DSM ENVIRONMENTAL SERVICES, INC.
Resource Economists
Environmental Scientists

December 16, 2014

Eric A. Goldstein
Natural Resources Defense Council
40 West 20th Street
New York, NY 10011

Re: Review of Economic Feasibility of Adding Food Service EPS to NYC's Recycling System

Dear Eric:

New York City passed legislation to ban Expanded Polystyrene (EPS) single-use food and beverage containers in the City on July 1 2015, unless the Sanitation Commissioner concludes that EPS single-use food and beverage containers can be collected in the City, recycled and sold in an environmentally effective and economically feasible way.

Specifically, Local Law 142 (2013) states that by January 1, 2015 the Commissioner shall

"determine, after consulting with the department's designated recycling contractor for metal, glass and plastic materials, manufacturers and recyclers of expanded polystyrene, and, in the Commissioner's discretion, any other person or group having expertise on expanded polystyrene, whether expanded polystyrene single service articles can be recycled at the designated recycling processing facility at the South Brooklyn Marine Terminal ***in a manner that is environmentally effective, economically feasible, and safe for employees****."*

"At such time, the commissioner shall report to the mayor and the council on such determination. If the Commissioner determines that expanded polystyrene single service articles can be recycled in such manner, the Commissioner shall adopt and implement rules designating expanded polystyrene single service articles and, as appropriate, other expanded polystyrene products, as a recyclable material and require the source separation of such expanded polystyrene for department-managed recycling."

NRDC contracted with DSM to analyze the feasibility of recycling EPS single service articles (referred to throughout for clarity as "single-use food and beverage containers"), concentrating especially on the economic viability of collecting, processing, and marketing the material. This Letter Report presents DSM's analysis and conclusions concerning the economic viability of recycling EPS single-use food and beverage containers in NYC's recycling program.

Scope of the Analysis

DSM completed the following tasks as part of our analysis.

- Estimated the potential quantity of EPS single-use food and beverage containers and rigid PS that might be received by SIMS through NYC's curbside program;

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- Toured the SIMS, Brooklyn facility to learn how the EPS single-use food and beverage containers might be separated and baled;
- Toured the Plastic Recycling, Inc. styrene reclamation facility in Indianapolis to learn how PRI plans to process bales received from SIMS;
- Investigated other potential markets for EPS single-use food and beverage containers: and,
- Conducted a literature search on the experience of other parts of the United States with respect to either, accepting EPS single-use food and beverage containers for recycling, or banning them.

The results of our investigation are presented below.

Potential Quantity of EPS Single-use food and beverage containers and Rigid PS Recycled

EPS single-use food and beverage containers are one component of the broader paper and plastic foodservice packaging category. According to the Foodservice Packaging Institute (FPI), these materials represent just under three percent (by weight) of all materials discarded in the municipal solid waste stream. This is about double what the US EPA estimates (1.4% by weight, US EPA, 2012). Of this, roughly one third is plastic and two thirds is paper by weight according to the FPI, although by units, plastic is roughly 50 percent.

According to the FPI, foodservice packaging is found at work, at home, in foodservice establishments and in public spaces. The FPI estimates that approximately two-thirds end up in the home and at the workplace, and only about one-third of foodservice packaging stays where it is purchased, or at the "front of the store."

While the proposed NYC ban focuses only on EPS single-use food and beverage containers, according to SIMS, this material would be processed with rigid PS and marketed as a single commodity, as discussed below. As such, DSM sought to identify the quantity of both EPS single-use food and beverage containers and rigid PS that might be processed for recycling to assess the economic feasibility of collecting, processing and marketing the EPS single-use food and beverage containers.

Quantities Generated

It is important to determine the quantities of EPS single-use food and beverage containers generated in New York City to project the amount of material that would potentially be collected, processed, and marketed if EPS single-use food and beverage containers were to be designated as recyclables under the City's curbside recycling collection program.

There are two potential sources from which to estimate the quantity of EPS single-use food and beverage containers generated in New York City.

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First, there is New York City's residential waste characterization.[1] Waste and recyclables collected by the Department of Sanitation of New York (DSNY) from residential, institutional and street basket waste has been characterized into 91 material categories. Unfortunately EPS single-use food and beverage containers falls into the category "Single Use Plastic Plates, Cups, Cutlery" which includes plastic spoons, forks, knives, plates, bowls and platters of various resins including polystyrene as well as cups, lids, takeout clamshells, and plastic straws.

