

**ALL**

**About**

**PLASTIC**



## INTRODUCTION

Plastic is so common today that it's difficult to imagine what life would be like without it. Since plastic was first mass produced almost 100 years ago, its uses have multiplied. It has made life more convenient, more sanitary, safer, and cheaper. Plastic has forever changed our lives.

This sounds good until you consider that plastic never really goes away. It can last 100 to 1,000 years -- or longer. As a result, plastic is piling up in the environment, absorbing toxic chemicals along the way. Ultimately, plastic gets into the food web, threatening the planet and every living organism.

In Indiana County, the first recycling program was started by a group that called itself "Pollution Solution." At the time, recycling was not mandatory. The non-profit organization was totally run by dedicated volunteers.

Having secured a location to collect recycled materials (courtesy of the Indiana County Commissioners), the volunteers opened for business. They also found businesses that would buy and re-use the recycled materials.

Today, recycling is the responsibility of the Indiana County Solid Waste Authority which was established in 1988 by PA Act 101.

This booklet is designed to show the magnitude of today's problem and to encourage *you* to become involved in finding solutions.

Together we **can** make a difference.

Environmental Issues Committee --  
Vera Bonnet, Ellen Chinn, Katie Farnsworth,  
Don Lancaster, Cindy Rogers

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DuPont advertisement. Used with permission.

## THE EARLY PLASTICS INDUSTRY

Plastic was invented in the late 1800s by chemists who were looking for a durable material suitable for various uses. Early plastic goods included “nylons” which became a fashion statement for the modern woman in the 1920s and 30s.

Later, during World War II, plastics were used to produce lightweight weapons and parachutes. Saran Wrap was also a WWII invention!

After the war, chemical companies like Du Pont, Dow Chemical, Monsanto and Union Carbide launched massive advertising campaigns promoting the new product. “Better Living Through Chemistry” became a well-known slogan.

Eventually, polyester clothing became a cheap substitute for natural fibers like wool and cotton. Chemical engineers set about creating a wide array of new products, from car parts, to vinyl siding and drainage pipes, to phones, rugs, clothing, toothbrushes and the universal plastic bottle.

While plastics can be made from agricultural products like soy, corn and hemp, most plastics today are made from crude oil or ethane that is found in natural gas.

## MAKING PLASTICS FROM NATURAL GAS LIQUIDS

Our local Marcellus Shale deposits have an unusually high proportion of ethane gas (10 –15%). As a result, western Pennsylvania has become particularly attractive to plastics manufacturers. But to convert ethane into plastic requires a series of chemical and refining processes.

When oil drillers find ethane, it is generally mixed with other gases, including the methane that is used to heat our homes. Until recently, these gases were flared off, because there was no easy way to transport the gas to a facility where it could be recovered.



*Gas flaring at a drill site in Indiana, PA. Today, the gases are captured for use in making plastic products.*  
Photo by Vera Bonnet

In order to separate the gas mixture into its component parts, it must be exposed to extremely low temperatures (approximately -148° Fahrenheit). At this temperature, the gases become liquid and the ethane can be separated out of the mix. The liquid ethane is then shipped to a “cracker plant” to be converted into plastic.

## THE MARCELLUS SHALE EFFECT

Until recently, the chemical industry was concentrated on the Gulf Coast where oil and gas deposits were discovered decades ago. But recently, the Gulf Coast has become more susceptible to “extreme weather events” (namely hurricanes and sea level rise), and this has inhibited further expansion.

<https://www.fractracker.org/2018/12/storing-natural-gas-liquids/>

Now, with the abundant ethane to be found in the Shale Crescent – as the Marcellus Shale area is known in the industry – chemical companies have settled on this area for the development of the plastic industry. The upper Ohio Valley is already home to chemical companies such as PPG, Dow Chemical and BASF.

In addition, Pennsylvania has given massive subsidies to persuade Shell Oil Company to build the cracker plant in Beaver County. (Shell Oil is a subsidiary of Royal Dutch Shell, one of the largest oil companies in the world.) The company received a fifteen-year tax amnesty, and an additional tax break that will grant Shell a \$2.10 credit for every gallon of ethane it purchases from Pennsylvania-based natural gas drillers.



*Beaver County Cracker Plant as of September 2018* Courtesy Marcellus Air

## THE CRACKER PLANT – FROM GAS TO NURDLES

The Beaver County plant will be supplied by a proposed “Falcon” pipeline to bring ethane to the facility from Houston, PA. (Two other branches will run through Ohio.) The ethane pipeline was approved in December, 2018 and construction is scheduled to begin this year. Meanwhile, the cracker plant is already taking shape on the Ohio River.

When complete, the cracker plant will have seven high temperature furnaces where the raw ethane molecules are converted into molecules of ethylene. The ethylene molecules are then chemically treated to bond with each other to form long chains of polyethylene and other plastic materials.

