RECYC-QUÉBEC
Québec

TECHNICAL NOTICE ON SHOPPING BAGS

ENVIRONMENTAL IMPACT ASSESSMENT

[TRANSLATION]

November 2007

Notice to the reader: Conclusions and recommendations provided in this technical notice could change according to results obtained from a complete lifecycle analysis of a whole range of bag types conducted in Québec according to recognized ISO standards.

Prepared by Sophie Taillefer
In cooperation with Hélène Gervais
Industrial Development Officers

TABLE OF CONTENTS

FOREWORD

RECYC-QUÉBEC's mission is to guide, implement and coordinate activities to support the recovery of waste materials. The mandate of this Québec government corporation is mainly to reduce the amounts of waste generated and lower quantities being sent for disposal so as to meet the objectives of the *Politique québécoise de gestion des matières résiduelles 1998-2008* (*Québec Residual Materials Management Policy, 1998-2008*).

In order to make an informed decision, both consumers and businesses must consider a number of factors when choosing a shopping bag. Over the past few years, RECYC-QUÉBEC issued two technical notices focusing on shopping bags.[1] Since then, several studies and programs have been initiated by the organization, including a Canadian program developed by the *Bureau de normalisation du Québec-–BNQ* (Québec's standards bureau) to certify compostable plastic bags, as well as a study by the *Centre de recherche industrielle du Québec-CRIQ* on the impact of degradable plastic bags on the recycling of conventional plastic bags. At the same time, a number of large food chains and other retailers introduced reusable bags, an initiative that has helped reduce the numbers of conventional plastic bags in circulation in Québec.

The purpose of this document is to support informed decision-making, from an environmental impact point of view, when choosing shopping bags. Economic and social considerations have been expressly excluded because of the variety of factors involved. Such an analysis could be the subject of a subsequent study.

This technical notice on choosing a shopping bag is based on three basic principles, i.e. the hierarchy of the 3Rs (reduce at source, reuse and recycle), product lifecycles (from production to the end of useful life), as well as available markets and services for recycled waste in Québec.

The information presented in this study was gathered from the most recent studies available on the subject. Nevertheless, some conclusions should be interpreted with care because the lifecycle studies consulted are not all based on the same indicators (water and energy consumption, generation of greenhouse gases, generation of production waste, potential recycling management systems, etc.). In addition, they were conducted outside Québec, and therefore in a different context. Only a lifecycle analysis conducted in a Québec context would allow a specific and accurate assessment of the impact of the various bags on our environment.

[1] RECYC-QUÉBEC (2004). Sacs d'emplettes : comparaison de leur impact sur l'environnement.
RECYC-QUÉBEC (2005). Sacs dégradables : propriétés et allégations environnementales.

Finally, the allegations and findings mentioned in this technical notice may vary considerably according to the situation and materials compared. Thus, the characteristics of a particular material could be assessed as beneficial in one situation but neutral, or even negative, in the calculation of the environmental assessment. For example, the biodegradability of a plastic bag may be an advantage when it is used for disposing of organic materials or when left as litter in nature. However, that same characteristic is insignificant or even negative when the biodegradable bag is sent to a landfill.

There is no clear cut and definitive answer that establishes which bag is best from an environmental point of view. The reader is therefore urged to use judgement given the situation at hand and to base his or her personal assessment on the 3Rs and conclusions provided in this technical notice.

BACKGROUND

Lightweight, flexible or rigid, malleable, resistant to shock, water, mould, bacteria, oils and even some chemical products, plastic is one of the most-used materials in the world. Those qualities make it an ideal material for packaging. Paradoxically, from an environmental point of view, it is criticized for those same qualities. Its resistance to physico-chemical factors ensures the longevity of plastics, thus creating environmental problems both for their disposal and their effects on land and marine ecosystems.

Each year, an estimated 2 billion shopping bags are distributed in Québec.

Though most shopping bags, generally made of plastic, are used to carry groceries, they are also distributed in pharmacies, clothing boutiques, convenience stores, department stores and anywhere products are sold. Each year, an estimated 1.4 to 2.7 billion shopping bags (generally made of plastic) are distributed in Québec.[2] That comes to around five bags per person per week. Designed to be used only once, some are also reused as trash bags or to carry a meal while others are recycled. The majority, however, are thrown in the trash.

Symbols of our overconsumption, plastic bags have recently become the focus of consumers and governments. Consequently, a multitude of alternatives to conventional plastic bags were produced. Canvas sacks, reusable plastic bags, and degradable bags, among others, have appeared on the market. What is the best choice from an environmental point of view? The answer to that question is both simple and complex.

This technical notice first provides a description of the various types of bags available on Québec's market and their main environmental impact. Conclusions of the various studies consulted are then presented to provide the reader with factual information on the best bag to choose. Finally, recommendations are offered according to the purpose of their use.

[2] Estimate based on a usage rate of one bag per 2 days to one bag per day, per person, applied to the population of Québec (according to household occupancy rates) i.e. 7,400,567 (2006 Census, Statistics Canada, 2006).

PART I: SHOPPING BAGS AND THEIR ENVIRONMENTAL IMPACT

1. THE BEST CHOICE: REDUCE AT SOURCE

In accordance with the 3R's hierarchy (reduce, reuse and recycle), the best solution to decrease overconsumption of shopping bags is to **reduce their numbers at the source**: i.e. use no bags! Of course, this option applies only if there are just a few items to carry away.

The best solution to the overconsumption of shopping bags is to reduce their numbers at the source!

2. THE SECOND OPTION: REUSABLE BAGS

If the number of items to carry away requires bagging, the best solution is to use reusable bags because fewer shopping bags are required. The challenge is to make their use a daily habit.

Which is the best reusable bag?

There is a great variety of reusable bags to choose from to satisfy every taste and every budget! People can easily find one to suit their needs. The choice of a reusable shopping bag with a low environmental impact will depend on the materials used to make it (recycled or secondary materials), the quality of the design, where the bags are produced and the potential for recovering them at the end of their useful life. An average reusable bag can replace two to three conventional plastic bags per use. The useful life of a reusable bag varies according to several criterias, including the quality of the materials it was made from, its design and the number of times it is used.

Every time a reusable bag is used, it replaces an average of two to three conventional plastic bags.

Reusable bags are made of two main materials: plastic and textiles.

Reusable bags made of woven plastic

Reusable woven plastic bags found on Québec's market are generally made of high density polyethylene (HDPE #2), polypropylene (PP #5) or polyester, which is a synthetic fabric made from polyethylene terephthalate (PET #1).

Easy to maintain and sturdy, the reusable plastic bag is often preferred to other types of reusable bags because of their low cost and the volume of products they can accommodate.

Reusable bags made of fabric

Fabric bags are usually made of cotton. They have a potential for reuse that is similar to woven plastic bags. People often choose them because they are not bulky to carry around when empty, can be repaired, are machine washable, and therefore easy to maintain.

Despite the environmental impact associated with their production, i.e. extraction of non-renewable resources (petroleum products and natural gas) for woven plastic bags, or intensive cultivation for cotton bags, reusable bags are considered as the most

environmentally-friendly choice, second to reduction at source, as a solution to the shopping bag issue.[3]

What should we do when a reusable bag is no longer reusable?

Because reusable plastic bags are made from recyclable materials, the best option is to recycle them at the end of their useful life. However, since they are designed to last a long time and introduced recently to the market, plastic reusable bags have not yet been identified as packaging accepted for curbside recycling. Recycling sorting centres will eventually have to assess the possibility of including them in their programs if the volume justifies it. Moreover, recycling these bags should be studied from a technical point of view since many of their components can impose certain constraints (handles and seams made from different resins, large quantities of ink, etc.), in addition to complications related to the recycling of woven plastic by conventional recycling equipment. Finally, some stores invite their customers to return to them any reusable bags that are at the end of their useful life so they can be turned over to the manufacturer for further recycling.

As for reusable bags made of fabric, these can be easily repaired, used as rags or for other purposes after some transformation. Moreover, cloth bags that are still usable can be dropped in one of the used clothes recycling bins found in many locations.

Fabric bags are recyclable. The recycled textile can be used to make a variety of products such as felting and insulating panels. However, textiles cannot be recycled through curbside recycling programs and no door-to-door services are yet available in Québec to ensure the specific collection of post-consumer textiles for recycling purposes.