The 2005 Study Results finds this category to be 0.51% of the total residential waste stream collected for disposal and recycling.[2] Applying this percentage to the estimated total MSW disposed and recycled (roughly 3.5 million tons in FY 2013) equals 17,877 tons of Single Use Plastic Plates, Cups and Cutlery collected.

Assuming 40 percent of this by weight is EPS single-use food and beverage containers equals a potential 7,150 tons (rounded) available from the residential sector, as shown in Table 1.[3] This is material that was ultimately discarded by households and collected by DSNY.

Also generated by households are rigid PS containers and packaging which includes #6 clear trays, salad container trays, clamshells, cookie tray inserts, dairy tubs, and CD boxes (among other items made with PS). Applying the estimated 0.24% results from the 2005 Waste Characterization study yields an estimated 8,400 tons (rounded) of rigid PS material disposed by NYC households. Table 1 illustrates these calculations.

TABLE 1:
Estimate of Rigid PS and EPS Single-Use Food and Beverage Containers Generated at Home

Material Category	**Percentage of Waste Stream** *(% by weight)*	**Total Refuse and Recycling Collected** *(tons)*	**Total Collected by Material Category** *(tons)*
Rigid PS Containers and Packaging	0.24%	3,505,320	***8,413***
Single Use Plastic Plates, Cups, Cutlery	0.51%	3,505,320	17,877
EPS Foodservice Ware	0.20%	3,505,320	***7,151***

The second method for estimating potential quantities of EPS single-use food and beverage containers is based on the recent study "*Fiscal & Economic Impacts of a Ban on Plastic Foam Foodservice and Drink Containers in New York City*" that estimated $97.1 million was spent in 2012 on EPS single-use food and

[1] *While a more recent waste characterization was conducted in 2013, the results have not been released to date and so DSM was forced to use the 2004-05 study data.*
[2] *DSNY has conducted an updated waste characterization study but the results are not yet publically available.*
[3] *This is DSM's best professional judgment because data do not exist to accurately estimate these quantities using waste characterization studies.*

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beverage containers.[4] By looking at the average cost per unit of Cups, Plates and Bowls and Clamshells, and estimating the percentage of sales in each category, an estimate of units per category can be made. Applying average unit weights and multiplying by the total unit estimates results in an estimate of the total tons of EPS single-use food and beverage containers sold in NYC. These represent total EPS single-use food and beverage containers potentially available for recycling.

TABLE 2:
Converting Sales Data to Estimates of the Quantity of EPS Single-Use Food and Beverage Containers Available for Recycling (Annual Tons)

Materials	Cost Per Unit ($)	% of Sales	Total Sales ($)	Units Sold	Weight/Unit (lbs.)	Total Weight (Lbs.)	Total Weight (tons)
Clamshells	$0.08	**40%**	$38,840,000	485,500,000	0.011	5,351,715	2,676
Cups	$0.03	**50%**	$48,550,000	1,618,333,333	0.011	17,839,050	8,920
Plates & Bowls	$0.02	**10%**	$9,710,000	485,500,000	0.018	8,562,744	4,281
Total:			**$97,100,000**	2,589,333,333		31,753,509	**15,877**

Obviously, by changing the composition of sales by material type, and altering weights, the total tons available change. A reasonable range might be that between 14,000 and 17,000 tons of EPS single-use food and beverage containers are generated from all sources in New York City, including households.

Potential Quantities Collected

EPS single-use food and beverage containers available for recycling in New York City would have to be collected through several different methods.

First, DSNY's residential and institutional recycling collection would need to add EPS single-use food and beverage containers as a designated material for recycling. Currently, the material is explicitly prohibited in the City's recycling program.

Second, workplace recycling programs would need to add EPS single-use food and beverage containers to their recycling programs. Currently under the City's Commercial Recycling Law, all businesses are required to source separate their recycling. However the number of workplaces that have convenient recycling for food packaging containers (as opposed to paper and cardboard, and perhaps deposit containers) is unknown and does not appear to be significant.

Third, commercial establishments using EPS single-use food and beverage containers would need to add recycling to their "front of the house" operations. While food and beverage service establishments are required to source separate metal cans, aluminum foil products, glass bottles and jars, plastic bottles and jugs (including materials generated from customers), this practice does not appear to be widespread.

