



In 1858, London was caught in the grip of a deadly health crisis: Its largest river was overflowing with poop.

BY ALLISON FRIEDMAN



Synthesizing As you read these articles, think about how big problems can spark the creation of new inventions.

LOOK FOR WORD NERD'S 10 WORDS IN BOLD



Let's journey to the city of London, England, in the summer of 1858. Horse-drawn carriages clip-clop through the streets. Ladies wearing giant, tentlike skirts glide past shop windows. Kids stand on street corners, selling newspapers and cigars and fried fish.

But you don't notice any of that. All you can think about is the overpowering, stomach-turning, eye-watering smell of poop.

As you will soon discover, the entire city is caught in the grip of a stinky crisis. For

years, Londoners have been dumping human waste into the Thames [temz], the great river that rushes through the city. Now, London is suffering the hottest summer in recent history. The steaming heat is cooking the filthy river into a bubbling, foul-smelling stew. Newspapers are calling this situation "The Great Stink."

The problem isn't merely gross. It's also deadly. Over the past 50 years, tens of thousands of people have died from drinking the polluted water of the Thames River. Can the Great Stink force the city to clean up the river before thousands more are sickened?

THE PROBLEM OF POOP

For as long as humans have walked the earth, figuring out what to do with human

waste has been one of our greatest challenges. In ancient South Asian cities, clay pipes and brick channels carried waste away from homes. An **intricate** web of stone sewers lay underneath the ancient city of Rome to take waste out of the city.

Until the early 1800s, London's system for dealing with waste was fairly simple. Most homes had a bathroom. People did their business on a wooden box with a hole that sat above an underground pit called a cesspool. These cesspools were usually 6 feet deep and 4 feet wide. When full, a "night soil man" would shovel out the waste and sell it to farmers to use as **fertilizer**. (Poop was known as night soil because it was carted away in the middle of the night, when the powerful odor wouldn't disturb people.)

But in the 19th-century, London—and all of England—was changing. Thousands were leaving their farms to work at factories in cities. Between 1800 and 1850, London's population more than doubled. By the middle of the century, London was the biggest city in the world, with 2 million people.

Soon, there was too much night soil to collect and not enough farmers to buy it. More and more people were forced to empty their cesspools into the city's creaky old sewers. But the sewers were never designed for human waste—they were built to drain rainwater



A RIVER OF DEATH

This cartoon drawn during the Great Stink captures the public's fear of cholera. It depicts the Thames as the River Styx. In Greek mythology, the Styx divided the world of the living from the world of the dead.

into the Thames, to prevent flooding.

To make matters worse, a dazzling new invention was becoming increasingly popular: the flush toilet. Waste could now be washed away as if by magic with the pull of a chain. But toilets used a lot of water, so they caused the cesspools to overflow. To avoid a goopy mess, people began connecting their toilets directly to the sewers—and therefore to the river.

Overloaded with human waste, the Thames grew thick, brown, and foul. Over time, the smell became a stench, and the stench became unbearable. And then, in the **scorching** summer of 1858, it became a crisis.



These fancy toilets were all the rage in 19th-century London. Having one showed you were wealthy and modern.

A WHIFF ON THE WIND

Londoners back then were no strangers to filth. Soot from factories blackened the air. Mountains of dung from thousands of horses choked the streets. Families crammed into tiny apartments thick with the smell of sweat. And everywhere there was garbage: broken dishes, moldy food, animal bones.

London's new sewers had roughly 13,000 miles of pipes. That's about the distance from the North Pole to the South Pole!

A DAZZLING WONDER

When London's new sewer system opened in 1865, it was considered a technological marvel. It was designed to prevent human waste from flowing into the Thames River.



Still, the Great Stink of 1858 was an odor more **putrid** than the city had ever experienced. Grown men and women fainted in the streets. People miles away threw up after catching a whiff on the wind. Government leaders, who worked in a building beside the Thames, fled with tears streaming from their eyes.

Londoners weren't just disgusted by the stink—they were terrified. At the time, it was widely believed that diseases spread by miasma: dirty, smelly air. And the most feared disease of all? Cholera [KAH-ler-uh], a violent stomach sickness that could kill a person within 24 hours. London had already suffered three major cholera **epidemics**. More than 30,000 people had died. Londoners worried that the Great Stink would unleash a new wave of death across the city.