AT A GLANCE

Ideally, reusable bags are chosen according to theirs sturdiness and ability to hold weight, their recycled or secondary material content, and their having been manufactured in Québec. If the bags are made of woven plastic, their components (handles, seams, and walls) should be made from a single type of plastic and contain little ink. The final challenge is to remember to take them with us to the store to carry home the products we buy! Tip: Always keep a reusable bag close at hand at home, in the car, and at the office.

[3] According to lifecycle analyses consulted (See Part II of this technical notice).

What measures can be applied to promote reduction of shopping bags?

Increasing quantities of waste and its impact on the environment are a major environmental issue. Over the past several years, RECYC-QUÉBEC has been monitoring options implemented in various countries designed to promote the reduction of plastic bag use. Each measure has pros and cons. For example, some countries such as Ireland chose to apply a tax on conventional plastic bags, which resulted in consumers switching to reusable bags and reducing the number of plastic bags in circulation by 90%. However, an increase in the sale of trash bags has been noted. In other countries such as Corsica, India and Bangladesh as well as such cities as San Francisco in the U.S. and Leaf Rapids in Manitoba, authorities chose to adopt legislation to abolish the use of conventional plastic bags. This measure significantly reduced the number of plastic bags in circulation but, in many cases, these were simply replaced by degradable bags, a solution that does not promote reduction.

In 2003, the Australian Retailers Association adopted a code of practice for the management of plastic bags. The objective was to reach a usage reduction of 50% by the end of the agreement in December 2005. Companies who signed on to the agreement committed to, among other things, promote the use of reusable bags, implement a point-of-sale plastic bag recovery program and train their cashiers to reduce the number of bags distributed. This approach resulted in large food retailers lowering bag usage rates by 40% and that of small retailers by 22%. Australia is currently evaluating various scenarios to further reduce plastic bag use.[4]

Closer to home, Ontario has recently concluded an agreement with various food distributor and retailer associations to reduce by half the number of plastic bags used by 2012. The agreement sets out specific reduction measures aimed at consumers and the implementation of programs to recover conventional plastic bags at points of sale.[5]

Finally, all the measures mentioned above could be further analyzed to determine the best option from environmental, economic and social points of view.

For the time being, a voluntary approach is favoured in Québec. Discussions with large retailer associations, i.e. the *Association des détaillants en alimentation* – ADA (Québec food retailers association), the Canadian Council of Grocery Distributors – CCGD, and the *Conseil québécois du commerce de détail* – CQCD (Québec retailers council), have resulted in the proposal of number of scenarios to reduce plastic bag use. The implementation of a voluntary code of best practices was the option favoured by industry. Since then, a number of large food chains have voluntarily introduced reusable bags in their stores, trained their employees and conducted an awareness campaign among their customers on reducing bag use. The introduction of reusable bags has been well received by customers. According to the Canadian Council of Grocery Distributors – CCGD, over 4 million reusable bags have been sold in Québec since their introduction in 2005, representing a potential reduction of

Over 4 million reusable bags have been sold in Québec since their introduction in 2005.

[4] Environment Australia - Environment Protection and Heritage Council (2007).
[5] Ontario's Ministry of the Environment (2007).

almost 20%.[6] Last spring, the *Association des détaillants en alimentation du Québec* – ADA conducted a survey of its members in which the bag issue was raised. Results revealed a significant reduction in conventional bag use (based on purchases). Considering certain variables, including the type of business, its size and location, the reduction varied between 15 and 35%.

3. CONVENTIONAL PLASTIC BAGS

What is the environmental impact of producing conventional plastic bags?

The production of polyethylene, a key component of conventional plastic bags, requires the use of a non-renewable raw material: petroleum.[7] Oil extraction can have a negative impact on ecosystems and on biodiversity. It also uses water and can result in degassing. In addition, transportation of oil products by ship presents a significant risk of leaks and spills that can have an impact on the environment.

On the other hand, the manufacture of plastic shopping bags represents less than 0.1% of Canadian hydrocarbon consumption.[8] In addition, over the past 20 years, the industry has adopted measures to reduce the quantity of materials used to manufacture plastic bags by 75% while still maintaining the bag's sturdiness and durability.[9]

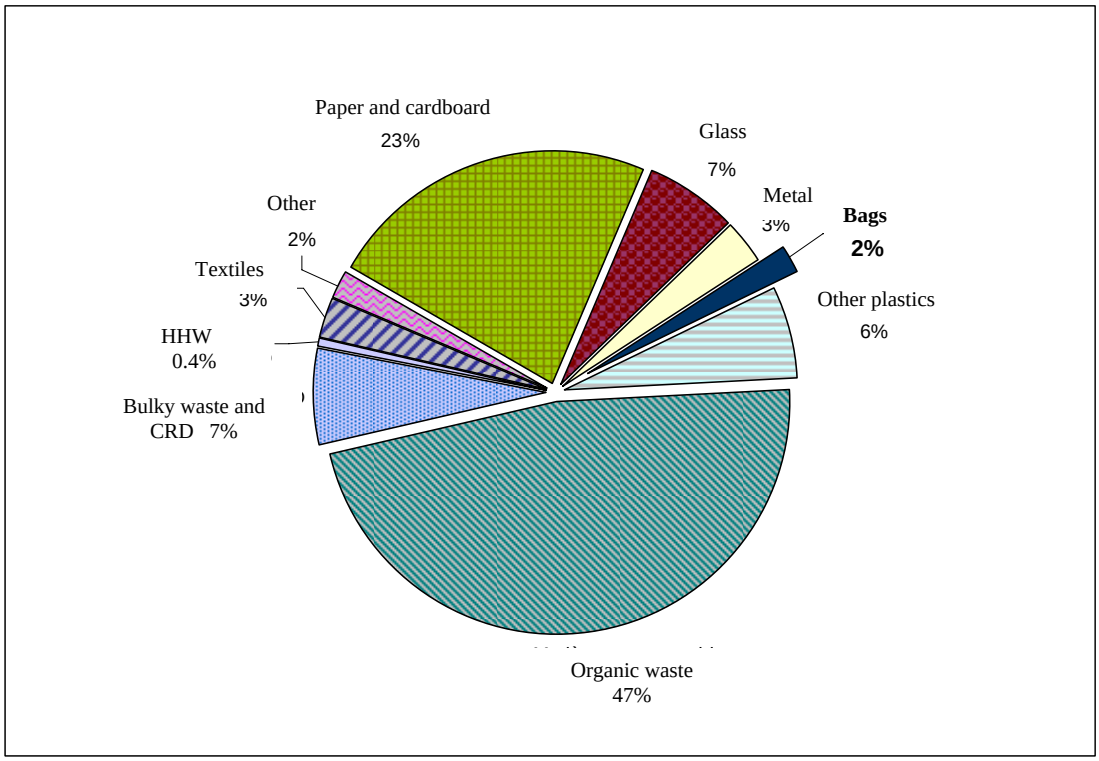
What is the scope of the plastic bag issue in Québec?

Plastic bags represent less than 2% of all waste generated each year by Québec households.

According to a recent characterization study of household waste[10], almost 6,700 tonnes of plastic bags (mainly shopping bags) are recovered annually through curbside recycling programs, while almost 42,000 tonnes of plastic bags, including shopping bags and trash bags, are thrown out (mainly in landfills). The recovery rate is therefore 14%.[11] The tonnage of plastic bags represents less than 2% of all waste generated each year by Québec households (Figure 1). Thus, in terms of weight, plastic bags are only a very small part of all waste generated. It therefore appears that the issue of plastic bags relates far more to its status as the symbol of our consumer society and the effect they have on the natural environment.

[6] Estimate based on 2.5 bags avoided each time a reusable bag is used, 3 times per week at a 25% usage rate.
[7] Ethylene is produced when hydrocarbons are steam cracked. *Société française de chimie* (2007); Environment Australia, Department of the Environment and Heritage (2002).
[8] Canadian Plastics Industry Association - CPIA (2007)a.
[9] CPIA (2007)b.
[10] RECYC-QUÉBEC (2007)a.
[11] This rate does not include the percentage of shopping bags used as trash bags.

CHART 1: COMPOSITION OF HOUSEHOLD WASTE GENERATED IN QUÉBEC (RECYC-QUÉBEC, 2007)



In what proportion are conventional plastic bags reused?

Because of their convenience, a great percentage of conventional plastic bags are reused for a variety of daily purposes, mostly as trash bags. In Canada, studies on waste management have shown that 50% of shopping bags are reused as trash bags.[12] Studies conducted abroad, France and Australia in particular, confirm this data.[13] Thus, only half of the bags that are thrown out are potentially recoverable, i.e. to be reused or recycled. Overall, our objective should be to promote the reuse of plastic bags and to consume only as few as are required for daily needs.

