# Department of Engineering – Risk Assessment Ref No.

**Title of project/experiment/activity**

## Whittle Lab 3D Printer

| **Location of activity** | **Start and end dates** |
|---|---|
| Whittle Laboratory, Natal Room (WWG-44) | 27/10/2015 ongoing |

**Brief description (or attach procedure/protocol)**

The Stratasys Connex2 350 3D printer is used to produce 3D parts from user supplied *.stl CAD geometry files. 3D parts are printed by the heads which build up the 3D part in thin layers of photo-reactive polymers which harden on exposure to UV light. All parts of the printer are enclosed and UV shielded during the printing process by an interlocked hood.

3D printer material is supplied in sealed 3.6kg cartridges. Under normal conditions of use, the substance is released from a cartridge only inside an appropriate printing system, and therefore, exposure is minimal. Materials in common use at the Whittle Lab include (but are not limited to) FullCure705 support, RGD-835 (VeroWhitePlus), RGD-515 (Digital ABS part 1) and RGD-531 (Digital ABS part 2).

The weight of the 3D printer waste container should be checked prior to every build. It should be replaced with an empty one if the weight of the waste container is greater than 7kg (total capacity 8kg). See “handling waste” procedure attached. The full waste container should be sealed, securely boxed up and sent to Ian Slack at the Engineering Department main site for proper disposal in accordance with the regulations.

After every build the 3D printer heads and build tray should be cleaned with a lint free cloth soaked in isopropanol.

Parts produced can be cleaned in a solution of sodium hydroxide to remove excess support material. See attached procedure.

Parts produced can be treated in a thermal treatment oven to improve the mechanical properties of the part. The maximum temperature of this post curing process is 100$^{o}$C. See attached procedure.

| **Hazard** | **Effect** | **Control measures** | **Residual risk** |
|---|---|---|---|
| Ventilation system failure | Exposure to uncured and partially cured 3D printer material fumes | Machine exhaust connected to external ventilation.<br><br>Any failure of the external ventilation or any fumes in the 3D printer room should be immediately be reported to John Saunders or Nick Hooper in the Whittle Lab workshop.<br><br>Operation of the 3D printer can continue in the event of failure of the external ventilation by switching on the room extractor fan and the Low Speed Lab extractor fan #6. | Low |
| Changing cartridges | Exposure to uncured 3D printer material | Inspect cartridge for damage. Do not use if damaged. | Low |

| | | | |
|---|---|---|---|
| | | When handling damaged cartridges, wear lab coat, safety goggles and nitrile gloves. In case of leak, follow spillage procedure below. Place damaged cartridge in properly labelled closed container.<br><br>Undamaged cartridges do not pose a spill risk - no protective equipment required.<br><br>See attached COSHH assessment(s) for handling 3D printer materials. | |
| Waste handling | Spill risk - exposure to uncured/ partially cured 3D printer material | Wear safety goggles, lab coat and nitrile gloves when removing and handling waste from the 3D printer.<br><br>See attached sheets for handling 3D printer waste and COSHH assessments for relevant 3D printer materials. | Low |
| Exposure to cleaning solvents | Chemical burns | Wear safety goggles and neoprene of nitrile gloves when handling isopropanol, sodium hydroxide or models soaked in sodium hydroxide.<br><br>See attached COSHH assessment for handling isopropanol or sodium-hydroxide. | Low |
| Risk of burn | Burns to hands | Wear oven gloves when removing parts from the heat treatment oven. | Low |

**Personal Protective Equipment required** [*eye/face protection, respiratory protection, gloves, lab coat etc*]

Nitrile gloves.
Safety goggles.
Lab coat.
Oven gloves.

**Emergency Instructions & First Aid**

<u>Spillage</u>
In the event of leakage or spillage of 3D printer material, use disposable towels or other absorbent material, such as sawdust or activated charcoal. Do not allow the spilled material to enter the public drainage system or open water sources. Rinse the spill area with denatured or isopropyl alcohol (IPA), followed by soap and water. Dispose of the absorbent material in accordance with applicable environmental and safety regulations.

Do not wash contaminated clothing at home; clothing should be professionally laundered. Dispose of contaminated shoes, belts and other leather items. Absorbed waste material may re-expose the user when these items are worn.

<u>First Aid – Exposure to 3D Printer Material/ Fumes</u>
In general, try to avoid direct contact with printer waste. If skin or eyes come into contact with it, wash the area immediately and thoroughly with water, and follow these first-aid instructions.

- Use cool water to prevent skin pores from opening.
- Do not use solvents to clean skin.
- If eyes or large areas of skin have been exposed or if irritation persists, seek medical attention.
- Avoid the accidental transfer of waste material from the hands to other areas of the body, especially to the eyes.
- If liquid waste splashes into the eyes when contact lenses are worn, immediately remove the lenses and flush the eyes with water.
- If printing material is swallowed, the victim should drink plenty of water, and immediately seek medical attention. Do not induce vomiting.
- If vapors from printer waste cause respiratory irritation, expose the victim to fresh air immediately, and seek medical attention.

<u>First Aid – Exposure to sodium hydroxide</u>

In case of direct contact with sodium hydroxide, clean the affected area immediately with running water and then seek medical attention.

<u>First Aid – Exposure to Isopropanol (taken from Isopropanol data sheet)</u>

- Eye contact – rinse immediately with fresh water, also under eyelids, for at least 15mins. Obtain medical attention.
- Skin Contact – wash off immediately with plenty of water for at least 15mins. Obtain medical attention.
- Ingestion – do not induce vomiting. Obtain medical attention.
- Inhalation – Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

<u>First Aid – Burns</u>

- Immediately place any burns under cold water for 15 minutes.
- Report to a first aider if deep or extensive otherwise protect with a plaster (band-aid).

**Any special monitoring required** [*e.g. hearing test, vibration monitoring, health surveillance*]

None

**Further control measures required? If yes, list with actions.**

None.

**Biological/Laser/Radiation Approval** [*requires relevant Specialist Safety Officer signature and date*]

N/A

**Out of hours/Lone working**

Permitted.
In case of damaged cartridge or spillage – seek assistance.

# Department of Engineering – Risk Assessment Ref No.

Signature to confirm that this is a suitable and sufficient assessment of risk and that stated control measures are in place. This risk assessment should be reviewed if additional risks not covered in this assessment are identified or if there is any reason to indicate that the control measures are insufficient.

| **Name of Assessor**<br>Anthony Dickens<br>Email: amjd2@cam.ac.uk | **Signature** | **Date** |
|---|---|---|
| **Name of Supervisor** | **Signature** | **Date** |

| **Local Safety Coordinator** | **Signature** | **Date** |
|---|---|---|
| **Departmental Safety Office** | **Signature** | **Date** |

## Department of Engineering – Risk Assessment Ref No.

| **Title of project/experiment/activity**<br>**Whittle Lab 3D Printer** |
|---|

| **Additional Users** | **Signature** | **Date** |
|---|---|---|
| | | |

Signatures to confirm that risk assessment has been read and understood.