The Facts
On 3D Printers

OCCUPATIONAL AND ENVIRONMENTAL SAFETY

3D printing is the additive manufacturing technology of making three dimensional objects by depositing successive layers of material under computer control. 3D printers are becoming more popular and can be used in scientific laboratories, workshops, and offices. This fact sheet establishes the health and safety practices for using 3D printers at Clemson University campuses.

Types of 3D Printers

There are different types of 3D printers depending on the printing process and media material used. The two most popular printer types are Fused Deposition Modeling (FDM) and Stereolithography (SLA).

FDM

FDM is the most widely used 3D printing technology. The thermoplastic filament materials are melted to build up the layers on a platform to create a 3D object.

PLA (Polylactic Acid) and **ABS** (Acrylonitrile Butadiene Styrene) are the most popular materials used in FDM 3D printer.

SLA

SLA is a prototyping process technology. The liquid form of photopolymer resin is solidified by applying the ultraviolet (UV) light to create a 3D object layer-by-layer.

The object usually follows by a chemical bath and a post-cure in an ultraviolet oven process.

Potential Hazards

- Chemical exposure to sodium hydroxide, paints, and resins.
- Chemical vapors from printing materials such as PLA and ABS. These materials release toxic chemical vapors into the air during heating.
- Exposure to Ultrafine Particles (UFP) and other microscopic particles are emitted from desktop 3D printers during operation.
- Moving parts while the printer is operating.
- Hot surfaces.
- High voltage power supplies, possibility for electric shock or fires.
- Sharp objects- scalpels, screwdrivers, and hand tools.
- Exposure to UV light laser, possibility of eye and skin burns.

Personal Protective Equipment

- Nitrile or chemical resistant gloves
- Lab coat or coveralls
- Safety glasses, goggles, or face shields.
- Respiratory protection when indicated and when engineering controls cannot control exposures, and in accordance with CU Respiratory Protection Program.

Safety Tips

- Select the lowest temperature to print to decrease emissions.
- A 3D printer that is larger than a desktop model, uses uncommon media (e.g., powdered metal) or special operations must be reviewed and assessed by OES on a case-by-case basis.
- 3D Printers should be placed in well ventilated areas.
- Supervisors are responsible for providing required personal protective equipment (PPE). Operators must be protected from physical hazards, such as hot surface, UV light, and chemical hazards associated with the printers.
- Operators must receive training by their supervisor in the correct and safe operation of the 3D printer before working with the equipment.
- Operators need to complete **HAZCOM**, and **Hazardous Waste** training.
- Safety Data Sheets must be readily accessible in the workplace. An emergency eyewash/shower and a chemical spill kit may be required to be in the immediate vicinity of work where chemicals, including resins and corrosives, are being used.
- All used chemicals and sharps should be collected and disposed as hazardous waste by following the university's disposal regulations.

For more information on the safety of 3D printers go to:

OES – 3D Printer Safety