in plastic recycling the demand and not the collection and supply determine the recycling rate of plastic.
- The "oversupply" of collected plastics is used to make very low value products, like poles and street furniture. At best they avoid the production of wood and concrete, but they will not avoid significant amounts of virgin plastic production. In chapter 4.5 the methodology is described better, stating assumptions on material and quality losses with partially addresses these observations. Reference is made to an operation in Dumfries, that is said to "accept" commercial LDPE, but it is unclear what this facility produces.
- Postconsumer shopping bags are printed, and probably often containing some unwanted materials; this would make it very difficult to use shopping bags as a high value plastics. Plastic waste created during the shopping bag production, like the waste occurring when handles are punched out can indeed be reused, and are often reused in the shopping bag extrusion again. In that case closed loop assumptions can be made and that type of recycling does avoid virgin material use
- In this study there are no alternatives made of recycled plastic (unless the Sainsbury bag is included). If this would have been the case, one would see a

double count. A bag, made of recycled plastic would in the end avoid virgin plastic. This can lead to the strange conclusion that the environmental load of this recycled bag, is negative.[23] This is counter intuitive as it implies the more bags are used, the cleaner the environment gets.

For paper the assumption is more realistic, recycled paper can indeed replace virgin paper to some extend.

One of the purposes of including the avoided production of plastics during the sensitivity analysis was to show the impact of recycling and also the potential effect of recycled content. As stated in the peer review comments, the inclusion of recycled content in the inventory would have double counted this effect. To provide greater simplicity it was therefore decided to only include the effect of recycling at end-of-life and within a separate sensitivity analysis therefore presenting a 'worst case' for each bag type in the main results. This has been made clear in the report. Greater details on the end-of-life assumptions for post consumer recycling, such as performance loss, have therefore been added to give greater clarity on this issue. The reference of the Schmidt and Stromberg paper has also been placed in a clearer context within the report. The reasons behind the inclusion of the avoided production of plastic from carrier bag recycling is outline in the response to comment 2.5.2.

Comment 2.3.6 – Allocation (section 3.4)

Waste incineration indeed leads to energy production, but also here it is unclear why this would be taken into account. The energy reclamation is a virtue of the waste incinerator and not of the plastic bag. There is also a double count, as the energy from waste incineration is also included in the production mix of energy (although the share is small, so this effect is limited)

None of the bags considered was produced in the UK and all were used to generate energy in UK incinerators. Therefore, these bags would not be used as feedstock in WtE plants in the countries of production. This has been made more explicit in the report as well as providing more information on the background data used to model waste incineration.

Comment 2.3.7 – Allocation (section 3.4)

Table 3.2 also refers to composting, it is not clear if any benefit is claimed for the compost produced.

This has been clarified in the report.

Comment 2.3.8 – Impact assessment: GWP (section 3.7.1)

It is unclear why a discussion on reuse is started in this section.

[23] Suppose the production of virgin material has a load of 100 points per kg, and the collection and recycling of secondary plastic has a load of 20 points. If all the other processes in the entire lifecycle has an environmental load of 30 points, the total environmental load would become 20 + 30 - 100 = - 50. So the more bags are used the cleaner the environment gets.

A discussion of the exclusion/inclusion of primary reuse has been added earlier in the report.

Comment 2.3.9 – Impact assessment: GWP (section 3.7.1)

Biogenic carbon uptake is apparently been excluded and a statement is made that biogenic carbon is seen as carbon neutral. We would like to see some more detail; is for instance biogenic methane also excluded. Or is the fact that generation of biogenic methane does significantly contribute to the climate change effect

The alteration of different characterisation factors has been made clear within this section.

Comment 2.3.10 – Impact assessment: Other impact categories (section 3.7.2)

We think it is difficult to accept the exclusion of the impacts of land-use in a study were also paper, PLA and cotton products are involved, and similarly the impact of water use is missing. The CML method does recommend a simple way of dealing with this, by simply adding the land occupation as area* time.

The Environment Agency made it clear that land and water use were not impact categories of interest to them in this study, because of difficulties in getting precise, verified data . However, land use has been included in the sensitivity analysis with the use of the eco-indicator 99 method and this has been stated in the text.

Comment 2.3.11 – Critical review (section 3.10)

This paragraph discusses the same topic as in chapter 2; we suggest to either discuss it here or in chapter 2.

The section on the critical review process has been moved to chapter 2.

