GROCERY CARRY BAG SANITATION

"A Microbiological Study of Reusable Bags and `First or single-use' Plastic Bags"

May 20th, 2009

The use of reusable food containers and carry devices for groceries is an important, to date overlooked piece in the study of the safety of the food supply in Canada. There has been little to no testing to investigate the risk reusables pose or do not pose to public health, yet increasingly reusables are being advanced as a viable substitute for first-use or single use packaging/ containers. The food service sector has been particularly concerned about the use of reusables.

Research conducted last fall on a sample of reusables during the City of Toronto in-store packaging reduction program sparked even more concern by industry about potential public health risks. The Environment and Plastics Industry Council (EPIC) accordingly agreed to fund this independent piece of research in response to these public health concerns.

The position of the plastics industry is clear. The industry strongly supports reduction and reuse, and recognizes use of reusables as good environmental practice, but it does not want to see these initiatives inadvertently compromise public health and safety. The industry believes that appropriate independent research and investigation must be pursued.

Testing Laboratories

Three independent testing laboratories were involved in this research study in order to provide broad and balanced testing and evaluation of the results. Two labs executed the testing – Guelph Chemical Laboratories (GCL) and Bodycote Testing Group of Montreal; and a third provided oversight and evaluative commentary of the results -- Toronto-based Sporometrics, the foremost experts in many aspects of fungal and environmental bacterial testing in Canada. GCL tested 23 used reusable bags, 4 control bags, and Bodycote tested two older used bags (2 and 3 years old).

Subject-matter expert, Dr. Richard Summerbell, Director of Research at Sporometrics, provided interpretation of the test results as well as critical direction and assistance in the writing of this report. Dr. Summerbell is a noted microbiologist who served as the Chief of Medical Mycology for Ontario Ministry of Health, Laboratory Services Branch from 1991-2000 and was senior researcher at the Centraalbureau voor Schimmelcultures, the world's most extensive fungal culture collection and mycological center at the Royal Netherlands Academy, in Utrecht, the Netherlands. He has also authored over 150 scientific papers.

The second series of testing took place from March 7th through April 10th, 2009.

Dr. Summerbell's report follows.

Cathy Cirko
Vice President, EPIC

Sporometrics

GROCERY CARRY BAG SANITATION

A Microbiological Study of Reusable Bags and "First or single-use" Plastic Bags

April 21st, 2009

Background

The use of reusable food containers and carry devices for groceries is an important, to date overlooked piece in the study of the safety of the food supply in Canada. There has been little to no testing to investigate the risk reusables pose or do not pose to public health, yet increasingly reusables are being advanced as a viable substitute for first-use or single use packaging/ containers. The food service sector has been particularly concerned about the use of reusables.

Environmentalists and some governments see the use of reusables and the elimination/reduction of first use containers as a way to reduce solid waste at source. A number of public policy initiatives have emerged over the past couple of years including voluntary reduction programs and fees on plastic shopping bags to force consumers to switch to reusable bags. And last fall, the City of Toronto as part of its in-store packaging reduction program began to actively promote the use of reusable containers. (The city hopes to enact a 20-cent rebate for reusable coffee cups and has just initiated a by-law mandating fees on first-use plastic shopping bags.)

In November 2008, swab testing of reusable packaging was undertaken in response to City of Toronto in-store packaging recommendations. The hypothesis was that reusable packaging could pose potential health risks versus proven, more hygienic single-use packaging. In this initial phase of the testing, two plastic Tupperware containers and one used reusable shopping bag (12 months) were tested along with two controls. The purpose of the testing was to determine if further testing of a larger sample of reusable packaging formats was merited.

The swab testing in November 2008 was done by Guelph Chemical Laboratories Ltd. (GCL). It found that the microbial levels on the reusable bag were significant enough to suggest the need for testing of a larger and more scientifically authoritative sample size. To be specific, the Nov 2008 pilot study showed considerable bacterial build-up both on the reusable bag and on one of the two Tupperware containers. (See Exhibit I) Mold and yeast were also present and there was a significant level of coliforms.

