

3D Printing Safety Fact Sheet

HS25-002A (04-25)

What is 3D printing and how is it used?

3D printing, also known as additive manufacturing, is a technology that creates three-dimensional objects by building them layer by layer from digital designs. This process uses materials such as plastics, metals, resins, and even biological substances. 3D printing is transforming industries by enabling rapid prototyping, custom manufacturing, and efficient production of complex parts.



Industries using 3D printing include:

- **Health care.**
Used for customized prosthetics, dental implants, surgical models, and drug delivery devices.
- **Aerospace.**
Used for lightweight, complex aircraft parts.
- **Automotive.**
Used for rapid prototyping, custom tools, and specialty vehicle components.
- **Construction.**
Used for building architectural elements and even entire structures.
- **Consumer goods.**
Used to make personalized products, toys, and electronics.

Hazards of 3D printing in the workplace

While 3D printing offers many benefits, it also introduces potential hazards for employees and organizations. These risks vary depending on the materials, printer type, and processes used.

Common hazards include:

- **Chemical exposure.**
Heating plastics and resins can release volatile organic compounds (VOCs) and ultrafine particles (UFPs), which may cause headaches, respiratory irritation, nausea, and long-term health effects like cardiovascular or pulmonary disease.
- **Nanoparticle emissions.**
Inhalation of nanoparticles produced during printing can lead to respiratory and cardiovascular problems.

- **Corrosive and flammable chemicals.**
Post-processing often involves solvents (like acetone) or corrosive baths, posing risks of burns, fires, and explosions.
- **Biological hazards.**
Printers using biological materials may generate aerosols that can be inhaled or contaminate surfaces.
- **Heat and burns.**
Printer components such as print heads and heated beds can cause burns if touched.
- **Fire and explosion.**
Fine metal powders and flammable solvents can ignite, especially in poorly ventilated areas.
- **Inert gas asphyxiation.**
Use of gases like nitrogen or argon can displace oxygen, creating a risk of suffocation.
- **Electrical and mechanical hazards.**
Unguarded components and moving parts can cause shocks, pinches, or other injuries.
- **Ultraviolet (UV) light and lasers.**
Some printers use UV light or lasers, which can damage eyes and skin.

Regulatory guidance and standards

Occupational Safety and Health Administration (OSHA):

- **Hazard Communication Standard (29 CFR 1910.1200):**
Requires employers to provide information and training about hazardous chemicals, including [Safety Data Sheets](#) (SDS) for all materials used in 3D printing.
- **General Duty Clause (29 USC 654(a)(1)):**
Employers must provide a workplace free from recognized hazards.

National Institute for Occupational Safety and Health (NIOSH):

- Publishes a detailed [guide on 3D printing safety for small businesses](#), emphasizing risk management, controls, and best practices for various workplace settings.

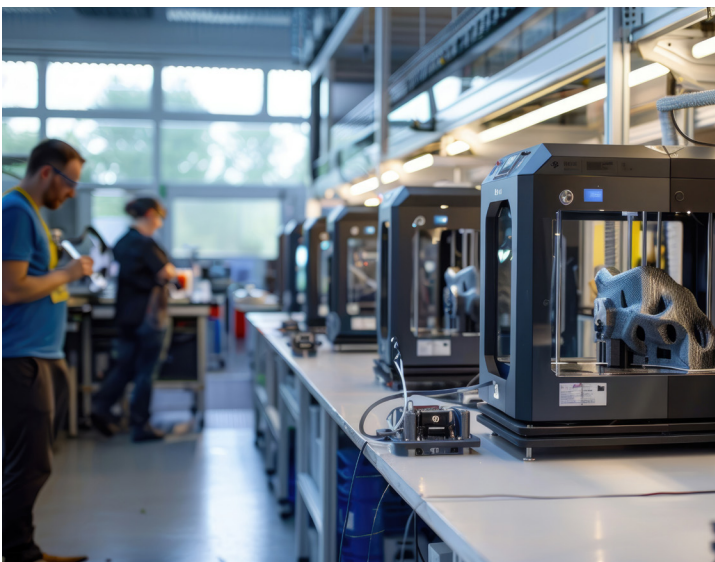
American National Standards Institute/Underwriters Laboratories (ANSI/UL) 2904:

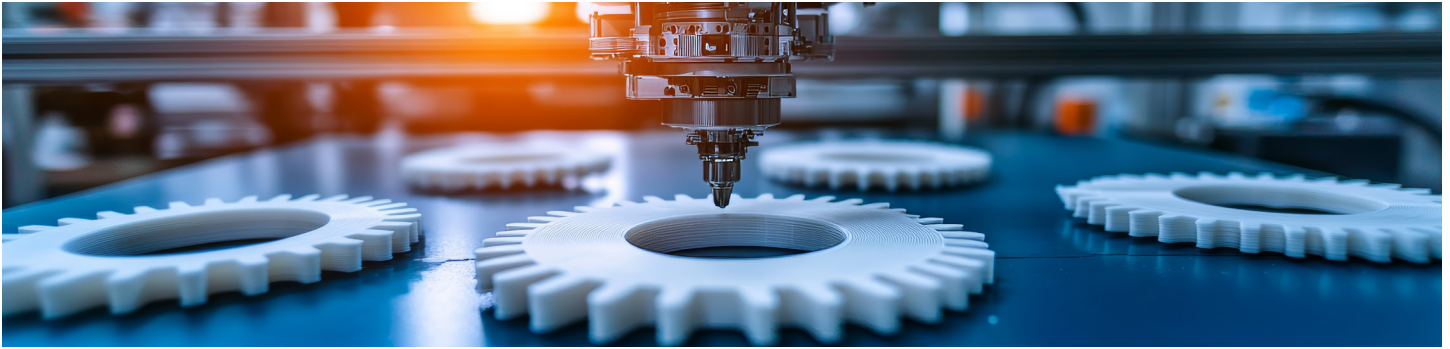
- Sets [standards for emissions from 3D printers](#), helping employers select safer equipment and materials.

Steps to reduce 3D printing hazards

For employers:

- Develop a risk management plan. Assess all 3D printing activities (pre-printing, printing, post-processing, and maintenance) and [identify hazards](#). Involve employees in planning and review.





- **Provide training.**
Ensure all workers receive [training on 3D printing](#) hazards, safe operation, and emergency procedures.
- **Limit access.**
Restrict printer use to trained, authorized personnel.
- **Improve ventilation and enclosures.**
Enclose printers and use with HEPA/VOC filtration. Only operate printers in well-ventilated, isolated areas to capture emissions and reduce exposure.
- **Choose safer materials.**
Select printing materials with lower emissions when possible and follow manufacturer safety instructions.
- **Supply personal protective equipment (PPE).**
 - Fit-tested respirators for fumes and particles.
 - Chemical-resistant gloves, such as neoprene or nitrile, for chemical handling.
 - Splashproof eye protection, such as safety goggles or face shields.
 - Flame-retardant or chemical-resistant coveralls, as appropriate.
- **Maintain equipment and clean regularly.**
Clean printers and surrounding areas

regularly using wet methods or HEPA vacuums. Do not use dry sweeping, which can spread particles.

- **Establish emergency procedures.**
Provide eyewash stations, fire extinguishers, and first aid kits near printing areas. Ensure employees know emergency protocols.

For employees:

- **Follow safety training and procedures.**
Always use the printer according to manufacturer instructions and workplace safety protocols.
- **Minimize exposure.**
Limit time spent near operating printers and avoid congregating in printing areas.
- **Wear PPE properly.**
Wear all required PPE when operating or maintaining printers, handling materials, or performing post-processing tasks.
- **Practice good hygiene.**
Wash your hands thoroughly after handling printing materials and before eating or touching your face.
- **Report hazards.**
Notify supervisors immediately about equipment malfunctions, chemical spills, or unsafe conditions.

Quick reference table: Summary of key safety measures

Hazard Type	Controls/Actions
Chemical exposure.	Ventilation, enclosures, PPE, material selection.
Nanoparticles.	Enclosed printers, HEPA filters, respirators.
Burns or heat.	Training, warning labels, PPE.
Fire or explosion.	Safe storage, no open flames, proper ventilation.
Electrical or mechanical.	Equipment guards, maintenance, training.
UV and lasers.	Eye and skin protection, safety interlocks.
Corrosive chemicals.	PPE, emergency eyewash, safe handling procedures.



3D printing is revolutionizing manufacturing, health care, and many other industries, but it brings new workplace hazards that must be managed. By understanding the risks, following regulatory guidance, and implementing practical safety measures, employers and employees can ensure a safe and productive 3D printing environment. For more information on workplace safety or upcoming training classes, contact DWC at safetytraining@tdi.texas.gov or 800-252-7031, option 2.





www.txsafetyatwork.com

1-800-252-7031, Option 2

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