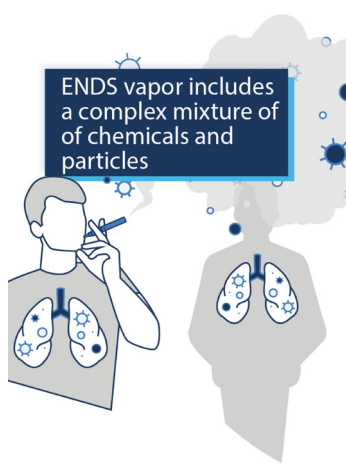


Foresight

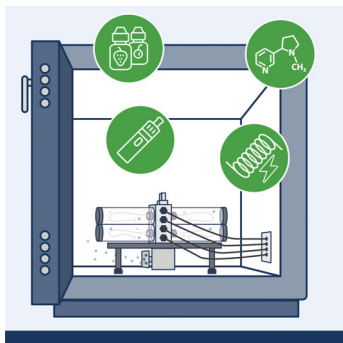
New School Year, Be Concerned About the Health Risks of Vaping



According to the 2022 National Youth Tobacco Survey, more than 2.5 million middle and high school students currently use electronic nicotine delivery systems (ENDS), bringing health risks to those vaping as well as bystanders. There is a perception that vaping is a safer alternative to cigarettes, but research shows that the use of ENDS results in exposure to numerous chemicals and small particles with associated adverse health impacts.

This month, considering the start of the school year, Chemical Insights Research Institute (CIRI) of UL Research Institutes is sharing in-depth research findings on the human health risks from vaping.

CIRI's State-of-the-Art Laboratory for ENDS Emissions Research

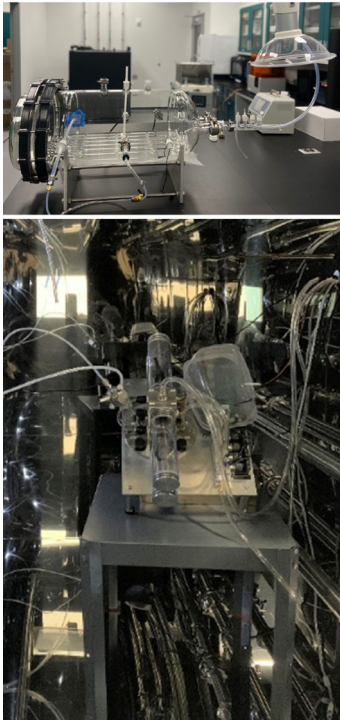


Multiple factors influence chemical and particle emission profiles and health risks from vaping, underscoring the need for accurate and reproducible laboratory techniques for evaluating real-world scenarios. As featured in CIRI's recent peer reviewed publication, [*Characterization of an Electronic Nicotine Delivery System \(ENDS\) Aerosol Generation Platform to Determine Exposure Risks*](#), our custom designed and automated ENDS aerosol generation system (EAGS) allows researchers to simulate real-life vaping scenarios. The EAGS allows scientists to adjust voltage, puff air flows and dilution, and set custom puff profiles that specify the volume and length of time between aerosol release. Using the EAGS in our dynamic exposure chambers allows researchers to operate different types of ENDS (vape pens, pods and mods) and to measure particle concentrations and size distributions for different puff fractions. Studies allow a variety of flavored e-liquids, nicotine levels and atomizer setups to be evaluated under comparable use and environmental conditions.

Using the EAGS, research data show that e-liquid flavorings and nicotine levels can impact particle emissions.

- Read the Toxics Article, "[*Characterization of an Electronic Nicotine Delivery System \(ENDS\) Aerosol Generation Platform to Determine Exposure Risks*](#)"

ENDS Particle Emissions Characterization



Top image: Glass Chamber set up

Bottom Image: EAGS inside the exposure chamber

ENDS usage can generate high levels of particulate matter (PM). CIRI's newest report, "[Characterization of Aerosol Emissions from Electronic Nicotine Delivery Systems \(ENDS\)](#)," details characterization of aerosol concentrations and particle size distributions across different vaping conditions using pen, mod-type and pod-type vapes. ENDS usage was found to emit a range of ultrafine particles of differing sizes, and pod-type devices were found to have higher particle emission levels than mod-type devices. Inhalation of ultrafine PM from ENDS usage is a critical health concern since inhalation of airborne PM is associated with respiratory and cardiovascular diseases and premature death. Additionally, ENDS use is a concern beyond the user, as secondhand emissions could present a risk to children and other vulnerable populations when exposed to the ultrafine PM.