[4] *MB Public Affairs, Inc., March 2013.*

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Finally, public space recycling and all other "on the go" litter locations would need to match litter containers with recycling containers. This is slowly occurring throughout the City, but would have to increase significantly in the future to make such "on the go" recycling opportunities available and convenient to New Yorkers seeking to recycle their EPS single-use food and beverage containers.

Implementation of comprehensive recycling programs in all four of these areas would be necessary to result in a reasonable recycling rate for EPS single-use food and beverage containers. Because it is likely that implementation of all of these programs will take time, estimates of recovery rates must be relatively low over the next five years or so.

Table 3 illustrates how much EPS single-use food and beverage container material might be available from each of these four areas if comprehensive recycling were in place uniformly. Applying realistically achievable recovery rates by generator sources, Table 3 then illustrates how much material might make its way to the Sims MRF or other recycling facilities serving New York City establishments. Because both workplace and "front of the house" material is collected by private carters, it would not be delivered to the SIMS facility, and therefore would not be part of the recycling stream processed by SIMS.

TABLE 3:
Potential Quantities Recovered from Sources Generating EPS Single-use food and beverage containers

Sources of Material	Available (tons)	Recovery Rate (%)	Delivered to MRF (tons)
DSNY Collection Programs	7,151	40%	2,860
Workplace Recycling Programs	3,540	40%	1,416
Front of House Foodservice Vendors	2,212	20%	442
On the Go/Public Space Recycling	3,097	20%	619
Total:	**16,000**		**5,338**

In addition to the estimated 3,479 tons of EPS single-use food and beverage containers (2,860 tons from DSNY Collection Programs and 619 from Public Space recycling), another 3,400 tons of rigid PS containers and packaging might be recovered by DSNY (assuming a similar 40 percent recovery rate) adding another 3,400 tons of rigid PS to the SIMS MRF.

Based on these rough tonnage estimates, DSM has assumed that the SIMS facility would see roughly 6,900 tons (rounded) of EPS single-use food and beverage containers and rigid PS during the first several years after implementation, or 13.8 million pounds of PS tipped at the two SIMS facilities.

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Potential Recovery of EPS Single-Use Food and Beverage Containers at SIMS Facilities

SIMS Facility and Process

DSNY has one vendor (SIMS) for all metal, glass and plastic (MGP) that it collects. SIMS has a twenty year contract with the City which included constructing the new processing facility in Brooklyn, with the capacity to process 1000 tons per day of MGP. SIMS operates a second, older processing facility for DSNY MGP in Jersey City, New Jersey.

DSNY added rigid plastic to the list of acceptable materials in May, 2013, and the SIMS Brooklyn facility opened in January 2014 having been designed to separate plastic bottles and rigid plastic containers by material type. Separation of bottle and rigid PET, PE and PP resins are all done through optical sorters strategically placed along the metal, glass and plastic (MGP) processing line. Quality control sorters pull residue out from the MGP line, helping to increase recovery of each resin and reduce bale contamination.

DSM toured SIMS Brooklyn facility, and met with the General Manager Tom Outerbridge as well as the Facility Manager Tom Ferretti to review how EPS might potentially be handled at the facility.

Currently PS rigid containers are one component of a residue stream coming off the end of the plastic processing line. Adding EPS single-use food and beverage containers to the facilities' list of commodities recovered, would require the purchase and installation of a new optical sorter dedicated to positively sorting all PS, including both the rigid PS currently disposed as residue, and the new EPS single-use food and beverage containers added to the recycling program.

In simplified terms, the process at the MRF starts with all bagged recyclables passing through a slow speed Primax Shredder to remove and break bags. Material then passes over a disc screen designed to break and remove glass, with the remaining material then passing under a drum magnet - which removes ferrous metals - and then an eddy current separator removes nonferrous metals (primarily aluminum).

All of the material left on the conveyors then travels over ballistic separators, which separate the majority of film and paper from plastic bottles, cans and cartons. Finally the plastic containers are separated using a series of Titec optical sorters, which recover segregated streams of colored HDPE, translucent HDPE, polypropylene (PP), PET and aseptic cartons. Quality control sorters then remove any remaining contaminants

Currently the last optical sorter is used to recover mixed paper remaining in the negatively sorted plastics (PVC - #3, PS - #6, and All Other - #7) which are then disposed as residue.