E.2.4 Chapter 4 Inventory analysis

Comment 2.4.1 – Material specifications (Table 4.1)

Whilst specs are wide ranging, and this item represents bags from the sampling done, but – if the vacuum pack for 1,000 HDPE bags is 55g, then 8.5g for 500 starch bags (which are thicker) 8.5g seems erroneous – perhaps this should in fact be 85g??

The HDPE bag is packaged using 390 grams of cardboard and 55 grams of film per 1000 bags. In contrast the starch bag is packaged using 868 grams of cardboard and 17 grams of film per 1000 bags. Although the film is lower the cardboard is significantly higher and we therefore feel that if all secondary packaging is considered it provides a fair indication of each bags requirement.

Comment 2.4.2 – Material specifications (section 4.1)

As noted in Chapter 1, some alternatives, like paper and starch-polyester seem to have a very low market share, how representative are these data? For instance, is Kraft strong enough to be used for a paper carrier bag. It would have to be laminated and, to be equivalent to the other bags, have handles, which would significantly increase its weight.

The weight represents the total amount of material required to provide the stated capacity for each bag type based on the samples used. As stated, more detail has been added to annex B about how the samples were selected.

Comment 2.4.3 – Material specifications (Table 4.1)

Editorial; Ink is missing from the bottom two central boxes, and probably cotton thread is missing, in the lowest

This table has now been moved to the annex and has been amended.

Comment 2.4.4 – Bag production processes (section 4.2)

Paragraph 3, line 3. Should read .. 90% of LDPE bags are produced in Europe especially Turkey and Germany, and 10% in the Far East especially Malaysia and China. The last sentence referring to use of hand sewing machines seems inappropriate.

The text in this section has been changed. However, the aim of this sentence was to set out the assumptions made on bag manufacture locations, not to reference the exact quote given (i.e. this was “based on conversations with industry experts”). Therefore, only Turkey and China were modelled and this has now been made clear in the text. The reference to hand sewing has also been removed.

Comment 2.4.5 – Bag production processes (section 4.2)

Paragraph 2, line 4 should read … Europe is the main producer especially Turkey and Germany.

The text has been changed.

Comment 2.4.6 – Bag production processes (Table 4.2)

It is not clear what happens with the waste reported in the last column; often plastic waste, especially if it is white and not coloured is reused, which avoids primary production; please clarify.

Production waste for all of the bag options (excluding the paper and cotton bags) is recycled and includes avoided products, as highlighted in the process diagrams in Annex C. This has been referenced and commented on in the text.

Comment 2.4.7 – End-of-life (section 4.4)

If the DEFRA stats are for UK paper recycling (applied for cardboard) are general figures, then when considering Supermarkets alone the 77.3% may be understated. This is because many stores have compactors / bailers, and sell the corrugated scrap – due to this commercial activity We would expect the % recycled by supermarkets to be higher (unless some of the recycled scrap sent to recycling is unrecyclable and therefore ends up in landfill??); please clarify

A comment regarding the statistics used has been added to the report. This states that, since the reference period, in-house cardboard recycling has increased significantly. However, the best card recovery figures provided for that period were by Defra and were

not significantly different to general in-house recycling figures reported by supermarket CSR reports.

Comment 2.4.8 – End-of-life (section 4.4)

Page 29: there must be a mistake on the size of incinerator – 225,000 not 225 tonnes.

This error has been amended.

Comment 2.4.9 – Avoided products & recycling (section 4.5)

Please describe what the Dumfries facility produces, and how realistic it is that this avoids virgin plastic production; then assess what these outputs actually would displace on the market.
The estimates for losses of plastic (10% and paper 20%) seem not to be based on any specific choice.

More detail has been added to the report regarding the end-of-life recycling assumptions made.

Comment 2.4.10 – End-of-life (section 4.4)

The HDPE prodegradant containing materials and the starch based materials, can indeed seriously disrupt recycling operations if these bags become a successful product. The argument that they have a small share now, is not too convincing, as no shares are given, and information is lacking if even a small share can have a negative impact on recycling. It is strange that the comment is only made referring to the prodegradant containing material and not the starch based material.
In table 3.2 we saw that Starch polyester was not assumed to be mechanical recyclable, and we think the same holds true for bags with a prodegradant additive. These bags should be considered as unrecyclable, and even worse as disrupting recycling.

The report has been adapted to exclude prodegradant bags from recycling.

