

3652119



# Indoor air quality assessment of classrooms with 3D printers

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10:20am - 10:40am - March 20, 2022

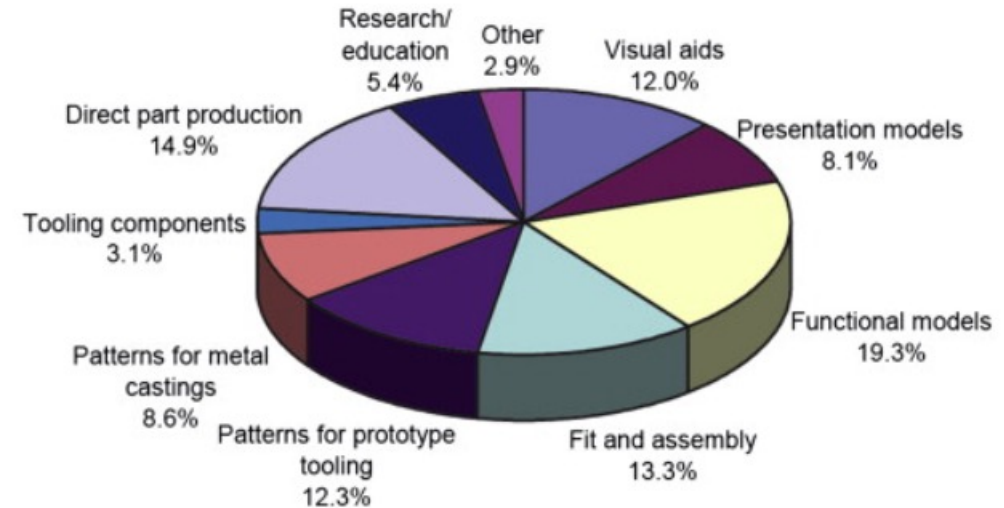
Room: Gallery 1



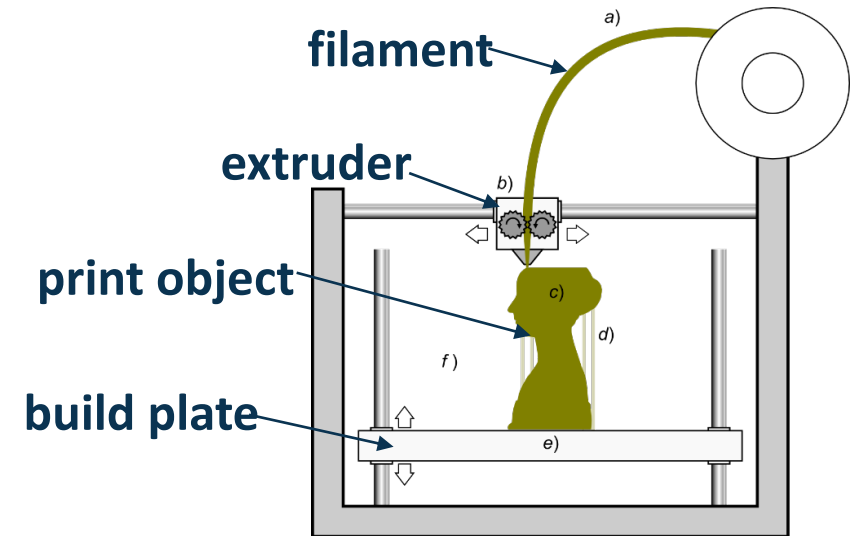
# 1. Introduction

Extrusion based fused filament fabrication (FFF) 3D printing

- Material is selectively dispensed through a nozzle or orifice
- Common material: filament of thermoplastics
- readily available to general population
  - Small size
  - Affordable
  - Easy to operate
- Widely used in schools, offices, and residences
- Health and safety concerns in schools
  - Non-industrial indoor environments
  - Susceptible populations
  - Particle and volatile organic compound exposures
  - Exposure mitigation strategies