Testing of the reusable bag was done on a clean-looking 10 cm X 10 cm square (100 cm^2, roughly equivalent to 4 inches X 4 in. = 16 sq. in.) of the reusable bag surface. Results showed an elevated bacterial count of 1,800 colony-forming units (CFU) on the test square – more than three times the level of 500 CFU considered safe per millilitre of drinking water (see http://www.toronto.ca/water/annual_report/pdf/annual_report_2004.pdf). The coliform (faecal bacterial) count of 10 on the same small square of bag surface exceeded the recommended

drinking water level of 0. The mold count of 290 was higher than the normal mold count of 150 or fewer per cubic metre of room air in the Canadian fall and winter months (Davies et al., 1995, see http://www.sporometrics.com/fpwgmaqpb001.pdf) .

November Testing (See Exhibit I attached)

Parameter cfu/swab	**Sample A Used reusable bag**	**Sample C Used Tupperware**
TPC	1,800	550
Yeast	<10	20
Mold	290	10
Total coliforms	10	10

Report No. 48284

Of concern, the reusable bag tested in the Nov series appeared to the naked eye to be very clean and neat -- in pristine condition – not a likely candidate as a breeding ground for bacteria. The bag was only 1 year old.

With 13 million cases of food poisoning reported in Canada yearly, at a minimum the public health implications of persistent use of reusable carry bags for food/groceries should be investigated and, as necessary, appropriate protocols on the usage, care and storage of such bags should be developed.

The core question is do reusable grocery carry bags pose a health risk? Do they represent a likely microbial growth habitat and how is that habitat affected by usage? The core concern relates to the potential for cross-contamination of food in transport from the store to home on successive trips and transfer from bag to bag in the packing process as material from the surfaces gets onto the hands of the check-out staff. Also in the event of a food poisoning incident after a person has eaten something purchased from a grocery store, how will it be determined if the victim became sick from the foodstuff purchased off the shelf or from something the food picked up in the reusable bag?

Purpose

Given the concerning results from the November testing of the single reusable bag – unacceptably high bacterial, mold and total coliform counts -- the Environment and Plastics Industry Council (EPIC) agreed to sponsor further testing. The focus of this testing was solely on reusable grocery bags, which have been assumed to be safe and hygienic after repeated use.

The purpose was to determine if reusable grocery bags provide a potential breeding ground for bacteria, mold and yeast. If so, a second task would be to analyze whether these bags pose a potential public health risk.

The position of the plastics industry is clear. The industry strongly supports reduction and reuse, and recognizes use of reusables as good environmental practice, but it does not want to see these initiatives inadvertently compromise public health and safety. The industry believes that appropriate research and investigation must be pursued. This testing sample is but a first step.

The New Study

To evaluate the findings from the initial November 2008 testing, the sample of reusable bags to be swab tested was expanded to a total universe of 25 bags plus four control bags (three popular reusables and one single-use (first-use) bag. This means that an additional 24 reusable bags were tested. The second series of testing took place from March 7th through April 10th, 2009.

Securing the sample bags for testing

All 24 reusable bags in series II were obtained through street intercepts throughout downtown Toronto. As shoppers left major grocery stores and shopping areas, they were approached and offered a new reusable bag as replacement for their existing bag. Bag users were also asked a series of questions – how long had the bag been in use, how often was it used, what was the purpose of the bag (single or multi-purpose bag), was the user aware it was plastic, was it ever washed and how often had it been washed. The bags intercepted ranged in age from 1 month to 3 years. It proved difficult to find bags that had been in use for more than 1 year as most users had purchased their bags recently, in keeping with current trends. The four control bags were purchased off-the-rack from local grocery stores in Toronto.

