

USING 3D PRINTERS SAFELY

Three-dimensional (3D) printers are a great educational tool. They provide rapid prototyping and the ability to create small-scale manufacturing for various lessons in science, technology, engineering, math, and art. Although a great tool, 3D printers produce hazardous byproducts including fine and ultra-fine particulates, volatile organic compounds, and heavy metals. When using 3D printers, required safety precautions protect students from inhaling hazardous particles and chemical vapors and avoid physical hazards such as burns, cuts, and pinches.

01 PRINTER SELECTION

- National Institute of Safety and Health (NIOSH) recommendations to select a fully enclosed printer to best protect from particulate, chemical, and physical hazards.
- Select a printer that can be used with polylactic acid filament (PLA). PLA is a biodegradable plastic made from natural substances including sugar, corn starch, or sugar cane. PLA filaments typically have the lowest emission rate of all filaments.

02 PRINTER LOCATION

- Choose the proper location, establishing appropriate ventilation, and place appropriate signage to provide visual reminders of safety practices.
- Set up the 3D printer in an area away from student desks or main workstations. This limits the time students spend near running 3D printers.
- Set up the 3D printer near a fire extinguisher.
- The printer must connect to an appropriately grounded outlet.

03 PRINTER VENTILATION

- Before using the printer, verify the effectiveness of the exhaust system.
- Here are ventilation options listed in order of preference:
 - Place the 3D printer inside an enclosure or fume hood that captures emissions and exhausts outside the building.
 - Place the 3D printer inside an enclosure or fume hood that captures emissions and filters them through charcoal and HEPA filters before discharging them within the building.

04 PRINTER SIGNAGE

- Appropriate signage and other visual cues provide important safety reminders to users.
- Post signs in a location directly visible to a person approaching the printer, on the front of the enclosure if possible.
- Signs should include:
 - Bulleted rules and procedures for safe use.
 - Identify and warn of hot surfaces.
 - Example signage: "Be cautious of burn risk when the 3D printer is preheating or powered on. Do not eat, drink, chew gum, or touch eyes, nose, or mouth when near or using a 3D printer. Wash hands thoroughly after use."

05 PRINTER OPERATION

- Safety training is needed before using the printer. It must include safe operating procedures and a discussion of potential hazards, including a review of the safety data sheet(s) for all products.
- A pre-use printer safety inspection by the classroom instructor.
- Students should not stand near or hover over the 3D printer when it is running.
- Only a classroom instructor or maintenance person should do routine maintenance or cleaning. Also, only a certified professional should service the 3D printer.
- Select the lowest temperature appropriate to filament materials to prevent unwanted emissions.
- Use a wet towel to clean surfaces. Sweeping or brushing will cause particles to go into the air and be inhaled.