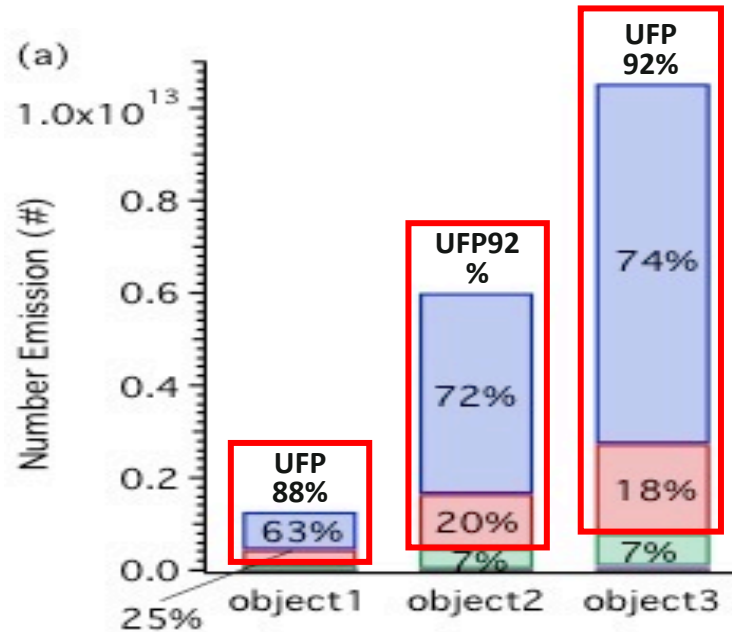


Wohlers, T. Wohlers Report: Additive Manufacturing State of the Industry. Annual Worldwide Progress Report, 2011, ISBN 0-9754429-6-1



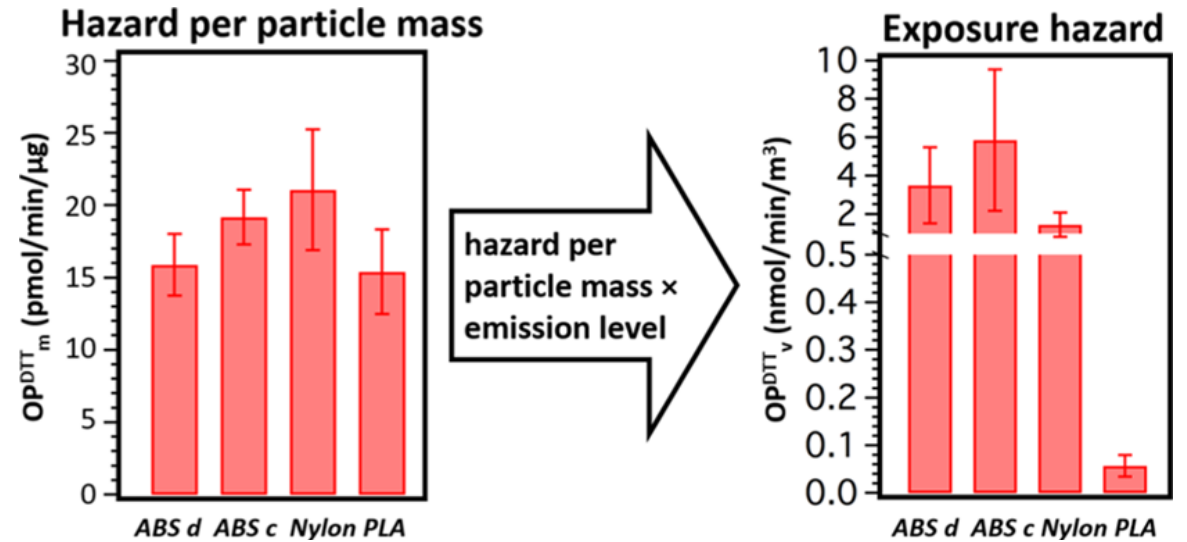
[https://en.wikipedia.org/wiki/Fused\\_deposition\\_modeling](https://en.wikipedia.org/wiki/Fused_deposition_modeling)

# Emissions from FFF 3D Printing



(Zhang et al. Aerosol Sci Tech, 2017)

- High levels of UFP (< 100 nm) emission
- Emissions varied with print conditions (filament material, brand- additives, nozzle T)

