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December 10, 2010

The Honorable Jon Leibowitz
Chairman
Federal Trade Commission
Office of the Secretary, Room H-135 (Annex J)
600 Pennsylvania Avenue
Washington, DC 20580

Re: Proposed, Revised Green Guides, 16 CFR Part 260, Comment, Project No. P954501

Dear Chairman Leibowitz,

We appreciate the opportunity to comment on the Federal Trade Commission's Proposed Revisions to the Green Guidelines. EcoLogic supports the need for the Green Guidelines, as it will provide necessary direction on product labeling to marketers of products and their suppliers.

The following comments from EcoLogic, LLC pertain to Section V.C devoted to Degradable Claim in the Proposed Revisions to the Green Guides.

Section V.C.3: The Commission references a September 2006 survey conducted by APCO Insight for the American Chemistry Council and mentions it was unaware of any additional consumer perception data on degradable claims.

Comment

> Synovate Inc., a global consumer research company was engaged to conduct a consumer research study on EcoLogic's behalf. The Synovate Consumer Survey Summary and Research Methodology (Tab A[1]) and Synovate Survey Detail (Tab B) are included in our submission. In November 2010, 2025 consumers participated in this web-based survey. This consumer survey included 2,025 respondents from a wide demographic array. Key takeaways are included here, and we will provide further comment on many of the specific survey results in subsequent comments.

[1] Attached to this letter is summary of tab attachments

Section V.C.1: The Commission mentions that it has challenged degradability claims based on the inability of products to degrade in the manner consumers expect.

Comment

There is no study, to our knowledge that has published what consumers believe to be the manner in which products biodegrade. This would be true for biodegradation in both a landfill as well as a composting site. However, the APCO and Synovate study do uncover interesting and compelling facts. Seventy Two Percent (72%) of the respondents in the Synovate survey detail (Tab B – Q5) indicated that they believe products labeled biodegradable will decompose in a landfill. The APCO survey had a similar finding. The Synovate Survey Detail (Tab B - Q3) also found that 60% of respondents state that they understand the meaning of "biodegradable" quite well. Additionally, over 50% of consumers believe that when something biodegrades, it gets transformed into soil and non-toxic substances (Tab B - Q4). Biodegradation in both a landfill and/or a composting site generates biogas. Only 16% of consumers in the Synovate Survey (Tab B- Q4) were aware of this. All of these facts lead us to believe that while we don't know for sure what consumers believe to be the process or manner of biodegradation, it is quite clear where they expect it to occur.

Section V.C.1, V.C.2 and V.C.4.a: The Commission mentions in all of these sections that typical solid waste disposal treatments, incineration or landfilling, inhibit degradation due to minimal interaction with moisture, oxygen and light. EPA 40 CFR Part 258 is referenced. A National Academy of Sciences paper is cited to support that absent a robust supply of these elements, decomposition is severely retarded.

Comment

40 CFR Part 258 addresses the issue of preventing contamination of groundwater. The Commission's use of this CFR in reference to minimal interaction with water inhibiting degradation in a landfill is potentially misplaced. The CFR has no relevance to the moisture needed to start and maintain the biodegradation process.

An article titled "Methane Generation in Landfills" by Dr. Nikolas J. Themelis and Dr. Priscilla A. Ulloa, published by the Earth Engineering Center and Department of Earth and Environmental Engineering, Columbia University in 2006 (Tab C) reports than on average, Municipal Solid Waste (MSW) contains at least 20% moisture which is sufficient to react the contained biomass. Additionally, the authors cite, a study conducted by M. Barlaz of North Carolina State University and presented at the Third Intercontinental Landfill Research Symposium in 2004, to understand the rate of biodegradation of MSW in landfills. The study notes that the reaction peaked in less than 100 days and was nearly complete in 320 days. There is ample and increasing scientific evidence showing that biodegradation does occur in landfills. A further review of the biodegradation process, biodegradation in landfills, and biodegradable plastics is summarized in Tab D.

Further comment is submitted regarding the number of landfills and the capture and disposal of the biogas (methane and carbon dioxide) generated during the biodegradation process in the landfills (Tab E). In the US, landfills have reduced GHG emissions by approximately 15% between 1990 and 2008 despite managing 24% more waste. As result of these efforts US landfills are the only major industry with declining GHG emissions. Since 1987 all large landfills are required to collect the methane generated during the biodegradation process. The landfill gas (LFG) is collected and either flared (converted to CO2 and water) off or converted to usable energy. Collecting landfill gas (LFG) to produce electricity improves air quality (odor and organic pollutants) and provides a clean, local, reliable and renewable power per the US EPA.

In the US the EPA's Landfill Methane Outreach Program (LMOP) estimates there are 2400 active and closed landfills in the US (Tab E). There are 518 active landfill gas to energy projects in 491 landfills generating 1,600 MW of electricity that can power 1 million homes per year. Another 520 landfills are good candidates and are expected to have operational projects by 2012 (Tab E). In 2009, 55% of US waste ended up in landfills that converted LFG to energy (Tab E).

Based on the foregoing scientific evidence and consumer perception data, EcoLogic respectfully submits that in this rapidly evolving technology, consumers do not expect that the biodegradation process will be complete within one year and that the current, proposed one year time frame will discourage, not encourage, continued technological investment and development.

Section V.C.4.a: The Commission references facts stated in the EPA publication, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2008", (Tab F) and infers that a total of 90% of materials will not decompose because of where they end up - 66% in incinerators and landfills, and 24% in recycling facilities.

Comment

EcoLogic's products are designed to facilitate biodegradation of plastics in landfills without changing the recyclability of those products. Should the products with our additive end up in a recycling facility there would be no adverse impact to the recycling process or resulting material. The amount of plastics in the MSW stream has increased from 1% in 1960 to 12% in 2008 (Tab F). The above referenced EPA publication also points out that over 93% of plastics in the United States' MSW stream end up in landfills (17% by weight of landfills is plastics) where they do not currently biodegrade. Based on evidence presented in the previous section around occurrence of biodegradation in landfills, there is a significant potential for biodegradation of plastics in landfills.

Section V.C.3: The Commission mentions that the APCO survey found 60% of consumers believed that a biodegradable package would disappear in one year or less.

Comment

The Synovate Consumer Survey (Tab B) specifically sought to probe what consumers believed to be a reasonable amount of time for a biodegradable package to decompose in a landfill. Contrary to the APCO survey, the Synovate survey (Tab B - Q19) found that only 25% of consumers believe it should be less than one year, while the majority of the respondents (70%) believed it should be less than 5 years, and 87% believed it should be less than 10 years (Tab B- Q19). Forty Five Percent (45%) of consumers believe it should take between 1 to 5 years and 17% believe it should take between 5 to 10 years (Tab B - Q19). These facts obtained from the more recent Synovate survey in which two times as many respondents were reached as compared to the APCO survey, present a very compelling evidence that almost 3 out of 4 consumers believe that a 5-year biodegradability window (Tab B - Q19) is acceptable and that a 5 year biodegradability window is not misleading for biodegradation claims.

Section V.C.4.a: Based on findings in the APCO Survey, the Commission proposed adopting a maximum period of one year for complete decomposition of solid materials marketed as degradable without time qualification.