It is DSM's understanding that if EPS single-use food and beverage containers were to be designated as recyclables under the City's program, new optical sorters would have be added at both the Brooklyn and New Jersey SIMS facilities to recover the PS - #6 from this mixed plastic residue stream. These optical

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sorters would be set to identify all PS, which means that they would identify rigid PS (e.g., cups, some yogurt containers, plastic plates and cutlery), EPS single-use food and beverage containers and EPS foam packaging, and any other PS, including high impact polystyrene (HIPS) products and packaging such as CD cases, video tapes, toys, razors, e-waste, and other consumer products. The resulting mixed PS recovered through the optical sorter would be baled using existing balers and stored until either a tractor trailer load or a rail car load had been generated, at which time it would be shipped to market.

Dart Container Corporation (DART) is the largest manufacturer of foam cups and containers in the world, and has a potentially large economic stake in the outcome of the New York City legislation. According to DART and SIMS, DART has agreed in principal to pay for the capital cost associated with adding the necessary conveyors, optical sorters and storage bunkers required to recover the PS at both SIMS facilities, with SIMS responsible for maintenance and operations. DART has also identified the potential market for the mixed PS bales (Plastic Recycling Incorporated - PRI), and is investing additional capital at the PRI facility in Indianapolis, IN to accept the mixed bales (see below).

Issues for SIMS

Assuming that DART pays the capital cost of the required new equipment and upgrades to the MRF, SIMS will still be left with significant challenges.

The first is whether the cost to operate and maintain the new optical sorters - including the cost for QA/QC labor to assure the sorters are operating effectively, conveyor operating and maintenance costs, and dedicated baler time - are justified by the quantities processed on a daily basis. At the time of DSM's visit to the SIMS Brooklyn facility SIMS had not yet run comprehensive tests to determine how well optical sorters would work to recover PS from the mixed plastic residue. In addition, at this time it is unknown as to how much material will be received by SIMS, and what the loss rate will be through the system before this material gets to the PS sorting area. The issue of throughput is important because it may take several years for the program to reach the level of recovery rates noted in Table 3.

The second, and related issue is how long SIMS will have to store the resulting bales until sufficient quantities are available to fill a rail car load – which is the way PRI expects SIMS to ship the material. Based on DSM's estimates of annual quantities delivered, minus losses at the plant, divided by 312 operating days per year at the SIMS facilities, yields roughly 13 bales of mixed PS per day (at 1000 pounds per bale) divided between two MRFs. While it is not known how many bales will fit on a rail car, the rail car can hold 100 tons which would mean that if the Brooklyn facility produces ten, 1000 pound bales per day, it could take as long as 20 days to fill a rail car even when the program has reached the recovery rates noted in Table 3. During the time period leading up to this, bale storage could be significantly greater.

If food residue contamination is a problem, as is quite possible with soiled EPS food containers, then storage of food contaminated bales for this period of time could be a significant rodent problem for SIMS, particularly in the first few years of the program.

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The third issue, is whether the bales produced by SIMS will be of reasonable quality for PRI, which is the only identified market at this time for the mixed PS bales. As stated above, because optical sorters are used, all PS will be ejected into the bunker for subsequent baling. This includes a variety of consumer products and packaging materials made of mostly, but not all rigid PS as well as EPS food and beverage containers, some of which may be very soiled with food residue.

Potential Recovery at SIMS

Losses of EPS single-use food and beverage containers will occur within the MRF before the material reaches the PS optical sorter. Again, this is important because the volume of EPS single-use food and beverage containers that is likely to be recovered at the SIMS facilities will be important in determining whether a recycling programs that collects this material in New York City will be economically viable.

There are at least four types of losses that will impact the amount of PS actually recovered for shipping. First, EPS single-use food and beverage containers can be entrained in the film and paper because it is likely to behave like these materials. This is potentially an important issue at the SIMS facility because ballistic sorters are being used to separate light materials (paper and film plastic) from heavier materials (bottles, cans, and rigid plastic containers). Some portion of EPS single-use food and beverage containers will flatten during collection compaction and on the MRF tipping floor and some portion of this flattened material will then be lost to the film bales, where they will be a contaminant in the film, potentially reducing the value of the film bales.

Second, small pieces of EPS may fall through the disc screens and be recovered with the glass, essentially becoming a contaminant to the recovered glass.

