The Vinyl Institute
A Division of The Society of The Plastics Industry, Inc.

Roy T. Gottesman
Executive Director

March 21, 1990

TO: The VI Health, Safety & Environment Committee

RE: Plastic Pellets in the Environment

I attach a letter from Phil Stapleton, Assistant Technical Director, Issues Analysis for SPI dealing with the above subject.

As you can tell, EPA will be taking a close look at pellet discharges into water streams. If you have plants that discharge into waterways where this might be a problem, I would strongly urge you to evaluate any mitigation measures that may be necessary.

Sincerely yours,

Roy

RTG/pmb

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Wayne Interchange Plaza II • 155 Route 46 West • Wayne, NJ 07470 • (201) 890-9299

The Society of the
Plastics Industry, Inc.

1275 K Street, N.W., Suite 400
Washington, D.C. 20005
(202) 371-5200
FAX 371-1022

TO: OHEIC

FROM: Phil Stapleton - Assistant Technical Director, Issues Analysis

RE: Plastic Pellets in the Environment

DATE: March 16, 1990

Th.. memo is to update you on recent and upcoming activities concerning the plastic pellets issue.

In February, EPA released its report to Congress entitled, "Methods to Manage and Control Plastic Wastes". The executive summary of EPA's report is attached. The report identifies plastic pellets as articles of concern because they have been found in high concentrations in the marine environment and they pose ingestion risks to marine life. Although the specific routes to the marine environment are not known, EPA assumes that pellets are released from plastics manufacturing and fabrication plants, as well as from transportation.

As described in the executive summary, EPA has conducted a limited number of harbor and beach surveys which indicate that plastic pellets are "ubiquitous in the environment" in U.S. coastal areas. EPA intends to conduct additional harbor and beach surveys this year.

On February 21, Ron Bruner, Pat Toner, Lew Freeman and I met with David Redford, EPA's project manager for the harbor and beach surveys. At that meeting, David Redford described the work completed thus far by EPA and asked for SPI's cooperation in carrying out an additional work assignment. The purpose of this work assignment would be to assess possible sources of plastic pellets released to the environment. EPA would like to conduct site visits to resin manufacturers, processors, and pellet transporters in various parts of the country in order to observe pellet handling and storage procedures, stormwater runoff systems, and pellet disposal methods. EPA would also like to interview facility operators to gauge their level of understanding of the pellet problem and obtain recommendations for controlling releases. David Redford has been invited to address the OHEIC meeting on April 5-6 to discuss EPA's work and to line up plant sites for EPA's site visit team.

It appears that EPA will probably act on the pellet issue after additional study, with or without our cooperation. At this time, David Redford seems to be focussing on stormwater discharge systems and pellet shipping containers as prime areas where pellet releases could be controlled. It may still be possible to institute voluntary programs to address the plastic pellets issue; but unless this occurs, it is likely that EPA will act independently. EPA action could take the form of wastewater or stormwater discharge permit conditions for resin producing and processing plants, among other options.

We plan to discuss the plastic pellets issue at the upcoming OHEIC meeting. In the meantime, if you have any questions or comments, please contact me.

PJS/rc
Attachment

cc: Pat Toner
Lew Freeman
Ron Bruner
Maureen Healey
Joe Pattok
Richard LaLumondier
John Dubeck - Keller & Heckman

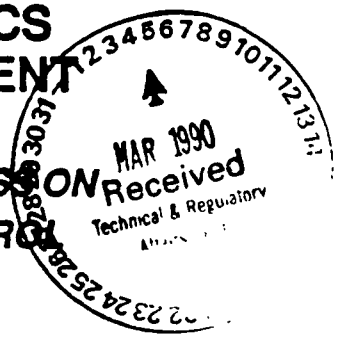
United States Environmental Protection Agency | Solid Waste and Emergency Response (OS-305) | EPA/530-SW-90-017B February 1990