Comment

Based on the consumer research study findings, 70% of the consumers responded that full biodegradation within five years was acceptable (Tab B - Q19). The proposed Guidelines will inhibit innovative solutions to address the increasing amount of plastics in landfills. Additionally, a 1-year time window limits biodegradation of plastics only to commercial composting sites and today the options for commercial composting that accept plastics are extremely limited. By limiting the timeframe for unqualified biodegradation claims to one year, the FTC may unnecessarily and unintentionally confuse consumers. Since a negligible amount (well under 1%) of plastics end up in composting sites and ~6% in recycling sites, the other 94% of plastics will stay as is, buried in landfills. Second, the adverse impact of greenhouse gas from composting sites is greater than that from landfills. A 2010 study by Hyder, titled Comparative Greenhouse Gas Life Cycle Assessment of Wollert Landfill" (Tab G) states anaerobic mechanical and biological treatment (MBT) of MSW is a better greenhouse gas option than aerobic MBT typical of a composting site. Biodegradation of plastics in landfills should be considered a viable strategic option.

Section V.C.4.b: The Commission mentions that it has not identified a testing protocol that which measures and hence substantiates complete decomposition within one year but also replicates the physical conditions found in the relevant disposal environment. It further states in a footnote, #203, that ASTM D5511 mimics a rare disposal environment – a highly controlled anaerobic digester with consistent heat, moisture and exposure to degradation catalysts.

Comment

ASTM D 5511 covers the determination of the degree and rate of anaerobic biodegradation of plastic materials in high-solids anaerobic conditions. The conditions of the test are optimized to show in real test time the ability of a plastic material to biodegrade under anaerobic landfill conditions. The generation of biogas in the initial 15 days of the test, and the continuing generation of biogas in subsequent 15-day intervals of time, demonstrates the plastic material will undergo biodegradation in a landfill environment. Subsequent Gel Permeation Chromatography (GPC) analytical testing has validated, and correlated with the ASTM D 5511 testing of plastic samples, by showing a molecular weight reduction equivalent to the weight loss associated to the biogas generated during the ASTM D 5511 test. This further demonstrates that polymer degradation has occurred through the action of microorganisms, and that it has occurred on chains of all lengths in the original plastic material matrix.

Based on (i) the capture and converting of landfill gas (LFG) to energy, (ii) consumer perception about about a 5 year biodegradation period, and (iii) the ASTM D5511 test confirming the biodegradation of plastics materials we would recommend accepting the ASTM D5511 test protocol as a scientific means of validating the biodegradability of plastic materials until another more advanced test method is developed and introduced.

Comment

We agree that we need to provide our customers guidance on claims that will meet the FTC Green Guidelines. Today the brands are hesitant to label products as biodegradable as they are unclear on claims that will be acceptable and want to mitigate any potential risk. Ecologic suggests that a claim as written below be deemed as acceptable:

"Biodegradable within 5 years in a specially managed, biologically active landfill. Today there are 13 major landfills in the US that meet this criteria."

"Proven to biodegrade using ASTM D5511*. *Testing under ASTM D5511 indicates X% biodegradation over YY days. Actual biodegradation rates will vary based on landfill conditions."

Such labeling would be accurate and would allow an industry for plastics designed to biodegrade in landfills to develop in the United States.

In summary, it is Ecologic's position that the consumer data that was recently completed by Synovate (Tabs A&B) provides valuable insight into consumer perceptions surrounding biodegradation. In addition, we have included in our response, technical data that supports biodegradation in landfills and the use of additive technology to render plastic products biodegradable. We would like to highlight the following:

- Science proves biodegradation occurs in landfills.
- Consumer research shows consumers expect biodegradation to occur in landfills.
- EPA Statistics highlight a compelling need to address the significant amount of plastics that end up in landfills.
- Consumer research shows majority of consumers expect a time period much wider than 1 year for the process to complete, specifically within five years.
- The proposal as stated in the Proposed Revisions to the Green Guidelines, will stifle innovation and create a scenario where biodegradation of plastics in landfills, which consumers have communicated they understand and support, will be severely limited.

We thank you for your consideration.

Best Regards,

James J. Rooney
President

Duane H. Buelow
Executive Vice President

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Background/Objectives

In an effort to improve the guidance given to marketers to help avoid making misleading environmental claims, the Federal Trade Commission has proposed revisions to the Green Guides. Changes to the Guides may address use of product certifications and seals of approval plus more claims on renewable energy, renewable materials, and carbon offset. The FTC is seeking public comments prior to making guide changes. EcoLogic would like to conduct consumer research on this subject so that it can report findings and recommendations to the FTC. The results will help enable EcoLogic to better understand consumer comprehension regarding sustainable packaging, namely packaging that biodegrades in a landfill and/or composting environment.

Research Overview

The questionnaire was developed by EcoLogic, with input from Synovate. The survey included two open-ended questions for which respondents had to type in their comments in a box. Responses were mandatory. Also, respondents were not allowed to go back and change answers to any questions. The survey was then programmed and hosted online by Synovate. Outgoing sample was balanced by age, gender, region, ethnicity, and household income to be reflective of the U.S. Census for adults age 18+. Respondents were all panelists on Synovate's Online Global Opinion Panel and were contacted via an email invitation, asking them to participate in the study. Fieldwork lasted 7 days. The quota was set for n=2,000, but we allowed for an extra 25 respondents to be included in the data – these respondents had already entered the survey before the quota was filled. Synovate then processed the data into tabulations and coded the verbatims from the open-ended questions.

Survey Population:	U.S. adults, age 18+
Sample Source:	Synovate's Global Opinion Panel
Sample Size:	n=2,025
Margin of Error:	± 2.2% at a 95% confidence level
Data Collection Methodology:	Internet
Interview Dates:	November 17-23, 2010

A total of 14,504 invitations were sent with 2,764 individuals responding. Below is a snapshot of the fieldwork activity:

- 2,025 qualified completes
  - 542 overquotas
  - 4 terminated respondents (Age <18)
  - 193 quits
- The overall response rate for this survey was 19%
  - (2,025 + 4 + 542 + 193)/14,504

Sample Distribution

Demographic Subgroup		Population %	Sample %
Age by Gender	Males 18-29	11.20	5.9
	Males 30-39	8.80	7.4
	Males 40-49	9.70	9.5
	Males 50-64	11.80	18.0
	Males 65+	7.00	9.7
	Females 18-29	10.80	10.9
	Females 30-39	8.9	11.0
	Females 40-49	9.9	8.4
	Females 50-64	12.5	12.4
	Females 65+	9.4	6.9
Race/Ethnicity	Hispanic	13.5	3.7
	Black (non-Hispanic)	11.3	5.2
	Other (non-Hispanic)	75.2	91.1
Region	Northeast	20.5	20.2
	Midwest	21.9	25.3
	South	33.5	31.0
	West	23.1	23.5

Research Findings

Highlights – Understanding of Biodegradation

Over 60% of respondents claimed they understand the meaning of "biodegradable" quite well[i].

- Of all the venues in which respondents were asked where products labelled biodegradable would decompose, "landfills" received the highest score (72%) followed by "open environment" (51%) and "commercial composting" (51%)
- 4 out of 5 (80%) respondents believe biodegradation in landfills is dissimilar to biodegradation in a composting environment
- More than half of the respondents (55%) were unaware that landfills currently capture gases generated as a result of biodegradation and convert them to energy

"What are the differences between biodegradation in landfills vs. biodegradation in composting environments?"

Many respondents attributed the differences to composition (27%), degradation process (26%), and/or duration of degradation (23%).