Profile of the bags

The age profile of the bags intercepted showed a bias to young bags; those that had been in use 1 year or less. Only 20% of the bags had been in use more than 1 year. (Age of bags: 5 > 1 year (20%); 6 -1 year old (24%); 6 < 4 months (almost new) (24%); 7 bags – between 11- 6 months (28%)); 1 bag – 4-6 months (4%). On usage, 44% of the bags were used every day as reported by the owners; 24% were used rarely; and 32% used at least once a week. The majority of bag owners (52%) indicated that they used the bag as a multi-purpose bag (for both groceries and other items). Close to 70% did not know that the bags were plastic and almost all of them had never washed their bag.

Testing Procedures

The bags were tested on a blinded basis with only the two older bags tested at Bodycote in Montreal tagged based on age.

The bags were tested for ‘total plate count’ (all readily grown aerobic bacteria), total coliforms, *Escherichia coli* (“E. coli”), *Salmonella*, mold, and yeast. Similar testing protocols were followed by the two labs – swab part of the inner bag surface, inoculate Petri plates, incubate for standard time periods (24 hours for bacteria, 5 – 8 days for mold and yeast), then count the outgrowing colonies. GCL Laboratories streaked Petri plates directly with swabs from the bags, while Bodycote suspended the swabs in sterile water and either drew the water through sterile membrane filters that could be plated out on growth media (E. coli, total coliforms, yeast and mold), or, for the total plate count, used a `pour plate’ technique. This `pour plate’ allowed counting of bacteria intolerant of oxygen, including some categories of human gut bacteria, as well as of bacteria growing well in normal air. GCL swabbed a clean looking 10 cm X 10 cm area within the bag, whereas Bodycote swabbed the entire bag inner surface.

The plate count method relies on bacteria growing a colony on a nutrient medium so that the colony becomes visible to the naked eye and the number of colonies on a plate can be counted. In the GCL protocol, fewer than 10 colonies makes interpretation statistically unsound and such low counts are simply listed as less than 10 (<10). In the Bodycote protocol where a much greater surface area was swabbed, counts below 100 are considered too low to specify.

Definitions

Total Plate Count (TPC) – This is a rough measure of overall bacterial presence and does not necessarily mean the bacteria seen are harmful. It is a count of the overall bacterial "loading" in the sample. In drinking water guidelines, 500 CFU/mL is considered the safe limit. A count of 1800, as noted in the first reusable bag swab test, was interpreted to give a bacterial exposure roughly equivalent to carrying your food home in your hands after not washing your hands all day. In terms of the bags, there is no current regulation with respect to permissible limits; however, a best practices approach would suggest that there should be no bacteria at all in the bags as was the case with the first-use bags in the control group. CFU means colony forming units.

Yeast – These are microscopic fungi that grow as single cells. They are generally benign, and some species are routinely used in cooking and in the fermentation of beverages. Some species, however, may be opportunistic pathogens in people with poorly functioning immune systems. For example, persons with poorly controlled type II diabetes, as well as persons who are on high dosages of steroid medications, or are medically considered immunocompromised, need to be concerned about items where high counts of opportunistic yeast may develop. The yeasts on the current bags were not tested to determine if they were of an opportunistic type or of a purely benign type. In general, though, substantial numbers of yeasts on some bags are mainly significant in showing that enough water and microbially available food material is present on the bags to allow the growth of a microbial community. That community or 'biofilm' may also include more dangerous organisms.