Are conventional plastic bags recyclable?

The great majority of conventional plastic bags are made from high density polyethylene (HDPE #2) or low density polyethylene (LDPE #4). These resins are recyclable and accepted in several regions of Québec.[14] More specifically, 21 out of 36 recycling sorting centres, serving around 60% of Québec's population through curbside recycling programs, accept plastic bags.[15] Recovered plastic bags are mainly used to make new plastic bags or plastic lumber.

[12] CPIA (2007)b.
[13] Ecobilan PriceWaterhouseCoopers (2004) ; Environment Australia - Department of the Environment and Heritage (2002).
[14] For more information on plastics and their different classifications, visit www.recyc-quebec.gouv.qc.ca/upload/Publications/zzzFich1552.pdf.
[15] CRIQ (2007)a.

Plastic lumber is a material that replaces natural lumber. It is used in a number of applications, including terraces, fences, trash containers, garden furniture, park benches, picnic tables, skids, etc. Some Québec companies as well as others in Newfoundland, Ontario and Virginia (U.S.) have specialized in the production of plastic lumber.[16] However, the main market for Québec plastic bags remains their export to Asia, mainly China, where significant economic growth is taking place.

The reasons some recycling sorting centres do not accept plastic bags include the additional investment required to sort them, costs and benefits that are not always favourable and the contamination of the bags when they are soiled or contain receipts, etc. If the bags are not accepted by the local curbside recycling program, residents can return them to voluntary collection programs.

Plastic bag recycling systems in Québec are faced with a number of constraints: the contamination of plastic bag bundles by other materials, the limited number of recyclers who accept plastic bags in Québec, as well as increasing requirements of Chinese and other Asian countries with regard to the quality of exported plastic bag bundles.

Moreover, some food distributors recover conventional plastic bags in their stores. This is a good alternative for residents who cannot recover them through their municipal curbside recycling program.

To find out if your municipality accepts plastic bags in its curbside recycling program, see RECYC-QUÉBEC's @bc du recyclage à domicile. Before putting plastic bags in your recycling bin, be sure to remove cash register receipts or other materials that could hamper the recycling of the bags.

What happens to conventional plastic bags once they're thrown out?

When dumped in landfills, conventional plastic bags remain stable and inert. Manufactured from oil-derived polymers, the complex organic molecules (macromolecules) that compose the bag eventually biodegrade; it is only a question of time, a really long time! The space that plastic bags use up, though very small when compared to other waste, contributes to reducing the service life of landfills.

If incinerated, conventional plastic bags provide good calorific value and generate few greenhouse gases. The burning of plastics can release pollutants into the atmosphere, including carbon monoxide (CO), nitrogen oxides (NO_x), sulphur oxides (SO_x), polycyclic aromatic hydrocarbons and particles (PAH).[17] However, because high performance filtration processes are used, these pollutants are reduced to levels

[16] CPIA (2007)c.
[17] Li C-H., *et al*. (2001).

that comply with regulations currently in effect in Québec. In Québec, only 3% of waste is eliminated by incineration.[18]

What impact do conventional bags have when dispersed in the natural environment?

Unfortunately, an undetermined number of plastic bags are blown around by the wind and end up as litter in the natural environment. In addition to being unsightly, lost plastic bags have a significant environmental impact on land and marine ecosystems. Birds and marine wildlife are particularly affected by this litter. According to Environment Canada, plastic debris, including plastic bags, cause distress to many marine animals such as fish, dolphins, whales, turtles and birds that mistake the refuse for food.[19] Thus, it is particularly important that people understand the importance of properly disposing of the plastic bags they use.

[18] RECYC-QUÉBEC (2007)b.
[19] Environment Canada (2007).

4. DEGRADABLE BAGS

Many types of degradable bags have appeared on the market over the past 20 years. With the increasing consumer pressure, more and more companies offer degradable bags to replace conventional plastic bags. However, simply using these bags instead of conventional plastic bags does not promote reduction at source.

There are different types of degradable bags on Québec's market.

What is a degradable bag?

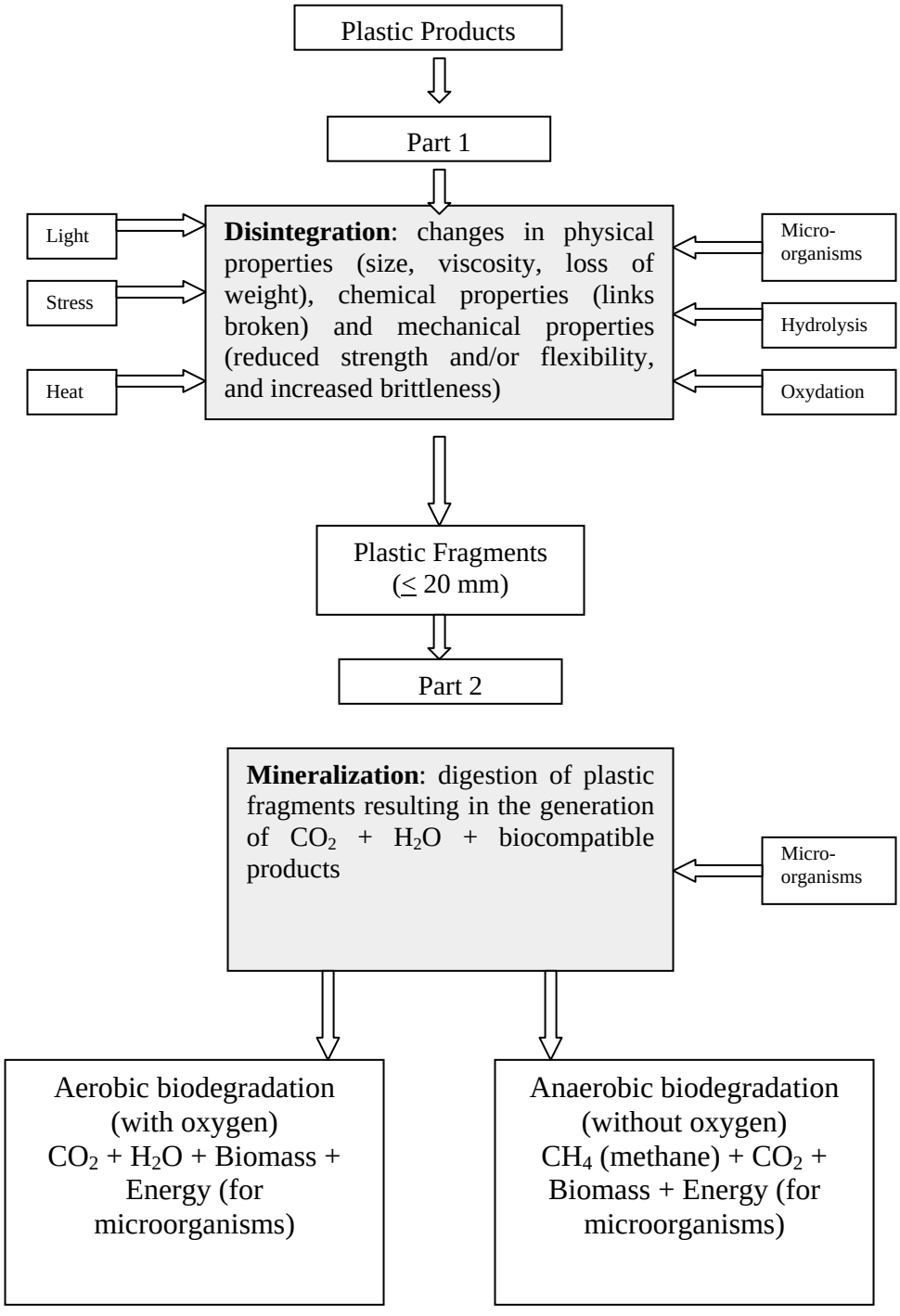
Contrary to conventional bags, degradable bags can disintegrate and biodegrade over a specific length of time given certain environmental conditions. The overall category of degradable plastics include oxo-biodegradable plastics and biopolymer-based (starch) biodegradable plastics.

Degradable plastic bags can be classified either according to their composition or to their degradation process.

