



# Labour

## HAZARD ALERT

### 3D PRINTERS

#### Background

Three-dimensional (3D) printers are increasingly common in workplaces. 3D printers can build and manufacture physical objects of various sizes and composition from computer images.

Common 3D printers melt plastic through a hot nozzle, and then layer it to construct solid objects. Printing at higher temperatures can cause the plastic to emit 10 times more hazardous dust and plastic vapours than printing at lower temperatures.

“Exotic” materials can also be combined with plastics that melt at a low temperature. Some of these materials are: dust (wood, bamboo or metal), carbon fibre, beer brewing by-products, cork, or coffee.

Metal 3D printing melts fine metal powder – such as aluminum or titanium – with laser beams, which can release fine metal particles into the workplace. Some 3D printers use a laser or an ultraviolet (UV) light to solidify liquid resin, which can release volatile organic compounds (VOCs). Other 3D printers use wood fibre nanoparticles and carbon nanotubes dissolved in hydrogel to create electrically conductive “wooden” objects.

These hazardous emissions and nanoparticles pose a risk to the health of workers, and can cause health problems such as: asthma, inflammation of the lungs, headaches, coughing, circulatory system problems, and skin illnesses. The applicable occupational exposure limits of the ingredients must be followed.

#### Hazards

Factors that can lead to an accident, death, or illness from using a 3D printer include:

- airborne microscopic dust from all types of 3D printers;
- emission of VOCs from plastic 3D printing;
- toxicity, flammability and explosiveness of the fine metal powder in metal 3D printing;
- toxicity of resin, residues, lasers/UV light, and VOCs from resin 3D printing; and
- physical injuries, such as cuts, during use and maintenance.

#### Eliminating and Controlling the Hazard

3D printers are more hazardous than paper printers, and must be treated with a similar level of care used for other industrial equipment. For example:

- before using a 3D printer, the employer must conduct a hazard analysis and take action to control the hazard;

- the employer should choose 3D printers already equipped with exposure limiting features such as covers, ventilation systems, and low emission features;
  - Always refer to the safety data sheet of the plastic or other printing media of the 3D printer and follow the WHMIS 2015 requirements.
- the area near the printer should be ventilated with a local air exhaust system equipped with a high-efficiency particulate air (HEPA) filter, and the room containing the 3D printer should have a general ventilation system;
- workers must be made aware of the potential hazards, basic first aid, and prevention strategies;
  - If a qualified person recommends a medical exam for workers at risk of exposure to hazardous substances in a hazardous substances investigation report, then a health monitoring program may be required to screen and update workers' files regarding changes to their health, including respiratory health.
- the employer should minimize the time that workers are required to work in close proximity to a 3D printer;
- the employer is required to train workers in the usage, cleaning, and maintenance of 3D printers, as applicable; and
- if other control measures do not sufficiently control the hazard, gloves and respirators can also be used.

## Legislative Requirements

Canadian Occupational Health and Safety Regulations (COHSR) Part X describes the requirements for such hazard investigations when there is a likelihood of a hazardous exposure that endangers the health or safety of a worker, including:

- workers being warned about the potential hazards present at the workplace;
- workers receiving adequate education and training;
- requirements for controlling hazard exposures in the workplace; and
- WHMIS 2015 requirements for the safety data sheets of the plastic or other printing media.

COHSR Part XII contains requirements for the appropriate personal protective equipment that must be used when using 3D printers, including: skin; eye; face; and respiratory protection.

COHSR Part XIX contains requirements for a hazard prevention program, including: identifying and assessing hazards; preventive measures; employee education and training; and program evaluation.

### Additional Resources

For more information on controlling exposure to hazardous substances, especially those that do not have an established occupational exposure limit, please refer to the: [Control Banding Guideline](#).

For more information on controlling exposure to nanoparticles, please refer to: [Engineered Nanoparticles: Health and Safety Considerations](#).

For further information, please contact the ESDC Labour Program Office at 1-800-641-4049. The [Labour Program website](#) provides information on occupational health and safety topics such as: [Right to Know](#), [Right to refuse dangerous work](#), and [Workplace Health and Safety Committees](#).