E.2.5 Chapter 5 & 6 Impact assessment & sensitivity analysis

Comment 2.5.1 – Impact assessment comparison

The reviewers have a problem with the way the bags are compared, as no comparison basis has been defined, and thus there is no comparison on the basis of a functional unit. The problem is caused by the lack of actual reuse estimates. The number of reuses is computed on the basis of the carbon footprint, but this has nothing to do with the real number of reuses and it is unclear if these numbers can actually be achieved. Reusing a PP “bag for life” 14 times seems realistic, reusing a paper bag 4 times does not. Reusing a cotton bag 173 times seems very ambitious.
We understand that it is difficult to determine actual number of reuses we are aware of the WRAP, Choose to Reuse study
http://www.wrap.org.uk/downloads/Choose_to_Reuse_Report_-_June_2006.c694423a.2998.pdf that tries to describe the actual reuse rates, but we have seen that also that study does not provide a clear answer.
The problem of presenting these numbers without any comments, the reader still does not know what the best bag is. One could interpret however that, the bag for life is a

good alternative of the HDPE bag for people who actually use the bag for life on a regular basis. At the same time the study can conclude that the paper bag is not a good alternative, as it is not plausible to assume it can be reused, and certainly not 4 times. In other words the second objective of the study, as defined in chapter 2.1 is not met; there is not even an attempt to try to compare products on the basis of a clearly defined functional unit, and this is a rather fundamental requirement in the ISO standard:

- Paragraph 4.1.4 of the 14040 standard clearly defines all impact assessment results are related to the functional unit
- Paragraph 4.2.3.7 of the 14044 standard clearly confirms this in the case of comparisons

As we already acknowledge the difficulty to determine the reuse rates, we would like to see a clear description of this limitation, and we would also like to see a clear statement that in fact the study failed to make a comparison due to the impossibility to define a realistic functional unit.

The Author agrees with the peer review findings that a true functional unit is not provided as this would require a set amount of reuse to accurately measure the bags function. A discussion of this has been included in chapter 3 (Scope) to provide a greater understanding of the exclusion of primary reuse. This has also been referenced in chapter 5 and the limitations of the results in meeting a functional unit have been acknowledged in the discussion. Efforts have also been made to reduce the influence of the reuse figures calculated in the impact assessment of GWP, such as including results that exclude primary reuse for the other impact categories.

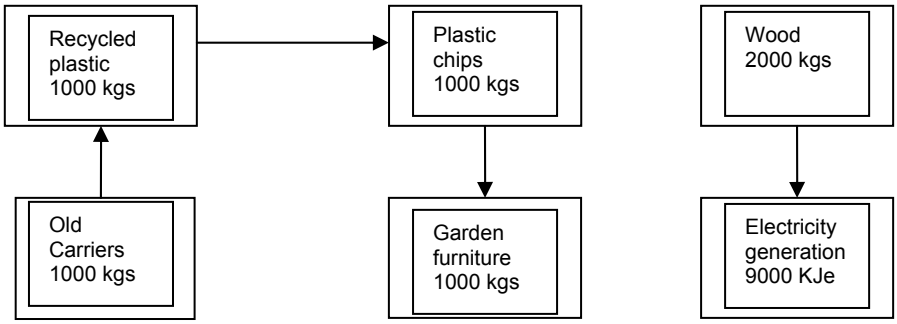
Comment 2.5.2 – Impact assessment (avoided products)

General, we do not agree with the way credits are determined in the case of secondary recycling, we think the assumption that primary materials are avoided is way too optimistic, and we would like to see this assumption replaced by a more realistic assumption. For the production of energy for waste incineration, we also do not agree; energy reclamation is a virtue of the incinerator, and the electricity grid, and has nothing to do with the plastic bag lifecycle. We would like to see this credit removed. As far as we can see such changes would not have significant impact on the conclusions.

We would like to credit the carrier system with the relevant credits from waste management. This is in line with government policy here and with the revised Waste Framework Directive, which gives a higher position to incineration with energy recovery.