- Read the full Report, "[Characterization of Aerosol Emissions from Electronic Nicotine Delivery Systems \(ENDS\)](#)"

Over 70 different VOCs Identified in ENDS Emissions

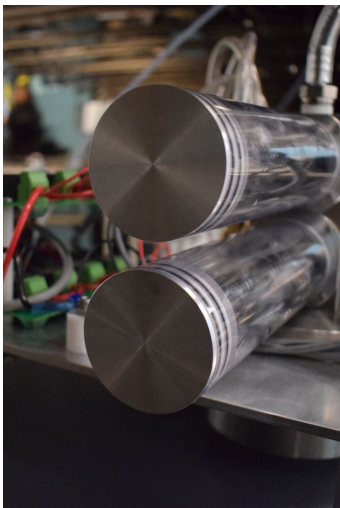
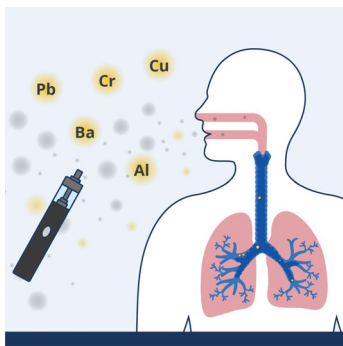


Image of the EAGS

The use of ENDS also generates high levels of volatile organic compounds (VOCs). This is concerning for users of ENDS and bystanders since exposure to VOCs can lead to acute and/or chronic health effects, including headaches and irritation to eyes, throat, and respiratory systems. Certain VOCs are also linked to cancer and damage to organs and the central nervous system during long term exposure. CIRI's latest research on VOC emissions from ENDS, "[Volatile Organic Compounds \(VOCs\) Released from Electronic Nicotine Delivery Systems \(ENDS\)](#)," reports on more than 70 different VOCs in ENDS emissions, including numerous aldehydes, glycols, alcohols, fragrances, siloxanes, and aromatics. The primary VOCs emitted were associated with the number of puffs, or the mass of e-liquid consumed, although specific amounts varied across vaping device types and e-liquids.

- Read the full Report "[Volatile Organic Compounds \(VOCs\) Released from Electronic Nicotine Delivery Systems \(ENDS\)](#)"
- Look through the Technical Brief, "[A Strategic Research Initiative on Physiochemical and](#)

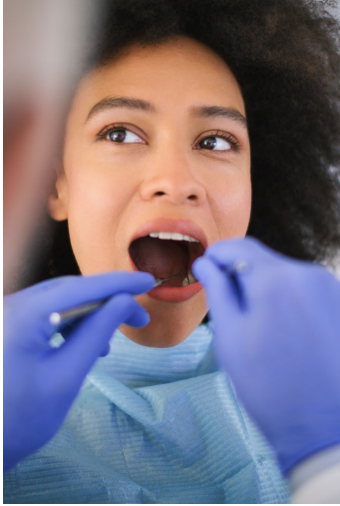
ENDS Usage Patterns and Device Age Can Influence Health Risks



ENDS research shows that usage parameters and device aging can impact respiratory health risks. CIRI's research publication, [*Toxicological Assessment of Particulate and Metal Hazards Associated with Vaping Frequency and Device Age*](#), reports that persistent use of pod-type ENDS devices and/or device aging may contribute to additional exposure risks to aerosols and metals that can lead to cellular changes and DNA damage. Analysis identified twenty-one heavy metals known to be hazardous to human health, including vanadium, manganese, cobalt, and strontium, in aerosols emitted during the use of pod-type ENDS devices. It was also observed that the particle concentrations increased as the device aged, and that continuous use of pod-type ENDS devices may pose a greater risk of exposure to hazardous levels of toxic metals. The research findings suggest that guidance on safer ENDS use patterns, may lower respiratory health risks.

