

## 3D printing - a “dusty” business?

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3D printers are becoming increasingly popular. They can be used to create a wide variety of three-dimensional objects based on computer templates. For example, depending on the method used, objects can be printed using plastics, synthetic resins, ceramics or metal. The material is applied layer by layer and, in doing so, building the printed object. But what about health risks from the extremely fine particles and volatile chemical substances that might be released and inhaled during printing?

To close the substantial gaps in our knowledge, scientists at the German Federal Institute for Risk Assessment (BfR) are investigating which particles are released into the environment and what their properties are. Different substances are released into the air depending on the material used for printing. For example, BfR experts were able to detect particles of the widely-used plastic polylactic acid and copper crystals, among other substances.

The size of the particles was 50 nanometres (polylactic acid) and 120 to 150 nanometres (copper). This means that they are so small that they can get into the alveoli, the smallest branches of the lungs. The higher the temperature during “printing”, the more particles were released. The BfR is now exploring whether “3D printer dust” poses a health risk.

Consumer safety regarding 3D printers was also the focus of an expert meeting (partly held online) that took place at the BfR on 28 August 2020. In addition to the BfR, the participating institutions were the German Federal Institute for Materials Research and Testing (BAM), the German Environment Agency (UBA), the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) and the US Consumer Products Safety Commission (CPSC). Research institutes from Technische Universität Berlin, interest groups and members of the 3D printing association “3DDruck e.V.”, in which users and manufacturers are organised, were also represented.

The event focused on fused deposition modelling (FDM, also known as fused filament fabrication, FFF). In this additive production process, a thermoplastic, the filament, is heated and then applied layer by layer to create the desired object.

The BfR, BAM and CPSC presented their initial results at the meeting. These showed that volatile components and particles are released during printing. Release is influenced by the materials used (plastic, dyes, additives) and the printing temperature. Investigations conducted by BAM and CPSC were carried out with 3D printers, while the BfR also tested 3D printing pens. There is little information available on possible health effects so far, so the BfR sees this as a core research area.

Different measures were discussed to reduce the release and ensure consumer protection. Other issues included possible risks in the subsequent treatment of 3D printed objects (e.g. through smoothing down) as well as the use of other 3D printing methods, such as stereolithography (SLA) or selective laser sintering (SLS). Better ways to distribute the information regarding possible health risks to the consumers were also discussed.

## About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the German federal government and German federal states ("Laender") on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

*This text version is a translation of the original German text which is the only legally binding version.*