ENVIRONMENTAL HEALTH & SAFETY
UNIVERSITY of WASHINGTON

3D PRINTERS

Health and Safety Hazards

3D PRINTING HAZARDS

3D printing, also known as additive manufacturing, is becoming more common on the UW campus in maker spaces and in research labs and classrooms. New users may not realize that 3D printers, the materials they use, or their products and waste could present health or safety hazards. Contact with hot internal parts or hot plastic resin could result in burns or other hand injuries. Toxic volatile compounds can be emitted. Respiratory irritation can be caused by ultra-fine ("nano") particles released during printing or by particles released during sanding and grinding to finish the object. Dust can also make floors slippery and some dust can be combustible. Some printers use lasers or ultraviolet light and direct exposure could cause damage to your vision.

SAFE WORK PRACTICES

Here are some ways to reduce exposure to hazards and prevent injuries:

- Get trained on the safe and efficient use of the printer before you use it.
- Read the printer manual and operating instructions, and don't operate it if it is not clean and in good working condition. Never try to defeat the safety features.
- Make sure the printer is enclosed and has an interlock system that prevents the machine from running while moving parts are exposed. (User-constructed prototypes may not have these safety features.)

- Ensure that printers with lasers or UV light are properly shielded to prevent eye exposure.
- Use manufacturer recommended materials, less hazardous or "green" resins, plastics or other materials to make your product.
- Ensure the room has an adequate air supply and exhaust to dilute and eliminate printer emissions.
- Promptly clean up and properly dispose of dust, scraps and waste.
- Turn off, unplug and cool down the unit prior to cleaning or repairing.
- Read the safety data sheet (SDS) and use the correct protective gear when using chemicals to clean printed parts. Dispose of chemical waste properly.
- If you are working with or producing metal dust, you need to have a Class D fire extinguisher on hand as other types are less effective.

CONTROLLING EMISSIONS

Some recent research characterizes 3D printer emissions. In 2016, NIOSH (the National Institute for Occupational Safety & Health) funded a study on emissions from a limited number of printer types. They provided some recommendations for controlling and reducing exposures:

- Always use and properly maintain the manufacturer's supplied controls and filter system.
- Use the printer in a large, open, well-ventilated place (open window or at least four air changes per hour) or exhaust the printer directly outdoors. The size, type and number of printers will determine if room ventilation alone is sufficient.
- Position work stations away from printers to minimize breathing in emitted particles, and choose a low-emitting printer and filament when possible.
- Turn off the printer if the printer nozzle jams, and allow it to ventilate before removing the cover.
- Use materials with lower emissions that are recommended by the manufacturer, such as PLA instead of ABS. ABS is also more toxic.
- Institute engineering controls, including manufacturer-supplied equipment and proper ventilation (a full enclosure appears more effective at controlling emissions than a cover).
- Finally, after doing all of the above, you can consider wearing a particle filtering respirator (N95) to reduce your exposure.

If you have a design and would like to try out a 3D printer, there are designated maker spaces that will provide you with training and safety orientation, such as the CoMotion MakerSpace at Fluke Hall. If you want more detailed information about 3D printer safety, or want to design a space, contact EH&S at ehsdept@uw.edu. Or check out these resources:

- 3D Printing Safety Fact Sheet -- Carnegie Mellon University
- Warning -- How Safe is Your Desktop 3D Printer? -- 3D Print Headquarters

Information about a new enclosure that features ultrafine particle and volatile organic carbon filtration can be found here:

- 3D Created Ultrafine Particles (UFP) Exposure -- 3D PrintClean
- 3D Printer Scrubber Filter -- 3D PrintClean

For questions about 3D printers, contact EH&S at 206.543.7262.