What few people in 1858 understood was that it wasn't the smell of the river that was deadly; it was the water. Poop is crawling with

microscopic germs that can cause dozens of diseases, including cholera. The poop-filled Thames was London's main source of drinking water. People had been gulping down poison.

SOMETHING HAD TO BE DONE

Even if government leaders didn't understand exactly why the Great Stink was dangerous, they knew something had to be done—fast. With handkerchiefs pressed to their noses, they quickly passed a law ordering the construction of a new sewer system. The new sewers would run underground alongside the river rather than into it, carrying waste out past the city and away from where people lived.

It took thousands of workers, 318 million bricks, 670,000 cubic meters of concrete, and what would be \$6 billion in today's money to construct London's new sewer system. The system officially opened in 1865.

Soon, the Thames was poop-free once again.

SEWER MONSTERS

This hunk of yuck is called a fatberg. Fatbergs are a problem in cities with older sewer systems. When cooking oil and grease are poured down the drain, they end up in sewers, where they harden into fat. These sticky blobs trap all kinds of stuff: baby wipes, cotton balls, food scraps. This stuff should be recycled or placed in the trash, not flushed. If a fatberg gets big enough, it clogs pipes and causes sewage to overflow.

A NEW CRISIS

London's new sewer system inspired similar building projects in cities around the world, including cities in the U.S., like New York. Many parts of those systems are still being used today, more than a century later. Over the years, however, these antique sewers have started to fall apart. Since the 1800s, the population of many cities has continued to multiply. Climate change has triggered heavier storms that overload pipes with rainwater.

Under these pressures, the original sewers—once a modern wonder—have begun to leak, break, clog, and overflow. In some places, waste has been oozing into the drinking water supply.

Many experts say we may be approaching a new **sewage** crisis. And if we don't take action, we could soon be holding our noses through the Great Stink Part 2. ■

Removing fatbergs from clogged sewers takes an enormous amount of time and millions of dollars. One fatberg that was removed in London stretched three city blocks and weighed more than 19 elephants.



TOILETS OF THE FUTURE

These toilets could help solve one of the world's most serious problems: how to safely get rid of human waste. **BY MACKENZIE CARRO**

Here in the U.S., most of us probably don't think much about toilets. We go, we flush, we wash our hands. But what if your home didn't have a toilet? What if no homes in your town had one? Where would all that waste go? Before long, there would be a crisis, just like there was in London 162 years ago.

Today, 4.5 billion people around the world do not have a way to get rid of human waste without harming people or the environment. It ends up in food and water sources. Many thousands of people die every year from diseases related to unsafe **sanitation**. Millions more are sickened.

This problem mainly affects developing countries, which tend to have high **poverty**. Building more toilets and sewers might seem like a simple solution. But sewer systems require a lot of money to build and water to operate. Many developing countries don't have enough of either.

The U.S. faces sanitation challenges too. Some aging sewers are crumbling from the strain of too many people using them.

Could one of these innovative waterless toilets be the solution to today's sanitation challenges?



SELF-POWERING TOILET

The Nano Membrane toilet gets rid of waste by burning it. When you close the lid, waste drops into a pan. From there, liquid waste—aka urine—is filtered into clean water that can be used for watering plants but not for drinking. Any solid waste—aka poop—is burned into ash. The best part? The whole process produces enough electricity to power the toilet, as well as other, small devices like, say, your smartphone.



WORM TOILET

The Tiger Toilet breaks down waste with worms. Beneath the toilet, and out of view from users, lives a cluster of tiger worms. These critters eat **organic** waste—including poop. As the worms digest waste, harmful germs are removed. In the end, all that's left is a mix of water, carbon dioxide, and some harmless worm poop that can be used as fertilizer.



COMPOSTING TOILET

Other new toilets turn waste into fertilizer by using heat. Here's how it works: Human waste is kept in a container attached to the toilet. The temperature inside the container is very high. This high heat, along with oxygen, makes certain bacteria grow—bacteria that naturally break down waste over time. Eventually, what's left can be used as fertilizer in gardens and backyards. But be careful: Not all composting toilets produce fertilizer that is safe to use for growing food.

MAKE A CONNECTION!

There is a saying that goes "necessity is the mother of invention." It means that people invent ways to solve a problem when there is a very strong need for it. In a short essay, explain how this saying applies to the Great Stink and today's sanitation problems.