Third, black EPS and rigid PS may not be identified by the optical sorter, because carbon black which is often used as a colorant can mask the resin type when it passes under the near infrared optical sorter. In addition, some “clamshell” EPS that has a label on it may also be lost because the label may blind the optical sorter. This is not a problem unique to PS.

Finally, optical sorters are not 100 percent accurate, missing perhaps 2 to 5 percent of the material.

The net result of all of these losses is unknown but can be assumed to run from 20 to 30 percent of the EPS single-use food and beverage containers entering the SIMS facility. This would reduce the recovery of EPS single-use food and beverage containers to roughly 2,500 to 2,800 tons per year, or an overall recovery rate by DSNY and SIMS of roughly somewhere between 15 and 17 percent of the estimated 16,000 tons estimated to be generated in NYC (see Table 3, above).

Markets

Just as important as the economic and process feasibility of recovering the EPS single-use food and beverage containers at the SIMS facilities is the capability of the marketplace to purchase and reclaim PS over the long term. Past efforts to reclaim soiled EPS single-use food and beverage containers have not

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succeeded over the long term. These include past efforts by Mobile, the Polystyrene Recycling Council, Evergreen Partnering Group in Boston, MA, and the Tomazak facility in up-state New York.

In fact, in a court decision in June 2013, the U.S. Court of Appeals, First Circuit states the following fact as accepted by all the parties:

"Past efforts to make polystyrene products more environmentally friendly resulted in failure, and the product defendants have maintained that their products are non-recyclable because recyclable polystyrene is not economically feasible".[5]

However, a recent study by Berkley Research Group (BRG) stated that the recovery of EPS single-use food and beverage containers is expected to increase at roughly 8 percent per year in the foreseeable future as a result of improved washing systems, and higher costs for virgin PS making the cost of recovering EPS more economical.[6] BRG does acknowledge that:

"*Because of its light weight, the cost associated with transporting the EPS can affect the economics of its collection and processing".*[7]

Some portion of the EPS single-use food and beverage containers has the additional disadvantage of being contaminated with food residue. While DSM has been involved in several contamination studies for the FPI which seem to indicate that food service packaging is not inherently more contaminated with food residuals than food contact packaging; because of the light weight nature of EPS, food contamination will represent a larger percentage of the total weight of the material (as is the case for film plastic) which means that the yield loss rates will be higher due solely to the light weight nature of the EPS single-use food and beverage containers.

Because of the proposed ban on EPS single-use food and beverage containers in New York City (and elsewhere in the U.S.), DART has recently moved aggressively to develop a potential market for recycled EPS, and has teamed with Plastic Recycling, Inc. (PRI) in Indianapolis to develop a processing facility potentially capable of reclaiming mixed bales of rigid and EPS PS.

DSM arranged with DART to tour the Plastic Recycling, Inc. facility in Indianapolis, which has been proposed by DART to handle the mixed PS bales that would be produced by SIMS. While the BRG report identifies a relatively long list of processors of EPS, virtually all of them process only relatively clean EPS material that is not commingled with rigid PS – as the material from SIMS would be (see above).

In fact, discussions with DART, as well as e-mail correspondence from Moore Recycling which conducts much of the research work on recycling for the American Chemistry Council, indicates that they know of

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[5] *United States Court of Appeals, First Circuit, No. 12-1730, Decided June 2013, Evergreen Partnering Group, Inc. v. Pactiv Corporation; Genpac LLC; Solo Cup Company; Dolco Packaging; Dart Container Corporation; American Chemistry Council.*

[6] *Berkeley Research Group, Memorandum to Lynn Dyer, Market analysis of end uses for recycled post-consumer expanded polystyrene foodware, prepared for the Foodservice Packaging Institute, October 9, 2014*

[7] *Footnoted as from "Freedonia Group, Recycled Plastics to 2016, Executive Summary, p. 2, and section entitled, Recycled Polystyrene Collection & Markets."*

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no other market, other than the proposed PRI facility, in the US that could process mixed (rigid PS and EPS) bales from SIMS. Moore Recycling did state that the alternative would be export markets, especially China. However, it is not clear to DSM that the restrictions on contamination imposed by the Chinese would allow for the export of SIMS bales.

