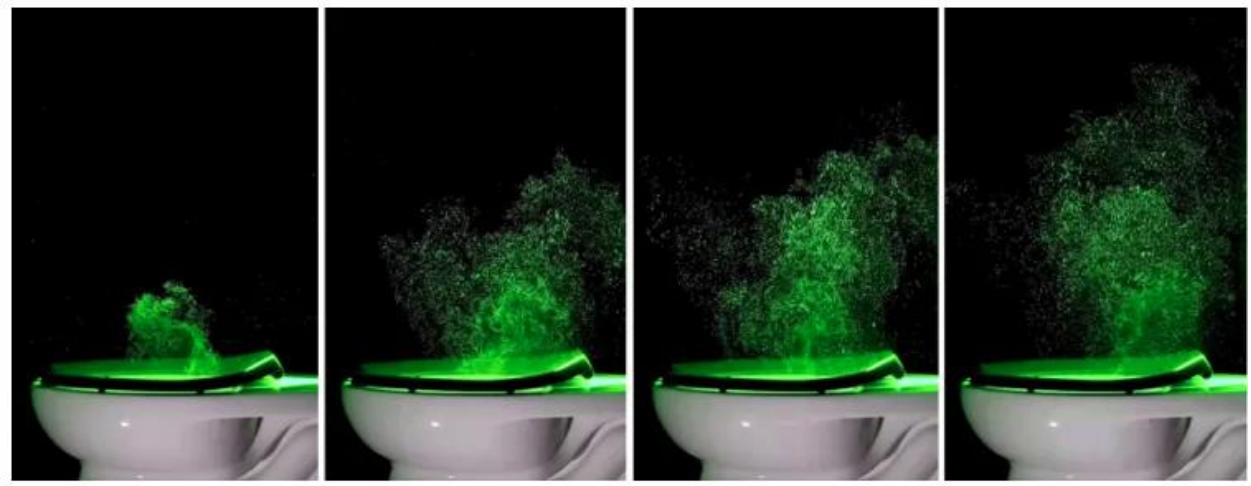
Toilet Plumes do not occur in www.NoFlushUrinals.com .
www.toiletplume.com – www.toiletplumes.com – www.invisibleplume.com – www.invisibleplumes.com – www.closethelid.com

Watch and cringe: Here's how much 'invisible' toilet water sprays into the air after you flush

Once you see these videos, you're never going to think about a toilet flush the same way again.'



BOULDER, Colo. — You may never forget to close the lid again after reading this study — and watching the video below. Scientists have demonstrated how toilet water sprays when we flush — carrying potentially dangerous germs into the air — in a series of experiments.

Scientists at the University of Colorado at Boulder say the "invisible plume," which contains microscopic particles of pee, poop and whatever else was in the bowl, is a health hazard for those who follow. The research team used bright green lasers and cameras to reveal for the first time how they are rapidly ejected from a lidless public cubicle.

If it's something you can't see, it's easy to pretend it doesn't exist," says lead author Professor John Crimaldi, a professor of civil, environmental, and architectural engineering, in a statement. "But once you see these videos, you're never going to think about a toilet flush the same way again. By making dramatic visual images of this process, our study can play an important role in public health messaging."

Video shows the airborne droplets shoot out at speeds of 6.6 feet per second, reaching 4.9 feet above the toilet within eight seconds. The largest droplets settle onto surfaces. Smaller ones — less than five microns, or one-millionth of a meter — linger suspended for many minutes.

They can transport the gut-turning bacteria *E. coli and C. difficile*, along with noroviruses and adenoviruses. The virus that causes COVID-19 is present in human waste as well. There is not currently conclusive evidence that it spreads efficiently through toilet aerosols, however.

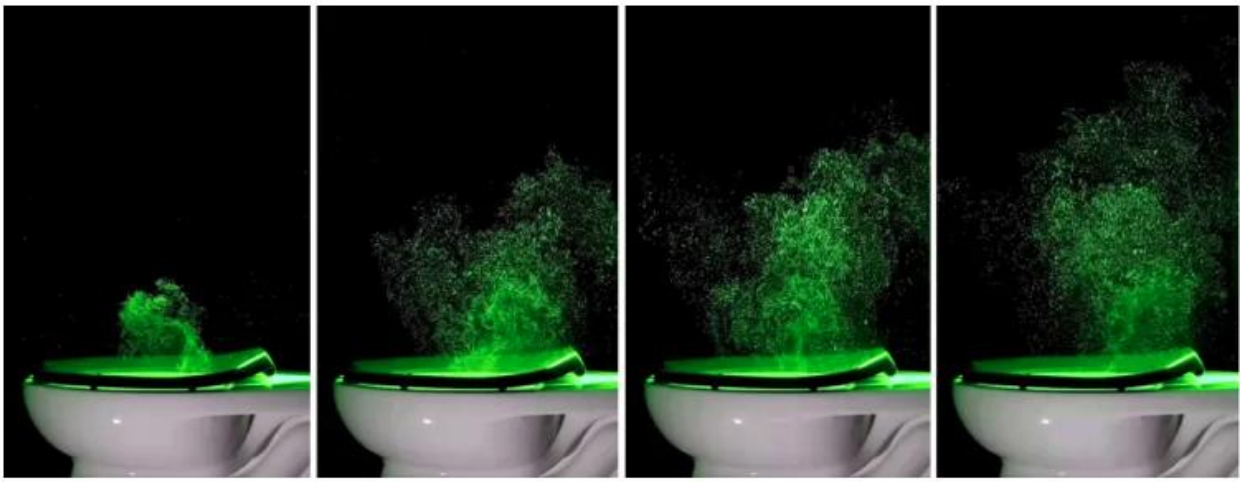
"People have known toilets emit aerosols, but they haven't been able to see them," says Crimaldi. "We show this thing is a much more energetic and rapidly spreading plume than even the people who knew about this understood."