Composition	Materials used in their manufacture	Degradation process [20]
Biopolymer	Polyester + starch (corn, wheat, potato or other starch)	Biodegradable (or hydro-biodegradable): a plastic that degrades as a result of the action of microorganisms normally present in the environment. (Note: When this process occurs in the presence of oxygen, the residues of this biodegradation are carbon dioxide, water, inorganic compounds and biomass.)
Plastic with an additive	Polymers produced from oil (polyethylene) + an oxidant additive	Oxo–biodegradable: a plastic to which an additive has been added to promote degradation from the sun's UV rays, heat and/or mechanical stress. The resulting residues (small particles of plastic) then biodegrade by microorganic action.

[20] Definitions adapted from ASTM standard 6400-04.

CHART 2: SIMPLIFIED SCHEMATIC OF THE PLASTIC DEGRADATION PROCESS
(Adapted from Krzan, A. *et al*. 2006)



Biopolymer biodegradable (starch-based) bags

Most biopolymer biodegradable plastic bags are made from starch (corn, rice, potato, etc.) and polyester. They are biodegradable thanks to the action of such microorganisms as actinomycetes, fungi and bacteria.

The production of biodegradable bags made from starchy biopolymers requires natural raw materials. Its environmental impact at the production stage depends on agricultural practices. For example, the fertilizers and pesticides used to produce corn may be a source of pollution. Other effects such as erosion and soil compaction due to heavy machinery also increase environmental effects corn production may have.[21] However, resins made from organically produced corn or according to environmentally friendly practices improve the environmental assessment of biodegradable bags.

Oxo-biodegradable bags

Oxo-biodegradable bags are made from conventional plastic (polyethylene) to which an additive is introduced. The degradation can be activated by the sun's UV rays, heat and/or mechanical stress. Then, the disintegrated plastic particles can biodegrade. The environmental impacts related to the manufacturing of these bags are similar to that for conventional bags.

Just like conventional plastic bags, oxo-biodegradable bags can be reused in different ways. However, some of them have a limited useful life, which can reduce their potential for reuse.

The only way to tell an oxo-biodegradable bag from a conventional plastic bag is by its label. There is currently no certification program to differentiate it from other types of degradable bags.

What is the advantage of using a degradable bag?

The first degradable plastic bags were designed to be used for disposing of organic waste and composted in industrial composting sites. Today, many types of compostable plastic bags are available on the Québec market.

The main advantage of compostable plastic bags is that they facilitate the collection of household organic waste. Some studies have shown that the rate of participation in household organic waste collection programs increases when residents can use compostable bags. At the time being, about twenty Québec municipalities offer organic waste collection services to their residents. Over the next few years, several other municipalities, mainly in more urbanized areas, plan to implement such services as part of their waste management plan.

The main advantage of compostable plastic bags is that they facilitate the collection of household organic waste.

Most three-way collection programs (organic waste sorted at the source) use a bulk system, i.e. recycling bins. Many programs do not handle organic waste in

[21] Environment Australia - Department of the Environment and Heritage (2002).

compostable plastic bags mainly because of the high cost of the bags and the increased risk of contamination from inorganic objects (e.g. plastic packaging, tin cans, glass containers, etc.).

Some manufacturers claim that their compostable plastic bags can be composted in backyard composters. The time required for the bag to biodegrade will be relatively longer than in an industrial composting site because of the lower level of microbial activity.

Is biodegradable the same as compostable?

The term "biodegradable" is not necessarily a synonym of "compostable"!

Plastics can be labelled as biodegradable without their necessarily being compostable. To be compostable, they must biodegrade at a rate comparable to that of other compostable organic waste (tree leaves, food waste, etc.), without generating residues that affect the quality of the compost. To avoid all confusion between the "biodegradable" and "compostable" qualifiers, the Bureau de normalisation du Québec has developed a new Canadian certification program to certify compostable plastic bags and authorize labelling with a certification trademark on bag packaging.[22] All types of degradable plastic bags (biopolymer or oxo-biodegradable based) can qualify under the program as long as they meet product requirements (rate of disintegration and biodegradation within a prescribed length of time, eco-toxic effects, volatile solid and metal content) and certification requirements.

There are other certification programs for compostable plastic bags, notably in the U.S., France and Germany. Though they are based on recognized standards, only the BNQ's new certification program takes account of Canadian criteria for compost quality.

[22] The BNQ's new certification program for compostable plastic bags has been in effect since September 2007. The BNQ and the Composting Council of Canada are the legal holders of the compliance trademark.

THE BUREAU DE NORMALISATION DU QUÉBEC (BNQ)'S CANADIAN CERTIFICATION PROGRAM FOR COMPOSTABLE PLASTIC BAGS

Initiated by RECYC-QUÉBEC, the certification program for compostable plastic bags is mainly based on ASTM standards 6400-04 and EN 13432, international ISO FDIS 17088 standards as well as Canadian standards CAN/BNQ 0413-200 on compost quality. The main objective of this program is to provide consumers and other users with a means to differentiate compostable plastic bags from other degradable bags and, ultimately, ensure the quality of resulting compost. As for manufacturers and distributors of compostable plastic bags, the certification program allows the promotion and recovery of certified compostable plastic bags and to receive recognition for their product thanks to the approval of a neutral and impartial third party. RECYC-QUÉBEC and the City of Montréal, principal partners, with such organizations as the Composting Council of Canada (CCC), the Biodegradable Products Institute (BPI), Oxo-Biodegradable Plastic Institute (OPI) and W. Ralston Enterprises (Canada) and Biobag Canada Inc., have participated in this project. This is one of the initiatives RECYC-QUÉBEC has undertaken regarding the compostable plastic issue. For more information on the advantages and specific requirements of the program, visit the following websites: www.compostable.info and www.bnq.qc.ca or contact Sophie Paré at 1 800 386-5114 ext. 2541, or by e-mail: sophie.pare@bnq.qc.ca.

Note regarding environmental labelling on bag biodegradability

Until it is required by specific legislation, product certification remains voluntary. A company may identify its bag as being "compostable" or "biodegradable" even if it does not meet Canadian certification standards. The *Consumer Packaging and Labelling Act* establishes the rules for labelling according to international ISO standard 14021 – *Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II environmental labelling)*. The application of the Act falls under the Competition Bureau of Canada. In short, it forbids manufacturers from labelling their products in a misleading or false manner, particularly with regard to their "biodegradability" and "compostability". Checks are made by a team of inspectors and investigators from the Competition Bureau, usually as a result of complaints filed by consumers.

A guide on environmental claims for industry and advertisers developed by the Canadian Standards Association in cooperation with the Competition Bureau of Canada is available at the following website:
http://www.bureaudelaconcurrence.gc.ca/epic/site/cb-bc.nsf/vwapj/guide-for-industry-and-advertisers-fr.pdf/$FILE/guide-for-industry-and-advertisers-fr.pdf

For more information on the *Consumer Packaging and Labelling Act*, contact the Information Centre of the Competition Bureau at 1-800-348-5358 or by e-mail at burconcurrence@bc-cb.gc.ca.

The impact of degradable bags on the recycling of conventional plastic bags

Up until very recently, many questions persisted regarding the impact of degradable bags on the recycling of conventional plastic bags. Recycling sorting centres, municipalities, salvage dealers and recyclers in Québec and elsewhere all had the same concerns regarding the effects degradable bags could have on the quality of recycled plastics.

These concerns prompted RECYC-QUÉBEC, in cooperation with the City of Montréal, the Canadian Plastics Industry Association (CPIA) and the Oxo-Biodegradable Plastics Institute (OPI), to mandate the *Centre de recherche industrielle du Québec* (CRIQ) to undertake a study on the subject. The objective of the study was to evaluate the potential impact of four types of degradable bags, available in Québec, on the recycling of conventional plastic bags. The biopolymer degradable bags studied (referred to in the study as “hydro-biodegradables”) were the “BioBag®” manufactured by Polar Gruppen and the “Eco Film™” manufactured by Cortec Corporation. The oxo-biodegradable bags studied were the “NéoSac” manufactured by Association NéoSac and the bag manufactured by Omniplast with an additive produced by EPI Company.

The bags were mixed in proportions of 5%, 10%, 25% and 50%, and evaluated in the following tests:

- Mix preparations with conventional plastic bags.
- Extrusion of shapes and film from the mixes.
- Mechanical performance of manufactured films and shapes following accelerated aging (UV + heat + humidity).

Study findings are as follows:

- The hydro-biodegradable bags studied (Eco Film™ and BioBag®) are incompatible with the traditional plastic bag recycling stream, mainly because of the proven difficulties encountered during the preparation of mixtures with traditional bags and of the extrusion of profiles and films.

