

GW 3D Printer Guidelines

The 3D Printer Policy establishes the minimum requirements necessary to allow for the safe use of 3D printers located in the George Washington University buildings. These guidelines covers all university and student owned 3D printers stored and operating on campus, including those affiliated with the sciences, engineering, libraries and arts and craft studios. Only GW Faculty, Staff and Students are allowed to use 3D printers located on campus.

Responsibilities

Health & Safety:

- HEMS will be responsible for coordinating the review and use with the appropriate university partners and ensuring the guidelines are met prior to giving final approval of 3D printers.
- HEMS may determine a modification of the proposed printer location, or the addition of improved exhaust ventilation is needed before approval of 3D printer use in the requested location.
- HEMS has the safety responsibility over the 3D printer location, use and process; if unforeseen issues or and may immediately halt any operations or procedures it considers unsafe at any time at its discretion.
- All users of a particular 3D printer will be listed on the appropriate use and acknowledgment form kept at each location.

Principal Investigators (PI) and Managers with 3D printer oversight:

- The Professor overseeing a 3D printer project, PI and 3D printer managers are responsible for enforcing the provisions of this policy including compliance with the training requirements.
- Print supervisors are responsible for providing required personal protective equipment (PPE) and enforcing its correct use.

General Safety -Users of 3D printers (Faculty, staff, students)

- The two most commonly used types of 3D printer media are Polylactic Acid (PLA) and Acrylonitrile Butadiene Styrene (ABS). When heated during the print process, both media types produce large concentrations of ultrafine particles (UFP). Exposures to UFP or nanoparticles, particularly at high concentrations, have been associated with adverse health effects. Elevated concentrations of volatile organic compounds (VOC) can also be produced during the printing process; the following precautions will be observed:
- Required personal protective equipment shall be used.

- No eating or drinking is allowed in areas where 3D printers are present.
- 3D Printers cannot be located in close proximity to flammable materials (as determined by the fire/safety Inspector).
- All printers must be installed according to the manufacturer's requirements, university policies and GW facilities recommendations.
- Safety Data Sheets (SDS) must be provided for all print media and for any other chemical product used in the printing process. SDS must be readily accessible for review in the event of an emergency.
- Operators must be protected from hot surfaces associated with the printers.
- If UV light is used in the curing process, personal protective equipment and/or shielding must be utilized to protect personnel.

Ventilation:

- 3D printers using PLA media exclusively may be set-up in any workspace having at least 4 air changes per hour.
- The number of PLA printers in one location should be limited by the size of the space. One printer per standard office and no more than two printers for a standard classroom or workroom is allowable.
- 3D printers using ABS media, including printers designed and set-up to use both PLA and ABS may only be used in work areas having a dedicated exhaust system or one pass air and at least six air changes per hour.
- It is recommended that printers using ABS media be used within a fume hood whenever possible.
- 3D printers using other types of media, including but not limited to thermoplastics, photopolymers, nylon, high impact polystyrene, high density polyethylene, powdered metals, biological media or other uncommon medias shall be reviewed by HEMS on a case by case basis with specific precautions required based on the hazards unique to the printing process.

Training Requirements

- All users working directly with a 3D printer and associated media are required to have operation and use training associated with the particular 3D printer being used. The training may be given by the Professor or PI in charge of the project, printer or work product; or by HEMS as necessary.
- All users working directly with a 3D printer and associated media are required to have hazard communication training covering any hazardous materials used in the process.
- Completion of the training must be documented in writing and copies sent to HEMS.

Personal Protective Equipment (PPE) Requirements

- Follow all PPE recommendations found in the Safety Data Sheet (SDS) for the specific printer media used.

- Eye protection is required during any activity where airborne projectiles may be present (i.e. cutting off rough edges of a printed item).
- For print processes using an alkaline bath to dissolve support material, an emergency eyewash will be required in the immediate vicinity of the work.

Safety, Engineering and Environmental Controls:

- Use 3D printers ONLY in properly ventilated areas, (as determined by Facilities and HEMS).
- Choose low-emitting printers and feed materials/filament when possible.
- Wear proper personal protective equipment. Have a risk assessment to determine what is required.
- Purchase and use the manufacturers supplied controls, such as an interlocked enclosure. (Enclosures appear to be more effective at controlling emissions than just a machine cover.)
- Maintain a safe distance from the printer to minimize the inhalation of emitted particles.
- Turn off the printer if the printer nozzle jams, and allow the printer to ventilate before removing the cover.

Laser Printers vs. 3D Printers:

Laser printers produce images or text on paper by using heat to melt toner powder, which is composed of carbon, plastic, and metals such as iron. Laser printers emit a large amount of particles and asthma-related chemicals. Several factors influence the hazards, such as toner and paper type. The latest investigations have found that 3D printer's emissions may combine to form new compounds, including a chemical linked to asthma. Anyone suffering from Asthma should take extra precautions prior to operating a laser 3D printer.

Alkaline Bath Management:

- Some 3D printers, like the Stratysus Dimension, require the use of an alkaline bath (corrosive) to remove the extra material surrounding each 3D printed item. Before installing or using an alkaline bath, HEMS must be contacted to ensure the following:
- Proper lab ventilation,
- Proper administrative controls, such as a written standard operating procedure,
- Proper chemical safety training, and
- Proper personal protective equipment to handle corrosive liquids.