Office of Solid Waste

EPA

Environmental Fact Sheet

THE FACTS ABOUT PLASTICS IN THE MARINE ENVIRONMENT



FROM EPA'S *REPORT TO CONGRESS ON METHODS TO MANAGE AND CONTROL PLASTIC WASTES*

Discarded plastic products and packaging make up a growing proportion of municipal solid waste. By the year 2000, the amount of plastic we throw away will increase by 50 percent. Current volume estimates for plastic waste range from 14 to 21 percent of the waste stream. By weight plastics contribute seven percent, and less than one percent of plastic waste is currently recycled. Additionally, some plastic items end up as litter that poses ecological risk to the marine environment and aesthetic and economic loss. The identification of the types, sources and impacts of plastic marine debris is necessary for the evaluation of solutions.

Plastics Found in the Marine Environment

The majority of items collected during EPA's harbor surveys and beach cleanups are plastic. These efforts have identified a wide variety of plastic items, including plastic pellets (the raw materials plastic processors use to make plastic products); plastic bags and sheeting; fishing gear (e.g., nets, traps, and monofilament lines); tampon applicators, condoms, beverage ring carriers, plastic straps, and a variety of plastic packaging.

Where Does this Plastic Come From?

Plastic wastes come from both marine-based and land-based sources. Possible land-based sources include plastic manufacturers and processors, sewage treatment systems, stormwater runoff, solid waste

disposal activities (e.g., barges), and litter. Marine-based sources include: intentional waste disposal from vessels (now prohibited by Coast Guard regulations); waste disposal from off-shore oil and gas platforms; and accidental loss of fishing gear.

The major sources vary from region to region. For example, fishing gear loss is a major concern in the North Pacific, while plastic from sewer-related activities is a problem in the Northeast.

Problems Caused by Plastic Wastes

The major impacts of marine plastics are entanglement and ingestion by marine animals, and aesthetic and economic losses caused by lost fishing gear and by litter on beaches.

Entanglement affects seabirds, seals, whales, turtles, fish and crustaceans, and may have an adverse impact on the populations of endangered species. Fish continue to be caught and killed by lost "ghost" nets.

Ingestion of plastic wastes is particularly serious among birds and turtles, who mistake plastic items for food. Impacts include injury to the digestive tract, intestinal blockage and starvation.

Aesthetic and related economic losses associated with marine debris may be severe (e.g., loss to the tourism and fishing industries). For example, beach debris incidents in New Jersey and New York in 1987 and 1988 cost an estimated $1 billion.

Where Can I Find Additional Information?

Call EPA's RCRA/Superfund Hotline for a free copy of the Executive Summary of the *Report to Congress on Methods to Manage and Control Plastic Wastes* (EPA/530-SW-89-051A). The toll-free number is 1-800-424-9346, or TDD 1-800-553-7672 for the hearing impaired. In Washington D.C., the number is 382-3000 or TDD 475-9652. The Hotline is open from 8:30 a.m. to 7:30 p.m. EST, Monday through Friday. Ask the Hotline for information on ordering the full report.

EPA/530-SW-89-051a

REPORT TO CONGRESS

Methods to Manage and Control Plastic Wastes

EXECUTIVE SUMMARY

February 1990

United States Environmental Protection Agency
Office of Solid Waste
Office of Water

Printed on Recycled Paper

EXECUTIVE SUMMARY

Plastics symbolize disposability, yet the issues associated with their disposal are both persistent and controversial. Local communities as well as Congress have begun to consider regulations to restrict sales of products in plastic packaging or to require that some plastic products be degradable. To respond to public concern regarding the impact of plastic wastes, as well as to highlight the best means of handling these wastes, Congress asked the U.S. Environmental Protection Agency (EPA) to investigate both the role plastics play in the solid waste stream and the management methods available for disposing of these wastes.