Mold – Another fungal group that includes some opportunistic pathogens. Mold may be present either as dormant spores from dust, or as actively growing material on food debris or remnants in the bags. When growing on a surface, mold indicates the presence of excess moisture, a condition also favouring the survival and growth of pathogenic bacteria. Mold growing on inert surfaces such as plastic and polished leather is often barely or not at all visible to the naked eye, but may still produce a considerable quantity of spores that can become airborne when the material is disturbed. Some molds are allergenic and, when becoming airborne, can trigger attacks in persons with diagnosed asthma. A few common environmental molds are opportunistic pathogens that, while harmless to people in good immunological condition, may cause aggressive infections in some types of cancer and organ transplant patients. In addition, they may cause painful ear canal infestations in children and rare cases of 'idiopathic' (unexplained severity) lung infections in otherwise healthy people. Some molds also produce mycotoxins that can pose serious health risks to humans and animals. Ingestion of high levels of mycotoxins can lead to neurological problems and in some cases death. The normal mold count is 150 or fewer per cubic metre of room air in the Canadian fall and winter months. (Davies et al., 1995, see http://www.sporometrics.com/fpwgmaqpb001.pdf)

Total Coliforms - These are intestinal, faecal bacteria, some of which are harmful and pathogenic to humans. The best known is E. coli, which is normally relatively harmless but which has some variants, such as E. coli O157:H7, that are deadly. The number of CFU of total coliforms is an indicator of potential faecal contamination and indicates the likelihood that E. coli is present. 100 total coliforms means that there are 100 colony forming units of bacteria that come under the coliforms category. The recommended drinking water level for total coliforms is 0 (http://www.toronto.ca/water/annual_report/pdf/annual_report_2004.pdf).

Topline Findings - Overall

The swab test results showed that:

- A number of reusables had become active microbial habitats and a breeding ground for yeast and mold.
- The single-use plastic shopping bags and first-use reusable bags – the control bags – showed no evidence of bacteria, mold, yeast or total coliforms; they were sanitary.
- 64% (16 of 25) of the "used" reusable bags showed the presence of some level of bacterial contamination.
- Close to 30% (7 bags) had elevated bacterial counts higher than the 500 CFU/mL of bacterial considered safe for drinking water.
- The presence of yeast was identified in 5 of the bags indicative of the presence of water; a key component of a microbial habitat.
- Mold was found in 6 of the bags swab tested.
- An unacceptable total coliform count was found in 3 of the bags tested indicating the presence of intestinal bacteria; bag 1 – 300; bag 2 – 100; bag 3 – 10.
- E. coli and salmonella were not present.

Specific Results of the Second Round of Swab Testing (See Exhibits I, II, III, IV)

- 13 bags in the GCL Laboratories series II testing showed some level of bacterial contamination, as did the 2 bags tested by Bodycote; and one bag from the Nov 2008 testing. In total of the 25 bags tested, 16 or 64% had some level of bacterial contamination.
- 1 bag in particular yielded a very high total bacterial count in excess of 300,000 CFU; this was a long-used 2 year-old bag. (See Exhibit IV Bodycote testing.)
- Only 9 bags tested by GCL showed no level of bacterial build up. In the total sample tested of 25 bags, only these 9 bags (36%) had bacterial counts <10.
- 6 bags (25%) in both the GCL and Bodycote series (Exhibit IV) had an elevated bacterial count (TPC) higher than 500 CFU/mL. (1->300,000, 2-5600, 3-4100, 4-900, 5-680, 6-640). When combined with the Nov 2008 testing, it rises to 7 bags or 28% of the bags tested have elevated bacterial counts higher than 500CFU/mL.
- Though direct comparison is not possible, 500 CFU is cited here as a comparison figure because 500 CFU/mL is the maximum allowable level for safe drinking water in Toronto. In a bag with this contamination level, for example, a damp romaine lettuce leaf scraping across the 10 X 10 cm patch sampled by GCL Laboratories, in a heavily contaminated bag, might pick up significantly more bacteria in the moisture on its surface than would be allowed in a milliliter (approx. 1/30 of a fluid ounce) of drinking water.
- 37.5% of the bags (9 bags) tested in series II showed the presence of either mold or yeast on the interior of the bag. (Exhibit II). Mold was identified in 5 bags and yeast in 5 of 24 bags tested in series II. Only 1 bag had both mold and yeast. In addition, the Nov 2008 test sample showed the presence of mold.
- No E. coli or *Salmonella* was detected in any of the bags.
- Most concerning, however, was the fact that the swab testing found the presence of total coliforms, intestinal or faecal bacteria, in 1 bag from the GCL series and 1 from the Bodycote series. These results complement the one bag positive for total coliforms in the