- Respondents defined composition as what exactly goes into each environment and their levels of aeration
- For the degradation process, respondents cited the end product of landfills as garbage and as soil for compost piles. Also they compared the ability of one over another to biodegrade matter, and referenced a presence of additives
- Of those who mentioned factors related to the duration of degradation, the majority said landfills take longer to biodegrade

[i] When asked to rate their understanding of the word biodegradable on a 5-point scale where 5 = I know it very well and can explain it to someone, 64% of respondents rated their understanding as being a 4 or 5.

Highlights – Biodegradation of Plastics

A good majority of respondents (72%) believe traditional plastics will not biodegrade on their own.

- Those who think plastics do biodegrade on their own think it mainly happens in landfills or commercial composting sites

A large number of respondents (84%) believe biodegradable plastic products will be beneficial to landfills.

- 74% believe biodegradable plastics will reduce the burden on landfills

7 out of 10 (70%) respondents were okay with a 5 year or less window for duration of the biodegradation of biodegradable plastic packages.

- 25% of respondents believe plastics should biodegrade in less than one year

Highlights – Package Labeling

An overwhelming number of respondents (93%) think it is okay to label a package "biodegradable" if it decomposes in a landfill.

- A majority of respondents (63%) think it is not okay to label a package "biodegradable" if it only decomposes in a commercial composting facility and not in their back yards.

Highlights – Attitude towards "green"

- Less than 2 out of 5 (38%) respondents claimed they often or always check for green aspects on a product label.
- Of the 6 attributes that contribute toward lowering a product's burden on the environment, respondents believe "biodegradable" and "recyclable" are the most important.
- Over 6 out of 10 (62%) respondents stated they are willing to pay a higher price for products that are less burdensome on the environment.

About Synovate

Company Profile

Synovate, the market research arm of Aegis plc, generates consumer insights that drive companies' marketing solutions. We are a full service agency offering a comprehensive suite of research services and analytical tools that allow businesses to make the most of their research investment. Our experience includes:

- For more than 60 years, Synovate has been developing and maintaining consumer research panels. This involves general consumer panels as well as specialized panels for healthcare, proprietary panels, qualitative and interactive panels and a range of business-to-business panels.
- Synovate first introduced online data collection in 1995 and has the infrastructure to design, manage and service a variety of online projects. We manage over 50 unique online projects per week.
- Synovate launched its US online panel in 1996 and now manages more than 1.5 million online panelists across 14 panels while continuing to grow.
- Synovate continuously researches and invests in the best online data collection capabilities. We license panel management software from NEBU as well as the SPSS mrInterview suite as an online data collection and reporting tool.

Synovate Panel

Synovate has been developing and maintaining consumer research panels for more than 60 years. Synovate first introduced online data collection in 1995 and has the infrastructure to design, manage, and service a variety of online projects. Synovate manages more than 1.5 million online panelists across 14 international panels. Panelists are actively nurtured through a comprehensive relationship management processes. We maintain an online community of panelists rather than simply running pools based on databases of email addresses. Synovate believes that online research panels should not be used for purposes other than surveys lest panelists' responses to surveys are conditioned by this marketing activity. Our panelists can visit the membership site, which has been personalized for them, at any time to learn about new initiatives we are taking, available surveys which they have been invited to and the incentives they have earned. In addition, panel members are measured against a data quality program. Respondents who don't pass quality standards are removed from the survey and potentially the panel.

Our panel management core competencies also transcend into our online data collection processes where we obtain quality through a three step approach:

- Panel recruitment – choice of sites, recruitment message, method of recruitment and reward scheme
- Panel management – panel representation of desired populations, avoidance of duplicates, best practices in sampling and database accuracy, as well as removal of repeat fraudulent respondents
- Study execution – invitations, cross panel duplication, and project level data quality tests

Panel Maintenenace Procedures

Synovate adheres to stringent panel maintenance procedures:

Recruitment

- To reduce the presence of “professional respondents, Synovate limits the recruitment of panelists through websites that promote or advocate completing online surveys solely for rewards. Synovate panel recruiting advertisements (banners, email, targeted ads) stress the importance of sharing opinions and survey behavior rather than a monetary reward. When registering for the panel, respondents must accept membership terms and conditions that include protection of confidentiality, the need for accurate and engaged responses, and the automatic revocation of membership due to fraud. Panelists are recruited on a continuous basis.

Bad Addresses

- “Non-deliverable email addresses are monitored and eliminated from sample selection.

Duplicate Records

- Details from new recruits are used to check whether the same individual or household is already represented on the Synovate panel and are rejected if there is a reasonable likelihood that they are duplicated. Duplication checks include name, details from postal addresses, ISP addresses, telephone numbers and other screened information. Ongoing checks are conducted for panelist duplication in case a respondent’s information has changed through the updating process.

Panel Member Removal

- Panel members are removed from the panel either by request, a lack of participation, or providing fraudulent responses.

Panel Recruitment

Panelists are required to double opt-in to Synovate Global Opinion Panels when they complete an enrollment survey that collects both personal and household level information. Once this enrollment survey is completed, an email is sent to the „registered panelist with a link that requires them to confirm their membership of the panel. This process also confirms validity of panelist's email address. Every survey invitation sent to panelist includes a link to access the survey – and confirm their intent on continuing their membership. Finally, every email invitation includes details on how to unsubscribe should they no longer wish to continue their

Synovate employs a rigorous double opt-in policy to confirm the email address of potential panelists and their willingness to participate in surveys. Panelists must accept membership terms and conditions that include protection of confidentiality, commitment to accurate and engaged response, and the automatic termination of the membership due to fraud.
To reduce the presence of professional respondents, Synovate does not recruit through partners that recruit simultaneously for several panels as well as promote or advocate completing surveys for rewards.

- Potential new panelists are rigorously checked for duplicates (same individual or in same household).
- Suspects are rejected.Checks include names, details from postal addresses, ISP addresses, telephone numbers and other screened information.
- Where duplicate recruitment is detected, then the original delinquent panelist is purged from the panel
- Panelists are asked to report membership of other panels and this information is used in selecting panel partners Synovate advertisements

Data Security and Privacy

A key issue in dealing with the transmission and use of survey data is security and privacy. Synovate employs stringent security protocols to protect all facets of electronic and paper-based data collection, transmission, distribution and storage.

We strongly adhere to the recommended standards outlined by IMRO, CASRO, AMA and AMRA concerning privacy, harassment, and spamming. We also implemented new and customized standards for financial services research in response to the Gramm-Leach-Bliley Act of 1999.

Our procedures, facilities, and systems have been thoroughly inspected by several firms in order to test for compliance with Gramm-Leach-Bliley. We have successfully passed these inspections and have updated any aspects necessary to remain in compliance.

To protect information from unauthorized internal or external access, at a minimum, we:

- Require a unique ID to authenticate anyone submitting, reviewing or working with information in our databases;
- Utilize firewalls to protect servers;
- Maintain audit records of log-ins, file accesses and other security incidents; and
- Employ a series of pass coded building security systems.

Our Chief Security Officer and his/her staff review security protocols on a monthly basis to ensure the system's integrity.

Access to all data collected by Synovate is limited to the internal Chief Privacy Officer and those staff members designated by him/her who manage surveys.

Synovate staff members receive training on this privacy policy and our general information practices. Each staff person who requires access to system data must sign a confidentiality agreement yearly, as contained in Synovate's human resources policy.