As the plastics industry has grown, the role of plastics in municipal solid waste has become both more obvious and more worrisome. U.S. production of plastics has leaped from 3 billion pounds in 1958 to 57 billion pounds in 1988 -- an annual average growth rate of 10.3%. That increase has been fueled by the advantages that plastics hold over traditional materials such as wood and glass: design flexibility (they can be modified for a wide variety of end uses), high resistance to corrosion, low weight, and shatter resistance. In addition, plastics are well suited to changing U.S. lifestyles with their increased requirements for convenience and speed, especially in food preparation. That market demand is reflected in the size of the plastic packaging industry (which produces, for example, polystyrene containers for fast food and trays for microwaveable dinners). Packaging is the single largest plastics market sector, with one-third of all sales.

Plastics are resins, or polymers, that have been synthesized from petroleum or natural gas derivatives. Additives are used to modify or enhance the properties of these resins -- for example, to make the plastic more malleable -- and thus to create a wide array of products meeting a wide variety of needs. Though hundreds of resins have been created for specialty purposes, five resins account for nearly 60% of all U.S. plastics consumption (see Table ES-1). Polyethylene terephthalate, although very familiar to consumers as the plastic in soft drink bottles, accounts for less than 3% of U.S. plastic production.

This report focuses on plastic waste in the municipal solid waste stream, that is, post-consumer plastic waste. The only non-municipal solid waste issue considered here is the disposal of plastic pellets, which are the raw materials used in the processing and manufacture of plastic products. These pellets are included because they have been found in high concentrations in the marine environment and they pose ingestion risks to marine life.

Plastics in the Marine Environment

Other plastic products disposed of or lost at sea also pose risks to marine life or human health, not to mention the aesthetic (and related economic) damage they cause. The articles of concern identified by EPA (besides pellets) are: pieces of polystyrene, syringes, beverage ring carrier devices, uncut plastic strapping, plastic bags and sheeting, plastic tampon applicators, condoms, fishing nets and traps, and monofilament lines and rope.

Table ES-1
PLASTIC RESIN CHARACTERISTICS, MARKETS, AND PRODUCTS

Resin Name	Characteristics	Primary Product Markets	Product Examples
Low-D nsity Polyethylene (LDPE)	Moisture-proof; inert	Packaging	Garbage bags; coated papers
Polyvinyl Chloride (PVC)	Clear; brittle unless modified with plasticizers	Building and construction; packaging	Construction pipe; meat wrap; cooking oil bottles
High-Density Polyethylene (HDPE)	Flexible; translucent	Packaging	Milk and detergent bottles; boil-in-bag pouches
Polypropylene (PP)	Stiff; heat- and chemical-resistant	Furniture; packaging	Syrup bottles; yogurt tubs; office furniture
Polystyrene (PS)	Brittle; clear; good thermal properties	Packaging; consumer products	Disposable foam dishes and cups; cassette tape cases
Polyethylene Terephthalate (PET)	Tough; shatterproof	Packaging; consumer products	Soft drink bottles; food and medicine containers

The route each of these plastic articles follows when ntering the marine environment is not precisely known; however, the major land-based sources include combined sewer overflows and sewage treatment plants, stormwater runoff, and plastic manufacturing and fabrication and related transportation activities (for pellets). The major marine-based sources include commercial fishing vessels and offshore oil and gas platforms. Littering (on land and from vessels) also contributes to marine debris. EPA's major actions regarding marine debris include:

- Ensuring that all permits for combined sewer overflow discharges include technology-based limitations for the control of floatable discharges
- Sampling a number of combined sewer overflow and stormwater discharges in late 1989 to pinpoint which articles are frequently released from these discharges.
- Development of a Report to Congress on stormwater discharges. Floatable discharges will be included in this report. The report is expected to be completed by mid-1990.
- Continuing to support and conduct a limited number of harbor and beach surveys and cleanup operations.
- Development of an educational program for consumers that describes the proper method for disposing of household medical waste.

