

**Society of Toxicology Conference Abstract Submission
March 15-19, 2020, Anaheim, Calif.**

Emissions from consumer level 3D printers

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Consumer level fused filament fabrication (FFF) 3D printers are widely used in small-scale indoor environments and public spaces. Therefore, concern of potential health impacts of emissions from 3D printers has been raised, especially for vulnerable populations, such as children. This study systematically characterized particle and volatile organic compound (VOC) emissions from multiple 3D printers using a standard test method. We found that 3D printing emits high concentrations of particles (especially ultrafine particles) and VOCs, the levels of which were associated with different print conditions like extrusion temperature, filament material, printer brand, filament brand and colour. The particle chemical compositions of 3D printer emitted particles were similar to or different from the bulk filament material, indicating particle formations associated with the bulk material or additives in filament. A chemical assay (dithiothreitol, DTT) was applied to estimate oxidative potential of the particles emitted from 3D printers; exposure levels of some VOC species were also predicted using a model. Overall, emissions from 3D printing should be mitigated.