Propane gas will be separated out in a distilling tower to operate an on-site co-generation plant. The non-marketable gases will be flared off. The three polyethylene production lines will be serviced by shipping and receiving facilities, warehouses and various labs and administrative buildings.



*Plastic pellets (aka “nurdles”) are produced in the cracker plant. These will be shipped to other facilities to be formed into plastic products – from drain-pipes to water bottles.  
Photo by Vera Bonnet*

The final product of the cracker plant will be tiny plastic pellets, known in the industry as “nurdles.” Easier and safer to transport than flammable, compressed gas, these solid pellets are shipped to manufacturers. There they will be melted down and treated with colorants and various other chemicals to produce an end product suitable for various everyday uses.

## POLLUTION STARTS AT THE WELL-HEAD

As in every industry, plastic manufacturing impacts our environment. The hazards involved during fracking operations, and those faced by the petrochemical industry have been covered extensively. <https://www.shalepalwv.org/wp-content/uploads/2018/12/2018-LWVP-Shale-Resource-Guide.pdf>

But the processing continues even after the nurdles are shipped from the cracker plant. To give each product the desired final qualities – durability, flexibility, color, etc. -- requires the addition of a slurry of chemical dyes and additives.

Plastic “microbeads” are added to many cosmetic products such as toothpaste, soap and facial scrubs. Smaller than nurdles, these small beads absorb toxic chemicals and pesticides from polluted waterways, and eventually wind up in the food chain. (The good news is that some states are working to ban the use of microbeads.)

<https://www.ewg.org/release/california-poised-ban-toxic-microbeads-cosmetics>

Whether you are a worker at a plastics plant or a consumer, some form of chemical exposure is almost inevitable, either through inhalation (what we breathe), ingestion (what we eat and drink), or dermal exposure (what we touch). (CIEL Powerpoint, 2018)

And despite the best precautions mandated by state and federal agencies, accidents happen. Commercial ships carrying shipping containers full of nurdles have been lost at sea. Pellets have been found in the stomachs of fish and birds, endangering the animals and the entire food chain.

*These symbols for separating plastic products help recyclers sort plastics made with similar chemical additives.*



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## SOME PLASTIC FACTS

- 8% of oil / natural gas liquids are converted into plastics:
    - 1/3 are used in toys, furniture, appliance housings and cars
    - 1/3 are used for construction
- 

### PLASTIC WASTE – FROM TINY FIBERS TO FLOATING ISLANDS

The useful life of plastic bottles and other plastic products is very short. How long does it take to drink a bottle of water? But a plastic bottle or plastic bag can live on for months and years – and even centuries!

#### **MICRO-FIBERS**

Polyester clothing like fleeces release plastic fibers each time they are washed.

As a result, micro-fibers are found in streams and lakes everywhere.

Like micro-beads, micro-fibers are barely visible to the eye, and they do not degrade like plant or animal fibers.

Entering the food chain, they contaminate fish and wildlife, as well as drinking water for human consumption.

After plastics are discarded, they do not bio-degrade because bacteria and other micro-organisms in the environment can't break them down.

As a result, plastics often end up by the side of a road, and eventually in our rivers and streams, and finally in the world's oceans (National Geographic, June 2018) In the U.S., awareness of these problems is growing, and individuals, businesses and governments are taking action to reduce or re-use plastics, or to switch to other materials.

In less-developed countries, however, demand for plastic products is still strong – and growing stronger! India is one of the largest consumers of plastic products. Today, most plastics made in the U.S. are geared for sale in developing countries.

## ENVIRONMENTAL IMPACTS OF PLASTICS

Some would argue that plastic positively affects the environment by making life better. For instance, cars are an essential and necessary part of our current lives. By using plastics to make cars lighter, they use less fuel and emit less carbon dioxide.

In our society, products range from critical medical devices to more common uses such as bags, cups, straws, balloons, flooring and a multitude of everyday items, including clothing. However, there is a price to pay for these conveniences. Problems may be as simple as plastic litter clogging storm drains and causing flooding.

Or the problems may be more complex. Chemicals that are used in manufacturing of plastics (like xylene, ethylene oxide and benzene) can impact our air, land and water, and in turn, result in harmful health consequences for people and animals.

With so much plastic being thrown into landfills, these harmful chemicals can leach into the soil, reaching into groundwater. Meanwhile, plastics in the oceans have been ingested by marine animals, resulting in biological changes, injury or death. Floating in the oceans, plastics can transport invasive species to new locations.

One solution for reducing the environmental impact of plastic waste is to redesign the material to speed decomposition. To date, scientists have not found a cost-effective and timely solution to these problems.