Plastics in the Municipal Solid Waste Stream

In the municipal solid waste stream, two areas have generated concern related to plastics waste disposal: 1) the volume of plastic wastes produced, and 2) possible environmental impacts of plastics disposal.

Plastic waste accounts for a large and growing portion of the municipal solid waste stream. While contributing only 7% by weight to municipal solid waste, plastics make up an estimated 15-21% of municipal solid waste volume. Figure ES-1 describes how plastics compare to other components of the waste stream and Figure ES-2 describes how the municipal waste stream is managed. Paper and yard waste make up a large proportion of the waste. Because of short product lifetimes (for example, fast food containers may only be used for a few minutes) and the size of the market segment, packaging makes up a large percentage of the plastics in the waste stream. Other components of the plastic waste stream include nondurable consumer goods such as pens and disposable razors and durable goods such as computer and appliance casings.

Most post-consumer plastic waste, like municipal solid waste in general, is landfilled. Only about 1% of plastic waste is recycled. The effect of the volume of plastic wastes on the critical problem of this country's landfill dilemma is currently receiving a great deal of attention. Available landfill capacity is rapidly shrinking: In the next five to seven years, almost half of municipal solid waste landfills will reach capacity, many more are expected to close for reasons such as increasingly stringent regulations on their operations, and few new landfills will be sited.