original pilot Nov 2008 study (Exhibit I). One bag which the owner confessed had experienced a serious meat spill and had never been washed had a total coliform count of 300. (Exhibit IV – Bodycote Testing). A second bag had a total coliform count of 100 (Exhibit IV) and the third bag tested in November had a total coliform count of 10 (Exhibit I). Two of these bags had been in use for an extended period of time; one for close to 2 years and the other for three years. The third bag had been in use for a single year.

Further Observations

- While some may argue that bacteria are everywhere, there is cause for concern in the elevated total bacterial plate counts seen in 7 bags, where small surface areas had considerably more than the 500 CFU of bacterial considered safe for a milliliter of drinking water. These counts strongly indicate that the bag surface can harbour or breed substantial bacterial populations. The moist, dark, warm interior of a folded reusable bag that has acquired a small amount of water and a trace of food contamination is an ideal incubator for bacteria.

- The strong presence of yeasts in some bags is of concern. Yeasts are not normally found in high concentrations in ordinary light room dust, and the appearance of substantial numbers in bag swabs indicates the presence of water and microbial growth substrate (food) in the bag. The yeasts are thus a 'miner's canary' that confirms that microbes are growing in the bag rather than just being deposited there in dust and grime. The same consideration may hold for molds but in this case, deposition in dust or grime smears is more likely and further study would be needed to show actual growth in the bags.

- Of further concern is that mold spores in the bags, while not visible to the naked eye, will be disturbed in the bag packing process and could readily become airborne, creating problems for asthmatics and those with allergies. There is also an issue of transfer from one reusable bag to another in the check-out process as material from the surfaces gets onto the hands of the check-out staff. When the control bags were purchased in-store for this study, grocery store staff remarked to the investigators that they found some reusable bags remarkably soiled in appearance and were reluctant to touch them.

- Reusable bags can in principle be cleaned, but drying them out thoroughly is problematical and their flimsy nature deters scrubbing that would remove organic deposits. Any imperfect cleaning would tend to add water to incompletely removed food material and thus inadvertently boost microbial growth. Serious consideration needs to be given to a microbiologically adequate cleaning protocol for such bags. At very least, if people do choose to wash their bags, it is critical that they not lay them flat to dry but instead turn them inside out and suspend them in order to properly air them out. This will avoid the creation of a moist habitat for bacteria, mold and yeast. Consideration should also be given to replacing the reusables regularly to avoid the whole issue of bacterial build up.

Conclusions

- **The test findings clearly support concerns that reusable grocery bags can become an active microbial habitat and a breeding ground for bacteria, yeast, mold and coliforms**. This is supported by the high bacterial counts showing that the bag surface (interior) can harbour or breed substantial bacterial populations.

- **The unacceptable presence of coliforms, that is, intestinal bacteria, in some of the bags tested, suggests that forms of E. coli associated with severe disease could be present in small but a significant portion of the bags if sufficient numbers were tested. Also, it is consistent with everything that is known about Salmonella ecology that it would also be present on rare occasions.** The most directly comparable situation that has been investigated previously is that of plastic cutting boards used to prepare food. Such boards may pose a significant risk of transmitting food poisoning microorganisms, including *Salmonella,* if they are not stringently cleaned after use (Maule 2000; Cliver 2006).

- **This study provides strong evidence that reusable bags could pose a significant risk to the safety of the food supply if used to transport food from store to home**. Public health risks relate to the possible cross contamination of food placed in bags contaminated by previous use in successive trips, as well as transfer of contaminants in the check-out packing process from one bag to another including the potential contamination of the more sanitary single-use plastic shopping bags and other first-use carry bag options. The possible disturbance and dispersal of mold spores from the contaminated bags into the air could also be a cause for concern, particularly for checkout clerks.

