



## **The 3 Simple Facts about Desktop 3D Printer Safety - YOU NEED TO KNOW!**

### **(1) The Law**

If your business uses or creates substances, or carries out processes which might cause harm to health, the law requires you to control the risks to employees. The Control of Substances Hazardous to Health Regulations (COSHH) apply to most harmful substances <http://www.hse.gov.uk/toolbox/harmful/coshh.htm>

### **(2) Desktop 3D Printer Emissions**

When operating, ALL desktop 3D Printers emit nanometre size plastic particles that can be breathed in and ingested in to your body REGARDLESS of the filament type used. See UK HSE Government documentation at <http://www.hse.gov.uk/research/rrpdf/rr1146.pdf>

### **(3) Additional Desktop 3D Printer Hazards**

When operating, ALL desktop 3D Printers have areas on the machine that operate at a hot enough temperature to cause severe skin burns with skin contact and ALL desktop 3D Printers have mechanical movement mechanisms that can potentially trap fingers/hair/clothing. Further hazards - see main document

#### **Conclusion**

WE BELIEVE THE KORA HSE TESTED SAFETY ENCLOSURE IS AN EFFECTIVE WAY TO ADDRESS THESE AND THE MAJORITY OF ADDITIONAL HAZARDS ASSOCIATED WITH DESKTOP 3D PRINTING.  
WE ALSO BELIEVE THAT USING THE KORA SAFETY ENCLOSURES IN CONJUNCTION WITH A COMPETENT RISK ASSESSMENT (help available later in this document) WILL REDUCE THE CHANCES OF HARM BEING CAUSED TO PEOPLE AND THE ENVIRONMENT.  
[www.kora3d.com](http://www.kora3d.com)



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**Desktop 3D Printer - Risk Assessment Guidance - this must be modified to suit your place of work / responsibility**

Your final completed Risk Assessment should take into consideration the points shown in this guidance AND also include the activities, age/pupil ability, department/working environment and the experience of the teacher/staff/supervisor in charge. If 'Control Measures Required' as described below are implemented to the shown Identified Risks, those risks should reduce to an acceptable level. Always follow current HSE Risk Assessment guidelines

Document Type: Risk Assessment Guidance

Title: **Desktop 3D Printing Machines**

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Identify the Risks	Who is at Risk?	What is the Harm?	Activity	Control Measures Required	Additional Information	Relevant Laws (see below)
Employees, teachers, technicians and students should be made aware of the following hazards.					Reference BS 4163:2014 - Health and safety for design and technology in educational and similar establishments. All manufacturer's instruction guides should be followed and kept within the department for future reference.	
1. Electric Shock.	Employees, teachers, technicians, visitors and students.	<b>Damaged cables can lead to the risk of electrocution.</b>	Desktop 3D Printing.	Power cables should be regularly checked to ensure that they are undamaged. The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.	The risk of electric shock is reduced by good maintenance.	(1), (2), (3), (7) (8)
2. Cable Trip Hazard.	Employees, teachers, technicians, visitors and students.	<b>Mains cable and USB cables present a trip hazard around the machine.</b>	Desktop 3D Printing.	Cables should be routed behind the machine or away from used walkways.	Best practice is to use a ceiling mounted drop down socket which also removes the mains cable tripping hazard.	(1)
3. Inhalation of Fumes and Particulates.	Employees, teachers, technicians, visitors and students.	<b>Toxic fumes and small particulates can be ingested by respiratory means with possible short, medium and long term consequences to human health.</b>	Desktop 3D Printing.	If fumes are produced that cannot be removed with general classroom ventilation, LEV should be provided. It is possible for school Desktop 3D printers to produce damaging toxic fumes and/or potentially dangerous small particulates. Full and correct use of a fully tested Safety Enclosure can control this hazard. Note: Time must be given after 3D model manufacture for the product to cool down and fumes to be totally filtered.	Where an effective LEV (Local Exhaust Ventilation) system (e.g. Safety Enclosure) is not in place, the Desktop 3D Printer should not be operated whilst people or animals are present in the same room/area, especially for prolonged periods of time. Any chosen Safety Enclosures should be tested to - <i>BS EN 1093 (2006) Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 3</i>	(1),(2),(4),(5)
4. Exposure to Toxic Materials and choking hazards.	Employees, teachers, technicians, visitors and students.	<b>Toxic materials can affect sensitive skin and allergies. Small parts can be ingested causing breathing airway blockage.</b>	Desktop 3D Printing.	Toxic materials which present high level risk should not be used. A safer alternative should be selected whenever possible.	Desktop 3D Printers should not be used with young children or pupils who are likely to put models in their mouths unless access to the printed model is under lock and key from easy access.	(1),(2),(4)

