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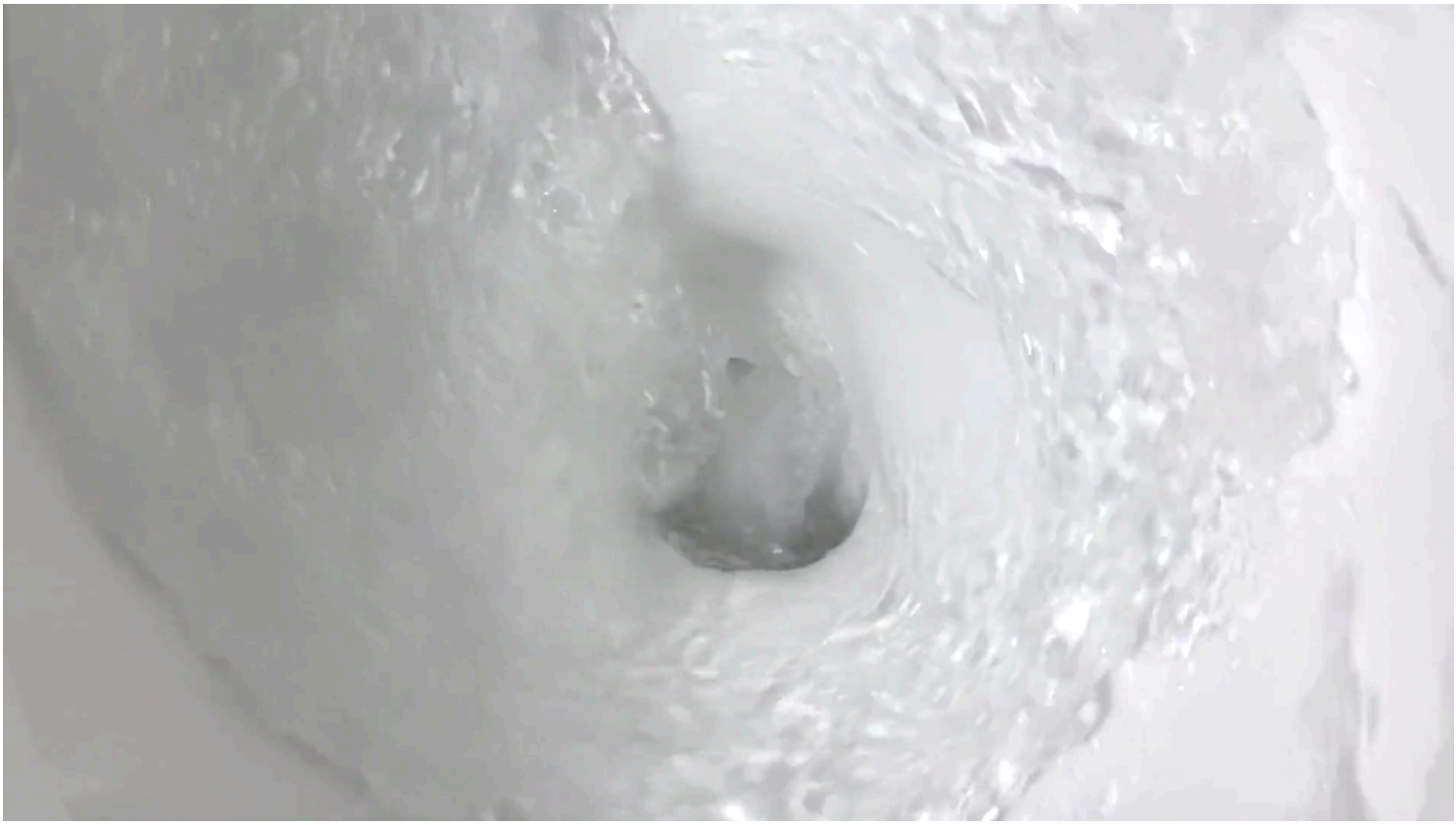

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SCIENCE

Flushed Away

The crappy lie Americans still believe about their toilets.

