TRASH TALK

Our history with trash goes back a long way. Our prehistoric ancestors simply threw the food waste, animal carcasses, etc. into heap and covered it with dirt. This was man's first version of a landfill.

With the advancement of societies came larger amounts of trash and the question of where to deposit it. Often waste was thrown into the streets, which resulted in very unsanitary conditions as well as disease. Consequently, cities began the practice of moving waste outside of inhabited areas and either burning or burying it.

Up until the dawn of industrial society the majority of waste was organic in nature because manufactured goods such as tools, furniture, clothing and household goods changed owners a number of times, passing through the entire social chain. What was considered useless by the rich, became precious for the poor.

As populations and technologies grew, so did the amount and variety of trash that was generated. In order to deal with trash municipalities organized solid waste disposal services. Great progress has been made in

the area of waste disposal. There are now a number of options, but digging a whole and burying It is still the most common.

The first modern municipal sanitary landfill in the United States was opened in Fresno, CA in 1937, underscoring the significance of waste disposal in urban society. In 1965 the Solid Waste Disposal Act created a national office of solid waste and by the mid-70's all states had some form of solid waste management regulations. In 1976, the Resource Conservation and Recovery Act divided wastes into hazardous and non-hazardous categories and directed the EPA to oversee the standards and compliance of sanitary landfills. Hazardous waste is banned from disposal in municipal sanitary landfills and dealt with separately.

Non-hazardous solid waste consists of everything else that is used and thrown away on a daily basis. Every year, the **United States** generates approximately **230 million tons of "trash"--about 4.6 pounds per person per day**. Grease-soaked pizza boxes, beer cans and banana peels can go many places after you throw them out, such as recycling centers, incinerators or even a compost pile. But more than **half** of America's garbage is bound for a landfill.

Modern landfills are **not** designed to break down waste, only to store it and manage its byproducts.

For building a municipal solid waste landfill, the ground is lined first with clay and then with a skin of flexible plastic about half an inch thick. Over this, drains and pipes collect a liquid byproduct called **leachate**, which is the contaminated fluid that trickles out of the body of the landfill.

Drained leachate is gathered in pools, allowed to settle and treated as waste water before being released. In 2008, 276 million gallons of leachate were collected from New York's landfills, according to the New York State Department of Environmental Conservation.

New scientific research from the U.S. Geological Survey details how landfill leachate, disposed from landfills to environmental pathways, is host to numerous **contaminants of emerging concern, or** (CECs).

In this national-scale study, scientists provide an assessment of CECs, in landfill leachate disposed of offsite, that has undergone treatment or storage processe, which is referred to as **final leachate**.

Final leachate samples from 22 landfills were collected and analyzed for 190 CECs including pharmaceuticals, industrial chemicals, household

chemicals, steroid hormones, and plant/animal sterols. The sampling network included municipal and private landfills with varying landfill waste compositions; geographic and climatic settings; ages of waste, waste loads, leachate production; and leachate management strategies. Scientists determined that final leachate samples contained 101 of the 190 chemicals analyzed for the study, with chemicals present in every final leachate sample collected at levels ranging from 2 nanograms per liter (ng/L) to over 17 million ng/L. The most frequently detected contaminants of emerging concern were LIDOCAINE (a local anesthetic, found in 91 percent of samples), CONTININE (a nicotine breakdown product, in 86 percent), CARISOPROLOL (a muscle relaxant, in 82 percent), bisphenol A (a component for plastics and thermal paper, in 77 percent), CARBAMAZEPINE (an anticonvulsant, in 77 percent), and N,N-di**ethyl**tolu**amide** (the insect repellant, DEET, in 68 percent). (1)