The Dumfries plant handles recycled agricultural film (80 per cent) and plastic carriers (20 per cent). The Dumfries plant was included in our waste management data because it was the only plant for which we could get good data. Generally we believe plastic carriers are now recycled into further carriers. However, if we assume that garden furniture (fencing, tables, chairs, decking) is produced from the Dumfries plant, then we have the following:

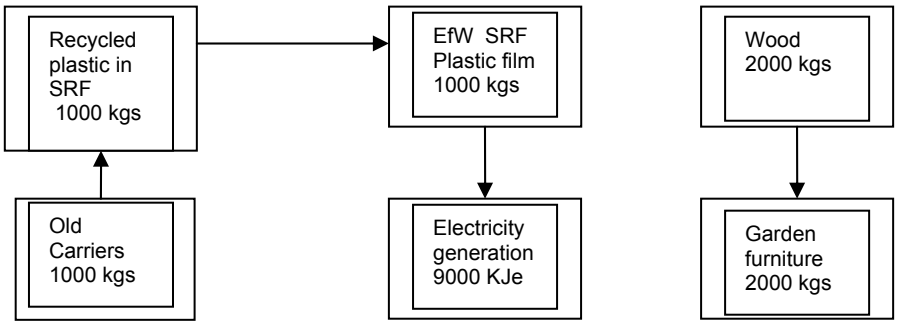
System A: Carriers recycled to garden furniture, wood burnt to generate electricity.



This assumes that the demand for garden furniture and for electricity is constant and for simplification that there are no losses of materials in the system.

The alternative scenario is shown in system B. Here the plastic carriers are collected for a waste fuel, SRF. This waste is burned in an energy from waste plant which generates electricity. To simplify things, because plastic is lighter than wood we can assume that our 1000 kgs plastic will make the same amount of furniture as 2000 kg of wood. Additionally, the amount of electricity generated is assumed to be the same, because the CV of plastic is 3 times that of wood, which makes up for the reduced weight and an overall efficiency of 24% for the EfW plant compared with 35% for the wood-fired power station.

Scenario B: Carriers burnt to produce electricity, wood used to make furniture



The two systems in Scenario A and B therefore have overall equivalence – each producing the same amount of electricity and garden furniture (even though the plastic furniture is lighter, it still performs the same *function* as the wood).
The LCA is not just about what carriers should be made, it's much more about which carriers people should choose, depending on their lifestyle, how they should use them to minimise the impacts and then the difference that different end-of-life choices make.

The type of bag (degradable or non-degradable) makes a real difference if they are landfilled. In WRATE, the landfill model is derived from another and the gas recovery and energy offset cannot be varied. Therefore the landfill model will show the effects of methane emissions and also the benefits of energy recovery from landfill gas. For consistency, this needs to be included for all waste management options.

Terry Coleman/Jo Marchant

16 February 2010

Comment 2.5.3 – Impact assessment

On several places reference is made to production in China, while actually China and Malaysia are meant.

Malaysia was not included as a production location in the inventory analysis and therefore the reference to Chinese and not Malaysian grid electricity is correct. This has been made clear in the Inventory analysis.

Comment 2.5.4 – Impact assessment methods (GWP)

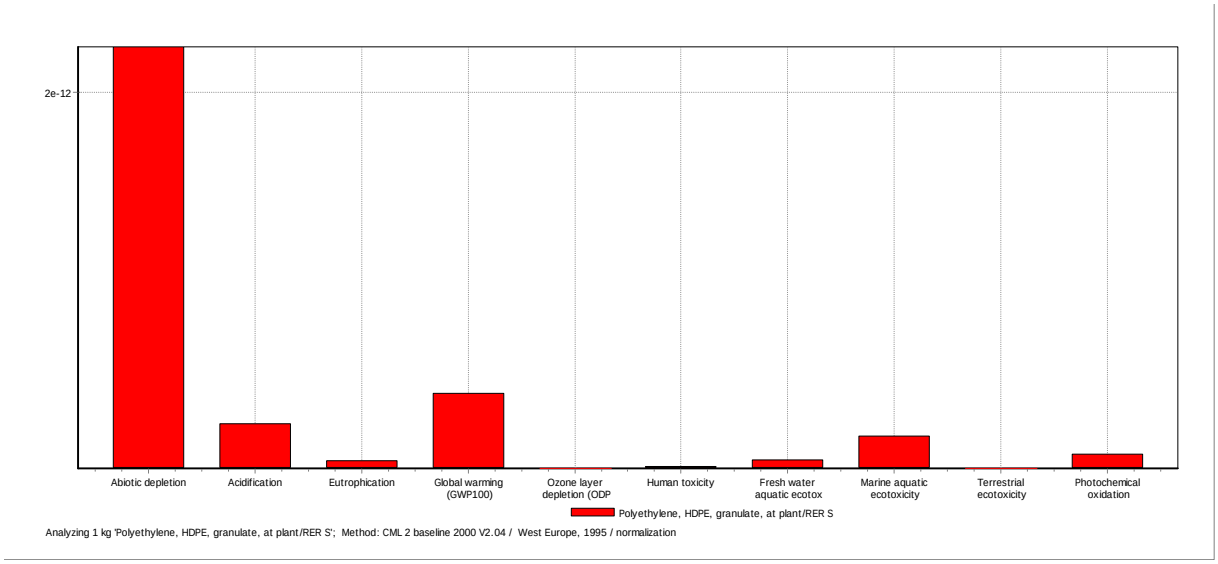
As noted under 3.7 it is unclear how biogenic carbon has been dealt with. Later in chapter 5, when the eco-indicator is used, suddenly carbon uptake is taken into account. Why have the authors not attempted to apply one consistent way, and use a variant in the sensitivity.

