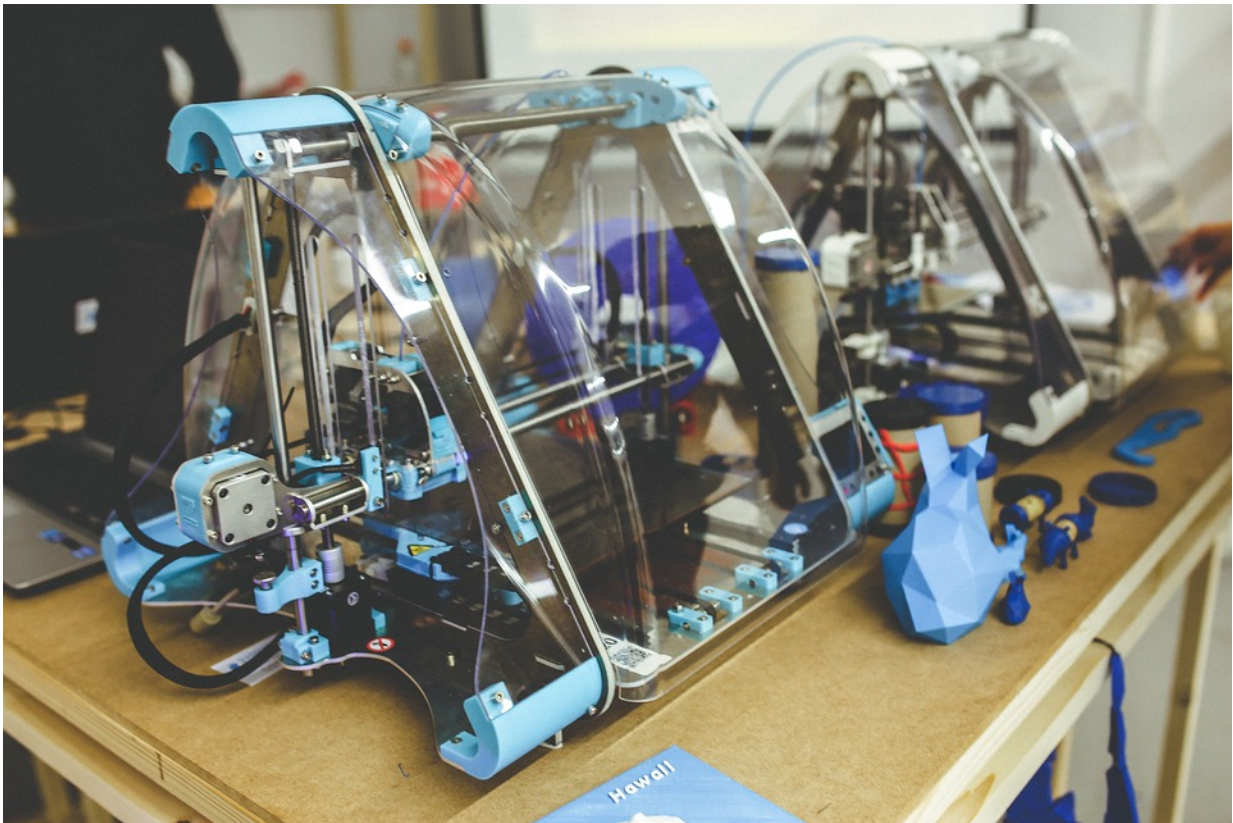


Researchers examine 3-D printers' particle emissions, safety tips

November 20 2018, by Nancy Cohen



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Desktop 3-D printers are no longer a big novelty and can be found in offices and in homes. A current concern is their particle emissions.

Tech sites by Monday were processing some bracing findings from a study at Georgia Institute of Technology and UL Chemical Safety- It was an in-depth two-year exploration of particle emissions as a result of [printer](#) use.

In fact, a senior technical advisor at UL called the study series "the most extensive to date on 3-D printer emissions." The team goal was to characterize particle emissions by the printers in a controlled environment.

"Studies have shown that fused [filament](#) fabrication (FFF) 3-D printers designed for general public use emit high levels of ultrafine and fine [particles](#)," said a professor in Georgia Tech's School of Earth & Atmospheric Sciences, Rodney Weber, in a news release. He led the research.

"The research endeavor revealed that more than 200 different volatile organic compounds (VOCs), many of which are known or suspected irritants and carcinogens, are released while 3-D printers are in [operation](#)," said the *ScienceBlog*.

How might they affect humans?

Printer-generated [particles](#), including ultrafine particles (UFPs), can be inhaled into the human pulmonary system, with an impact on respiratory health. Weber stated in the news release that "Preliminary tests with in vivo, in vitro and acellular methods for particles generated by a limited number of filaments showed adverse responses." Air quality can take a hit in an environment without good ventilation.

Wait. Run it down. What is it about 3-D printers that has researchers concerned about risks? The box? The filament? The temperature settings? Actually, take your pick. "Many factors, including nozzle

temperature, filament type, filament and printer brand, and filament color, affect emissions," said the news release provided by Underwriters Laboratories (UL).

ScienceBlog noted temperature. "We found that one of the overriding principles is the temperature of the filament," Weber said in *ScienceBlog*. "If you use a filament that requires a higher temperature to melt, such as ABS plastic, you produce more particles than PLA plastic filaments, which require lower temperatures."

The research findings were published this year and last year in *Aerosol Science and Technology*. Other studies are forthcoming, said *ScienceBlog*.

Meanwhile, *3ders.org* had more details on the two [papers](#), "Characterization of particle emissions from consumer fused deposition modeling 3-D printers" and "Investigating [particle emissions](#) and aerosol dynamics from a consumer fused deposition modeling 3-D printer with a lognormal moment aerosol model."

According to reports, forthcoming papers are under review. They will also look at 3-D printer particles and chemical emissions.

What's next?

ScienceBlog said UL is advocating for risk assessments of 3-D printers. Factors suggested to explore would be (1) dose (2) personal sensitivities (3) more marketplace information published that would help consumers pick safe options.

Also anticipated is a UL/American National Standards Institute (ANSI) consensus standard for testing and evaluating 3-D printer emissions.

Erin Winick weighed in. She is the associate editor of the future of work

at *MIT Technology Review*. She wrote in "The Download." "There is so much we don't know about the potential health impacts of desktop 3-D printing, but a [new](#) study has shined a bit more light on the precautions makers—like me—should be taking."

UL has shared a list of recommended safety measures one can take: Operating 3-D printers only in well-ventilated areas; setting the nozzle temperature at the lower end of the suggested [temperature](#) range for filament materials; standing away from operating machines; and using machines and filaments that have been tested and verified to have low emissions.

"The dangers may not be huge, but we just don't know yet. And until that research is done, taking extra precautions is the right move," she remarked.

More information: Qian Zhang et al. Characterization of particle emissions from consumer fused deposition modeling 3D printers, *Aerosol Science and Technology* (2017). [DOI: 10.1080/02786826.2017.1342029](#)

Qian Zhang et al. Investigating particle emissions and aerosol dynamics from a consumer fused deposition modeling 3D printer with a lognormal moment aerosol model, *Aerosol Science and Technology* (2018). [DOI: 10.1080/02786826.2018.1464115](#)

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