## Roger Williams University 3D Printer Procedures

3D printers have become increasingly popular in recent years, with many people using them to create a variety of objects. 3D printers have associated chemical, electrical, fire, and ventilation hazards, and as such, 3D printers need to be selected, operated, and maintained correctly to prevent injuries and property damage.

### 3D Printer Use - General Procedure:

Every 3D printer needs to be operated according to the manufacturer's instructions for the specific make/model. All users need to review the manufacturer's instructions (operator or user manual) prior to using a 3D printer, and have completed the relevant online and hands-on training sessions. The manufacturer's instructions must be readily available to the user in the work area at all times.

**NOTE 1:** Never leave the 3D printer unattended while it is running. The equipment can get hot and it can be a fire hazard.

**NOTE 2:** Always keep the work area around the 3D printer clean and free of debris and clutter. The equipment can get hot and debris/clutter can be a fire hazard.

**NOTE 3:** Never use a 3D printer without its associated exhaust fan on and properly ventilating all fumes to either a filtration system or an exterior exhaust stack. The fumes can be a health hazard as well as a fire hazard.

**NOTE 4:** Read the user manual and product safety data sheets (SDS) prior to use **NOTE 5:** Never touch the printer components while it is printing. Electrified parts and/or parts in motion can cause electrical shock, burns, or pinch/crush body parts.

- Prepare your design for printing using the associated 3D printer software.
- Select the filament you will be using and confirm software/print settings match the filament you have selected
- Record the following information on the 3D Printer Use Tracking Sheet: the date of use, the product manufacturer/color/diameter, the name of the user, and the print run time in minutes.
- Turn on the ventilation fan (if it is activated separately)
- Set up the print bed height and level the bed, being aware of possible pinch points
- Start the print and monitor the print while the printer is running
- Remove the work piece from the 3D printer when it is cool to the touch
- Turn off the ventilation fan (if it is activated separately)
- Check that your filament use is properly recorded on the 3D Printer Use Tracking Sheet

#### 3D Printer Emergency Procedures

- If the 3D printer ventilation fan suddenly stops working:
  - Immediately stop the printer and notify the faculty member, technician, or monitor on duty.
  - The printer is now considered placed out of service.

- Do not resume printer use until the printer has been put back into service.
- If a 3D printer user shows signs of chemical exposure or other injury/illness: Note: check product's Safety Data Sheet for possible symptoms; general VOC respiratory exposure symptoms may include dizziness, headache, faint/lightheaded feeling, confusion, slurred speech, etc.
  - Stop printer use and immediately notify the faculty member, technician, or monitor on duty, who will call RWU Public Safety at 401-254-3333.
  - Provide a copy of the product SDS to RWU Public Safety and/or other responding emergency personnel
- If a 3D printer product ignites, begins to smoke, or otherwise catch fire:
  - Immediately stop the printer and notify the faculty member, technician, or monitor on duty
  - Evacuate the building following emergency evacuation procedures
  - From a safe place, call RWU Public Safety at 401-254-3333.

#### **3D Printer Training Requirements**

All 3D printer users must complete the following safety training requirements:

- Have a current Shop and Studio Safety Agreement on file
- Have current completions for all relevant general safety training for the work area, as listed on the <u>RWU Laboratory, Shop, and Studio Safety Training Requirements Links</u> for the current academic year
- Have current completion for the 3D Printer Training on the <u>RWU Laboratory</u>, <u>Shop</u>, and <u>Studio Safety Training Requirements Links</u> for the current academic year
- Have completed a documented hands-on 3D printer training session with an approved faculty member, technician, or monitor for the current academic year
- Reviewed Safety Data Sheet(s) (SDS) for all products they will be using

#### 3D Printer Recordkeeping Requirements

- The shop/studio safety technician (RWU employee not a student monitor) is responsible for maintaining the following records and providing a second set of copies to EHS on a monthly basis:
  - o 3D Printer Use Tracking Sheet for the previous month
  - Any new student and staff training records
  - Any new maintenance records, including any cleaning documentation

#### 3D Printer Installation Requirements:

- EHS must be notified at least three months in advance of any 3D Printer purchases.
  - 3D printers that are connected to exterior exhausts must be registered with Rhode Island Department of Environmental Management.
- 3D printers must have the following equipment located adjacent the printer (purchasing department is responsible for buying):
  - Product storage: an OSHA and NFPA-compliant flammable storage cabinet for isopropanol (IPA) used for cleaning
  - Waste disposal: a 4-liter plastic waste bottle (must include properly fitting cap), satellite accumulation area signage, and a label stating: "Hazardous Waste: 3D Printer Cleaning Solution (Isopropanol, Residual Printer Resin).")

- Glove disposal: a metal step-can (foot pedal-operated lid) for used gloves with a label stating: "Used Gloves for Disposal."
- Single-use saline eyewash bottles/cartridges OR a plumbed eyewash
- A portable ABC fire extinguisher
- A clipboard with a 3D Printer Use Tracking Sheet

#### 3D Printer Maintenance Requirements

- Ensure power is disconnected before performing any maintenance on the 3D printer or equipment (follow RWU Lockout Tagout Procedures)
- Follow manufacturer's instructions for maintenance and repair
- The shop/studio safety technician (RWU employee not a student monitor) is responsible for visually inspecting the 3D printer on a routine basis and scheduling maintenance and repairs, and completing the routine cleaning with isopropanol (IPA).

#### 3D Printer Routine Cleaning – General Process

Follow the manufacturer's specific recommended procedures and cleaning frequency schedule. Every 3D printer is different – **always follow the manufacturer's instructions for that specific make/model 3D printer.** 

The general cleaning process typically includes these steps:

- Turn off and unplug the printer.
- Wear ANSIZ Z87.1+ rated safety glasses and disposable nitrile gloves
- Remove any filament or resin according to the manufacturer's instructions.
- Use a soft cloth or sponge with IPA to clean the following areas:
  - The build plate
  - The extruder (the hotend, nozzle, and other extruder components)
  - $\circ$  Printer frame and bed
  - NOTE: Dispose of the used IPA following RWU Hazardous Waste Management procedures:
    - Place used IPA into closed, compatible, disposable container (e.g., 4 liter plastic bottle) with label stating "Hazardous Waste: 3D Printer Cleaning Solution (Isopropanol, Residual Printer Resin)."
    - Place the closed IPA waste container into the area's Hazardous Waste Satellite Accumulation Area
    - Submit a "Health/Safety" work order on the RWU Facilities Work Order System when waste container is ~70% full, so it will be included in the next waste pickup date
- Use a soft brush or compressed air to clean:
  - $\circ$  the printer fans
- Use a soft cloth or lens cleaning tissue to clean:
  - $\circ$  the print head or laser lens
- Reassemble the printer according to the manufacturer's instructions, and plug in the printer.

# RWU 3D Printer Use Tracking Sheet

Spray Booth:

Month/Year:

Date	User Name (e.g., "Jane Smith")	Filament Type	Prod. Mfr./Color/Diameter (e.g., "Colorfabb Black 3mm")	Print Run Time in Minutes
		□ PLA □ TPE/TPU □ ABS □ Nylon □ PETG		
		$\Box$ PLA $\Box$ TPE/TPU $\Box$ ABS $\Box$ Nylon $\Box$ PETG		
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Please scan copies to <u>safety@rwu.edu</u> at the end of each month, no later than the 5<sup>th</sup> of the following month