Synovate is committed to incorporating new technologies as they evolve in order to ensure the highest level of protection at all times.

- All mission critical production servers and associated data are housed in a physically secure environment with access controls that do not permit unauthorized users to gain physical access to production data or server environments.
- All storage resources for mission critical production data are stored in a physical facility that provides a controlled temperature environment, redundant backup power, automated fire suppression, server monitoring and reporting, and restricted access controls.
- All mission critical production system data is stored using enterprise storage resources with preference to dual attached specific storage resources to ensure no single point of failure, redundant storage of data and consistent disaster recovery data storage.
- All servers are protected inside enterprise standard hardware firewalls and all relevant Windows security upgrades and service packs are applied regularly.
- All production data is backed up on a regular basis as required by the data and application owner, and backups are stored off-site. All backup data media is reused on a 4 week rotation and all data are destroyed upon reuse.
  - Backup media are tested at least quarterly to ensure the data contained on them can be successfully recovered.
  - The data being backed up is periodically analyzed to ascertain that all elements are present to successfully recover the application.
- Data storage systems are monitored 24 X 7 for failure on redundant storage system by an outside vendor. Any failed component will be replaced by vendor and data contained on defective media destroyed on site.
- Synovate periodically runs simulations to test the disaster recovery/business continuity plan as per Synovate policy. Senior management is actively involved in implementing BCP/DRP. Also, every six months plans are reviewed and tested.

[INTRO]

Thank you for taking this survey. We are conducting a survey on behalf of a company that is striving to develop products that they believe will be helpful to the environment and will improve the ways that plastic products are disposed. We would like to understand your perceptions about plastic products on the environment and how that impact could be reduced. Hope you have fun taking the survey!

Q1. What is your age?

Please enter a number

[PROG: NUMERIC RANGE 12-99. TERMINATE IF UNDER 18.]

Q1a. [PROG: AUTO-PUNCH AGE CATEGORY BASED ON Q1]

Less than 18	
18-24	7%
25-34	19%
35-44	18%
45-54	19%
55-64	21%
65+	17%

Q2. What is your gender?

Please select one

Male	50%
Female	50%

Q3. How would you rate your understanding of the word ++biodegradable++?

Please select one

5 – I know it very well and can explain it to some one	33%
4	30%
3 – I know it somewhat and can understand it when people talk about it)	32%
2	3%
1 – I don't know what it means	1%

Q4. In your opinion, what happens to something that biodegrades?

Please select all that apply

Gets transformed into soil	53%
Gets transformed into gases	16%
Gets transformed into non-toxic substances	58%
Gets transformed into toxic substances	5%
None of these	7%

Q5. If something is labeled ++biodegradable++, where will it decompose? If you are not sure, please take your best guess.

Select all that apply

In the open environment (land or water) as litter	51%
In a landfill	72%
When buried in your backyard	43%
In a home composting device	46%
In a commercial composting facility	51%
None of these	2%

[PROG: RANDOMIZE RESPONSES]

Q6. Please select a response that you believe to be true about biodegradation in a landfill versus biodegradation in a composting environment (such as a home composting device or commercial composting site).

Please select one

Both are exactly the same	20%
There are some differences	58%
Both are very different	20%
Both are complete opposites	3%

[PROG: ASK IF Q6 = There are some differences, Both are very different, OR Both are complete opposites.]

Q6a. In your opinion, what are the differences between ++biodegradation in a landfill++ and ++biodegradation in a composting environment++?

Please be specific

Environmental factors (net)	5%
Human control factors (net)	14%
Level of toxicity/safety (net)	8%
Reusability (net)	11%
Degradation process (net)	26%
Duration of degradation (net)	23%
Composition (net)	27%
Miscellaneous mentions (net)	10%
No difference	1%
Don't know/no answer	15%

Q7. In your opinion, which of the following is best for the environment?

Please select one

A recyclable product	11%
A biodegradable product	12%
A product that is both recyclable and biodegradable	77%
A product that is neither recyclable nor biodegradable	1%

Q8. Where do you believe traditional plastic products biodegrade? If you are not sure, please take your best guess.

Select all that apply

In the open environment (land or water) as litter	4%
In a landfill	15%
When buried in your backyard	3%
In a home composting device	3%
In a commercial composting facility	13%
Traditional plastics do not biodegrade	72%

[PROG: IF Q8 = Traditional plastics do not biodegrade SKIP TO Q9.]

Q8a. How many years do you think it takes for traditional plastic products to biodegrade?

	Less than 10 years	10 to 50 years	50 to 100 years	100 to 500 years	Greater than 500 years	Don't know
In the open environment (land or water) as litter	16%	28%	18%	4%	14%	20%
In a landfill	16%	31%	15%	10%	9%	19%
When buried in your backyard	32%	28%	12%	-	20%	8%
In a home composting device	31%	26%	8%	2%	10%	23%
In a commercial composting facility	44%	21%	5%	2%	4%	24%

Q9. You may have come across many products or packages (water bottles, coffee cups, food takeout containers, shopping bags, disposable cutlery etc.) labeled as being biodegradable. Assuming they are not recycled, where do you believe the majority of these products end up after they are used?

Please select one

In the open environment (land or water) as litter	10%
In a landfill	80%
When buried in your backyard	1%
In a home composting device	1%
In a commercial composting facility	8%

Q10. Which of the following do you believe is more beneficial to a landfill?

Please select one

Biodegradable plastic products	84%
Non-biodegradable plastic products	3%
Not sure	13%

Q11. Did you know that traditional (non-biodegradable) plastic products take hundreds of years to decompose, if they do so at all?

Please select one

Yes	82%
No	18%

Q12. What percentage of plastic products disposed in the U.S. would you say end up in landfills?

Please select one

Less than 10%	2%
10-19%	3%
20-49%	7%
50-69%	22%
70-89%	39%
90% or greater	27%

[PROG: TRANSITION SCREEN]

Fact: Per the US Environmental Protection Agency (EPA), approximately 93% of plastics discarded end up in landfills

Q13. Did you know a biodegradable plastic will generate gases during the biodegradation process in a landfill and the gas can be used as a clean source of alternate energy?

Please select one

Yes	37%
No	63%

Q14. Organic waste (like food scraps, yard waste etc) biodegrades in a landfill. Were you aware landfills currently capture the gases generated during this process and convert the gas to usable energy?

Please select one

Yes	45%
No	55%

Q15. The useful life of a landfill is the number of years it stays open to accept waste before it fills up. In your opinion will biodegradable plastics free up space and increase the useful life of a landfill?

Please select one

Yes	63%
No	13%
Not sure	24%

Q16. Do you believe biodegradable plastics will help reduce the burden on landfills?

Yes	74%
No	10%
Not sure	16%

Q17. Which of the following best describes the average time it takes for a landfill to reach its full capacity? Please take your best guess if you are not sure.

Please select one

20 to 40 years	63%
30 to 50 years	28%
40 to 60 years	9%

Q18. Of the following products which would you prefer?

Please select one

Plastic products that will biodegrade in a landfill	96%
Plastic products that will not biodegrade in a landfill	4%

Q19. What do you believe is a reasonable amount of time for a ++biodegradable++ plastic package to decompose in a landfill?

Please select one

Less than 1 year	25%
Less than 5 years	45%
Less than 10 years	17%
Less than 20 years	6%
Less than 40 years	3%
40 years or greater	4%

Q20. Would it be okay, in your opinion, is it correct for plastic packaging to be labeled ++biodegradable++ if it is designed to decompose in a landfill in [INSERT RESPONSE FROM Q19]?