An innovative way to decrease use of plastics has been effective in Germany where manufacturers are required to pick up all discarded packaging. This has had the effect of encouraging industry to reduce its use of plastic in packaging.

And finally, everyone can do their part by refusing, reusing and recycling plastic.

## TAKING ACTION – SOME EXAMPLES

### BUSINESS –

- Polo, a division of Ralph Lauren, is marketing a polo shirt made entirely from plastic bottles. (USA Today, April 18, 2019)  
Adidas plans to use only recycled polyester in its shoes by 2024. <https://www.ft.com/content/73ca70d8-84e1-11e8-96dd-fa565ec55929>
- Trigon Plastics (Lebanon County) converts recycled plastics into “poly lumber” and other products. In Clarion, Advanced Drainage Systems (ADS) uses 40% recycled plastics to make drainage pipes.
- Walmart, Pepsi, and Ikea to name a few, have committed to using only reusable or recyclable packaging by 2025.  
(Associated Press, 2/21/18)

### GOVERNMENT –

- Thirty years ago Pennsylvania passed Act 101 requiring municipalities of over 10,000 people to recycle. Today, more than 94% of Pennsylvania residents have access to recycling. And recycling has created over 66,000 jobs!
- Ten states have passed container deposit legislation, popularly called “bottle bills.” These may include bottles, cans, or jars made of glass, metal, or plastic. Prices vary between \$.05 and \$.10
- The European Parliament approved a ban on single-use plastics, by 2021. The law also strengthens provisions to ensure that companies pay to clean up their pollution.  
[www.ecowatch.com/europe-plastics-ban-2633124406.html](http://www.ecowatch.com/europe-plastics-ban-2633124406.html)

### CONSUMERS – THE THREE R’s

**Reduce**

**Reuse**

**Recycle**



## REDUCING YOUR PLASTIC FOOTPRINT

This strategy requires some planning. But don't feel overwhelmed. Start by taking a few steps to get you going, then add more actions as you get into the habit. Soon it will become second nature.

The biggest impact you can make is to refuse single-use plastics and packaging. By analyzing your usage you can replace straws, water bottles and other "disposable" plastic items with plastic-free reusable items.

<b>Refuse Single-Use Plastic Products</b>	<b>Immediate Action</b>
Plastic bags	Bring your own reusable cloth bags.
STOP buying bottled water	Use your own container made of glass or metal.
Plastic or plastic-lined hot beverage cups/lids	Carry your own mug made of glass, ceramic or stainless steel.
Plastic food containers including Styrofoam	Carry reusable non-plastic (or reused plastic) containers.
Plastic plates/utensils	Pack a travel kit with washable/ reusable utensils and plates made of bamboo, stainless steel, or wood.
Plastic straws	Refuse straws or carry straws made of paper, bamboo or metal in your travel kit.
Plastic packaging	Choose to buy cardboard packaging when available, or no packaging at all.

## COMMUNITY ENGAGEMENT – PLASTIC WASTE AUDITS

Recycling is the last of the 3R's. If you are concerned about this issue, you are not alone. By setting an example (for instance, by using washable dishes and cloth napkins for parties and avoiding giving plastic gifts), you will find you have some kindred spirits in your community.

The fact is that less than 10% of all plastics are recycled. By engaging interested friends and neighbors, you can make an impact on the community. Decide on a community project like a plastic audit. This might involve several steps, including:

- 1. An audit of common sources of plastic pollution in the community** to determine the numbers of plastic bottles, plastic bags, straws, cups, utensils and a stream of plastic products, and where they might come from. Keep track of numbers so that you can report your results.
- 2. Evaluate and identify viable, locally sourced alternatives to the sources of the pollution.** With a little planning you can collect valuable information.
- 3. Develop a presentation showing your results. Host a screening** of informative documentaries like *Bag It* or *Plastic Paradise* as a way of getting people together to talk about the issues and possible alternatives.
- 4. Engage the community in recycling efforts and supporting locally sourced alternatives.** You may find help from an existing non-profit organization. . . or create your own "Pollution Solution." Involve your elected officials to pass a local ordinance designed specifically for your community.

## LAWS ADDRESSING SINGLE-USE PLASTICS

Three states have laws regarding single use plastics. In 2016, California became the first state in the nation to impose a ban on single-use plastic bags from major retailers. In March 2019, New York state followed suit, banning most single-use plastic bags. New York also allows individual counties to place an optional fee on paper bags. Finally, Hawaii has a *de facto* ban since its most populous counties have passed their own local rules.

