Chemical Insights
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Foresight

Highlighting Chemical Insights' Research and Education for Safer Environments and Healthier People

Our Featured Initiatives

Indoor Air Quality

Most Common VOCs

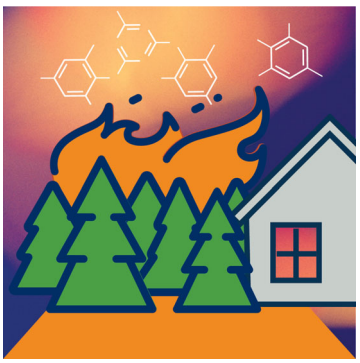
The indoor environment typically contains anywhere from 300 to 1,000 different volatile organic compounds (VOCs) at any time. The specific VOCs and their levels depend on many factors including sources, ventilation, and type of environment. From our research, we are developing a significant database of specific VOCs being found in indoor and outdoor air, their levels, and their primary sources. Those VOCs commonly and frequently being found include:

- Acetaldehyde
- Ethylene glycol
- Acetophenone
- Cyclohexane
- Xylenes
- Naphthalene

- Phenol
- Ethyl benzene
- Propyl acetate
- Tetrachloroethylene
- Methylene chloride
- Formaldehyde
- Cyclopentasiloxane

We will continue to feature specific information on these VOCs and to date have provided an update on Formaldehyde and Toluene.

Wildfires

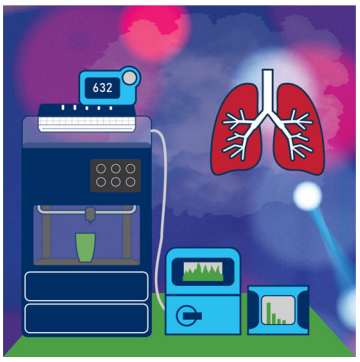


The Chemistry of Urban Wildfires

Wildfires are a significant environmental and human health threat. Our technical brief, "Understanding Wildfires," outlines the global activity of these fires along with significant environmental and human health threats. Chemical Insights participated in the National Academies of Sciences, Engineering, and Medicine's workshop, "The Chemistry of Urban Wildfires," on June 8. This workshop brought together key experts to discuss urban materials and combustion products; emission sources during a fire and potential exposure routes and impact; and chemical processes associated with the urban-wildfire interfaces.

Residential construction materials and furnishings can have an impact on fire burn emissions. Chemical Insights' research on furniture flammability discusses the smoke toxicity during furniture burns and identifies numerous releases of VOCs during the burns. These include carcinogenic and hazardous VOCs such as benzene, styrene, benzonitrile, acetaldehyde, formaldehyde, naphthalene, and toluene.

3D Printing



Toxicity Analysis of 3D Printer Emissions

Chemical Insights and its research partners are continuing research initiatives on the emissions of 3D printing. Early work focused on the heating and extrusion of thermoplastics using fused filament fabrication, also known as FFF, with the findings that numerous VOCs were released as well as high levels of ultrafine particles (UFPs). Initial in vitro and in vivo toxicity studies of emitted particles from ABS and PLA filaments showed toxicity responses. The full results can be found in the journal article, "Chemical Composition and Toxicity of Particles Emitted from a Consumer-Level 3D Printer Using Various Materials," as published in *Environmental Science & Technology.*

Additional research on the toxicity of 3D printer emissions is being conducted to determine respiratory dose potentials and toxicological characterizations of the

particles. This will include cell-based assays and a look at metabolomic profiles for unique metabolite signatures. A key objective is to assess adult and child respiratory risks during realistic printing scenarios. Read our latest technical brief on this research initiative, "A Strategic Research Initiative on the Dosimetric and Toxicological Analysis of 3D Printer Emitted Particles."

New 3D Printing Educational Tools

Our collection of tools and resources on 3D printer emissions and the impact on human health is growing and can be found on our new landing page: chemicalinsights.org/3DP.

In addition to our existing toolkits, videos and eLearning modules describing the emissions, and ways to reduce exposure to consumers, students, and others, the page features a new handout, *10 Ways to Promote Healthy Indoor Air Quality While Using a 3D Printer*, and a wall poster highlighting how to safely use 3D printers in schools.

If you are interested in receiving a poster to hang in your classroom or 3D printer laboratory, please email us at ChemicalInsights@ul.org.

Recent Publications and Upcoming Events

- We participated in the Georgia Chapter of the Association for Learning Environments' Summer Conference on June 28 in Jekyll Island. Our presentation, "Keeping School Buildings Healthy: Emerging Issues in Managing for Occupant Safety and Health," focused on prioritizing IAQ as we re-enter our schools.
- Technical Brief, "A Strategic Research Initiative on the Dosimetric and Toxicological Analysis of 3D Printer Emitted Particles"
- Look for us at the upcoming 68th Campus Safety, Health, Environmental Management Association (CSHEMA) Annual Virtual Conference from July 26-28. Our virtual booth will provide insight into our current 3D printing research initiative, IAQ, and results from multi-year studies. Registration information can be found here.
- Podcast, "Green Building Matters: Interview with Material Chemical Expert Dr. Marilyn Black"