Biogenic carbon was excluded from the main results of the study. However, to show its effect, the sensitivity analysis used the eco-indicator method to show the implications of using a methodology which includes biogenic carbon. The exclusion of biogenic carbon from the main results and the inclusion of biogenic carbon within the sensitivity analysis will be made more explicit throughout the report.

Comment 2.5.5 – Other Impact categories (section 5.2)

This chapter is lengthy and, although well done, not overly interesting to read. The results are given per bag type, and it is very hard to put the statements into perspective. As a reader, I would be very interested to start with a comparison between the different bags. As discussed above it seems to be impossible to give a real comparison on the basis of a real functional unit, but we suggest to give a direct comparison without any reuses, like in figure 5.1. If the authors consider such a direct comparison in chapter 5.1, why not repeat this in 5.2. In the same way a figure analogue to figure 5.2 could be given. This figure is now presented in 6.2.

In general the observations made are clear and relevant, although it is not so clear why impact categories that would hardly have any relevance after normalisation, such as ozonelayer depletion are discussed as if they are relevant in this context. Below we copy the normalised results of LDPE production to illustrate the point; ozonelayer depletion levels are far too low to be ever relevant.



We suggest explaining the reader that the 100% score for each column does not imply each impact category has the same order of magnitude or importance, we suggest to illustrate this by using normalised results in the final comparison which is now in figure 6.1. We understand that the approach chosen is not wrong.

In response to the peer review comments, the results per bag type have been simplified to give a more concise analysis of each bags result and ozone layer depletion has been excluded as an impact category. The conclusion and discussion sections have now been separated to provide a better discussion of the overall results. In addition, figure 6.2 has been replaced with a bar chart showing a normalised comparison of the bags with reuse.

Comment 2.5.6 – Other Impact categories (section 5.2)

5.2.1 Titanium Dioxide is only used in opaque bags, some of the main supermarkets in the UK (Asda, Morrisons, Somerfield) use a clear bag - therefore the impact of some HDPE bags would be overstated in terms of fresh water ecotoxicity.

This has been added to the text in this section.

Comment 2.5.7 – Paper carrier bag (section 5.2.4)

Surprised how low the transport element is in figure 5.6, given its relative bulk, given what is stated in paragraph 2, perhaps the true bulk of the product has not been correctly taken into account?

The transportation of the paper bag includes the weight of just over 65 bags travelling a distance of 1200km journey from bag producer to supermarket. Although the impact of transportation is proportionately smaller than other bags in figure 5.6 (due to the higher impact of the extraction and production of raw materials) the actual impact of transportation is larger than other formats. For example, 14% (the proportional impact of transport on the paper bag) of 5.523 kg CO2 eq. (the GWP of the paper bag with no reuse) is 773 g CO2 eq. However, for the HDPE bag, 8% (transport impact) of 1.578 kg CO2 eq. (GWP impact) is 126 g CO2 eq.

Comment 2.5.8 – LDPE carrier bag (section 5.2.5)

Paragraph 3 needs to add reference to Germany.

Only Turkey was included as a production location in Europe in the inventory and therefore Germany should not referenced in this section. The text now makes it clear that this is an assumption.

Comment 2.5.9 – Starch-polyester blend carrier bag (section 5.2.3)

In the paragraph below figure 5.5 reference is made to the way data was presented/collected; it would be very useful to have a short explanation what this means, and how this data was aggregated. The same applies for the first paragraph on the paper bag.

A reference will be added to Annex C which contains more information on the inventory data used.

Comment 2.5.10 – Sensitivity analysis (section 6)

In several graphs the captions are missing

All captions have been included.

Comment 2.5.11 – Sensitivity analysis (section 6.1)

The title is somewhat confusing, as secondary use seems to be equivalent with primary recycling.