<https://www.forbes.com/sites/trevornace/2019/04/23/new-york-officially-bans-plastic-bags/#7e8ad5215b77>

Some 165 municipalities across the United States have adopted a variety of similar ordinances. In Pennsylvania, the municipality of Narberth, PA passed an ordinance banning single use-plastics. However a clause appended to the 2019 budget blocks the imposition of new taxes, rules or regulations on single-use plastics until the PA Fiscal Office issues a report on the economic and environmental impact of such regulations. The final report is due on July 1, 2020. <https://philadelphia.cbslocal.com/2019/06/28/pennsylvania-blocks-all-bans-taxes-on-plastic-bags-for-at-least-one-year/>

The new measure was appended to the 2019 budget bill by legislators from the State College area, home to the world's largest manufacturer of single-use plastic bags. It will go into effect in one year, or after the PA Fiscal Office completes its study.

<http://www.pahouse.com/Vitali/InTheNews/Opinion/?id=90116>.

By signing the budget, Governor Wolf effectively reversed an earlier veto of a similar bill. Wolf had justified the veto saying that the bill violated the intent of the Environmental Rights Amendment to Pennsylvania's state constitution.

In defiance of the newly passed state law, on July 19, 2019 the Borough Council of West Chester, PA voted to approve an ordinance banning plastic bags and straws. It will go into effect after the one-year waiting period has passed. <https://patch.com/pennsylvania/westchester/west-chester-passes-ban-single-use-plastic-bags-straws>

## PLASTIC RECYCLING

What could be easier than recycling? Almost everywhere you go these days, there's a convenient bin for your empty water bottle. In Pennsylvania, statewide recycling began in 1988 with enactment of the Municipal Waste Planning Recycling and Waste Reduction Act (Act 101). It was one of the most sweeping recycling programs enacted by any state at the time.

Act 101 requires larger municipalities to "implement a source separation and collection program for recyclable materials."

It resulted in developing a Recycling Marketplace that has generated \$22.6 billion annually to Pennsylvania's economy.

<http://paenvironmentdaily.blogspot.com/2018/07/pennsylvanias-waste-planning-recycling.html>

And yet, most single-use-plastics end up in landfills. To increase participation, many municipalities have started "single stream" recycling programs. In this system, plastics, metals, glass, and cardboard are mingled together and sorted at a local recycling facility.

The plastics are then sent to a Materials Recovery Facility (MRF). Since plastics melt at different temperatures, MRF workers are hired to sort the plastics by type, before they are cleaned and made into pellets. The pellets are then melted down and used by manufacturers to make recycled items.

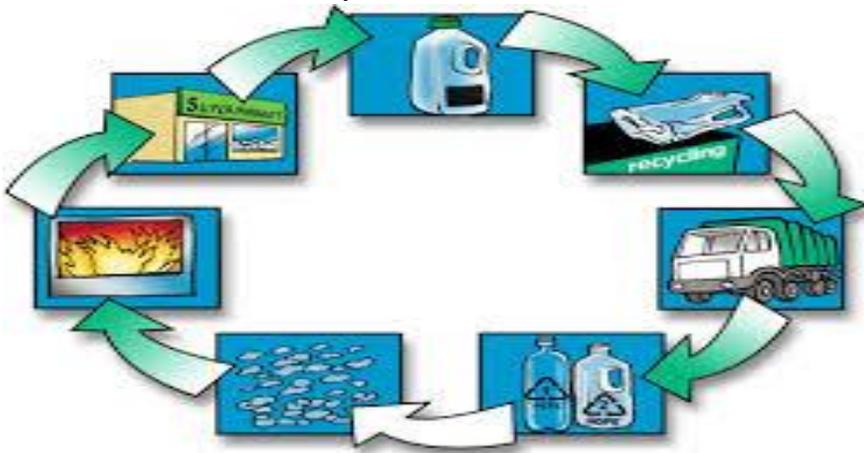


Image Credit: **BareekSudan**

## PLASTIC BY THE NUMBERS

<https://www.earthday.org/2018/03/29/fact-sheet-single-use-plastics/>

In 2016, world plastics production totaled around **335 million metric tons**. Roughly half of annual production goes into single-use products like bottles, bags, straws, and cups.

An estimated **4 trillion plastic bags** are used annually world-wide. Americans throw away **100 billion plastic bags** annually. That's about 307 bags per person! Only 1% are returned for recycling.

**Half a million straws** are used in the world *every day* and **500 billion disposable cups** are consumed *every year*.

Americans alone throw away **26 billion Styrofoam cups** every year. Styrofoam cannot be completely recycled. Most Styrofoam thrown out today will still be present in landfills 500 years from now.

The main reason for the increase in production is packaging. Plastic packaging was 42% of all non-fiber plastic produced in 2015, and it also made up 52% of plastics thrown away.

Most single-use plastics never make it to a landfill or recycling facility. Fully 32% of the yearly production of plastic packaging ends up in our oceans -- the equivalent of pouring one garbage truck of plastic into the ocean every minute. If this increases as expected, by 2050 the world's oceans could contain more plastic than fish.