PRI Facility

DSM made arrangements with DART and PRI for Ted Siegler of DSM to tour their facilities in Indianapolis on November 4, 2014. Ted met with the following representatives:

- Alan Shaw, President, Plastic Recycling, Inc.
- Brandon Shaw, Marketing Manager, Plastic Recycling, Inc.
- Alex Ramion, Project Manager, Plastic Recycling, Inc.
- Brian Kruse, Senior Project Engineer – Polymers, DART
- Ruben Nance, Biopolymers R&D Assistant, Engineering Recycling Coordinator, DART
- Perre Burns, President, Principal Engineer, Burns Environmental Engineering, Inc.

Quantities and Contamination

DART and PRI stated that no formal analysis had been done, but it was their expectation that they would receive somewhere around 10 million pounds of mixed rigid PS and EPS single-use food and beverage containers per year from SIMS. That estimate was based purely on the New York City Waste Characterization studies, and was considered a rough guess, but is consistent with DSM's estimates presented above, after adjusting for losses.

PRI currently processes roughly 70 million pounds of polystyrene (PS) per year, which means that if PRI were to receive roughly 10 million pounds from the SIMS facility, the SIMS material would add about 15 percent to PRI's current throughput. However, the vast majority of PS reclaimed by PRI is post-industrial and commercial scrap from manufacturing purges and cuttings and compact disc cases as well as some material from commercial activities such as Walmart bales of coat hangers, and Publix bales of post-consumer EPS egg cartons returned by customers to Publix stores. According to Alan Shaw, PRI wants to continue to grow and believes that post-consumer PS bales represent the best new potential source of supply, which is why they are interested in partnering with DART on this project.

A decision has jointly been made by DART and PRI that the processing line would first separate rigid PS from EPS single-use food and beverage containers, and then the EPS single-use food and beverage containers would be ground and washed to remove food residue. DART has purchased, and moved to Indianapolis, equipment from the shuttered Nextlife Holdings, LLC plastics recycling facility, and stated that they have tested a number of different wash systems and believe that they can adapt a PET wash line to clean the EPS. They have batch tested different levels of contaminated ESP single-use food and beverage containers and claim that washing would not be a problem given the technologies that are currently available. However, DART has not actually set up a wash line in Indianapolis to test a continuous throughput of large quantities of material.

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DART and PRI also claim that they can sort the High Impact Polystyrene (HIPS) from the rigid PS and the EPS using optical and color sorting technologies, and therefore are not concerned about brominated fire retardant contamination (primarily from e-waste). PRI represented that they have not found bromine contamination at levels of concern in all of the various PS materials that they currently process.

DART and PRI expect that the bales received from SIMS will be roughly 25 percent EPS single-use food and beverage containers, and 75 percent rigid PS (by weight), based on a limited number of mixed PS bales they have acquired from Titus in southern California, although they do not have enough data to accurately determine this. As of the date of the DSM visit, they also did not have a specifications for allowable levels of contamination. They had contracted with Moore Recycling to develop a bale specification, which they expect to have ready in the next several weeks. When asked whether contamination levels of up to 30 percent were acceptable PRI indicated that they believe they would be.

However, one of the problems with EPS single-use food and beverage containers recycling, which is similar to plastic film recycling, is that the material is so light that contamination ends up being a higher percentage, by weight, than for heavier plastics. This has contributed to on-going problems with recycling dirty plastic film, and it could be conjectured that this has been one of the reasons that so many previous EPS single-use food and beverage containers recycling programs have failed. For example, if an average EPS single-use clamshell weighs between 5 and 10 grams, then a relatively small amount of food residual, or oils and fats on the clamshell could mean a yield loss rate on a weight basis of roughly 50 percent of the incoming EPS material.

While we did not ask PRI about this issue, we suspect that they have not fully confronted this issue and may be surprised by the resulting losses once they start processing the material. This is an important concern because, as stated above, DSM has not identified any other markets that could accept the material generated by the SIMS facilities.

Processing and Markets for the Reclaimed PS

It is DSM's professional opinion that ***if*** the wash line functions effectively (from a process, yield rate, and cost point of view) that PRI is capable of producing a pelletized PS that is marketable from the resulting washed material. PRI both sells pellets (picture frame producers and 3M tape dispensers are two primary markets) and produces value added products, including black cash register spools which have a relatively high level of tolerance for color and contaminants.