- **The swab testing demonstrates that single use plastic shopping bags and other first use carry bag options are more hygienic than reusables**. For those with health conditions affecting the immunity (i.e. those with hard to control forms of Type II diabetes, those on heavy corticosteroid doses or those with serious immunocompromising conditions), first use bags are a safer health choice.

- **In future cases of food poisoning, family doctors and public health officials should add the reusable grocery bag to the list of possible sources of contamination to be investigated.** The 13 million annual cases of food poisoning in Canada often involve contaminated surfaces passing bacteria on to food**.**

- **The use of reusable bags as a multi-purpose tote by a majority of bag owners in this study is a cause for concern, particularly if the reusable bags are used to transport gym equipment or diapers**. Gym equipment may carry drug-resistant *Staphylococcus aureus* strains, skin infecting dermatophyte fungi and other dangerous microorganisms.

- **In conclusion, the drafting of protocols on the hygienic use of reusables should be considered a public health policy priority including the suggested regular replacement of their reusable bag**. This is especially true at a time when governments and retailers are making strong efforts to reduce the use of single-use/first use carry bags and replace them with carry bags that are used repeatedly by consumers.

Recommendations

1. **On research:** Given the gravity of the results, more research is needed. The research points to the possibility of microbial build up over time as the reusable bags are used and reused multiple times.
2. **On safety standards - Immediate Priority**: The unacceptable presence of coliforms, that is, intestinal bacteria, in some of the bags suggests that all meat should be double-

packed in a first-use bag to prevent accidental leakage or drips into the reusable bag. This should become a mandated safety standard across the entire grocery industry for reusable bags.

3. **On food poisoning investigations:** In future cases of food poisoning, family doctors and public health officials should add the reusable grocery bag to the list of possible sources of contamination to be investigated.
4. **On cleaning reusables:** Proper cleaning instructions should be provided to the public. Cleaning is no guarantee of removal of possible pathogens. All bags at a minimum should be turned inside out and air dried.
5. **On drafting of usage protocols:** The drafting and dissemination of usage protocols should be considered an immediate priority in public health education including the suggestion that the reusable bags be replaced regularly to avoid the whole issue of bacterial build up.

References

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EXHIBIT I

November 18, 2008 Report No. 48188

RESULTS OF ANALYSIS – SERIES I

Parameter cfu/swab	Sample A Used reusable bag	Sample B Used Tupperware	Sample C Used Tupperware	Sample D Unused, new reusable bag – CONTROL	Sample E Unused, new Tupperware – CONTROL
TPC	1,800	<10	550	<10	<10
Yeast	<10	<10	20	<10	<10
Mold	290	<10	10	<10	<10
E. coli	<10	<10	<10	<10	<10
Total coliforms	10	<10	10	<10	<10
Salmonella	Absent	Absent	Absent	Absent	Absent

cfu = colony forming units

Sample Descriptions

Sample A	Used reusable bag.
Sample B	Used Tupperware. Used for lunch and washed with soap and water at work.
Sample C	Used Tupperware. Used, washed and stored.
Sample D	Unused, new reusable bag. Control sample for comparison with used reusable bag.
Sample E	Unused, new Tupperware container. Control sample for comparison with two used Tupperware containers.