Another byproduct of concern in landfills is gas. As noted previously, landfills are not designed to break down waste, only to store it. But garbage

in a landfill does decompose, albeit slowly and in a sealed, oxygen-free environment. Because of the lack of oxygen, bacteria in the waste produce a gas referred to as landfill gas, which is highly flammable and dangerous if allowed to collect underground. This gas is composed of roughly 50 percent methane (the primary component of natural gas), 50 percent carbon dioxide and a small amount of non-methane organic compounds. Methane is a potent greenhouse gas which is 28 to 36 times more effective than carbon dioxide at trapping heat in the atmosphere over a 100-year period. (2)

Modern landfill systems collect methane in a layer of pipes placed above the solid waste layer. Some landfills burn, or FLARE, the methane to prevent pollution and explosions. Many landfills treat the landfill gas by removing the carbon monoxide, water vapor and hydrogen sulfide and then either sell the remaining methane gas or use it to produce energy,

Once the landfill has reached its maximum capacity, the owners/operators follow strict rules for final cover and closure and are required to do post-closure monitoring for a period of 30 years.

Of course we still have the age-old option of composting organic waste. Many people compost their food waste and yard waste for use in gardens and flower beds. But for the majority of Americans simply food waste is simply put down the garbage disposal, which in turn goes to the municipal water sewage treatment plant where it eventually becomes sludge. The sludge is then sterilized and often used for soil application.

Another method of managing solid waste is WtE or Waste to Energy plants. WtE is the generation of energy from waste though a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion and landfill gas recovery. According to an Advancing Sustainable Materials Management report, the United States combusted over 34 million tons of MSW with energy recovery in 2017. This account s for a small portion of US waste management. WtE has experienced slow growth due to several factors such as; WtE plants are significantly more expensive to build than landfills, typically requiring at least 100 million dollars to finance the construction with economic benefits that may take years to realize. Another factor is public opposition to these facilities. Early on WtE plants did not have adequate air emission control systems and garnered a

reputation as high polluting. Consequently, due to the expense and air quality issue, many communities were opposed to waste to energy plants.

With new technology came a new kind of waste to deal with. In 1907 Leo Baekeland invented Bakelite, the first fully synthetic **plastic**s, meaning it contained no molecules found in nature.

Throughout World War II, the military was starting to find uses for plastics. During this time the production of plastic increased in the United States by 300%. But it wasn't until 1953 that anyone figured out how to make high-density polyethylene—the plastic that's identified in the recycling system as No. 2 and that's generally used to make grocery store plastic bags.

The possibilities of plastics gave some observers an almost utopian vision of a future with abundant material wealth thanks to an inexpensive, safe, sanitary substance that could be shaped by humans to their every whim. Economic forces drive the demand for plastic goods. Cheap, light weight packaging results in higher profit margin due to a cheaper cost of shipping goods as well as less loss due to product damage. With plastics also came the ever popular single use disposable products, plastic product containers, grocery bags, etc. that provide us so much convenience.

In the 1970s and 1980s anxiety about waste increased because while so many plastic products were disposable, plastic lasts forever in the environment. It was the plastics industry that offered recycling as a solution. In the 1980s the plastics industry led an influential drive encouraging municipalities to collect and process recyclable materials as part of their waste-management systems. We all felt good about "keeping America Beautiful "

Many of us used to pain stakingly separate plastic, glass, paper and metal. Then came single-stream recycling, the system in which all paper fibers, plastics, metals, and other containers are mixed in a collection truck and then sorted by hand or by robotics at the collection facility. Never had it been easier to "do the right thing". However, since then the plastics industry has widened to include many types of plastic that don't all recycle equally and the sorters now must remove any recyclables that have food contamination or that are not actually recyclable. So in the long run much of the "recycled waste" ends up in the landfill or waste to energy anyway.

Recycling is only effective if we, the consumers, take care to know what is recyclable. Much packaging claims to be recyclable, so we think we're

doing the right thing. Unfortunately, these unrecyclable plastics will be either buried in the landfill and end up in the ocean or be incinerated at the Waste to Energy plant and end up in our air.