Identify the Risks	Who is at Risk?	What is the Harm?	Activity	Control Measures Required	Additional Information	Relevant Regulatory Laws (see attached)
5. Unauthorised Use.	Unauthorised User.	<b>Unauthorised use.</b>	Desktop 3D Printing.	The Desktop 3D printer should be switched off when not in use. If the machine is being left on over break or lunchtime, clear signage should be present for the machine not to be touched or interfered with, especially if the model type has no outer guarding.	Enclose 3D Printer in a lockable Safety Enclosure to prevent unauthorised use or unauthorised interference during authorised use.	(1),(2),(3)
6. Mechanical Machine Movements Trapping Fingers/Hair/Clothing.	Employees, teachers, technicians, visitors and students.	<b>Fingers/Hair/Clothing can be trapped between moving parts inbound of the machines casing.</b>	Desktop 3D Printing.	The Desktop 3D Printer should have locking door(s) to avoid the operator's fingers/hair/clothing being trapped by moving parts. If the machine has no outer guarding clear signage should be present to highlight the risk of finger trapping.	If the 3D printer has no enclosure on the printing mechanism, consider placing the Desktop 3D Printer inside a lockable Safety Enclosure to keep fingers and hands away from moving parts whilst the machine is operational.	(1),(2),(3)
7. Skin Burns.	Employees, teachers, technicians, visitors and students.	<b>Heated parts (hot end, nozzle and heated build plate) on a Desktop 3D Printer can lead to severe skin burns on contact.</b>	Desktop 3D Printing.	Make certain no person approaches the Desktop 3D Printer whilst in operation or places hands or body near any of the machine working or heated parts.	If the 3D printer has no enclosure on the printing mechanism, consider placing the Desktop 3D Printer inside a lockable Safety Enclosure to keep fingers and hands away from heated parts whilst the machine is operational and during a period of cooling down, post printing.	(1),(2),(3)
8. Manual Handling.	Employees, teachers, technicians and students.	<b>Skeletal/Muscle injury due to attempted heavy machine lifting/relocation.</b>	Desktop 3D Printer relocation.	Some Desktop 3D Printers may exceed the recommended maximum 1 person lift limit. Make certain such Desktop 3D Printers are lifted/relocated by 2 or more persons only.	If the Desktop 3D Printer is enclosed in a Safety Enclosure, consider locating the Safety Enclosure on a specifically constructed wheeled Safety Trolley. This will offer safe 1 person relocation without the manual lift requirement.	(1),(2),(6)

## IT IS NOW WRITTEN IN LAW THAT:

Where FFF / FDM Desktop 3D Printing takes place in the work-place and Education establishments, employers will have duties to apply relevant legislation, and ensure that suitable and sufficient risk assessments are carried out. Measure to address those risks will need to be implemented. <http://www.hse.gov.uk/toolbox/harmful/coshh.htm>

Operators of FFF / FDM Desktop 3D Printers who fail to carry out suitable and sufficient risk assessments or fail to put adequate measures in place to mitigate those risks could be in breach of their responsibilities. They could be liable to enforcement action including prosecution. This may be exposing employees / students and other third parties to a risk of harm or injury that should be avoided. This could lead to personal injury claims or employment related claims.

The legislation below has been independently advised by Health and Safety Lawyers and has been deemed relevant to the Risk Assessment for Secure Micro Solutions, Unit 6, United Business Park Lowfields Road, Leeds LS12 6UB.

### (1) Health and Safety at Work etc Act 1974

Employers and those in control of premises are responsible for the health and safety of employees and others who may be affected by risks arising at that premises. The duty to employees is a duty to ensure their health, safety and welfare, and includes providing plant and systems of work which are safe and without risks to health, safe arrangements for handling, storing and transport of articles and substances, training and supervision and a safe working environment without risks to health.

Risk management measures need to be adequately communicated to staff and others who may be affected.

The majority of risks arising from 3D printing in the workplace are likely to be regulated by this Act. Penalties could include imprisonment and an unlimited fine for those in breach of their obligations.