It's not only their own waste bathroom patrons have to worry about. The pathogens can persist in the bowl for dozens of flushes, increasing potential exposure risk.

"The goal of the toilet is to effectively remove waste from the bowl, but it's also doing the opposite, which is spraying a lot of contents upwards," adds Crimaldi. "Our lab has created a methodology that provides a foundation for improving and mitigating this problem."

Scientists used two lasers for the study. One shone continuously on and above a toilet, while the other sent out fast pulses of light over the same area. The constant laser revealed where in space the airborne particles were, while the pulsing laser could measure their speed and direction. Meanwhile, two cameras took high resolution images.

The toilet itself was the same kind commonly seen in public bathrooms: a lidless unit accompanied by a cylindrical flushing mechanism.



Whether manual or automatic, a flushometer-style valve sticks up from the back near the wall. The brand-new, clean toilet was filled only with tap water.

"We had expected these aerosol particles would just sort of float up, but they came out like a rocket," notes Crimaldi.

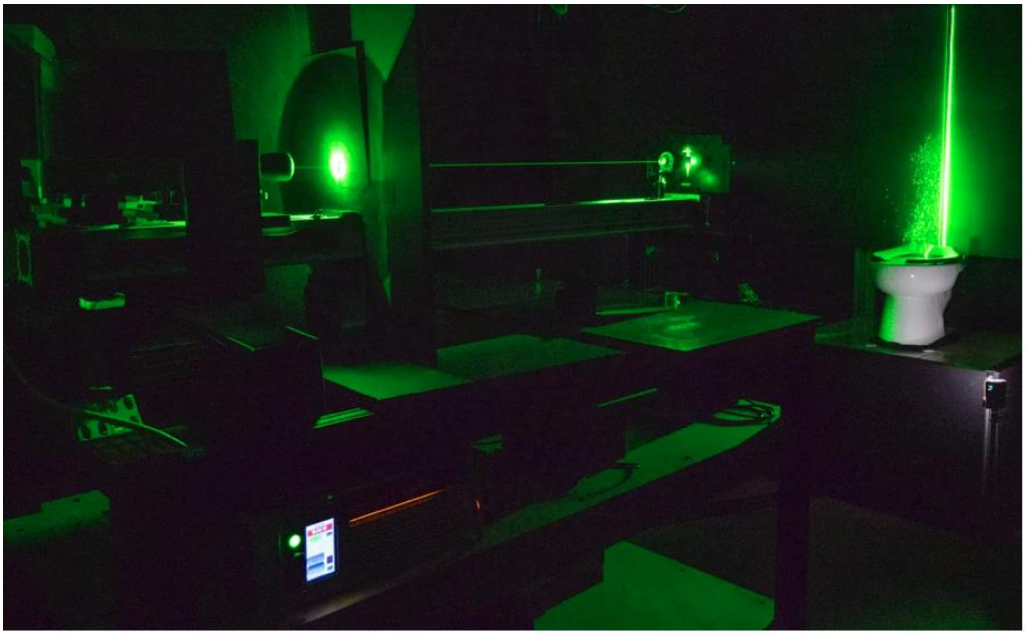
The particles headed mostly upwards and backwards towards the rear wall, but their movement was unpredictable. Similarly, the plume also rose to the lab's ceiling, and with nowhere else to go, moved outward from the wall and spread forward, into the

room. The experimental setup did not include any solid waste or toilet paper in the bowl, and there were no stalls or people moving around.

These real-life variables could all exacerbate the problem, study authors warn.

The team also measured the airborne particles with an optical particle counter, a device that sucks a sample of air in through a small tube and shines a light on it, allowing it to count and measure the particles. Smaller particles not only float in the air for longer but can escape nose hairs and reach deeper into one's lungs, making them more dangerous to humans.

The disconcerting results shed fresh light on just how many particles end up in the air and what size they are. But they provide experts in plumbing and public health with a consistent way to test improved design, disinfection and ventilation strategies to reduce exposure risk.



A powerful green laser helps visualize the aerosol plumes from a toilet while it's being flushed. (Credit: Patrick Campbell / University of Colorado Boulder)

"None of those improvements can be done effectively without knowing how the aerosol plume develops and how it's moving. Being able to see this invisible plume is a game-changer," says Crimaldi.

The study is published in the journal *Scientific Reports*.