BY ANNA GIBBS

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They used to work so poorly that people were upset to receive them for free. John Koeller found that out the hard way. In the early 1990s, he was working on a program that handed out environmentally friendly toilets across Southern California to help households save water and money. The Energy Policy Act had recently mandated that all toilets sold in the U.S. use no more than 1.6 gallons per flush. Previously, a

single flush could send 5 to 7 gallons—an office watercooler's worth of water—down the drain. Almost literally so: The water we flush is the same quality as the stuff we drink.

The new toilets should have been a miracle. Over the course of eight years, the program funded over a million free units for households from Oxnard to the Mexican border. The effort promised to save a staggering amount of water every year, enough to flood 43,000 acres a foot deep (a measurement known as *acre-feet*)—a huge win for water conservation, especially in water-starved California.

There was just one problem. Many of the new toilets were—forgive me—downright shitty.

"Generally, you don't complain about free products," says Koeller. But complain people did. *"I've got to double flush my toilets, or triple flush,"* Koeller recalls people saying, specifically about the problem of removing solid waste. *"How does that save any water?"*

People across America were similarly frustrated with these newfangled toilets. "Often I find myself having to flush 2 or 3 times to cleanse the bowl," wrote one person on an online forum in 2000. Another posted: "When I'm being particulary generous in the number of kids I'm dropping off at the pool, I just start flushing." Cleaning the toilet bowl was a sticking point, too. "I felt I literally lived with a toilet brush in my hand," wrote a disgruntled citizen to an Annapolis newspaper columnist in 1997. "I thought I was going to go crazy."

Consumers who bought the toilets were angry. Building managers and property owners who had to maintain the toilets were angry. "There were legislators who were pounding the gavel and saying, you know, 'We got to repeal this,' " recalls Bill Strang, president of North American corporate strategy at TOTO, a popular toilet company based in Japan. In 1997, when a representative from Michigan moved to undo the mandate put in place by the Energy Policy Act, his supporters sent complaints to other members of Congress written on pieces of toilet paper. Some folks started buying high-flow toilets from Canada; others scrounged for beloved older models in salvage yards.

Today's water-efficient toilets, experts insist, are a very different story. Everyone from plumbers to manufacturers to third-party testers agrees: Thanks to lessons learned from the disastrous low-flow products of the '90s, the latest toilets not only work, but they work *better* than the old water-guzzling ones ever did. Stroll down a Home Depot aisle, and most toilets you see will use a mere 1.28 gallons per flush. That low of a flush not only works, but it can save households nearly 13,000 gallons of water per year, in addition to a bit of money, according to the Environmental Protection Agency. If everyone opted for a 1.28 gpf toilet,

the country could save 260 billion gallons of water per year. (For comparison, about 60 billion gallons careen over Niagara Falls per day.)

There's one group that has yet to completely embrace the low-flow toilet: consumers. It's not that people aren't buying them. (There is a mandate in place, after all.) But people continue to blame low-flow products for their bathroom problems, and generally disdain them. In 2019, Donald Trump brought the conversation back to the national stage when he complained about having to flush "10 times" with low-flow toilets (and then, realizing the implication, added a hasty "Not me, but you" and pointed to a poor fellow in the crowd). On his very first day back in office this January, he signed an executive order promising, among other things, "to safeguard the American people's freedom to choose"—toilets, that is.

The skepticism of low-flow toilet performance persists even on salesroom floors. While reporting this piece, I visited a Kohler showroom in Manhattan and asked a sales representative if they had any 1.6 gpf toilets, as I could only find the 1.28 gpf ones.

"There's a few in the back," he told me.

"Are they better than the toilets that use less water?" I asked.

"Of course," he said. "More water will always make the flush better."

It's high time that we dispel this notion.

* * *

There are two things that a good toilet must do: empty waste from the bowl, and clean the bowl's surface of any streaks. Old-fashioned toilets usually succeeded at those things, but there was no science or technique to how much water they used.