- Read the Toxics Article, ["Toxicological Assessment of Particulate and Metal Hazards Associated with Vaping Frequency and Device Age"](#)
- See a summary of the Society of Toxicology Presentation, ["The Unknowns of Vaping: Oxidative Stress, Toxicity, and DNA Damage Across the Device Lifetime"](#)

ENDS Research Expansion and Resources



CIRI recently expanded its NIH funded research on [early onset periodontal disease due to ENDS usage](#). This expansion will define the links between ENDS usage patterns and changes in oral health. Read CIRI's new Technical Brief, "[A Strategic Research Initiative for Extended Research on Periodontal Disease and Electronic Nicotine Delivery Systems \(ENDS\) Usage](#)" to learn more about the research expansion. Stay tuned for upcoming press releases, news alerts, and additions to CIRI's extensive [Resource Library](#).

- Read the Technical Brief, "[A Strategic Research Initiative for Extended Research on Periodontal Disease and Electronic Nicotine Delivery Systems \(ENDS\) Usage](#)"
- Look through the Technical Brief, "[A Strategic Research Initiative on African American Susceptibility to Periodontal Disease due to Electronic Nicotine Delivery Systems \(ENDS\) Usage](#)"
- View the Press Release, "[Chemical Insights Research Institute Receives Prestigious Award from the National Institutes of Health](#)"

Publications and Events

Recent Publications



- Reports
 - "[Characterization of Aerosol Emissions from Electronic Nicotine Delivery Systems \(ENDS\)](#)"
 - "[Volatile Organic Compounds \(VOCs\) Released from Electronic Nicotine Delivery Systems \(ENDS\)](#)"
 - "[Physicochemical and Toxicological Characterization of Electronic Nicotine Delivery Systems](#)"
- Toxics Articles
 - "[Characterization of an Electronic Nicotine Delivery System \(ENDS\) Aerosol Generation Platform to Determine Exposure Risks](#)"

- [*"Toxicological Assessment of Particulate and Metal Hazards Associated with Vaping Frequency and Device Age"*](#)
- Technical Briefs
 - [*"A Strategic Research Initiative for Extended Research on Periodontal Disease and Electronic Nicotine Delivery Systems \(ENDS\) Usage"*](#)
 - [*"Second Edition of ANSI/CAN/UL 2904: Standard Method for Testing and Assessing Particle and Chemical Emissions from 3D Printers"*](#)
 - [*"Tetrahydrofuran - A Common Air Pollutant"*](#)
 - [*"Tetradecamethylcyclodimethylsiloxane - A Common Air Pollutant"*](#)
- June 2023 biannual bibliography, [*"Environmental Pollution and Health Impacts: Measurements, Sources and Solutions"*](#)

Upcoming Events



- [ASID GATHER 2023](#), August 13 - 15, 2023
 - "Understanding WUI and How to Protect Our Homes"
 - "Forever Chemicals: What Designers Need to Know"
 - "Reducing Fire and Chemical Risks to Safeguard Human Health"
- [ACS Fall Meeting](#), August 13 – 17, 2023, "Utilizing Cheminformatics to Determine Primary and Secondhand Vaping Exposure and Health Risks"
- [ISES 2023 Annual Meeting](#), August 27 – 31, 2023
 - "Exposure to metal-containing aerosols emitted from material extrusion 3D printing with thermoplastic and composite materials"
 - "Associations between Personal Apparent Temperature Exposures and Asthma Symptoms in Children with Asthma"
 - "Characterization of Potential Exposure and Inhalation Risks During Firsthand and Secondhand Vaping"
- [Greenbuild 2023](#), September 26 – 29, 2023
 - "Resiliency for Health"

- “The Latest Science on WUI Fires and the Built Environment”
- [AAAR Annual Conference](#), October 2 – 6, 2023, “Particle Emission and Metal Composition Characterizations for Fused Filament Fabrication 3D Printers Using Emerging Materials”



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