

Environmental Health Committee (EHC) Emerging Issue Brief

Electronic Nicotine Delivery Systems (ENDS) in Indoor Environments

Also known as E-cigs / E-cigarettes / “Vaping”

What is the issue?

Vaporizers, vape pens, hookah pens, electronic cigarettes (e-cigarettes) and e-pipes are referred to as Electronic Nicotine Delivery Systems (ENDS) in that they convert nicotine into an inhalable aerosol without combustion.

Clean air ordinances and smoking bans, found across much of the US and worldwide, do not necessarily extend to the use of ENDS (McGill 2015), though prohibitions against involuntary second-hand exposure are increasing. ASHRAE Standard 62.1 already includes e-cigarette and cannabis emissions in its definition of environmental tobacco smoke (ETS) (ASHRAE 2016).

ENDS are promoted as a beneficial alternative method of delivering nicotine that avoids the harmful combustion byproducts of traditional methods of smoking tobacco. They are often marketed as a smoking cessation device, but this claim is disputed. Some recent studies suggested use of E-cigarettes is associated with significantly less cessation than without their use (Kalkhoran and Glantz, 2016; Zawertailo, 2016). Furthermore, there is evidence they increase youthful nicotine addiction (Singh 2016). Approximately 21% of tobacco smokers have used e-cigarettes at least once (Tushar 2014) and their use is increasing (CDC 2015).

Many ENDS are often made to look and feel like conventional cigarettes, cigars or pipes. Recently, some larger devices such as tank systems or “mods” have appeared that bear little or no resemblance to cigarettes. For more information about ENDS, see information from the US Food and Drug Administration at www.fda.gov/tobaccoproducts/labeling/productingredientscomponents/ucm456610.htm (accessed 2017-06-26).

The vapor or aerosol emitted from these devices contains varying amounts of nicotine dissolved in a carrier fluid, e.g., propylene glycol or glycerol along with volatile organic compounds (VOCs), ultrafine particles, metals, and other contaminants (Cooke 2015, Offermann 2015).

Formulations are currently not regulated and vary widely among products; as of January 2014, there were 466 brands (each with its own website) and 7764 unique flavors. (Zhu 2014). Manufacturers are free to change their formulations, and the technology and substances employed are still developing. The user also has the option of adding flavors and customizing the volume, color and nicotine level of the vaping solution. There is also a significant DIY (do it yourself) market in which users compound their own formulations using online recipes.

Ohta (2011) demonstrated that when propylene glycol or glycerol are heated and vaporized, aldehydes, including formaldehyde, a known human carcinogen, are created. Propylene glycol was found to produce acetaldehyde, formaldehyde, and methylglyoxal, and glycerol produced acrolein, formaldehyde, glyoxal, and methylglyoxal. Offermann (2016) measured significant emission rates of formaldehyde and acetaldehyde from six different brands and flavors of e-cigarettes.

Limited studies have been performed to evaluate the health effects of additive and flavoring compounds (AIHA 2014), and little is known about chemical reactions and health interactions that may occur between ENDS emissions and other airborne contaminants commonly found indoors.

Unique to the use of ENDS is the concentration and type of exhaled compounds and solvent that may deposit and remain on indoor surfaces, since a commonly used carrier, propylene glycol, adheres to surfaces. These deposits represent a unique source of contamination in buildings that varies depending on indoor climate, airflow, room size, and rate of e-cigarette consumption (Schripp 2013) and may require specialized cleaning, HVAC maintenance and other operational practices and schedules.

Electronic delivery devices for non-nicotine substances (such as cannabis) are not in the scope of this EIB, though the issues raised in this Brief may also apply to electronic delivery of other substances.

What does it mean to ASHRAE?

Because e-cigarettes have become so prevalent, indoor building components and occupants are currently being exposed to passive vapors. Health risks of secondary involuntary exposure to ENDS emissions are not well understood, in part because they are new, evolving, diverse and customizable (see discussion above) and have been subject to only very limited study.

Many cognizant public health authorities argue that ~~the~~ caution should prevail in all situations of human exposure when limited data is available about health impacts. This is often called the precautionary principle. Applying this principle to ENDS argues that involuntary exposure should be banned (i.e., CDPH 2015) in order to keep exposure to airborne emissions as low as possible.

Practitioners, building operators, and policy makers look to ASHRAE for practical guidance on reducing indoor environmental exposures. ASHRAE is an authoritative source for public and private authorities considering banning indoor use. In the absence of bans, ASHRAE is the authoritative source of information regarding engineering solutions.

What action should ASHRAE consider?

ASHRAE should consider the following actions:

- Educate engineering practitioners and the public by summarizing what is known about the chemical composition of emissions from ENDS, the health effects that have been identified, and the uncertainties noted in this EIB. Publish this information in the ASHRAE Journal and support future EHC program sessions at ASHRAE conferences.
- Support research to :
 - Study the role of building, ventilation and filtration system design and operation on passive vapors from ENDS.
 - Demonstrate whether or not the Standard 62.1 requirements for separating smoking and non-smoking spaces are sufficient to protect building occupants from

ENDS emissions.

- Identify additional recommendations for design and control measures,
 - Evaluate the deposition rate and composition of passive vapors on indoor surfaces and their potential impact on the efficacy of the Standard 62.1 separation requirements,.
 - Evaluate cleaning practices, HVAC system schedules and other operational practices necessitated by the deposition issue described above.
 - Address the role of variations in puff profile, temperature, mixture, etc. on emission rates, composition and resulting health effects.
- Formulate recommendations to building owners and policy makers regarding potential bans on the use of ENDS in indoor environments to limit the involuntarily exposure of building occupants.
 - Examine all its publications, including Standards, Guidelines, Handbooks and others for consistent consideration of emissions from ENDS. Depending on the publication, this may be the same or different from the approach used in Standard 62.1.

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