Figure ES-1

COMPOSITION OF THE MUNICIPAL SOLID WASTE STREAM FOR 1986

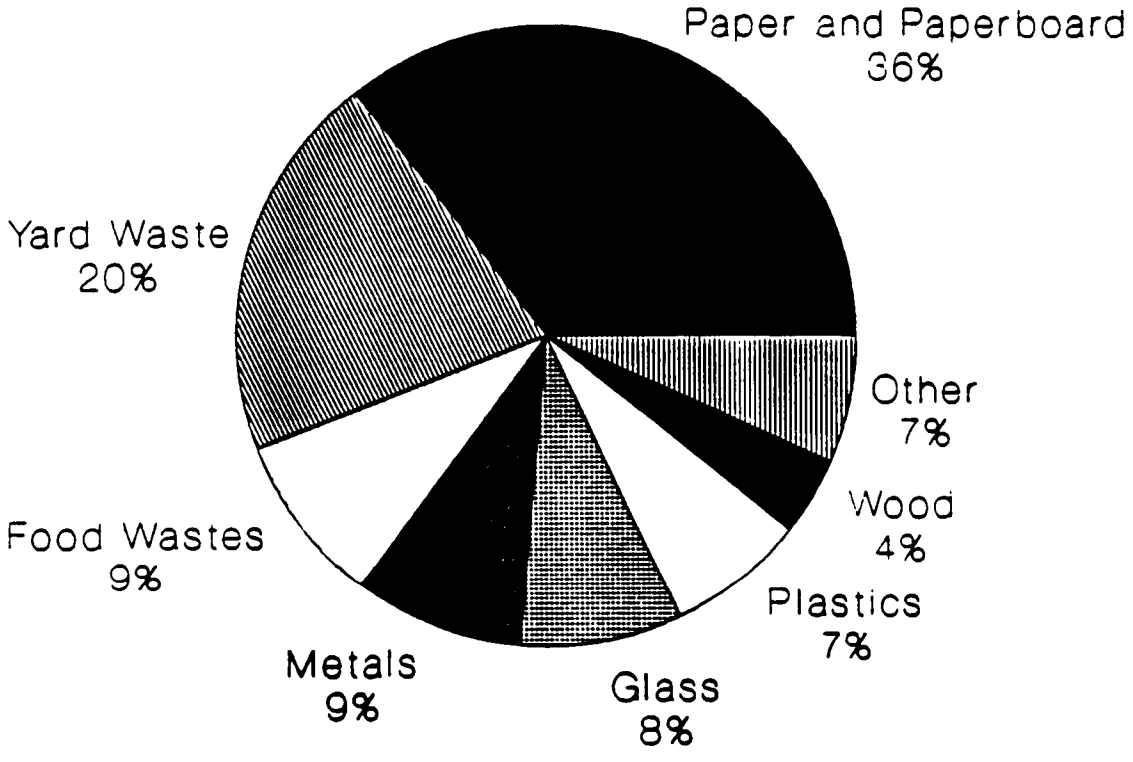
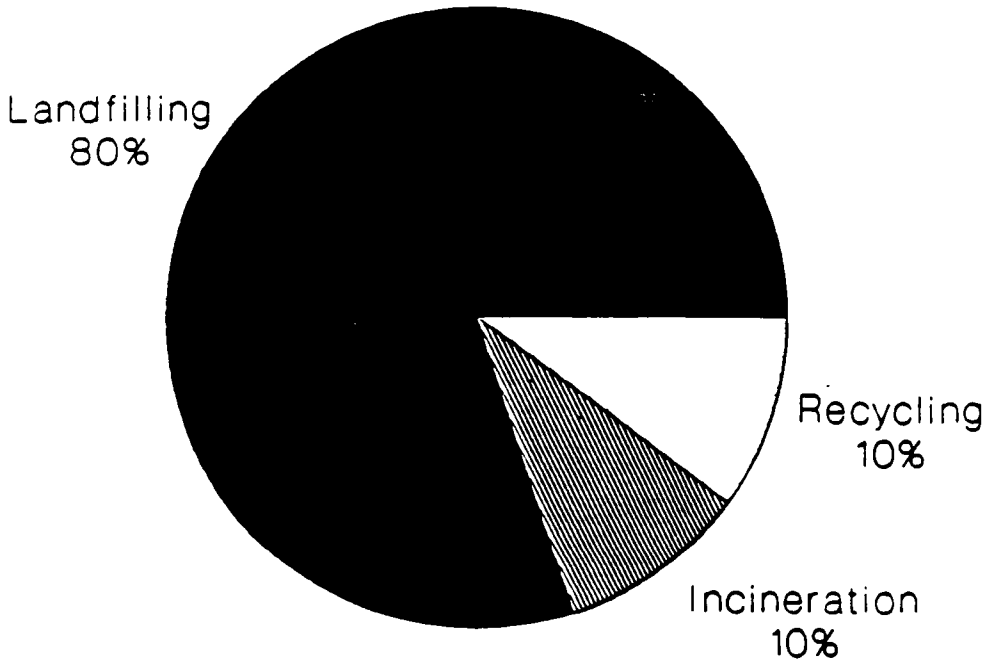


Figure ES-2

DISPOSITION OF MUNICIPAL SOLID WASTE
IN THE UNITED STATES



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The added burden of plastics on landfill capacity is due to the large and growing amount of plastic waste now being produced, not to differences in the speed of degradation of wastes. While it is true that plastic wastes are very slow to degrade in landfills, other wastes, such as paper and food waste, are also slow to degrade. In fact, recent landfill excavations have identified 30-year-old readable newspapers and recognizable carrots and cabbages. Degradation of waste, therefore, has little effect on landfill capacity.

The plastic products in municipal solid waste consist of plastic resins, or polymers, and a wide variety of additives incorporated to impart desired product characteristics (color, flexibility, resistance to microbes, etc.). Plastic polymers are large but simple molecules that are extremely resistant to degradation. Their potential contribution to landfill leachate is not an environmental concern. Some additives, however, include toxic constituents (e.g., lead and cadmium). Data are too limited to determine whether plastic additives contribute significantly to leachate produced in municipal solid waste landfills.