- The "NéoSac" and "EPI" oxo-biodegradable bags studied show excellent compatibility with traditional plastic bags during the preparation of mixtures and during the extrusion of profiles and films. However, the films obtained from mixtures of "NéoSac" bags and traditional plastic bags showed significant degradation after only a few days of accelerated aging. Consequently, these bags cannot be considered as being perfectly compatible with the traditional plastic bag recycling stream.

- EPI oxo-biodegradable bags studied are compatible with the traditional plastic bag recycling stream in terms of preparation of mixtures, extrusion, initial mechanical performance as well as mechanical performance after accelerated aging.

Degradable bags do not all react the same way when they are mixed with conventional plastic bags.

The study revealed that degradable bags do not all react the same way when mixed with conventional plastic bags. The chemical nature of degradable bags (oxo and hydro) has a distinctly significant effect on final performance. Also, the performance of degradable bags from a same category showed marked differences, as observed when two types of oxo-biodegradable bags were compared under the effect of accelerated aging.

The complete study on the impact of degradable bags on the recycling of plastic bags is available on RECYC-QUÉBEC's website www.recyc-quebec.gouv.qc.ca at the "Centre de documentation" tab under "Plastiques."

How can we avoid the negative impact of some degradable bags on the recycling of conventional plastic bags?

The study on the impact degradable bags on the recycling of conventional plastic bags is limited to the bags studied. The degradable bag market is evolving rapidly and many new products are being introduced in Québec. Given the problems related to the recyclability of biodegradable bags vs. conventional plastic bags, several possible solutions should be evaluated to avoid any impact on plastic recycling systems.

In fact, the Canadian Plastics Industry Association (CPIA) and the Oxo-Biodegradable Plastics Institute (OPI) recommend the development of a certification program that would differentiate degradable bags that are compatible with conventional plastics recycling systems from those that are not. The program could refer to a simplified methodology based on the protocol established in the CRIQ study. This possibility still needs to be evaluated by the industry and other concerned organizations.[23]

The CPIA recently announced the development of its G*uide and stewardship commitment for degradable plastics* to provide a framework for the design, manufacture and marketing of products.[24]

[23] Edgecomb, F. (2007) Canadian Plastics Industry Association (CPIA); Doty, L. (2007) Oxo-Biodegradable Plastics Institute (OPI).
[24] CPIA (2007)d.

Environmental impact related to the disposal of degradable bags in landfills

Contrary to conventional plastic bags, degradable bags can disintegrate and biodegrade in landfills. The speed with which the degradation occurs depends on the type of degradable bag, its degradation process as well as a multitude of physico-chemical factors: oxygen, water, bacteria, heat, pH, etc. In most Québec landfills, waste is compacted to limit the decomposition process. We therefore create buried cells without oxygen (anaerobic). Under these conditions, organic material, including degradable plastic bags, biodegrade at a slower pace and generate, among other gases, carbon dioxide (CO_2) and methane (CH_4), which are greenhouse gases. The biodegradation of bags in landfill conditions could possibly contribute to the intensification of leachates.[25] Finally, even today, there are very few objective studies on the impact of degradable bags in landfill conditions.

In short, the biodegradability of plastic bags is a useful property when managing organic waste but offers little added value when disposed of in landfills.

BILL 390

On April 27, 2005, Stephan Tremblay, then M.L.A. for Lac-Saint-Jean and Official Opposition spokesperson on the environment, tabled Bill 390 to prohibit the distribution of non-biodegradable plastic bags. More specifically, the bill stipulates that it is prohibited to distribute to users in a commercial transaction any non-biodegradable plastic bag for packaging their purchases.

The bill does not follow the logic of the 3Rs that advocates reduction at source and reuse before recycling. Indeed, no study had been previously undertaken to evaluate the environmental, social and economic impact of such a bill. Biodegradability does offer an advantage when the bags are dispersed in nature but they can also have a negative impact on conventional plastics recycling systems and in landfills.

[25] Environment Australia - Department of the Environment and Heritage (2002).

5. PAPER BAGS

Paper bags found on the Québec market are mainly manufactured locally from sawmill by-products (chips and sawdust) and recycled paper and cardboard.[26] Paper bags represent a very small proportion of residual waste generated in Québec, i.e. 0.6% or 15,500 tonns.[27] In fact, these bags are seldom offered as shopping bags in food stores mainly because they have a higher comparative cost than plastic bags.

Environmental impact related to paper bag production

The environmental impact of paper bag production is measured in terms of the effects on deforestation (degradation of soils and biodiversity) and of polluting emissions generated from pulp and paper production. The environmental assessment of paper bags is directly proportional to its recycled content. According to the Québec Forest Industry Council, Québec paper manufacturers have greatly improved their environmental performance over the past fifteen years. Significant reductions have been observed in chlorine compound emissions, suspended particles in water, greenhouse gases and other atmospheric pollutants (particulate matter, sulphur dioxides, and nitrogen oxides) as well as water and energy consumption.

Can paper bags be reused?

Paper bags can be used to collect paper and cardboard as part of municipal curbside recycling programs (separate collection), as well as tree leaves and gardening residues in the framework of a green waste collection program. The main limits to the reuse of paper bags include poor resistance to water and tear.

Are paper bags recyclable?

Paper bags are recyclable and compostable.

"Kraft" type (sturdy) paper bags are manufactured from strong fibres and are easily recyclable. Paper bags are accepted by the great majority of municipal curbside recycling programs. According to the most recent data, the rate of recovery of paper in the municipal sector reaches 57%. However, significant variations in the types of paper recovered have been observed. Indeed the rate of recovery of kraft paper bags is about 30%.[28]

Are paper bags compostable?

Paper bags are biodegradable and compostable. In fact, several Québec municipalities use paper bags as containers for their green waste collection program.

[26] Québec Forest Industry Council (QFIC) (2005).
[27] RECYC-QUÉBEC (2007).
[28] RECYC-QUÉBEC (2007).

Environmental impact related to paper bags in landfills

As previously mentioned, paper bags are biodegradable. Consequently, their biodegradation in landfill conditions will generate greenhouse gases. The scope of their environmental impact depends on the physico-chemical conditions present in that environment. Nevertheless, the biodegradability of paper bags constitutes an advantage over conventional plastic bags if they are dispersed in the natural environment.[29]

[29] Environment Australia - Department of the Environment and Heritage, (2002).

FIGURE 3: SHOPPING BAG CHARACTERISTICS AND POTENTIAL FOR RECOVERY AT THE END OF ITS USEFUL LIFE

	REUSABLE BAG (WOVEN PLASTIC OR FABRIC)	CONVENTIONAL PLASTIC BAG	BIOPOLYMER (STARCH) BIODEGRADABLE BAG	OXO-BIODEGRADABLE BAG (POLYETHYLENE + ADDITIVE)	PAPER BAG
1. REDUCE	**First objective**: reduce the number of shopping bags				
2. REUSE	Designed for reuse. Potential reuse for several years according to the quality and number of times the bag is used	Possible reuse for other products or waste disposal. Reuse limited to the quality of the bag	Reuse limited due to reduced strength of the bag. Reuse for the disposal of organic waste	Possible reuse for other products or waste disposal. Reuse limited due to shorter useful life of the bag	Reuse possible but limited due to poor resistance to water and tear
3. RECYCLE	Made of recyclable materials but is not currently accepted by curbside recycling programs	Recyclable but limited to curbside recycling programs that accept plastic bags	Non-compatible with conventional plastic bag recycling systems	Not always compatible with conventional plastic bag recycling systems	Recyclable and accepted by the great majority of curbside recycling programs (except if soiled)
4. RECOVER THROUGH COMPOSTING	Non-compostable	Non-compostable	Designed for organic waste disposal in industrial composting sites. Many meet plastic biodegradation standards for composting	Not demonstrated: No oxo-biodegradable bag has been proven to comply with biodegradable plastic standards for composting	Compostable
5. DISPOSAL IN LANDFILL	Stable in landfill (reusable plastic bag) but has an impact on the service life of the landfill because of the volume occupied, as small as that may be	Stable in landfill but impacts the service life of the landfill because of the volume occupied, as small as that may be	Potential biodegradation according to physico-chemical conditions of the environment and greenhouse gas emissions	Potential biodegradation according to physico-chemical conditions of the environment and greenhouse gas emissions	Potential biodegradation according to physico-chemical conditions of the environment and greenhouse gas emissions

PART II: LIFECYCLE ANALYSES

How is each bag's environmental impact evaluated?