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EXHIBIT II

COMBINED RESULTS OF SWAB TESTING – TOTAL SAMPLE TESTED (SERIES I AND II)
25 REUSABLES, 4 CONTROL BAGS

PARAMETER	TPC CFU	YEAST CFU	MOLD CFU	*E.COLI* CFU	TOTAL COLIFORMS CFU	SALMONELLA CFU
GUELPH CHEMICAL LABORATORIES SERIES II(22 BAGS)						
Sobeys, IGA, Price chopper, Foodland Used Bag 1	200	<10	40	<10	<10	Absent
Whole Foods Market Used Bag	<10	<10	<10	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 1	4,100	<10	<10	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 2	160	<10	10	<10	<10	Absent
PC Greenest Used Bag 1	120	<10	<10	<10	<10	Absent
PC Greenest Used Bag 2	100	<10	<10	<10	<10	Absent
PC Greenest Used Bag 3	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 4	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 5	900	20	<10	<10	<10	Absent
Green No Label Used Bag 1	60	<10	10	<10	<10	Absent
Green No Label Used Bag 2	<10	<10	<10	<10	<10	Absent
Live Green Moksha Yoga	30	<10	<10	<10	<10	Absent
Sobeys, IGA, Price Chopper, Foodland Used Bag 2	230	10	<10	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 3	680	<10	70	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 4	<10	<10	<10	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 5	<10	<10	<10	<10	<10	Absent

Aspen Ridge Homes	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 6	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 7	<10	<10	<10	<10	<10	Absent
Crunch, Longo's Used Black Bag	140	<10	<10	<10	<10	Absent
A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 6	5,600	300	<10	<10	100	Absent
RABBA Used Red Bag	20	<10	<10	<10	<10	Absent
CONTROL BAGS						
No-Frills Control Bag –Single Use	**<10**	**<10**	**<10**	**<10**	**<10**	**Absent**
PC Greenest Reusable Control Bag	**<10**	**<10**	**<10**	**<10**	**<10**	**Absent**
Metro Control Reusable Bag	**<10**	**<10**	**<10**	**<10**	**<10**	**Absent**
BODYCOTE (Series II – 2 Bags)						
2 YEAR OLD BAG PC Greenest	>300,000	500	100	<100	300	Absent
3 YEAR OLD BAG	640	100	<100	<100	<100	Absent
GUELPH CHEMICAL LABORATORIES (Series I – 1 Bag) NOV 2008						
1 YEAR OLD BAG	1800	<10	290	<10	10	Absent
CONTROL BAG – METRO Reusable	**<10**	**<10**	**<10**	**<10**	**<10**	**Absent**

cfu: Colony Forming Units **TPC: Total Plate Count**

*** 25 reusable bags listed under parameter; they are described by logo names on the bag. Each row represents one bag**.

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EXHIBIT III

March 23, 2009

Report No. 48284

RESULTS OF ANALYSIS SERIES II – 22 BAGS

Parameter Bag with Logos	TPC cfu	Yeast cfu	Mold cfu	*E.Coli* cfu	Total Coliforms cfu	Salmonella cfu
Sobeys, IGA, Price chopper, Foodland Used Bag 1	200	<10	40	<10	<10	Absent
Whole Foods Market Used Bag	<10	<10	<10	<10	<10	Absent
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 1	4,100	<10	<10	<10	<10	Absent
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 2	160	<10	10	<10	<10	Absent
PC Greenest Used Bag 1	120	<10	<10	<10	<10	Absent
PC Greenest Used Bag 2	100	<10	<10	<10	<10	Absent
PC Greenest Used Bag 3	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 4	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 5	900	20	<10	<10	<10	Absent
Green Used Bag 1	60	<10	10	<10	<10	Absent
Green Used Bag 2	<10	<10	<10	<10	<10	Absent
Live Green Moksha Yoga Used Bag	30	<10	<10	<10	<10	Absent
Sobeys, IGA, Price Chopper, Foodland Used Bag 2	230	10	<10	<10	<10	Absent

