

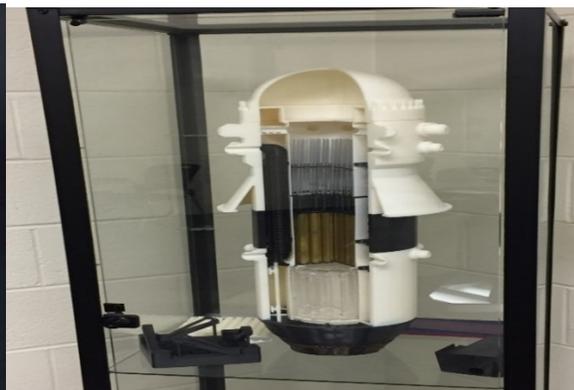
3D PRINTING SAFETY INFORMATION

Overview

3D printing uses varying types of feedstock to place layers of filament on top of one another to create a precise 3D replica of an image. It has made rapid prototyping and small-scale manufacturing more accessible than ever. However, the feedstock and processes by which the printer builds objects can be a safety concern for the user. Many 3D printers require dedicated ventilation or filtration accessories, so the location of the printer must be carefully considered.



Miss Georgia's (Maggie Bridges) shoes for pageant – created with 3D printing
Courtesy: <http://replicatorld.com/georgia-tech-students-3d-print-miss-georgias-shoes/>



3D-printed Nuclear Reactor in Boggs Building

EH&S Operating Safety/Training Requirements

- Notify EH&S when acquiring a 3D printer so a thorough safety assessment can be completed by an EH&S professional (lab-chemsafety@gatech.edu) to determine the following:
 - Exhaust requirements if hazardous gases or vapors are emitted
 - Appropriate PPE for type of 3D printer, feedstock, and process
 - Training requirements
- Use manufacturer's instructions as a guide for installation and use. This shall include prohibition of tampering/override of safety interlocks and the use of appropriate feedstock.
- Consult Safety Data Sheets (SDSs) for product-specific information and safe handling recommendations on the material feedstock.

Potential 3D Printing Hazards Associated with Printing Materials

General

- Nanoparticle generation that can become a human exposure concern. Learn more about nanomaterial safety at: <https://ehs.gatech.edu/chemical/nano>
- Dust generation
- Waste products from the printing process may be hazardous waste
- Hot surfaces including print-head block and UV lamp
- High voltage power supply – verify ground and ensure electrical outlet meets electrical requirements
- UV radiation: never look directly into the lamp and make sure the UV screen is intact
- Moving parts of the inner printer assembly are dangerous while in operation

Lasers

- Many 3D printers use a high power laser to fuse the print media. Systems properly certified according to US FDA or international IEC laser product regulations typically pose no laser hazard during normal operation. Laser hazards can exist during maintenance or service operations, even with properly certified systems. Contact the Laser Safety Officer for an assessment prior to operation at laser@ehs.gatech.edu.

Thermoplastics and Photopolymers

- Skin can be irritated and may become sensitized to contact with these materials. Thermoplastics tend to be flammable and are at an elevated risk to become ignited inadvertently. Photopolymers often contain acrylates and/or other hazardous monomers. Exposure to UV to harden the product during the printing process can be a significant radiation safety concern causing damage to skin and/or eyes. For concerns, contact ors@ors.gatech.edu.

Metal Material

- Combustible/reactive metal powders are often used in construction of 3D-printed alloy metals and tools. Finely divided powders such as titanium and aluminum can spontaneously combust causing fires. Sources of ignition must be eliminated during the course of use intrinsically in the printer as well as in its storage location. This process uses very high heat which may expose users to thermal injury. Inhalation of the powders must also be avoided.

Support Material

- The process of 3D printing often requires support material providing the structure to battle the natural activity of gravity and allows for the creation of empty spaces in the 3D design. These materials often contain harmful chemicals, such as phenyl phosphates, that are incorporated into the polymer and must be treated as such during use and disposal.

Biological Materials

- 3D cell printers used in engineered tissue generation are becoming more prevalent. Potential exposure to the aerosols generated can be hazardous, and appropriate exposure controls must be considered. A risk assessment must be conducted by the GT EH&S Biosafety team: biosafety@gatech.edu

Baths to Clean 3D-Printed Parts

- Several types of chemical baths may be used to refine and clean the 3D-printed product. These baths often consist of organic solvents such as acetone or strong bases such as sodium hydroxide. The inhalation of these vapors and/or potential eye and skin contact risk is significant.



EOS Formiga P110 Laser Sintering 3D printer
(Industrial-grade)

3D Printer Installation and Maintenance

- If the printer requires specific ventilation, a project request form may need to be submitted through GT Facilities Design and Construction:
<https://facilities.gatech.edu/node/add/project-request>

Consumer-grade 3D Printers

- Must be installed and maintained according to the manufacturer's instructions.

Industrial-grade 3D Printing Systems

- Must be installed and maintained according to the manufacturer's instructions.
- Complete training provided by the manufacturer
- Needs to be serviced by the manufacturer or by personnel trained by the manufacturer

Maker Bot
3D Printer for
Rapid
Prototyping
(Consumer-
grade)