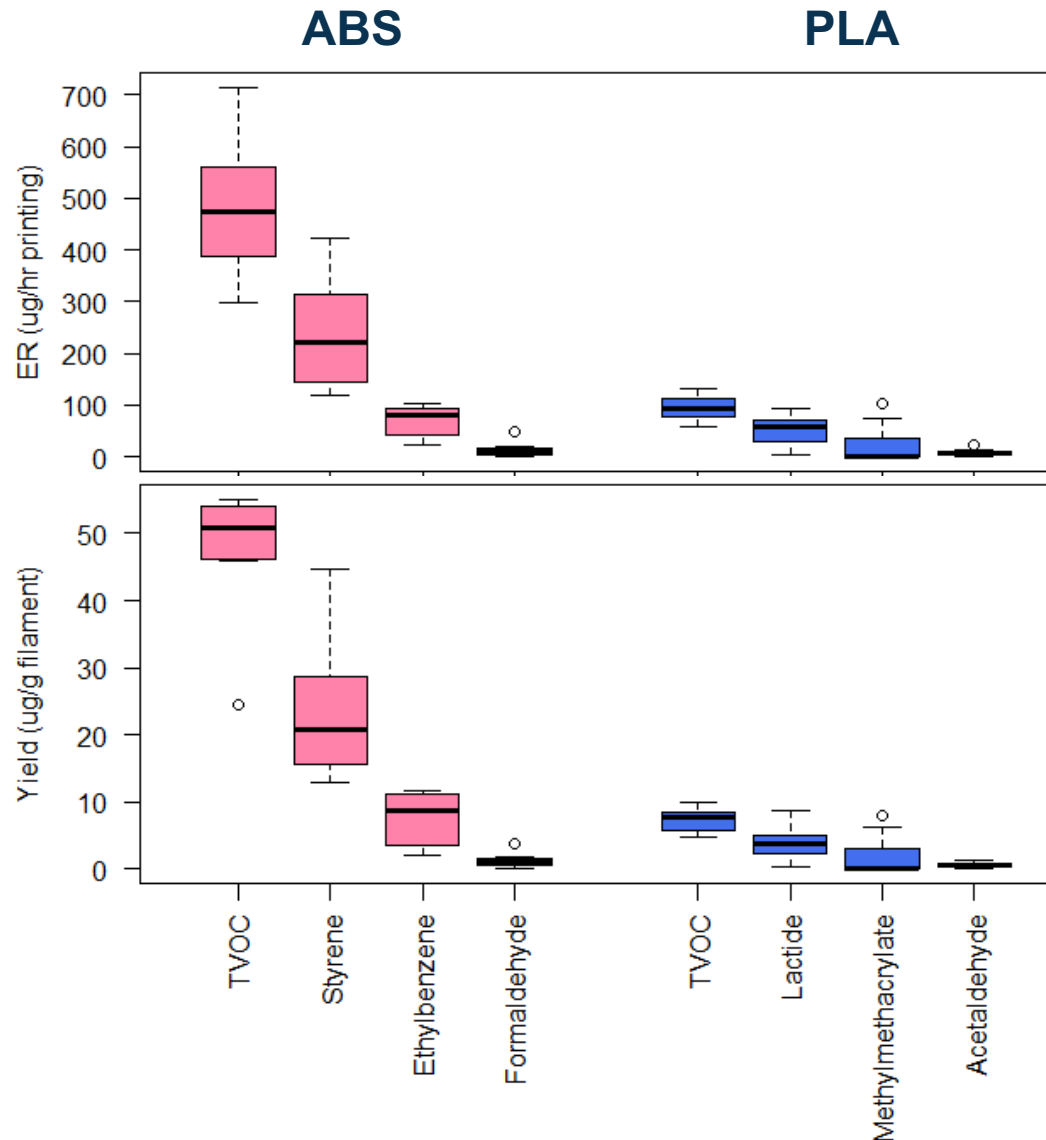


(Zhang et al. Environ Sci Technol, 2019)

- Particles emitted from various materials showing signs of negative health effects

# VOC EMISSION

Total VOC and highest 3 emitted VOCs

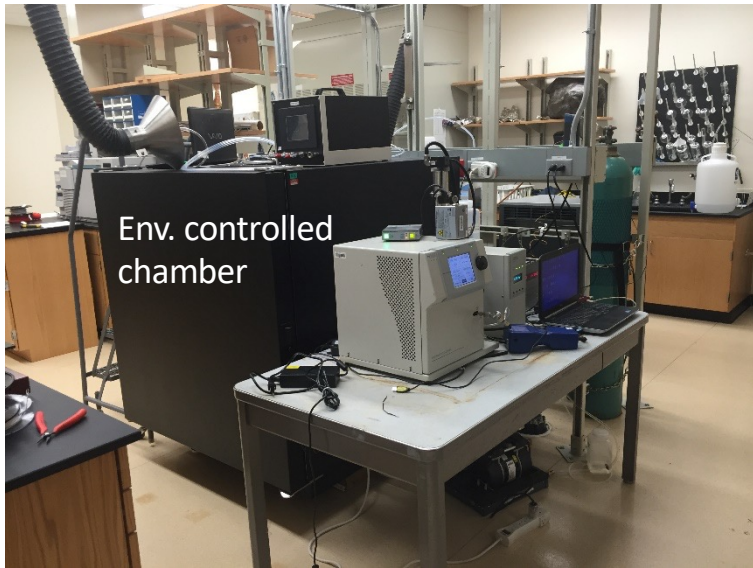


- Both VOC emission rates and overall yields are higher for ABS and nylon
- Similar to particles, PLA VOC emissions and yield are lower