A lifecycle analysis is the tool used to calculate the environmental impact of a product beginning with its design through to the end of its useful service life. It is the most complete method for evaluating the impact of products on the environment. Over the past fifteen years, several lifecycle analyses have been conducted on shopping bags. However, they cannot be extrapolated in every point to apply to Québec's context because of major differences, among other things, in sources of energy.[30] Only a complete lifecycle analysis conducted according to Québec conditions by an independent organization can provide certainty as to which is the best option. Nevertheless, some parallels can be drawn to provide guidance on the choice of shopping bags.

The findings and conclusions identified should be interpreted with care because lifecycle analyses consulted did not all use the same indicators (water and energy consumption, greenhouse gases, atmospheric acidification, eutrophication of water, littering factors, solid waste production, potential for reclaiming at the end of the product's useful service life, etc.). In addition, the studies did not necessarily look at the same types of bags. Certain analyses concentrated on reusable bags made of fabric, conventional plastic bags and paper bags; others looked only at conventional plastic bags and paper bags. Also, some studies cited references whose analyses had been conducted several years before. It is therefore possible that the current environmental impact could be different from that measured at the time the study was conducted because, among other factors, technological developments or other changes have since been implemented to the manufacturing processes of certain bags.

Lifecycle analyses

A document entitled *The use of LCSs on Plastic bags in an IPP context*, produced by EuroCommerce in 2004, provides a summary of five lifecycle analyses, of which four are presented in detail in Annex I. The main findings mentioned are:

- Using a reusable plastic bag four or more times is estimated to have a better environmental assessment than that of conventional plastic bags. The environmental impact of reusable bags is proportional to the number of times they are used. Reusable bags result in fewer shopping bags in circulation and consequently avoid the environmental impact associated with their production and disposal.
- Conventional plastic bags that are reused at least once and disposed of by incineration constitute the most environmentally friendly option after reusable bags.
- Producing a conventional plastic bag requires less energy than producing a paper bag.

[30] Estrella, S. (2007) Centre interuniversitaire de recherche sur le cycle de vie des produits, procédés et services (CIRAIG).

- Conventional plastic bags have a better environmental assessment than do paper bags and biopolymer biodegradable bags. However, their impact on the natural environment, particularly on marine wildlife, is a major negative point.
- Biopolymer degradable bags require less energy to produce than conventional plastic bags. Quantities of greenhouse gases generated during production are about the same as for conventional bags. However, the manufacture of biopolymer degradable bags uses more raw materials comparatively to conventional plastic bags. Their contribution to climate change is less than that observed for paper bags.
- There is little advantage to using degradable bags over conventional plastic bags except when they litter the natural environment.

PART III: MAIN FINDINGS

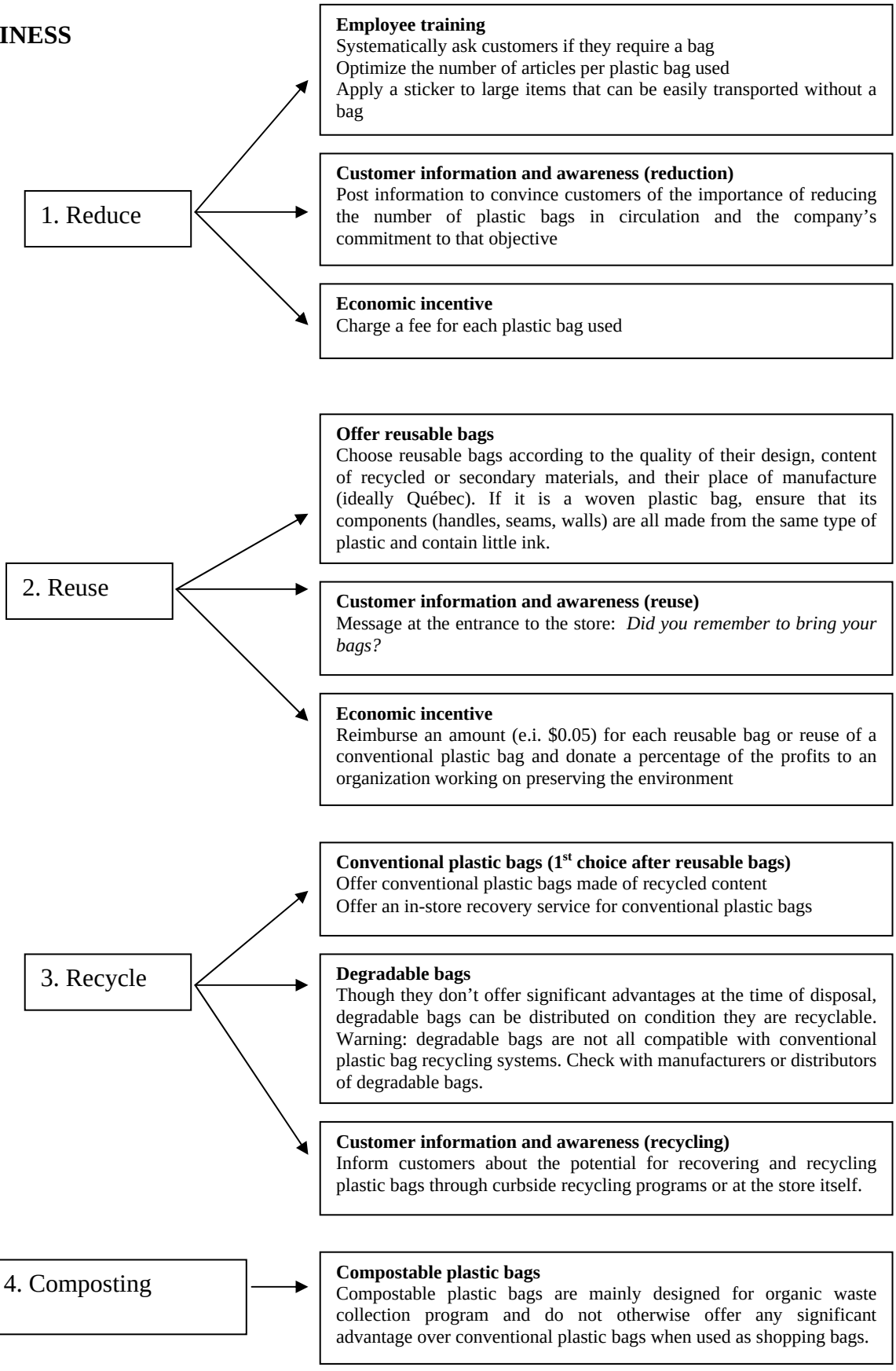
Following an evaluation of the environmental impact of the various types of shopping bags as well as a review of lifecycle analyses and studies conducted on the subject, our main findings are as follows:

- Reduction at source is the best option to solve the shopping bag problem.
- Using reusable bags reduces the number of conventional bags in circulation and has a lower environmental impact than any other type of shopping bag. This practice implies a change in consumer behaviour.
- Most lifecycle analyses consulted place the conventional plastic bag above the degradable bag on condition it is reused and recycled at the end of its useful service life.
- There are few advantages to using degradable bags to replace conventional plastic bags, except for the collection of organic waste (if compostable) or when they litter the natural environment.
- Degradable plastic bags certified as compostable (BNQ certification) can be composted through organic waste collection programs.
- According to the CRIQ (2007)b study, degradable bags do not perform in the same way once mixed with conventional plastic bags. Even degradable bags in a same category show significant differences. The two biopolymer-based degradable bags studied were not compatible with conventional plastic bag recycling systems. NéoSac type oxo-biodegradable bags cannot be considered as perfectly compatible with conventional plastic bag recycling systems. Only the EPI type studied has showed to be compatible with conventional plastic bag recycling systems and could therefore be placed in municipal recycling bins.
- Lifecycle analyses consulted placed paper bags at the bottom of the choices because of their environmental impact at production. Nevertheless, they can be reused, recycled and composted.

PART IV: RECOMMENDATIONS ON THE CHOICE OF SHOPPING BAG

Notice to the reader: Conclusions and recommendations provided in this technical notice could change according to results obtained from a complete lifecycle analysis of a whole range of bag types conducted in Québec according to recognized ISO standards.

BUSINESS



MUNICIPALITY

Notice to the reader: Conclusions and recommendations provided in this technical notice could change according to results obtained from a complete lifecycle analysis of a whole range of bag types conducted in Québec according to recognized ISO standards.