The title has been changed to 'Secondary use of lightweight bags'. Secondary use is discussed throughout the report as the reuse of lightweight carrier bags in secondary applications such as for bin liners. The inventory analysis also states how this has been modelled by including the avoided production of bin liners. Greater reference to this has now been added to this section to make this clear.

Comment 2.5.12 – Sensitivity analysis (section 6.2)

As noted we do not agree with the way the benefits of secondary recycling are computed. We also do not agree that bags with prodegradant bags can be assumed to be recyclable. On the contrary they may make it impossible to recycle other bags, in case the different bag types are mixed.

The prodegradant bag has been excluded from recycling within the sensitivity analysis.

Comment 2.5.13 – Sensitivity analysis (section 6.3)

We think the way carbon storage is described is confusing, and we do not understand the second paragraph after figure 5.15. Also here we suggest to start with a comparison like in figure 5.1

The paragraph describing carbon storage has been reworked to provide a better explanation of its inclusion in the impact assessment.

E.2.6 Chapter 7 & 8 Discussion and conclusions

Comment 2.6.1 – Discussion and conclusion

The comparison with other studies is very interesting and provides a very nice background, and addresses objective 3 in chapter 2.1 nicely.

The second paragraph, contains a note to the authors, for internal use. In fact it addresses the problem we have, that is there is no real comparison, and thus that objective 2 of the study could not be reached, at least a comparison as meant in ISO 14040, using a distinct functional unit was not possible due to the lack of information on reuses.
We think it is still possible to make more concrete recommendations if three classes are chosen:

1. Relatively favourable solutions are the HDPE bag (preferably not opaque) and the PP bag for life, as the number of reuses required to score better seem realistic.
2. The prodegradant additive, does not seem to add much benefits, and has a negative impact is it increases the weight of the bag (which is not clear). If a recycling system is developed for bags, it should not be used. The Starch polyester bag also has no benefits.
3. The paper bag is not a good alternative, as it is more realistic to assume people will reuse such a bag 4 times or more.
4. The cotton bag does not seem to be a good alternative due to the high impact of cotton production

We are aware of the fact that reviewers are not supposed to draw conclusions, so this proposal should be seen as an example of what seems possible.

The discussion and conclusion have been reworked to include greater clarity in the conclusions made. A discussion of the issue surrounding the functional unit has also been added.

E.3 Final review statement

We believe this is a very well presented and clear study, conducted in a very professional way. The review took place in two major stages. At the end of 2009 a first version was produced and reviewed. Many comments have been taken into account, and a new version was produced in the summer of 2010.

The review panel has checked this version and have seen most comments have been properly addressed The major improvements between the first and second study were:

- More realistic assumptions on post consumer recycling, and especially how the benefits of recycling were taken into account, which were too optimistic; in the final study this has been properly addressed, and we agree on the approach.

- A better clarification on the selection of alternatives under investigation.

- Overall improvements in the data collection.

There are also a number of comments that could not be addressed, such as, the lack of consideration for land-use and water consumption in the case of cotton and biobased materials which is difficult to justify, but we accept the problems in data collection.
The reviewers have difficulty understanding why the results were presented in a relatively complex way. There is no clear comparison on the basis of a functional unit, while much work has been done to get information on a comparison basis. Instead a comparison is made on the basis of the required reuse (section 7.2). Whether the required number of reuses are realistic is left over to the reader to assess. We do understand the sensitive nature when the comparison is presented in a more clear and directly comparable way, and we can accept this, even though the ISO standards do require to base comparisons on a clear functional unit.

Overall we think the study in its final form fulfils the requirements in the ISO 14040 standards; in particular:

- the methods used to carry out the LCA are consistent with this International Standard,
- the methods used to carry out the LCA are scientifically and technically valid,
- the data used are appropriate and reasonable in relation to the goal of the study,
- the interpretations reflect the limitations identified and the goal of the study, and
- the study report is transparent and consistent.

The reviewers:
Mark Goedkoop; PRé consultants B.V.
Keith Elstob, Bunzl Retail
Jane Bickerstaffe, INCPEN, Reading

Would you like to find out more about us, or about your environment?

Then call us on
08708 506 506* (Mon-Fri 8-6)

email
enquiries@environment-agency.gov.uk

or visit our website
www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)
floodline 0845 988 1188

* Approximate call costs: 8p plus 6p per minute (standard landline).
Please note charges will vary across telephone providers

Environment first: This publication is printed on recycled paper.