Incineration of municipal solid waste is also affected by plastics. For example, plastics have a much higher heat content than most other municipal waste constituents, and so contribute significantly to the value of municipal solid waste as fuel for waste-to-energy boilers. The primary issue related to plastic incineration is not the capacity of available incinerators but the possible environmental impacts of incinerating certain types of plastics. Controversy surrounds the question of the contribution of halogenated plastics (e.g., polyvinyl chloride) to emissions from municipal waste incinerators. Emissions of particular concern are acid gas emissions and dioxin/furan emissions. The U.S. Food and Drug Administration is analyzing these issues. Final conclusions await completion of these additional analyses.

In addition, plastic additives containing heavy metals (e.g., lead and cadmium) contribute to the metal content and possibly the toxicity of incinerator ash. Additional investigation is needed to determine with greater accuracy the impact of plastic additives on incinerator ash toxicity (i.e., whether lead- and cadmium-based plastic additives contribute to leachable lead and cadmium in ash).

To deal with the issue of plastic waste disposal, EPA is exploring the efficacy of several options: source reduction, recycling, and making plastics degradable.

Source Reduction

Source reduction is defined to include activities that reduce the amount or toxicity of all waste generated. Source reduction can be achieved in a number of ways by both consumers and industry. For example, industry can modify the design of a product or package to decrease the amount of material used, use economies of scale with larger size packages or product concentrates, make materials more durable so that they may be reused, or substitute away from toxic constituents in products or packaging. Consumers can reuse products and packages as much as possible, avoid the use of disposable items, and try to buy concentrates or other products that require less packaging.

It is difficult to consider source reduction of plastic waste or any single component of the waste stream in isolation because the goal of source reduction is to reduce the amount or toxicity of the entire waste stream, not just of one component. Attempts to reduce the amount of one component may actually cause an increase in another component and possibly in the entire waste stream. For example, while replacing a plastic cup with a paper cup reduces the amount of plastic waste produced, it may not reduce the total amount of waste produced, especially when the wastes associated with the entire production process are considered (e.g., if emissions to air and water during paper production are greater than those from plastics production).

For this reason, source reduction actions need to be carefully examined. In cases involving substitution of materials, an evaluation should be completed that examines the impacts of the substitution over the entire product lifecycle -- from production to disposal. For example, the changes in natural resource use, energy use, consumer safety and utility, and product disposal that may result from the substitution of another material for plastic should be considered. With this precaution, source reduction efforts that merely shift environmental problems from one waste stream to another (e.g., from the municipal solid waste stream to the industrial waste stream) will be avoided.

EPA's major actions regarding source reduction include:

- A grant to the Conservation Foundation to convene a national steering committee of municipal solid waste source reduction experts. These experts will discuss source reduction opportunities and incentives to promote source reduction, including development of recommendations for selection criteria for a corporate source reduction awards program.
- Development of a model for conducting lifecycle evaluations of products and materials.
- Analysis of the environmental impact of six different packaging materials and the effects of various public policy options that are aimed at altering the mix of packaging materials.
- Evaluation of the potential substitutes for lead and cadmium-based additives.
- Support for the Coalition of Northeastern Governors (CONEG) in developing preferred packaging guidelines and a regional framework for encouraging source reduction actions.
- Examination of the potential incentives and disincentives to source reduction of municipal solid waste.

Recycling

Plastics recycling is in its infancy. Efforts under way right now by industry and State and local governments are numerous and varied. Thus, the information presented in this report represents the current state of plastics recycling and may be quickly out of date. It is very difficult to predict the future of plastics recycling because so much depends on the outcome of research efforts now underway and on the success of recycling programs targeted at a variety of municipal solid waste components in addition to plastics.

Most plastic recycling efforts to date have focused on polyethylene terephthalate (PET) soft drink bottles and to a lesser extent on high-density polyethylene milk jugs. While approximately 20% of all PET soft drink bottles are recycled, only about 1% of all post-consumer plastic waste stream is currently recycled.

A major technical hurdle for plastics recycling to overcome is the heterogeneity of plastics. There are many different resins, and the modification of resins with additives multiplies the number of distinct plastics in the waste stream. Furthermore, many plastic products (e.g., soft-drink bottles, packaging materials) contain more than one resin. Separation of all of these resins presents some technical difficulties.