Please select one

Yes	93%
No	7%

Q21. In your opinion what percentage of plastics in the U.S. is composted?

Please select one

Less than 1%	33%
1-9%	21%
6-10%	15%
11-19%	8%
20-29%	9%
30-39%	5%
40-49%	3%
Greater than 50%	7%

[PROG: TRANSITION SCREEN]

Fact: Less than 0.5% of plastics discarded end up being composted

Q22. Which of the following is true?

Please select all that apply

I have a composting device or a compost pile in my home or yard	19%
Curbside composting pick-up is available in my area	14%
Curbside recycling pick-up available in my area	62%
None of these	27%

Q23. In your opinion, is it correct for plastic packaging to be labeled ++biodegradable++ if it is designed to decompose specifically in a commercial composting site and will not readily decompose in your back yard?

Please select one

Yes	37%
No	63%

Q24. As a consumer, what supporting information would you like to see on a package labeled ++biodegradable++? Please be as specific as possible.

Where it biodegrades (net)	27%
How long it will take to biodegrade (net)	39%
Conditions under which it will biodegrade (net)	18%
Contact details (net)	1%
What should be done with it after use (net)	10%
Safety/toxicity issues (net)	5%
Environmental benefits (net)	1%
Miscellaneous mentions (net)	11%
Don't know/no answer	23%

Q25. How often do you look for Eco-Friendly/Green labels when purchasing a plastic product?

Please select one

Always	8%
Often	30%
Occasionally	35%
Rarely	17%
Never	11%

Q25a. Each one of the following attributes contributes to lowering a product's burden on the environment.

Please rank the following six attributes on what you believe to be the most beneficial for the environment with "1" being the most beneficial and "6" being the least beneficial of the response options.

Please rank the following attributes

	Ranked 1st	Ranked 2nd	Ranked 3rd	Ranked 4th	Ranked 5th	Ranked 6th
Made from recycled materials	14%	17%	23%	21%	14%	9%
Made with renewable materials	7%	11%	17%	20%	27%	18%
Biodegradable	28%	24%	16%	15%	11%	7%
Recyclable	19%	27%	21%	14%	13%	7%
Made with renewable energy	6%	10%	11%	17%	24%	33%
Non-toxic	26%	11%	12%	13%	12%	26%

[PROG: RANKING 1-6. RANDOMIZE RESPONSES.]

Q26. Please indicate how much you agree or disagree with the following statement.

If the products I currently purchase were made less burdensome on the environment, I would be willing to pay a higher price.

Strongly Agree	10%
Somewhat Agree	52%
Somewhat Disagree	24%
Strongly Disagree	14%

[PROG: IF Q26 = Somewhat Disagree OR Strongly Disagree SKIP TO D1.]

Q27. How much more would you be willing to pay for products that are less burdensome on the environment?

Please select one

5% - additional 5 cents per $1 spent	47%
10% - additional 10 cents per $1 spent	29%
15% - additional 15 cents per $1 spent	7%
20% - additional 20 cents per $1 spent	3%
25% - additional 25 cents per $1 spent	2%
More than 25%	1%
Not sure how much	12%

Q28. You indicated that you would be willing to pay [PROG: INSERT SELECTION FROM Q27.] for products that are less burdensome on the environment. Please explain why you selected this response.

	5% addt'l	10% addt'l	15%+ addt'l	Not sure
Seems to be a reasonable amount/what can or can't afford/cost factors (net)	77%	74%	49%	52%
Impact on the environment (net)	20%	26%	39%	12%
The companies should be responsible too (net)	4%	4%	2%	6%
Miscellaneous (net)	3%	5%	7%	28%
Don't know/no answer	5%	6%	15%	15%
No reason/had to put something down	3%	2%	4%	2%

D1. What is the highest level of education you have completed?

Please select one

Some high school	2%
High school graduate	17%
Some college	33%
College graduate	34%
Post graduate degree	15%

D2. What is your current employment status?

Please select one

Employed full-time	40%
Employed part-time	12%
Seeking employment	8%
Full-time homemaker	12%
Student	4%
Retired	24%

[PROG: ASK IF D2 = "Employed full-time" OR "Employed part-time"]
D3. What industry do you work in?

Please select one

Banking/finance	4%
Construction	3%
Education	14%
Entertainment/hospitality/tourism	2%
Food service	2%
Government/public service/military	8%
Healthcare	11%
Manufacturing	6%
Professional/business services	12%
Retail	7%
Skilled trades	3%
Social services	2%
Transportation	3%
Other	22%

D4. Which of the following best describes your racial or ethnic background?

Please select one

White/Caucasian	85%
Black/African-American	5%
Hispanic/Spanish/Latino	4%
Asian	4%
Other	2%

D5. What is your annual household income?

Please select one

Under $30,000	25%
$30,000 to $49,999	21%
$50,000 to $74,999	19%
$75,000 to $99,999	14%
$100,000 to $149,999	14%
$150,000 to $199,999	3%
Over $200,000	3%

Biodegradation 101

True biodegradation is a process in which molecular structure of materials is broken down through metabolic or enzymatic processes. The decomposition process occurs via enzymes secreted by naturally present or naturally occurring microorganism (or microbes) such as bacteria, some fungi, etc. These microbes work alone or in colonies and play a vital role in our ecosystem not just in the biodegradation process. Products made from plant or animal sources such as paper, vegetable scraps, and some plastics that have special ingredients in them will biodegrade. Biodegradation can occur in aerobic (requiring oxygen) or anaerobic (without oxygen) conditions. Biomass (humus) and biogas (carbon dioxide and methane) are the products of a biodegradation process. Under aerobic biodegradation carbon dioxide is the primary gas emitted while in the case of anaerobic biodegradation methane is the primary gas.

Biodegradation in Landfills:

The main bioreaction in landfills is anaerobic biodigestion. Microbes in landfills break down the organic matter and reduce its bulk or mass. To be accurate, it is a series of smaller processes. In the first step, called **Hydrolysis** (*chemical* reaction of a compound with water), fermentative bacteria break down the complex insoluble organic molecules into soluble molecules. The second step, **Acidogenesis**, is a *biological* reaction where these soluble molecules are converted by acid forming bacteria into volatile fatty acids, hydrogen and carbon dioxide to make them available to other bacteria. What follows is another *biological* reaction called **Acetogenesis**, in which the volatile fatty acids are converted into acetic acid, hydrogen and carbon dioxide. In the final stage, **Methanogenesis**, yet another biological reaction, methanogenic bacteria convert the acetates into methane and carbon dioxide. Hydrogen is consumed in this final stage which continues until the only element left is a nonliving finely divided organic matter called humus (highly nutritional soil made up of carbon, nitrogen, phosphorous and sulfur).

Most landfills these days have approximately 20% moisture levels due to the organic matter in them. Some even have greater moisture levels (as high as 40%) due to moisture or leachate re-circulation to promote/encourage anaerobic biodegradation.

Biodegradable Plastics:

Biodegradable plastics are plastics engineered to decompose in the natural environment. They are either completely or partially derived from renewable sources or are petroleum based with an additive that allows them to biodegrade. Plastics containing Eco-One™ fall in the latter category.

ASTM Test Methods and Standards for Biodegradation of Plastics:

The American Society for Testing and Materials (ASTM) has established a number of scientific and technological tests to measure true biodegradation in plastic products.