(Davis et al. Building and Env., 2019)

# Objective

Characterize 3D printer emissions

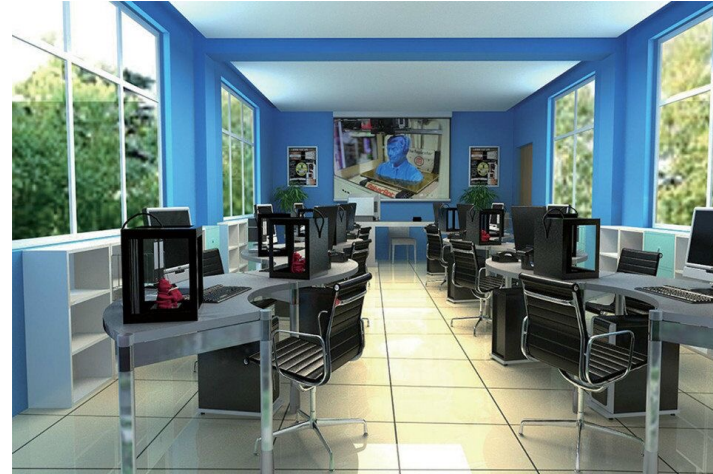


Exposure  
Assessment



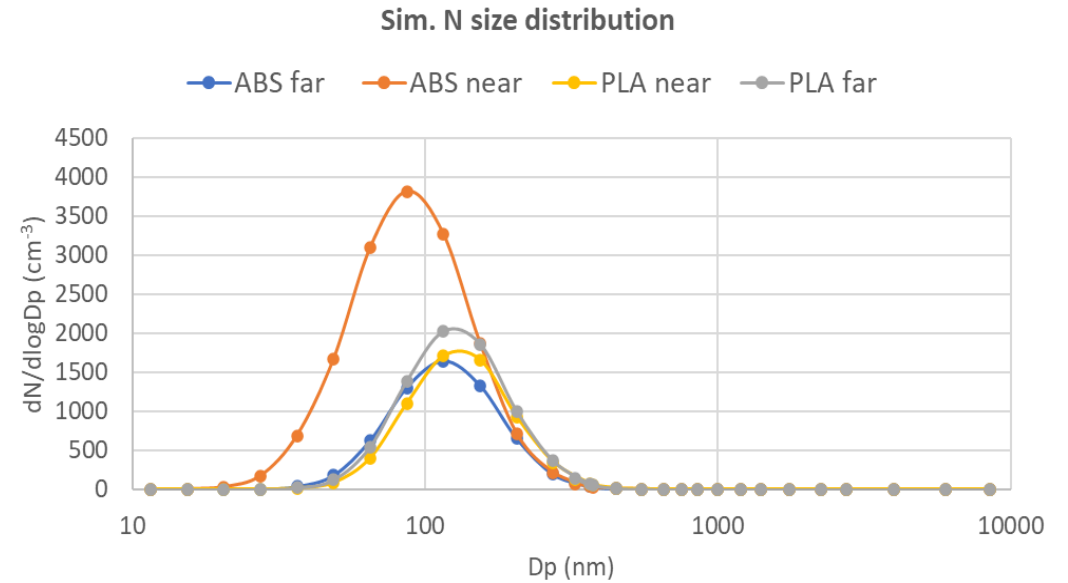
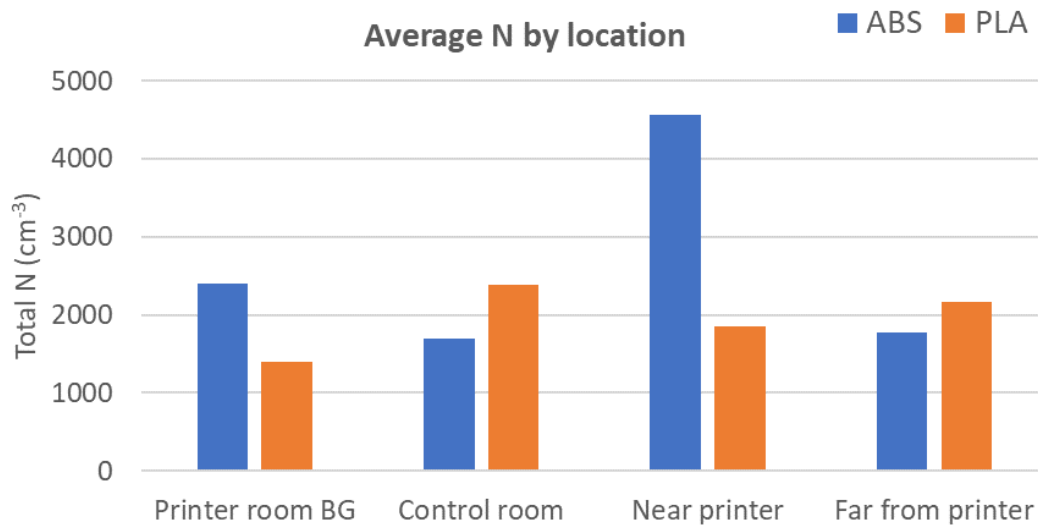
Apply results to  
determine  
exposure in  
various settings