PRI has also invested in a number of Ettlinger melt filter continuous screens which appear to be efficient at removing contaminants from the PS. Based on discussions with PRI it appears that PRI's experience, technologies, and markets should be sufficient to manage the quantities coming from SIMS, again, assuming that the EPS separation and wash lines work cost effectively, which is a major uncertainty at this point in time.

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Observations and Conclusions

If New York City were to add EPS single-use food and beverage containers to the list of mandated recyclables, the City would be moving into more or less uncharted territory. Many large MRFs operating today in the U.S. have the capacity (technical and physical) to add EPS single-use food and beverage container, and non-food PS packaging, and explicitly have not because the economics are not favorable and the markets unreliable.[8]

While it is true that Los Angeles County accepts EPS single-use food and beverage containers in their curbside program, to the best of DSM's knowledge[9] LA MRFs do not combine the EPS with rigid PS to produce the type of bale contemplated by SIMS and DART/PRI[10]. As such there are a number of uncertainties that must be considered as the backdrop for the conclusions that DSM can draw.

These uncertainties include the following.

Uncertainty #1 – What quantities of EPS single-use food and beverage containers would actually be recovered by DSNY and SIMS

It is ***very difficult*** to estimate how much EPS single-use food and beverage containers SIMS would actually receive, particularly in the first years of a new program. This has a significant impact on the potential economics of the program, because if the amount of recovered EPS is too low, per ton operating costs will increase.

There are several reasons why quantities of EPS potentially collected are so uncertain and could be lower than DSM estimates.

First, the 2005 DSNY waste characterization study does not break out EPS from other materials. As such, there is no way for DSM to know for certain how much EPS single-use food and beverage container material is being thrown away in New York City. As such, estimates need to be made using EPS single-use food and beverage containers sales data, which include single-use food and beverage containers consumed at restaurants, take-outs, supermarkets and delis and at home. Assumptions then have to be made about what the average weight of a single-use food and beverage container is, to convert from sales to pounds/tons.

Second, it is very difficult to estimate what percent of EPS single-use food and beverage containers generated in New York City would be collected by DSNY and end up at the SIMS facilities. There are almost no data on recovery rates for EPS single-use food and beverage containers because so few

[8] *DSM discussed the feasibility of adding EPS with Rumpke, which operates three large single stream MRFs in Ohio; Casella which operates a number of large MRFs in the northeast; and the Green Stream, Brookhaven MRF on Long Island; all of whom stated that they did not believe it was economically feasible to add this material given processing issues, transport costs to markets, and the current market price.*

[9] *DSM has made repeated efforts to contact the Los Angeles Recycling Manager, but he has not responded as of the date of this report.*

[10] *The Titus facility in southern California that shipped bales to PRI does however separate PS from plastic residue coming from southern California MRFs.*

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programs accept EPS single-use food and beverage containers for recycling. In this case DSM has had to make assumptions about what percent of EPS single-use food and beverage containers will be generated by households as opposed to businesses (and therefore go to the SIMS facility), and then make another set of assumptions about the recovery rate from households as opposed to businesses, and public spaces. All of these are speculations since consumers may or may not place EPS single-use food and beverage containers in the recycling, instead of the garbage due to the food contamination.

Uncertainty #2 – What percent of EPS single-use food and beverage containers delivered to SIMS will be lost during processing?

Because PS has not been recovered to date at the SIMS MRF there is no way of knowing for certain how the EPS material will behave as it moves through the MRF. As stated in the MRF discussion above, it is certainly possible that MRF loss rates could be as high as 20 to 30 percent, and some of that loss may be as a contaminant to film, fiber, or glass, potentially reducing the value of these materials. In addition there will be losses associated with the optical sorters not identifying PS in some black EPS materials.

No data are available to DSM as to what these losses may be, so we have had to make educated guesses as to the loss rate. The loss rate is important for two reasons. First, because SIMS will need a certain volume of PS to be able to justify the cost of operating the optical sorters at both MRFs as well as the cost of labor, conveying, baling and storage. Second, if losses of EPS materials occur to other marketable materials, what impact will this contaminant have on SIMS revenues for those materials?

Uncertainty #3 – Will adequate markets be available for the mixture of rigid PS and EPS single-use food and beverage containers?

The only reason that adding EPS single-use food and beverage containers might work at the SIMS facility is that optical sorters can be used to identify all PS, which includes the rigid PS and HIPS that is already being received at the SIMS facility, together with the EPS. This has the benefit of allowing the EPS single-use food and beverage containers to “ride on the back” of the heavier, and more valuable rigid PS, which is currently not being recovered by SIMS. In addition, without the rigid PS, baling of the EPS material would be much more difficult and SIMS might be forced to densify the EPS. Densifying dirty EPS further limits the marketability.