1. Reduce

Population information and awareness (reduction)
Inform and make people aware of the importance of reducing the number of plastic bags in circulation

2. Reuse

Offer reusable bags at events organized by the municipality
Choose reusable bags according to the quality of their design, content of recycled or secondary materials, and their place of manufacture (ideally Québec). If it is a woven plastic bag, ensure that its components (handles, seams, walls) are all made from the same type of plastic and contains little ink.

Population information and awareness (reuse)
Conduct a public information and awareness campaign through various communications tools about the need to reuse plastic bags

3. Recycle

Recovery of conventional plastic bags (1st choice after reusable bags)
Offer a conventional bag recovery service through curbside recycling programs

Population information and awareness (recycling)
Inform residents about plastic bag recycling services offered by the municipality and tips on avoiding contamination

4. Composting

Compostable plastic bags
Using BNQ-certified compostable plastic bags or paper bags in the framework of organic waste collection programs can facilitate the participation of residents and increase volumes recovered. Factors to consider include:

- *Are the bags accepted by the composting site?* Some composting sites are equipped to receive organic waste in all types of bags. Ask the composting site manager before choosing a bag
- *Are the bags really compostable?* Choose bags that have been certified by the BNQ or paper bags. Inform residents about the types of compostable bags accepted by the collection program

- *Are the bags available to residents?* Distribute the bags free of charge to residents or ensure that they have access to the designated compostable bags at a variety of points of sale

CONSUMER

Notice to the reader: Conclusions and recommendations provided in this technical notice could change according to results obtained from a complete lifecycle analysis of a whole range of bag types conducted in Québec according to recognized ISO standards.

1. Reduce

Do I need a bag?
If you don't have many items to carry, say: No, thanks!
Reducing at the source is the best solution to the shopping bag problem

2. Reuse

Do I have a reusable bag?
Always have a reusable bag on hand
Keep a few at home, in the car and at the office
When purchasing a reusable bag, ask yourself the following questions: is the bag made of reused or recycled materials? Is it sturdy? Is it manufactured in Québec?

Can my conventional plastic bag be reused for other purposes?
Conventional or degradable plastic bags can have many uses: to carry your lunch, as a trash bag, etc.

3. Recycle

Conventional plastic bags are the number 1 choice after reusable bags as long as they are reused and recycled

Do I have access to a recycling program for conventional plastic bags?
Conventional plastic bags are recyclable. To find out if your municipality accepts plastic bags in its curbside recycling program, consult RECYC-QUÉBEC's @bc du recyclage. Before placing the bags in the recycling bin, be sure to remove the cash register receipt or other materials that could hamper recycling.
* Warning: Some degradable plastic bags are not recyclable with conventional plastic bags and should not be placed in recycling bins.

4. Composting

Do I have access to an organic waste collection program?
Plastic bags that have been certified as compostable (BNQ certification) and paper bags can be used to collect organic waste (table scraps and/or green waste). Look for the BNQ certification or ask your municipality which compostable bags are accepted by the collection program.

COMPOSTABLE
www.compostable.info

CONCLUSION

The purpose of this technical notice is to provide guidance to consumers, municipalities and businesses, mainly food retailers, in choosing the best shopping bag according to the environmental impact they have. To do so, the analysis was based on three principles: the 3Rs hierarchy, product lifecycle and existing markets and services in Québec for recycled waste materials.

We must point out that this study has certain limits. First, no lifecycle analysis of shopping bags in Québec's specific context has yet been conducted. The lifecycle analyses consulted were conducted abroad and necessarily refer to input and output that are sometimes different from those in Québec. In addition, since data may evolve over time and notably with the introduction of new technologies, prudence is recommended in interpreting the information provided. Moreover, the objective of the analysis was to evaluate the environmental impact of shopping bags. Consequently, it did not consider any social and economic aspects that could influence the decision-making process with regard to the best choice of shopping bag.

From an environmental point of view, reducing use at the source, when applicable, remains the best solution. Using reusable bags comes in second place. As for single-use bags, the choice will depend on several factors. Overall, conventional plastic bags should be chosen over degradable or paper bags on condition they are reused or recycled. As for degradable bags, including paper bags, these offer added value in the framework of municipal collection of organic waste and when they are left as litter in the natural environment. However, the appearance of degradable bags on the market could result in significant problems for conventional plastic bag recycling systems as well as a negative environmental impact if dumped in landfills. The various stakeholders concerned will need to find solutions to counter these problems.

REFERENCES

American Society for Testing and Materials (2004) *D 6400-04***:** *Standard Specification for Compostable Plastics*, ASTM Subcommittee D20.96 on Environmentally Degradable Plastics and Biobased Products, 3p.

Canadian Plastics Industry Association (CPIA) (2007)a *Les sacs à emplettes en plastique – La réutilisation d'une ressource précieuse*, www.cpia.ca/files/files/Plastic_Shopping_Bags_and_Reuse___Backgrounder__French_.pdf , website consulted on August 15, 2007.

Canadian Plastics Industry Association (CPIA) (2007)b *Quels sont les avantages découlant des sacs à emplettes en plastique?* www.myplasticbags.ca/ , website consulted on August 16, 2007.

Canadian Plastics Industry Association (CPIA) (2007)c *Possibilités du marché* www.cpia.ca , website consulted on August 16, 2007.

Canadian Plastics Industry Association (CPIA (2007)d *CPIA product stewardship guide for degradable plastics: session materials*, website consulted on November 15, 2007.

Australian Retailers Association (2005) *Australian Retailers Association Code of Practice for the Management of Plastic Bags*, Final Report, December 2005, 8p.

British Plastics Federation (2002) *The Winnipeg Packaging Project: Comparison of Grocery Sacks*,

Bureau de normalisation du Québec (2007) 9011-911/2007 *Sacs en plastique compostables - Programme de certification-*, 28p.

Centre de recherche industrielle du Québec (2002) *Projet pilote de collecte, transbordement et compostage de matières putrescibles avec sacs dégradables*, Final report presented to RECYC-QUÉBEC, Sainte-Foy (Qc), 29p.

Centre de recherche industrielle du Québec (2007)a *Diagnostic des centres de tri 2005-2006*, Final report presented to RECYC-QUÉBEC, Sainte-Foy (Qc), 34 p.

Centre de recherche industrielle du Québec (2007)b *Évaluation de l'impact des sacs biodégradables sur le recyclage des sacs en plastique*, Final report presented to RECYC-QUÉBEC, Québec, 53 p.

Québec Forest Industry Council (QFIC) (2005) *Performance environnementale – Un portrait de l'industrie papetière québécoise*, 12 p.

Ecobilan PriceWaterhouseCoopers (2004) *Évaluation des impacts environnementaux des sacs de caisse Carrefour – Analyse du cycle de vie de sacs de caisse en plastique, papier et matériau biodégradables*, study conducted for Carrefour, critical review carried out by ADEME, 103 p.

Edgecomb, F. (2007) Personal interview, Canadian Plastics Industry Association (CPIA), September 16, 2007.

Doty, L. (2007), Personal interview, Oxo-Biodegradables Plastic Institute (OPI) September 16, 2007.

Estrella, S. (2007) Personal interview, Centre interuniversitaire de recherche sur le cycle de vie des produits, procédés et services (CIRAIG), July 26, 2007.

Environment Australia - Department of the Environment and Heritage (2002) *Plastic Shopping Bags – Analyses of Levies and Environmental Impacts* – Final report, Australia, 129 p.

Environment Australia - Department of the Environment and Heritage (2003*) The Impacts of Degradable Plastic Bags in Australia*, Australia, 129 p.

Environment Australia - Environment Protection and Heritage Council (2007) *Consultation Regulatory Impact Statement (RIS) Investigation of options to reduce the environmental impact of plastic bags – January 2007*, Australia, 92 p. http://www.ephc.gov.au/pdf/Plastic_Bags/PlasticBags_Final_RIS.pdf

Éditeur officiel du Québec (2005) Bill 390, *Loi interdisant la distribution de sacs de plastique non biodégradables*, tabled by Stéphan Tremblay, M.L.A. from Lac-Saint-Jean, National Assembly, 37th legislature, April 27, 2005. www.assnat.qc.ca/fra/37Legislature2/Projets-loi/publics/05-f390.htm

Environnement Canada (2007) *Les débris marins au Canada*, www.ec.gc.ca/marine/debris/fre/facts.htm, website consulted on August 1, 2007.