"It was whatever you needed to do to make that toilet flush," says Luke Bartel, a senior product manager at Kohler, a major toilet manufacturer. He says that his engineers have joked that "if it didn't work, we just added more water." That didn't make for an elegant flush. Waste would go down, but it could take a dozen or more seconds—a long time, if you are standing next to a flushing toilet.

Then, in 1992, the government decided to cap water use at 1.6 gpf. Where that number came from seems to have been forgotten, but it may have been arbitrary, too. "My understanding was there wasn't an awful lot of deep research," says Strang of TOTO. He guesses that the policy experts took a typical flush at the time and just said, "We're gonna cut it in half."

Manufacturers were taken off guard. “We had to make these really quick adaptations to the product,” says Bartel. Some tried to keep toilets the same and just use less water, or to get away with small tweaks. Kohler, for instance, made the toilet’s exit hole smaller to create a stronger flush with less water. But this ended up clogging the toilet more.

The reality was that the American flush toilet needed to be completely reimagined. “You can’t take a big tractor trailer and say, ‘OK, smaller engine, but it should still work the same,’ ” says Bill Gauley, an engineer and water efficiency consultant based in Toronto. “It’s not going to work the same.”

Gauley was pretty bothered by the malfunctioning low-flow toilets. He met Koeller, of the ill-fated free-toilets program in California, at a water conservation conference in Monterey in 1999. They immediately hit it off, bonding over their shared frustrations over environmentally friendly toilets. These toilets weren’t being deployed with proper scrutiny, they thought. Before a toilet reaches the market, it has to be certified, which includes a flush performance test. But at the time, the test involved a series of plastic balls, paper wads, and sponges—nothing like real waste. Worse, the test only required 79 percent of the “waste” to disappear. “If you fly an airplane with four engines and three are fine, but one isn’t, that’s ridiculous,” Koeller says. Plus, the test was Pass/Fail. There was no way to know whether a toilet was just barely acceptable, or excellent.

“It was just like, ‘This test makes no sense,’ ” Gauley recalls the two of them thinking. Surely together they could come up with a better one.

In an attempt to find material that mimicked the density and moisture content of human waste, Gauley started flushing all kinds of things down the toilet: mashed potatoes, mashed bananas, various concoctions of flour mixed with water. The material had to be thick enough to make a log, and maintain that consistency as tests took place. Nothing quite met the criteria: “After very few minutes, I’d reach in the bowl to get some more mashed potato, and it would feel totally different,” Gauley remembers.

The answer finally came from a toilet company that *was* getting things right. Around that time, during a tour of a TOTO plant in Atlanta, Gauley and Koeller noticed that one of the Japanese company’s performance tests involved soybean paste. Back at his lab in Toronto, Gauley struggled to procure soybean paste in large quantities; local suppliers were understandably wary of lending their food product to be used as “artificial shit,” as Gauley puts it. But once he finally got his hands on it, the paste was a clear winner.

The next question was how much soybean paste to flush. In other words, how much does a person usually poop? The pair scoured medical archives and found a 1977 study that looked at 20 healthy subjects' bathroom patterns. The largest poop among almost all male participants was approximately 250 grams, so Gauley and Koeller started by testing that amount. They also added four "loosely crumpled balls" of toilet paper, six squares each.

Then they just needed money to run a test. By 2002, a total of 22 water utilities and municipalities across the U.S. and Canada—frustrated by consumers wanting to return their poorly performing toilets—were willing to contribute. It was a very inexpensive project, Gauley says, so everyone just tossed in a few thousand dollars until there was enough to test a selection of around 50 popular toilet models.

The results made it clear why customers were so unhappy: Only *half* of the toilets were able to pass 250 grams of waste in a single flush. And while TOTO's Drake model passed with flying colors, flushing 900 grams—nearly 2 pounds of fake poo—other companies' models flushed less than 150 grams.