cfu: Colony Forming Units **TPC: Total Plate Count**

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EXHIBIT III CONTINTUED

March 23, 2009 Report No. 48284

RESULTS OF ANALYSIS SERIES II – 22 BAGS

Parameter	TPC cfu	Yeast cfu	Mold cfu	*E.Coli* cfu	Total Coliforms cfu	Salmonella Cfu
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 3	680	<10	70	<10	<10	Absent
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 4	<10	<10	<10	<10	<10	Absent
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 5	<10	<10	<10	<10	<10	Absent
Aspen Ridge Homes Blue Used Bag	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 6	<10	<10	<10	<10	<10	Absent
PC Greenest Used Bag 7	<10	<10	<10	<10	<10	Absent
Crunch, Longo's Used Black Bag	140	<10	<10	<10	<10	Absent
*A & P, Dominion, Ultra, The Barn, Loeb, Food Basics Used Bag 6	5,600	300	<10	<10	100	Absent
RABBA Used Red Bag	20	<10	<10	<10	<10	Absent
No-Frills Single-use Bag **Control Bag**	<10	<10	<10	<10	<10	Absent
PC Greenest Reusable **Control Bag**	<10	<10	<10	<10	<10	Absent
Metro Reusable, clean polypropylene bag **Control Bag**	<10	<10	<10	<10	<10	Absent

cfu: Colony Forming Units **TPC: Total Plate Count**

*** Each row listed under "parameter" represents one bag; bag described in some instances with multiple names because multiple logos were present on the bag outside surface.**

R. N. Pandey, Ph.D. (Queen's)
General Manager, Research & Services

EXHIBT IV

Bodycote

TESTING GROUP
www.bodycote.com
www.bodycotetesting.com

Certificate of Analysis

Request number:	**09-330482**
Date Received:	2009-03-30
Date Certificate Issued:	2009-04-07
Certificate Version:	1

☑ Official Certificate of Analysis

☐ Preliminary Certificate of Analysis

Client

PR POST

P.O. Number	Your project ID.	Project Manager
NA	NA	JACLYN CLARE

Comments

This version replaces and cancels all earlier version.

Bodycote Testing Group
121 Boul. Hymus - Pointe-Claire - Québec - Canada - H9R 1E6 - Tel: +1 (514) 697-3273 - Fax: +1 (514) 697-2090

Bodycote

TESTING GROUP
www.bodycote.com
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Request Number: **09-330482**

Client: **PR POST**

P.O. Number	Your Project ID.	Project Manager
NA		

		Sample(s)	
Lab. No.		**1565466**	**1565467**
Your Reference		BAG #1 (Black)	BAG #2 (Blue)
Matrix		Swab	Swab
Sampled by		A.R. & S.P.	A.R. & S.P.
Site sampled		NA	NA
Date sampled		2009-02-27	2009-02-27
Date received		2009-03-30	2009-03-30
Parameter(s)			
Method			
Reference			
Escherichia coli (count)	Preparation	-	-
Escherichia Coli Count (membrane filter) PON-81-11-08 (SM9222D)	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Escherichia coli	CFU/bag	<100	<100
Mold count	Preparation	-	-
Yeast and mold counts (membrane filter) PON-81-42-06 (SM9610D)	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Mold count	CFU/bag	100	<100
Salmonella spp.	Preparation	-	-
Salmonella : presence/absence PON-81-16-08	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Salmonella spp.	(bag)	absence	absence
Tot. coliforms & atypic bacteria	Preparation	-	-
Total coliform count (membrane filtration) PON-81-16-08 (SM9222B)	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Total coliforms	CFU/bag	300	<100
Atypical colonies	CFU/bag	<100	<100
Total plate count (35°C)	Preparation	-	-
Total plate count (AAHS/ pour plate) PON-81-17-06 (SM9215B)	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Aerobic plate count (35°C)	CFU/bag	>300000	640
Yeast count	Preparation	-	-
Yeast and mold counts (membrane filter) PON-81-42-06 (SM9610D)	Analysis	2009-03-30	2009-03-30
	Sequential No.	NA	NA
Yeast count	CFU/bag	500	100

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This certificate must not be reproduced, except in its entirety, without written consent from the laboratory. The official version of this certificate is protected and cannot be modified. The above-mentioned samples will be retained for a period of 30 days following the issue of this certificate with the exception of microbiology samples or as instructed by the client. Results pertain only to the samples submitted for analysis.