The success of widespread plastics recycling may be dependent on developing technologies to separate mixed plastics into homogeneous resins or on increasing the markets for mixed recycled resins. Relatively homogeneous resins present the most economic advantages for recycling because the resulting products compete with virgin resins. Mixed plastics can be processed only into relatively low value items (such as plastic lumber, parking lot bumpers, and plastic flower pots), and it is questionable whether the markets for these products will economically support major recycling efforts. Homogeneous plastics recycling and mixed plastics recycling offer contrasting advantages and disadvantages in terms of their long-term impacts on waste disposal and their ability to capture a large percentage of the plastic waste stream.

Like other recyclable components of municipal solid waste, plastics also face the requirement that effective collection programs be implemented to divert them from municipal solid waste before disposal. There are several methods of collection, including curbside collection, drop-off centers, buy-back centers, and container deposit legislation (i.e., "bottle bills"). Curbside collection and bottle bills have received the most attention:

Curbside collection of plastics (and other recyclables such as aluminum cans, glass containers, and newspapers) can capture a great variety and amount of plastic waste. Container deposit legislation (originally adopted to control litter, not increase recycling), has proven effective at diverting plastic soft drink containers from disposal; however, soft drink bottles represent only a small percentage (approximately 3%) of plastic wastes. Thus, this method, as currently implemented, will not divert significant amounts of plastic wastes.

These two collection strategies are interrelated. For example, recycling officials have raised concerns that container deposit systems may impair local efforts to recycle plastics and other materials (e.g., newspapers, cans, etc.) by removing the most valuable revenue generating

materials from curbside collection programs. Waste management officials need to carefully weigh the costs and benefits related to each strategy and the relationship between the two choices before selecting a collection mechanism.

EPA's major actions regarding plastics recycling include:

- Technical assistance and general information to the public on plastics recycling through a municipal solid waste clearinghouse and a peer match program.
- Examination of potential incentives and disincentives to recycling of municipal solid waste components.
- Encouragement of the plastics industry to continue to research and provide technical and financial assistance to communities on plastics collection, separation, processing, and marketing.

Degradables

Finally, there has been a significant amount of legislative activity at the Federal and State levels regarding degradable plastics. Various mechanisms are technically viable for enhancing the degradability of plastic, but biodegradation and photodegradation are the principal mechanisms currently being explored and commercially developed. The most common method for enhancing the biodegradability of plastics has involved the incorporation of starch additives. Production of photodegradable plastics involves the incorporation of photo-sensitive carbonyl groups or the addition of other photo-sensitive additives.

Before the application of these technologies can be promoted, the uncertainties surrounding degradable plastics must be addressed. First, the effect of different environmental settings on the performance (e.g., degradation rate) of degradables is not well understood. Second, the environmental products or residues of degrading plastics and the environmental impacts of those residues have not been fully identified or evaluated. Finally, the impact of degradables on plastic recycling is unclear.

EPA does not believe that degradable plastics will help solve the landfill capacity problems facing many communities in the U.S. However, there may be potentially useful applications of this technology, including agricultural mulch film, bags for holding materials destined for composting, and certain articles of concern in the marine environment (e.g, beverage container rings). The acceptability of these uses depends upon the environmental and aesthetic impacts of the residues left by the degrading plastics.

EPA's major actions regarding degradable plastics are:

- Two major research efforts on degradable plastics evaluating the impact of different environmental settings and the effects of degradable plastics on post-consumer plastics recycling.

- Encouragement of manufacturers of degradable plastics to generate and make available information on the performance and potential environmental impacts of their products in different environmental settings.

- Development of rules mandated by Title I of the 1988 Plastic Pollution Control Act, which requires that beverage container ring carrier devices be made of degradable material unless such production is not technically feasible or EPA determines that degradable rings are more harmful to marine life than nondegradable rings.