EuroCommerce (2004) *The Use of LCAs on Plastic Bags in an IPP Context*, 34p. www.repak.ie/files/PDFs/Life%20Cycle%20Analysis%20(LCA)%20on%20Plastic%20Bags.pdf

Fenton, R. (1992) *Grocery Bag Comparison Report, The Winnipeg Packaging Project*, Winnipeg University in British Plastics Federation (2003) *The Winnipeg Packaging Project: Comparison of Grocery Bags*, www.bpf.co.uk/bpfissues/plastic_bag_tax_further_info.cfm

Franklin Associates, Ltd. (1990) Paper vs. Plastic Bags, summary on the website of the Institute for Lifecycle Energy Analysis, Washington, www.ilea.org/lcas/franklin1990.html

ISO 14021 : 1999 (F) – *Marquages et déclarations environnementaux – Auto déclarations environnementales (Étiquetage type II),* International Standards Organisation, Geneva, 24 p.

James K. & Grant, T. (2005) *LCA of Degradable Plastic Bags*. Presented at the 4th Australian LCA Conference, February 2005, Sydney. 17 p. www.cfd.rmit.edu.au/services/publications_web_tools/articles/lca_of_degradable_plastic_bags

Krzan A., Hemjinda S., Miertus, S., Corti, A. and Chiellini E. (2006) *Standardization and certification in the area of environmentally degradable plastics,* Polymer Degradation and Stability 91 : 2819-2833

Li C-H., Zhuang H-K., Hsieh L-T., Lee W-J. and Tsao M-C. (2001) *PAH Emission from the Incineration of Three Plastic Wastes,* Environment International v.27, i.1, Jul01 Department of Environment Engineering, National Cheng Kung University, Taiwan, www.ecologycenter.org/iptf/toxicity/PAHemissions3plastic.html

Ontario's Ministry of the Environnement (2007) *Le gouvernement McGuinty veut réduire de moitié, d'ici à 2012, la quantité de sacs en plastique utilisé en Ontario,* May 9, 2007 press release, www.ene.gov.on.ca/fr/news/2007/050901.php

RECYC-QUÉBEC (2004) *Sacs d'emplettes : comparaison de leur impact sur l'environnement*, 20p. www.recyc-quebec.gouv.qc.ca/upload/Publications/zzRap_Ut856.pdf

RECYC-QUÉBEC (2005) *Sacs dégradables : propriétés et allégations environnementales* www.recyc-quebec.gouv.qc.ca/upload/Publications/zzSacs_d915.pdf

RECYC-QUÉBEC (2007)a *Étude de caractérisation du secteur municipal*, Dessau-Soprin et NI Environnement. http://www.recyc-quebec.gouv.qc.ca/upload/Publications/Rapport-Synthese-Caract.pdf

RECYC-QUÉBEC (2007)b *Bilan 2006 de la gestion des matières résiduelles au Québec*, 24 p.

Société française de chimie (2007) *Éthylène* $H_2C = CH_2$, www.sfc.fr/Donnees/orga/ethylene/cadet.htm , website consulted on August 25, 2007.

Statistics Canada (2006) *2006 Census*, www.statcan.ca

ANNEX I

This section is a translated excerpt of RECYC-QUÉBEC's document entitled, *Sacs d'emplettes : comparaison de leur impact sur l'environnement de RECYC-QUÉBEC (2004)*

In order to summarize the various analyses without having to explain each methodology and units of measure used, comparison factors have been established and identified by the numbers in brackets.

Study by the Australian Department of Environment and Heritage

A study conducted by Australia's Department of Environment and Heritage (2002) shows that, for the types of bags being studied here, cloth bags use fewer materials throughout their lifecycle (1), followed by plastic bags (3) and biodegradable bags (7). Paper bags come in far behind (22).

As for greenhouse gas generation, cloth bags are those that produce the least (3), followed by plastic bags (6), biodegradable bags (7) and paper bags (12). With regard to energy consumption, biodegradable bags used the least energy (6), followed by cloth bags (16), plastic (21) and far behind, paper bags (72).

Overall, reusable fabric bags appear to be preferable. Coming in equally in second place are conventional plastic bags and biodegradable bags, and far behind come paper bags.

The Winnipeg Packaging Project – Grocery Bag Comparison Report

This study compared plastic bags to paper bags. The study revealed that plastic bags used fewer resources per bag than paper bags do (1:4), require less energy (1:2) and emit fewer contaminants in the air (1:3) and in water (between 1:4 and 1:16).

However, this study was conducted in 1992 and was itself based on studies going back to 1974.

Franklin Associates, Ltd., study: *Paper vs. Plastic Bags*

This study was conducted in 1990 and is summarized on the website of the Institute for Lifecycle Energy Analysis in Washington. The study concluded that plastic bags were preferable to paper bags both with regard to total energy consumption (15:17), waste produced (7:25) as well as aquatic (1:15) and atmospheric (3:7) pollutants emitted. The study was based on a functional equivalence of two plastic bags to one paper bag.

The study noted that, with regard to energy, the preference of one type of bag over another could vary according to their respective effective rates of recycling.

Ecobilan PriceWaterhouseCoopers : *Évaluation des impacts environnementaux des sacs de caisse Carrefour – Analyse du cycle de vie de sacs de caisse en plastique, papier et matériaux biodégradables*

The lifecycle analysis conducted for the Carrefour food chain in France focused on four types of bags: the usual 14-L polyethylene throw-away bag, the 37-L reusable polyethylene shopping bag, the 20-L paper bag and the 25-L biopolymer degradable bag.

In the case of the reusable bag, several use rate scenarios were studied, i.e. 2, 3, 4 or 20 times. For all the criteria studied, the results showed that the benefits of reusable bags over other bags begin with the third or fourth use.

As for non-renewable energy consumption, the best choice is the reusable bag (factor 7 after four uses, factor 1 after twenty uses), followed by the biodegradable bag (9), and plastic and paper bags (10). Please note that, with regard to energy production, the data used are those for the countries where the bags were manufactured, i.e. France, Italy, Spain and Malaysia as well as all of Europe for some data. In these regions, sources of energy are nuclear, natural gas, heavy fuel (31% in Italy) and coal (32% in Spain). Hydraulic energy represents only between 13% and 19% of electricity production in these countries. Any parallel between their situation and that in Québec should therefore be drawn very carefully.

With regard to water consumption, reusable bags again provide the best performance (factor 7 after four uses, factor 1 after twenty uses), followed by plastic and biodegradable bags (10). Paper bags come in far behind (33). Reusable bags produce fewer greenhouse gases (factor 7 after four uses, factor 1 after twenty uses), followed by plastic bags (10), biodegradable bags (14), and paper bags (19).

Focusing on atmospheric acidification, reusable bags also provide the best performance (factor 7 after four uses, factor 1 after twenty uses), followed by plastic bags (10), biodegradable bags (16), and paper bags (18). As for the formation of photochemical oxidants, reusable bags are again in first place (factor 3 after four uses, factor 1 after twenty uses), followed by biodegradable bags (4), paper bags (9), and plastic bags (10).

Regarding the eutrophication criteria, reusable bags are preferable (factor 7 after four uses, factor 1 after twenty uses), followed by plastic bags (10). Biodegradable and paper bags come in far behind (110 and 120 respectively). Reusable bags produce the least waste (factor 7 after four uses, factor 1 after twenty uses), followed by plastic bags (10), biodegradable bags (11), and paper bags (18).

These findings show that reusable bags are clearly preferable in all cases when they are used twenty times. Even if used only four times, they are still preferable to all other bags except for the photochemical oxidant criteria, in which case biodegradables are clearly preferable.

This study supports the premise that the conventional plastic bag is a significantly better choice than the biodegradable bag. However, in a situation where the biodegradable bag can be subsequently used to facilitate the collection of organic waste, it would then provide an environmental benefit that was not considered by the study.

Paper bags come in dead last in almost all the factors considered. Their main drawbacks are significant water consumption, greenhouse gas emissions, atmospheric acidification, eutrophication and waste production.

The study also evaluated the polluting potential of litter. This is the main weakness of conventional plastic bags. That risk is lower for reusable and biodegradable bags while it is very low for paper bags. Note that the analysis also evaluated the bags according to a variety of other scenarios (recycling of plastic bags, incineration with energy recovery, etc.). In all these cases, reusable bags take first place when they are used twenty times.

Again, we urge that any adaptation of this data to Québec's situation be done with much care. The main scenario also considers France's waste management practices that, excluding paper that is recycled at a rate of 45%, send 51% of waste to landfill and 49% to incineration. Nevertheless, in the study's complementary scenario where all waste is sent to landfills, the reusable bag is again the first choice in shopping bags.