Manufacturers rushed to change their toilets. Since engineers could no longer just add more and more water until a flush worked, the new strategy was hydrodynamics: How does the water move inside the toilet, and how can it do as much work as possible? They began hiring engineers with backgrounds in computational fluid dynamics, who could model water flow on a screen without having to test everything in ceramic. "It's the same approach as you would use for designing a streamlined car or a rocket ship," says Francis de los Reyes III, an environmental engineer at North Carolina State University. Just as there are different kinds of cars, the internal engineering of today's toilets varies a lot by manufacturer and model. Some have a jet in the bottom to help usher the solid waste out; others spray the sides with diagonal streams of water to prevent streaks of poo.

"We all get the same amount of water to work with," says Bartel. "As manufacturers, what we do with it is up to us."

However they do it, today's toilets have to be able to flush 350 grams of soybean paste—based on Gauley and Koeller's research—using no more than 1.6 gpf, per that 1992 mandate. Manufacturers who want to go above and beyond can take Gauley and Koeller's full test, today known as MaP Testing, short for Maximum Performance, which many opt to do. Over 4,500 toilet models have been tested, and around a dozen labs worldwide are certified to perform the test. Labs can purchase soybean paste—now also packaged in condoms to encase the paste like a sausage—on Koeller and Gauley's website. (The two of them have

accidentally become professionally inseparable: “Almost every research thing we do, they always ask both of us,” says Gauley.)

In its current iteration, MaP tests a toilet until failure, up to 1,000 grams, or roughly 2.2 pounds of soybean paste, which is well beyond a normal dump. “I promise you, if you’re putting 2.2 pounds’ worth of stuff into your toilet when you sit down, you don’t feel well,” says Strang. Nonetheless, many toilets can now handle that superhuman amount of poop.

* * *

When, in 2019, Trump huffed about having to flush low-flow toilets multiple times, experts rolled their eyes. Making fun of an environmentally friendly innovation might play well with a certain crowd (“I never understood wind,” Trump said last year, referring to the form of green energy), but even manufacturers and trade groups that might be traditionally anti-regulation jumped to say they weren’t interested in rolling back the mandate for toilets to use less water, the Washington Post reported.

“That’s old news,” says plumber Thomas Hicken, who leads a plumbing apprenticeship program at Utah State University Eastern. “The fact is, the new toilets with less water are doing a great job.”

You don’t have to take his word for it. In 2002, Consumer Reports rated 32 percent of water-saving toilets as poor, and zero as excellent. By contrast, their top five toilets of 2025 are all so efficient that they flush with a mere 1.28 gpf.

Hicken recalled a time in the early 2010s when he had frequent conversations with customers worried about water-efficient products. Now, he rarely hears concerns from people—or if he does, in many cases, it’s from people who are still dealing with the pesky low-flow toilets installed in the 1990s and early 2000s. Residential toilets are replaced, on average, every 30 years, though many last much longer given the toughness of ceramic. (Curious what kind of toilet you’re working with? Take a peek behind your toilet’s seat or on the wall inside the tank, where it usually says the gpf or year.)

Hicken is empathetic to the resistance that’s still out there. “It’s frustrating when your toilet fails,” he says.

But data show that we do not flush more today than we used to. Gauley points to studies that have collected flush data from thousands of homes over the years, as low-flow toilets

became more and more common in households. They show that in 1999, the average person flushed about 5 times per day. By 2016, that number had not changed.

One complaint about environmentally friendly toilets that might be valid: the tricky little innovation of the dual flush. Dual-flush toilets use more water for solid waste, less for liquid. The feature, popular in Australia, was introduced in the U.S. at the same conference where Koeller and Gauley met in 1999. Koeller, for all his enthusiasm for toilet innovation, doesn't care for dual flush. The labeling can be confusing, which leads to unnecessary double flushes and frustration. And now that the overall amount of water used in a flush is so low, there's not really a need for a lower-flush button—so much water is already being saved.