For the first time, researchers have published a sweeping, public, and in-depth accounting of all plastic that has ever been made in the entire world. The number defies human comprehension: 8,300 million metric tons since 1950. Of this, 6,400 million metric tons has outlived its usefulness and become waste; 79 percent of that waste is sitting in landfills or in the natural environment, 12 percent has been incinerated, and just 9 percent has been recycled. In the years from 2004 to 2017, the world had produced as much plastic as it had the in the previous half century. These statistics have made evident how quickly the production of plastic is accelerating and carrying us into the Plastic Age. (3)

Of the 6,400 million metric tons of plastic waste, 5,056 million metric tons are still in existence. It is in ocean and in the air. Most plastics in the ocean break up into very small particles. These small plastic bits are called "microplastics."

Other plastics are intentionally designed to be small. They're called microbeads and are used in many health and beauty products. They pass

unchanged through filtration systems and end up in the ocean and Great Lakes posing a great threat to aquatic life and birds which can ingest microbeads and mistake microplastics for food. When aquatic life ingests microplastics and microbeads they become a part of the food chain. On December 28, 2015, President Obama signed the Microbead-Free Waters Act of 2015, banning plastic microbeads in cosmetics and personal care products.

The media is abundant with articles and images of wildlife that has ingested or tangled itself in some sort of plastic packaging. We know that the oceans are full of plastic waste. Many of you may have heard of the Great Pacific Garbage Patch. The GPGP, as it is called, is the largest of five offshore plastic accumulation zones in the oceans. The GPGP covers a surface area of 1.6 million square kilometers and has a mass of 80,000 tons. We know the impact that this has on wildlife and then environment. But what affect does it have on humans, if any? The answer is that we don't know. Not yet anyway.

The World Health Organization (WHO) launched a review of the potential risks of plastic particles in drinking water, after a study found tiny pieces of

plastic in more than 90% of samples from the world's most popular bottled water brands. (4)

Yes, microplastics are everywhere. They sit at the bottom of the sea, mix into beach sand, and blow in the wind. They're also inside us. Last October, microplastics were found in fecal samples from eight people participating in a pilot study to research how much humans might be inadvertently consuming plastic.

Humans consume microplastics via many channels. We might ingest them while eating seafood, breathe them in through the air, or consume food with trace amounts of its plastic packaging. Microplastics in the indoor air are the result of synthetic fibers released from carpeting, clothing and textiles used in home furnishings. The laundering of synthetic fabrics such as nylon, acrylic and polyester also causes microplastic fibers to end up in the waste water treatment facilities where they are too small to be filtered out. Today synthetic materials make up around 60% of the global textile production.

Now, a new study in the journal *Environmental Science and Technology,*

says it's possible that humans may be consuming anywhere from 39,000 to 52,000 microplastic particles a year. With added estimates of how much microplastic might be inhaled, that number is more than 74,000. (5) After reviewing the potential risks the WHO says that microplastics are "ubiquitous" and have been detected in fresh water, wastewater, food, air, bottled water, tap water and more. However, despite widespread concern, The study concluded that "There is currently no evidence to suggest a human health risk from microplastics associated with biofilms in drinking-water," referring to microorganisms that attach to microplastics. (6)
The key words here are “currently no evidence”. At this point, nobody knows how microplastics affect human health.

Plastics play an important role in aspects of our lives, from recreation, convenience, food packaging, electronics and medicine, just to name a few.. Some scientists are attempting to make plastics safer and more sustainable by developing plant-based plastics that would be more biodegradable than petroleum based plastics. Innovators are searching for ways to make recycling plastics more efficient, and they even hope to

perfect a process that converts plastics back into the fossil fuels from which they were derived. All of these innovators recognize, and we must as well - plastics are not perfect, but that they are an important and necessary part of our future. (7)

I believe we can continue to enjoy the benefits that it provides, if we can learn to use it judiciously and to recycle it.

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4) Scott Newman, NPR, August 27, 2019

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