For anaerobic biodegradation, the ASTM D5511-02 test method, equivalent to ISO DIS15985 (International Standards), is used for determining biodegradation under high-solids (>30% total solids) conditions. It determines the degree of biodegradation of plastic materials. The test sample is exposed to a methanogenic inoculum cultivated from a wastewater treatment facility's anaerobic digester operating household waste (methanogens are microorganisms that produce methane as a metabolic byproduct in oxygen-deprived conditions). Incubation (in dark) is typically for 15 days. During this time, the volume of carbon dioxide and methane emitted from the biodegrading test sample relative to a positive control (typically cellulose), a negative control (same resin without the additive), and the inoculum alone is measured at different intervals. At the conclusion of the test, the mass (weight) of the remaining solid test sample and all the control samples is determined. ASTM D5526 is used for determining biodegradation under accelerated landfill conditions. Neither standard stipulates how long it should take for a certain amount of biodegradation.

For aerobic biodegradation (what happens in a commercial composting site), ASTM D5338 test method is used for determining biodegradation under controlled composting conditions while ASTM D6400 sets the specification for compostable plastics. According to the ASTM, for plastic to be considered compostable it must meet 3 criteria:

- It must biodegrade as in be able to break down to carbon dioxide, water and biomass
  - It requires more than 60% of the organic carbon in homopolymers and 90% in copolymers to be converted to carbon dioxide within 180 days

- It must disintegrate, that is, it should be visually indistinguishable after breaking down and look like compost
  - Less than 10% of original dry weight should remain on a 2mm screen after 120 days

- No adverse impact on ability of compost to support plant growth (and not introduce unacceptable levels of heavy metals or toxic substances into the environment)

If plastics are biodegradable in landfills, per ASTM D5511, they may not necessarily be biodegradable ("compostable") in municipal and industrial composting facilities per specifications outlined in ASTM D6400. The reverse is also true. Compostable plastics may not biodegrade in a landfill. Commercial composting sites grind material and turn over the piles at high temperature to achieve biodegradation and disintegration. Home composting takes at least 2 times as long to achieve the same results.

Degradable and Biodegradable Plastics:
Plastics may be degradable but not necessarily biodegradable. There are two primary differences between 'degradable' and 'biodegradable'. First, one or more - heat, moisture, oxygen and/or UV exposure - most often cause the degradation of a degradable product. It is a chemical and/or mechanical process. Microorganisms on

the other hand degrade a biodegradable product through a biochemical process. Secondly, degradable products tend to take much longer to break down into carbon dioxide, biomass and water. When degradable plastics break down into smaller molecules, they *may* eventually be small enough to be consumed by microorganisms and so biodegradation may occur. It is very likely they may leave metals, toxins and polymer residue in the environment.

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Plastic Can Assist in the Call for the Conversion of Methane to Energy

The EPA has taken an aggressive stance on methane for recapture and conversion to energy. Methane for energy is a great solution to landfill gases. Plastics are going into landfills in enormous quantities - 30 million tons in 2008. If these plastics can become biodegradable; therefore reducing the amount of plastic in landfills and if the gases resulting from biodegradation are then used for energy, this will be a win-win for all.

The current drivers for energy recovery from landfill gas (LFG) include tax credit and utility pricing incentives as well as more recent incentives for renewable energy, green power, and greenhouse gas (GHG) reduction credits[2]

Center of Sustainable Use of Resources (SUR) of Columbia University states there are only two appropriate ways for managing non-recyclable municipal solid wastes (MSW)[3]:

- ❑ Combustion with energy recovery (WTE)
- ❑ Sanitary landfilling with LFG recovery

Federal Regulations:*

- ❑ Large** landfills have to collect landfill gas
  - ➢ LFG is ~ 50% methane
  - ➢ % of methane emissions in the US coming from landfills
    - 40% in 2000
    - 22% in 2008
  - ➢ Landfill methane accounts for only 4% of all US greenhouse gases (GHG)
  - ➢ In 2009, 80% of large US landfills collected gas[4]

LFG Collection:

- ❑ Gas collection and utilization could reduce methane emissions from landfills globally by 70% at negative to low costs by 2030[5]

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[2] Sullivan, 2010

[3] Themelis, March, 2009

*1996 EPA regulations under Clean Air Act (New Source Performance Standards (NSPS) & Guidelines for Control of Existing Sources) & 2003 National Emission Standards for Hazardous Air Pollutants (NESHAPP)
** Design capacity > 2.5 mil. metric tons & uncontrolled NMOC*** emission rate > 50 metric tons per/yr
***Non Methane Organic Compounds

[4] USEPA, 2009

[5] Bogner, 2007

- Collected methane is either flared or converted to energy

- US has highest percentage of landfills with LFG collection systems (51% of active landfills)
  - Weighted average collection efficiency is 75%[6]
  - 66% of US waste ended up in landfills that had gas collection systems in place[7]
  - 55% of US waste ended up in landfills that also convert the collected methane to energy

- Landfills have reduced GHG emissions by approximately 15% between 1990 and 2008 despite managing 24% more waste[8]
  - The only major industry with declining GHG emissions!

Methane-to-Energy Benefits:

Per http://epa.gov/lmop/basic-info/index.html#a02, *"Using LFG for energy is a win/win opportunity. LFG utilization projects involve citizens, nonprofit organizations, local governments, and industry in sustainable community planning and create partnerships. These projects go hand–in–hand with community and corporate commitments to cleaner air, renewable energy, economic development, improved public welfare and safety, and reductions in greenhouse (global warming) gases. By linking communities with innovative ways to deal with their LFG, LMOP contributes to the creation of livable communities that enjoy increased environmental protection, better waste management, and responsible community planning."*

- Collecting LFG to produce electricity improves air quality (odor and organic pollutants)[9]

- LFG engines, which represent the largest majority of landfill gas-to-energy (LFGTE) devices, achieve 98%-99% control of methane[10]

- Cost of energy from LFGTE projects is one of the lowest amongst not only renewable sources such as wind, solar, and geothermal sources but also when compared to conventional nonrenewable sources like coal and advanced natural gas (factoring in the cost of carbon control and sequestration)[11]

[6] USEPA AP-42, 1997, Leatherwood, 2002
[7] Themelis, Jan., 2009
[8] USEPA, 2010
[9] Sullivan, 2010
[10] SWICS, 2007
[11] EIA, 2009

- LFGTE is more cost effective at achieving GHG reductions than composting[12]

- LFG provides constant power
  - Clean, Local, Renewable, Reliable (24x7) – defined by EPA

Other Interesting Facts:

- Globally, methane gas recapture is on the forefront

- Waste Management (largest waste operator in US) will have invested $400 mil. in gas-to-energy projects from 2007 to 2010 with a 55% increase in projects

- 30% of New Jersey homes will be powered by methane in 2011

- University of New Hampshire
  - UNH - First campus in the U.S to use landfill gas as primary fuel source
  - As of 2009, 85% of energy (electricity and heat) used by the 5 million square foot campus comes from EcoLine project, a landfill gas-to-energy project that uses methane gas from a nearby landfill

- Closed landfills too have gas to energy conversion projects
  - Des Plaines (IL) Landfill Project ('04) - capture and convert 2.25B ft^3 of CH over 10 years

Facts From EPA's Landfill Methane Outreach Program (LMOP) Project Database:

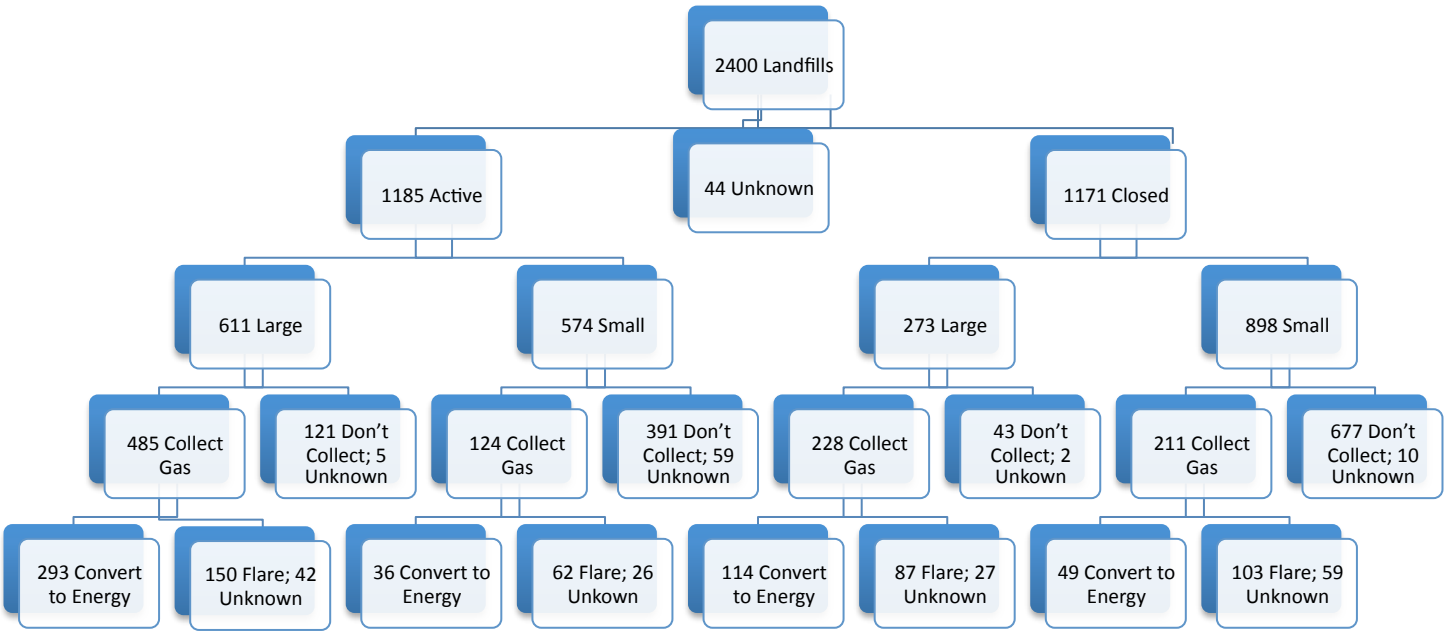
- In the US, LMOP estimates there are 2400 landfills (total, between active and closed)
  - There are 518 active gas to energy projects generating ~ 1,600 MW of electricity (1MW can power 636 homes)
  - 491 landfills drive these 518 projects

- EPA estimates another 520 landfills to be good candidates and expects to have operational projects by 2012

- In 2006, 52% of methane captured in the US was converted to energy[13]

- In 2009, 55% of US waste ended up in landfills that converted LFG to energy

[12] Bogner, 2007
[13] Themelis, 2008



CEOs are learning quickly that proper sustainability practices are good business:

- ❑ 93% of CEOs say sustainability is critical to success
- ❑ Companies with a vision and sustainable solutions achieve above average financial performance
- ❑ Unlike other sectors of the packaging industry, sustainable packaging has showed good over the past two years bucking the economic downturn
- ❑ Greater awareness about environmental concerns, government initiatives, growing economies, and burgeoning population are identified as the drivers behind this growth
- ❑ Companies are trending toward using sustainable packaging as a marketing tool

Prominent companies are using landfill gas for energy:

Current industries using LFG include

Auto Manufacturing	Pharmaceutical	Consumer Electronics
Chemical Production	Cement & Brick	Paper production
Food Processing	Wastewater Treatment	Prisons & Hospitals

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Plastic Biodegradation in Landfills Helps Business Owners Tackle Non-Recycling Product Issues and Helps to Create Methane for Energy

There is a school of thought in the environmental community that biodegradable plastics in landfills is an inadequate solution to the millions of tons of plastic which sit in these mountains of waste for an indefinite time period. Some believe recycling or failing that, using professional or even home composting facilities is the only true solution and the only truly sound environmental avenue. Unfortunately, the reality is plastic is going into landfills in enormous amounts. Having a solution that rectifies this reality, i.e., makes the plastic disappear in 1-5 years, deals with the landscape as it is today and not how we hope it will be in 10-15 years. It is like saying the best way to deal with forest fires is to never light a match. How realistic is that?

The Facts:

- Landfills are the preferred means of Municipal Solid Waste disposal in the US with an overall increase in MSW consistent with increases in the population.
  - 17% of landfill weight is plastics (EPA 2008)

- Plastics in MSW has increased from 1% in 1960 to 12% (30 million tons) in 2008
  - 43% from containers and packaging (13% recovery rate)
    - 11.3 million tons end up in landfills
  - 22% from nondurable goods (negligible recovery rate)
    - 6.5 million tons end up in landfills
  - 35% from durable goods (3.7% recovery)
    - 10.1 million tons end up in landfills

Most agree recycling is a preferred method of dealing with plastics. However, the majority of Municipal Solid Waste is not recycled[14]:

- Only 33% of MSW was recovered in 2008 (recycling + composting)
  - Modest increase over 2000 when it was 29%
  - Recycling rate is 24% and composting 9%

Specifically, there is a lackluster recovery rate for plastics:

- While 55% of paper board is recovered, only 7% of plastics are

- Plastic bottles constitute ~ 50% of recyclable waste in dumps
  - PET soft drink bottles – only 37% recycled
  - HDPE milk containers and large water bottles – only 28% recycled
  - 38 bn PET water bottles – only 23% recycled