Of course, many low-flow toilets don't have the dual flush. And some toilets do simply work better than others. Which is to say: If you think you hate low-flow toilets, you might just need a different design. I asked the engineer de los Reyes, over Zoom, if there's a winning toilet design, one best way to get the job done. He gave me a look of bewilderment before answering: "It's like asking 'Is there a winning pair of pants?' "

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Here are some ways in which toilets aren't one-size-fit-all: They can be one piece (more expensive) or two pieces (harder to keep clean). They can have heated seats and cleansing sprays. They come in different heights and with different bowl shapes. And yes, there are better options for those who anticipate regular superloads—consider investing in a toilet with a higher MaP score. Your plumber can help you with these things; they deal with toilets much more than the guy at Home Depot.

Gauley recalled visiting a plumbing supplier in the early 2000s to buy a 3.5 gpf toilet, which were still legal in Ontario, Canada. He wanted to have one to test against the 1.6 gpf models.

"I got to tell you, the 1.6 is all you need," the supplier said. "You don't need the 3.5."

Gauley decided to play dumb and simply refuse the low-flow toilet. The supplier tried again to convince him. "The new ones are so much better," he said. Gauley refused again. Finally the supplier grabbed a printed-out report to show him how well the different toilets work. It was Gauley and Koeller's report.

"Do you trust this report?" Gauley asked him. "100 percent," the supplier said; it had sold him on the water-efficient toilets. When Gauley finally revealed his identity, the supplier

asked him if he could autograph his report, recalls Gauley: "The only autograph I've ever given."

* * *

The thing is, people don't change their toilets unless they have to. Toilets aren't like cellphones, points out EPA engineer Stephanie Tanner: You don't just buy a new one when the latest model drops. If they're not broken, consumers usually replace them only when they're renovating the bathroom.

In 2014, drought-stricken California went a step further than the federal mandate and required all toilets sold to be 1.28 gpf, the high-efficiency flush that earns toilets a "water-efficient" label as part of the EPA's WaterSense program. But a 2019 study found that only about 25 percent of people had updated their toilets from the models that were 1.6 gpf or higher. (A total of 12 states have implemented the same requirement; the number of homes nationwide that have upgraded to 1.28 gpf is estimated to be 17 percent.)

"There is no such thing as toilet police, right?" says Kerry Stackpole, CEO and executive director of Plumbing Manufacturers International, a trade group of plumbing product manufacturers. "If you have 5-gallon flush toilets in your house, nobody's going to come and tell you you can't have them." In California, authorities can enforce the rule through building permits; if you're remodeling your house—even if it's not the bathroom—the local building code official is supposed to check that your toilet meets the 1.28 gpf requirement, says Stackpole. But that doesn't always happen.

That's why the leading strategy, championed by PMI, is to encourage replacement through rebates and giveaways, like the ill-fated California one in the 1990s, which happened before it was the low-flow toilets' time to shine. Perhaps the most famous example of a *successful* toilet giveaway happened in the city of San Antonio, which handed out about 200,000 free toilets over nearly two decades.

There is a sense of urgency, from Stackpole's perspective. Extreme weather events, the kind that are becoming more common with climate change, can suddenly wipe out access to water. The flooding last fall in Asheville, North Carolina, for example, required residents to flush toilets using water they'd hauled from town—and to make choices about whether to save water for drinking and bathing, or for flushing. In that scenario, every gallon counts enormously (and toilets actually use the most water, by far, versus any other appliance in the home). Then there's the fact that over time, as droughts and storms increase, water will become more scarce, driving water prices up even higher than they already are. That spike

will cause the biggest problem for people in lower income brackets, Stackpole says, and those people are also the most likely to have not replaced their toilet.

"Part of our goal here is to say, 'Hey, look, we know this is coming,' " says Stackpole. " 'Let's do something now.' "

Many municipalities have taken it into their own hands. In Seattle, the public utilities department will replace any toilet older than 2004 for free for qualifying people with low income. In Westminster, Colorado, the water bill assistance program works with landlords to install toilets in affordable housing complexes. Replacing legacy toilets may be a move that anticipates higher water bills in the future, but it also provides immediate monetary benefits: Families start saving money on their water bills as soon as the new product is installed. If the toilet is free, it's a no-brainer cost-saver.