### (2) Management of Health and Safety at Work Regulations 1999

Under Regulation 3, every employer is obliged to make a suitable and sufficient assessment of risks to employees and non-employees to identify necessary preventative and protective measures.

Employers may need to appoint competent persons to assist them and shall provide information and adequate training to employees.

These Regulations are likely to apply to the use and operation of 3D printers, for example both to those operating them and those present while printers are operating.

A risk assessment under these Regulations is unlikely to be suitable and sufficient unless it identified and addresses all recognised risks, including for example inhalation of particles and vapors, burns, traps and manual handling injuries.

### (3) Provision and Use of Work Equipment Regulations 1998

Equipment provided by an employer shall be suitable for its purpose. In selecting work equipment, an employer should have regard to the risks to the health and safety of people in the premises and any additional risk posed by that equipment.

Equipment should be maintained in an efficient working order and in good repair. It should be inspected at suitable intervals where risks arise from its use.

Those using equipment shall have adequate health and safety information, written instructions and training. Hazards that are specifically referred to in these Regulations include unintended discharge of dust, vapour or other substance, and prevention of burns from equipment operating at high temperatures. These are hazards which may be associated with the use of 3D printers.

#### (4) Control of Substances Hazardous to Health Regulations 2002 (COSHH)

Employers owe a duty to employees and other affected persons to protect them against risks to their health arising from exposure to substances which are hazardous to health. This could include a substance which is not listed in the regulations but because of its chemical or toxicological properties, and the way it is present at the workplace, creates a risk to health.

Employers must make a suitable and sufficient risk assessment and take the steps that are needed to address those risks. The risk assessment should consider a range of information listed in Regulation 6(2). Regulation 7 requires an employer to prevent exposure to substances hazardous to health where it is reasonably practicable to do so. If it is not possible that exposure should be adequately controlled.

Control measures need to be available and in use. They also need to be maintained in good working order.

These Regulations apply to nanomaterials; being material that has extremely small internal or surface structure.

Exposure to certain particulates can cause lung disease, skin irritation and long-term illnesses which do not manifest for some time after the exposure.

#### (5) Workplace Health Safety and Welfare Regulations 1992

Workplace equipment shall be subject to a suitable system of maintenance. Every enclosed workplace shall be ventilated by a sufficient quantity of fresh or purified air. Where 3D printers are in operation and are not in enclosed filtered enclosures, it may be necessary for an organisation to assess emission levels of any vapours or particles together with working practices and ventilation arrangements, so it can establish the measures which are necessary to address those risks.

#### (6) Manual Handling Operations Regulations 1992

Employers should avoid the need for employees to undertake manual handling which involves a risk of injury. Where that is not possible a risk assessment should be undertaken and appropriate steps to reduce the risks to the lowest level reasonably practicable. Where a 3D printer cannot be wheeled and must instead be lifted and carried, employers should take appropriate measures to reduce the risk to employees. The same applies to any article produced by the printer.

#### (7) Electricity at Work Regulations 1989

All systems in the workplace should be maintained to prevent danger, and various specific provisions apply to electrical equipment such as 3D printers.

Additional requirements for schools

Local authority run school premises and facilities in England must be maintained to a standard which ensures the health, safety and welfare of pupils under The School Premises (England) Regulations 2012. Similar provisions are found in Education (School Premises) Regulations 1999 for Wales, and for private schools in separate legislation. These will all apply to the areas in which 3D printers are housed.

#### (8) Regulatory Reform (Fire Safety) Order 2005

Under the Regulatory Reform (Fire Safety) Order 2005 a responsible person (for example an employer in a workplace or person who has control of the premises, or the owner of a premises) is required to take general fire precautions that are necessary to ensure the safety of employees and to ensure that the premises are safe.

A suitable and sufficient risk assessment should be made, which identifies the fire precautions that are necessary to address those risks. Preventative and protective measures should be taken to eliminate or reduce those risks. These measures and risk assessments should be regularly reviewed, and the premises and equipment should be maintained under Regulation 17.

3D printers may operate at high temperatures or carry elevated risks of fire and should be considered as part of any risk assessment under this legislation.

Further legislation may apply to 3D printers or to the premises in which they are located. Every operation is unique and should apply the legislation that is relevant to the operation, and the risks and hazards which are identified.

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