[14] Arsova, 2008

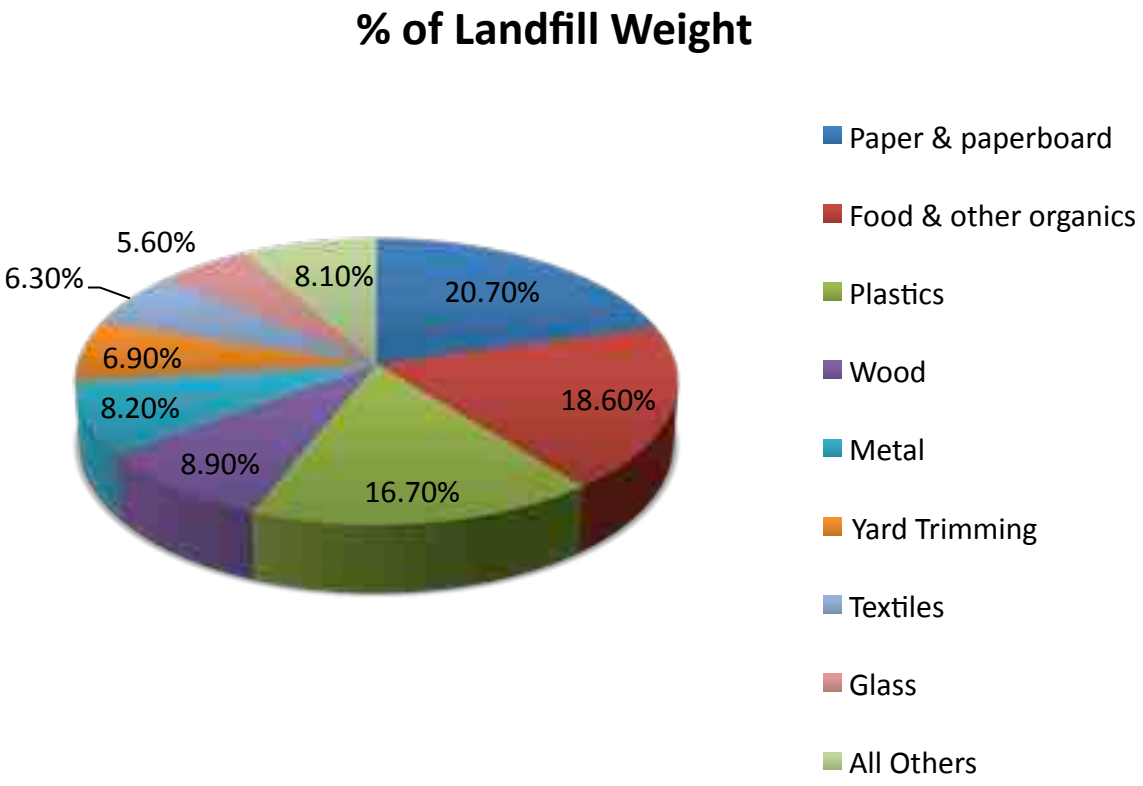
What if all of this plastic could simply disappear? What if what was left behind could fuel homes, schools, businesses and industrial compounds?

US Municipal Solid Waste Disposal Over Five Decades

Activity	1960	1970	1980	1990	2000	2008
MSW Generated (million tons)	88.1	121.1	151.6	205.2	239.1	249.6
Recovery for Recycling	5.6	8	14.5	29	52.9	60.8
% for Recycling	6.3 %	6.6 %	9.6 %	14.1 %	22.1 %	24.3 %
Recovery for Composting				4.2	16.5	22.1
% for composting				2.0 %	6.9 %	8.8 %
Combustion with energy recovery		0.4	2.7	29.7	33.7	31.6
% Combustion			1.8 %	14.5 %	14.1 %	12.7 %
Landfilled	82.5	112.7	134.4	142.3	136	135.1
% Landfilled	93.5 %	93.1 %	88.6 %	69.3 %	56.9 %	54.1 %

US Landfill Composition

- 2008 EPA Publication (Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2008)



Modern Landfills:

- MSW contains at least 20% moisture[15]
  - This is just about sufficient to react the contained biomass
- Anaerobic bacteria thrive at water concentrations above 40%[16]
- Modern landfills use leachate recirculation and bioreactor methods to incorporate liquid management and pumping systems to maintain higher moisture content
  - Bioreactor landfills use other liquids in addition to leachate to achieve > 40% moisture
  - All modern landfills are required to install and operate LFG collection and control systems
  - Bioreactor landfills have to do this earlier than other landfills

[15] Themelis, 2006
[16] Themelis, 2006

Is composting better than landfilling?

Contrary to popular belief compost sites also generate methane. Only in very few cases where the compost sites have adequate controls in place to collect and filter the volatile organic compounds (VOCs) and methane that is generated, would composting be an equivalent or perhaps a better option to landfilling. If the landfill converts the methane to energy then landfilling will be a better option. Less than 10% of compost sites have adequate controls in place because these controls are too expensive to implement.[17]

- Anaerobic mechanical and biological treatment (MBT) is a better greenhouse gas option than aerobic MBT[18]
  - It is better to focus on maximizing energy recovery from biological material than to generate stabilized organic products

- Emissions during transportation of waste should be considered
  - With fewer composting sites compared to landfills, transportation distances are longer[19]

- According to the National Resource Defense Council (NRDC) and earth911.org, only 8% of Americans compost their waste, including residents in cities like San Francisco and Seattle where composting is part of the general waste pickup
  - Products that incorporate compostable packaging have grown very slowly and have had mixed reviews
  - Confusion about what to do with these products at time of disposal has also been a factor in the slow adoption
  - Composting sites that accept plastic are a fraction of that of landfills and are not expected to grow fast enough

CEOs are learning quickly that proper sustainability practices are good business:

- 93% of CEOs say sustainability is critical to success

- Companies with a vision and sustainable solutions achieve above average financial performance

- Unlike other sectors of the packaging industry, sustainable packaging has showed good over the past two years bucking the economic downturn

- Greater awareness about environmental concerns, government initiatives, growing economies, and burgeoning population are identified as the drivers behind this growth

[17] Hyder, 2010 & SCAQMD, 2001
[18] Hyder, 2010
[19] Jackel, 2005

- ❑ Companies are trending toward using sustainable packaging as a marketing tool

Prominent companies are using landfill gas for energy:

Current industries using LFG include:

Auto Manufacturing	Pharmaceutical	Consumer Electronics
Chemical Production	Cement & Brick	Paper production
Food Processing	Wastewater Treatment	Prisons & Hospitals

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Duration Of Biodegradation Of Plastics In Landfills Vs. Compost Facilities

Must plastic biodegrade in a landfill in the same "short period of time" as a compost facility?

There is a puzzling position in part of the environmental community which believes in order to claim a plastic material biodegradable in a landfill, at least 90% of the carbon substrate must be completely assimilated by the microorganisms present in the disposal channel within a "reasonably short period of time"? Our simple question is, why?

One reason presented is the safety concern with partially degraded plastic in landfills. The argument is if it takes plastic a long time to biodegrade (over a year per proponents of biodegradation in composting sites) it poses an environmental hazard. The belief is that certain components of biodegrading plastic could leach into the soil and get into ground water. However, this is an inaccurate assumption. All landfills built since 1993 conform to the October 1991 Criteria for Municipal Solid Water Landfills (40 CFR Part 258) under the Resource Conservation and Recovery Act (RCRA). These criteria include subsurface migration controls and require liners to be in place that do not allow material to leach into the soil.

So where did the notion of time come from? The answer is from industrial composting sites. In these cases, the compost site must make room for the next batch of incoming organic waste, which creates a need for a defined time for biodegradation. However, for a disposal channel such as a landfill where anaerobic (without oxygen) biodegradation takes place, it really does not make sense to define and impose a similar compressed time frame for plastics to biodegrade. Reason would seem to indicate, since plastics stay in landfills for a very long time – hundreds of years, it would be a true environmental win if an additive embedded in plastic would allow it to biodegrade completely within several years and the resulting methane gas could be used as a source of energy.

Composing sites follow a very regimented procedure (controlling temperature and moisture) making it relatively easy to follow standards. Specifications and test methods are defined and designed to measure the rate of biodegradation for compostable plastics (60% loss of carbon for homopolymers and 90% for copolymers in 180 days). Every landfill on the other hand is different. Even the new bioreactor landfills are different from each other. How can one say that plastic in these varying microbial and humidity conditions must biodegrade within a prescribed (and short) period of time? It is precisely why a specification similar to ASTM D6400 has not been written for biodegradation in landfills.

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