Work Spaces, Classrooms, Libraries, etc.



# Particles

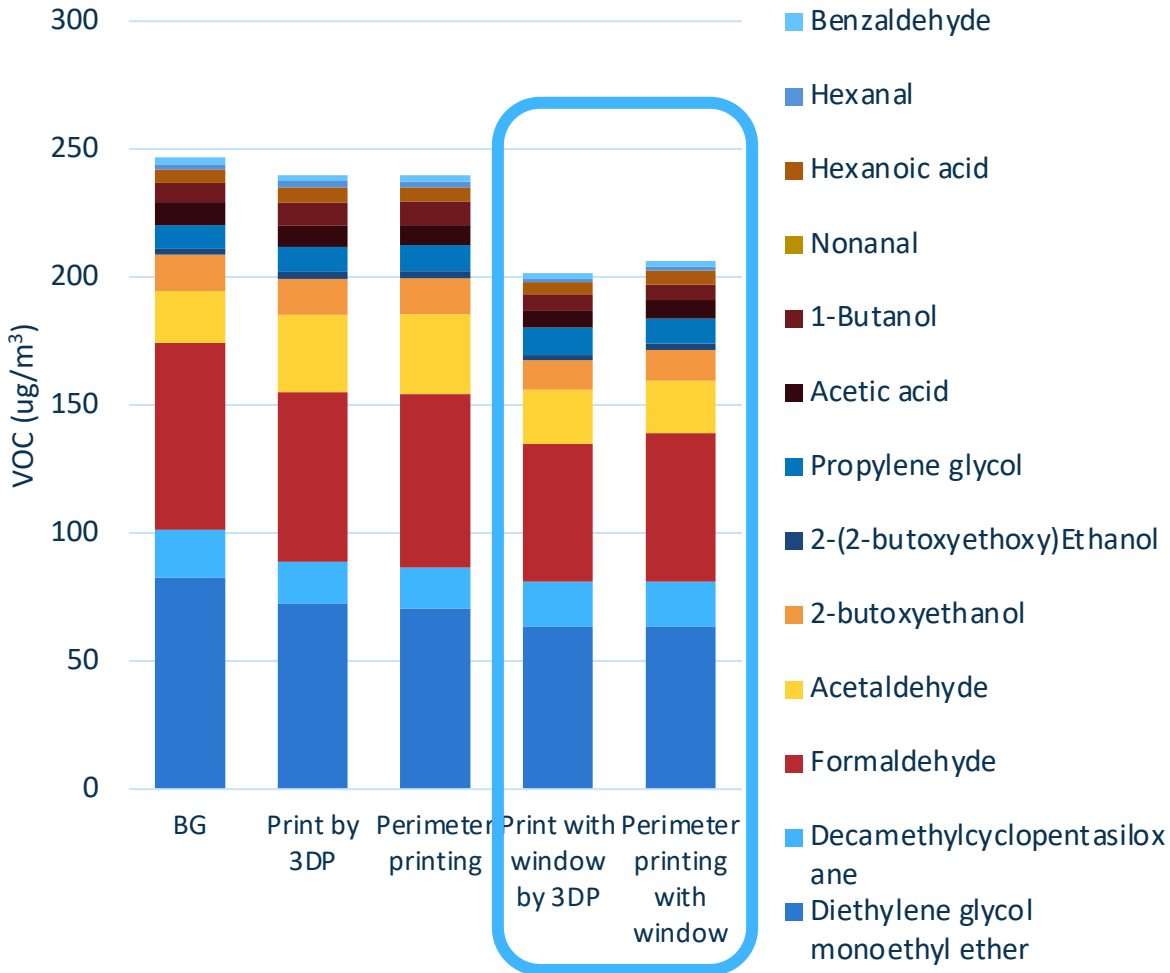
High school



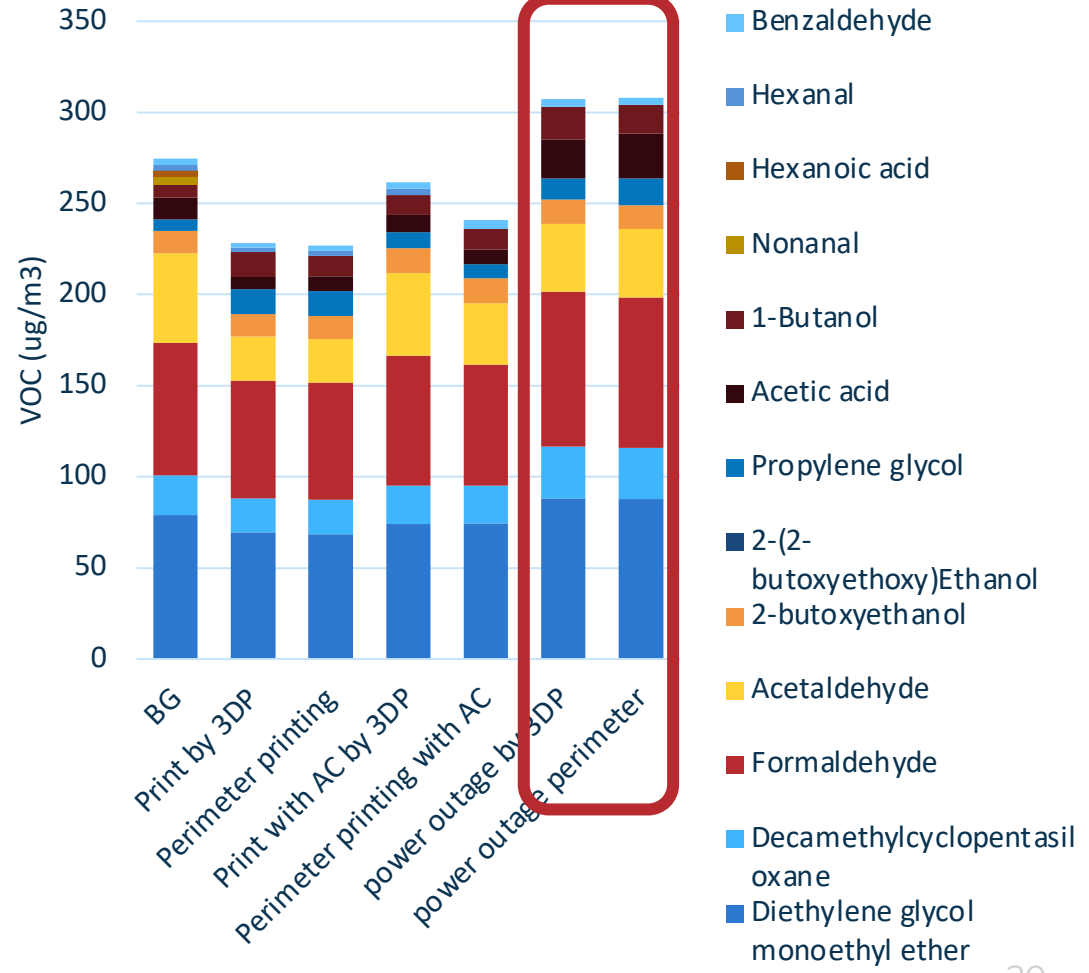
- ABS increased particle concentration near printer, but not away from printer
- PLA slight increase from background but comparable to control room

# Mitigation Strategies: Ventilation

Windows



Without Ventilation



# Thank you

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