The benefit of these mixed bales is a heavier bale, and greater quantities, making it easier to accumulate enough EPS to ship to market. The problem with this approach is that there are no markets other than the single DART/PRI market potentially available to process these mixed bales, and there are very limited data on what the mix of EPS and rigid PS will be in these bales.

While PRI is certainly a reputable reclaimer for post-industrial and commercial recycled PS, there is no way of knowing if PRI is going to be capable of reclaiming the SIMS material in an economically viable way until SIMS actually produces the mixed bales. If PRI were to determine that the cost, or yield rates, were unacceptable once they began processing the mixed bales, there are no other markets available in the United States for this material at this time.

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While it is possible that an export market could be identified in this situation, it is likely that potential export markets would face the same uncertainties as the domestic market. The "Green Fence" erected by China to stem the import of dirty bales of recycled material illustrates the pitfalls of producing bales of recycled materials that are too contaminated for domestic markets.

Uncertainty #4 – What impact will contamination of the mixed PS bales have on the market for these bales?

Contamination concerns revolve around two primary areas. The first is what percent of PS sorted using the optical sorter will be difficult to handle PS. This material will typically be contaminated with oxide coated tape, wire, metals, and other plastics, and in some cases fire retardants that will all be contaminants to the PS.

PRI believes that they can manage these types of contaminant, although it is unclear how much experience PRI has with MRF material contamination. To this point, PRI has primarily received post-industrial and commercial PS material as well as homogenous post-consumer PS material.

Second, and potentially more important is the potential for food contamination of the EPS single-use food and beverage containers. This has been a significant problem in past failed attempts to recycle EPS single-use food and beverage containers, resulting in existing programs that focus on cleaning at the source and collecting the material separate from all other materials. This will not be the case for material delivered by DSNY to the SIMS facilities.

While DART/PRI maintain that they can separate the baled EPS single-use food and beverage containers from the rigid PS, and then wash it; to date, only batch testing has been carried out by DART to demonstrate this. There is a significant difference between controlled experiments and real world conditions, and those conditions are unknown – both in terms of attraction of rodents at the SIMS facility, and then de-baling, separating and washing the material at the PRI facility.

Conclusion

Local Law 142 requires that the Commissioner of Sanitation determine whether *expanded polystyrene single-use food and beverage containers can be recycled at the designated recycling processing facility at the South Brooklyn Marine Terminal* ***in a manner that is environmentally effective, economically feasible, and safe for employees****.*

In this analysis, DSM has concentrated on the economic feasibility of recycling EPS single-use food and beverage containers.

It is DSM's conclusion, given all of the uncertainties summarized above, that neither SIMS, nor DART/PRI will know, or be able to determine whether the purchase price of 8 cents per pound, FOB SIMS loading dock is economically feasible by January 2015.

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It is DSM's opinion that New York City would be implementing a City-wide recycling program for a material without a proven track record of recycling success. While DSM is convinced that with DART's financial and technological strength, and PRI's twenty plus years of PS reclaiming experience, the attempted market would be a genuine effort, it remains a speculative, and untested market.

More importantly, it is only potentially economically feasible because DART is choosing to subsidize the capital costs of sorting the material at the SIMS facility, as well as the capital cost associated with separating and washing the EPS single-use food and beverage containers at the PRI facility.

Past history has not been kind to these types of subsidized EPS recycling programs. And while the technology has certainly come a long way, both in terms of separation using optical sorters, and washing of plastics, there is no operating system of this scale and type in the United States to point to that demonstrates the technology or the costs.

As such, DSM would be reluctant to find economic feasibility in a situation where the market consists of a single potential purchaser for all of the material generated by SIMS. This would create economic and logistical vulnerabilities for SIMS and DSNY should PRI determine that it was not cost effective for them to continue to purchase the material, or if the price offered should drop.

In essence, New York City would be entering into a very large pilot program based on a single market, and unproven systems technology. If the system were to fail, finding another domestic market for this material would be unlikely, and it would be necessary for New York City to either drop this material from its recycling program, or continue to accept it and landfill it while searching for an export market which the City may not find.

Signed:
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