Which is why it's surprising to Andrew deLaski, executive director of the Appliance Standards Awareness Project, that Trump is so anti-low-flow toilet. "The president has said he's focused on making things more affordable for families," deLaski says. "Yet rolling back standards that reduce energy and water use and bills isn't going to save people money. It's just the opposite."

I asked deLaski about toilets making it onto the president's first-day priority list. Despite being familiar with Trump's penchants from the 2019 debacle, deLaski still found the move "striking" and "surprising." "*No one's* looking to go backwards on toilets," he says. "It's just a pet peeve that's stuck in the president's head from the 1990s."

Fortunately, there's not much that Trump can do to mess up toilets' good standing. The 1992 mandate has a no-rollback provision that requires any new standard to be stronger than the existing one, explains deLaski. The only way to change the standard by presidential action alone is to find a loophole, which Trump did find for showerheads in 2020. Previously, showerheads were limited to a flow of 2.5 gallons per minute; Trump reinterpreted the ruling to mean that every individual nozzle on the showerhead could use 2.5 gallons per minute, significantly increasing the possible total amount of water.

But the Appliance Standards Awareness Project didn't find a single manufacturer who took advantage of that loophole. (Joe Biden reversed the change in 2021.) As with toilets, there was simply no good reason for manufacturers to go backward. "Our commitment to water conservation and superior performance remains steadfast, regardless of changes in federal standards," TOTO's Strang wrote in an email. "We believe that high efficiency standards benefit both the environment and consumers."

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While toilets and showerheads might be safe from Trump's weirdly specific peeves, the administration's attacks on appliance standards are still troubling, because they challenge the fundamental idea that it's good to be conservative with natural resources—and the reality that efficient appliances can, despite bumps in the road, be designed to work just as well as or better than their wasteful counterparts. "Efficiency is a *good* thing," as deLaski put it.

Another Trump ruling, in 2019, delayed the country's transition to efficient light bulbs, and was estimated to increase energy costs for consumers by $14 billion and carbon dioxide by 38 million tons per year before Biden reversed the ruling in 2022. These days, deLaski is most worried about standards related to gas appliances, particularly gas tankless water heaters. Unlike water utilities—which are usually public entities—the gas industry stands to profit from reduced regulations. If Trump successfully slashes standards, the individual consumer will be left with higher heating bills.

"These efficiency standards for energy- and water-using products have been quietly saving energy and water for consumers for decades now," says deLaski. "Going back to the old ways is not the answer."

* * *

On a warm November afternoon, I visited the TOTO showroom in Manhattan to see the future of water-efficient toilets. Toilet lids sprung up as I walked by. Mist sprayed politely onto the bowls in preparation of a potential visit. I saw the latest version of one of their most popular toilets, the Drake, whose predecessor cleared 900 grams in the first MaP report. It only uses 1.0 gpf, with the help of two strong jets concealed in a concave rim beneath the seat that create a strong swirl during the flush.

Then I was shown to a bathroom, where I tested out the NEOREST LS dual-flush heated toilet, which washed both bottom and front and finished my experience with a blow-dry, which can only be described as delightful. After my tour, my tour guide sent me the link to the store toilet. It cost nearly $10,000.

Bartel, of Kohler, told me that toilet engineers aren't really worried about clogs anymore. Today's problem-solving, in addition to making toilets incrementally more efficient and high-performing, is more about enhancing aesthetics and comfort. You can enjoy an expensive toilet—I certainly did—but you don't need one to get the job done. "The water efficiency isn't why it costs $8,000," says the EPA's Tanner, speaking generally. "It costs $8,000 because it's electronic, and it has lights, and it tests everything that goes on, and it's heated."

And truthfully, in the course of my reporting, I was actually more blown away by how inexpensive an everyday, normal-person toilet is. You can buy a well-performing, water-efficient toilet for $200 or less; the average price is around $285, says Koeller. To maximize performance, Hicken recommends looking in the $400 to $500 range. Not bad for a household necessity that will last a few decades. The evolution of the toilet is a success story that, against all odds, has brought us an efficient, affordable, and high-performing consumer good. And it's hard to flush that kind of progress away.

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