IEA EBC Annex 78 & AIVC Webinar

**Substituting Ventilation by Gas Phase Air Cleaning**
**7th November 2022 [15:00-16:45 CET] - 15:20-15:30**

# "Existing standards for testing gas phase air cleaners"

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1

## Gas-phase air-cleaning performance metrics

Why are we interested in a standardized test method for such equipment?

1. Removal efficiency of gaseous pollutants: 1 minus penetration, i.e., the ratio of downstream to upstream pollutant concentration; for supplementing ventilation, typically, the pollutants are VOCs
2. Airflow resistance through the gas-phase air cleaning system; it is linked not obviously to fan energy use or airflow reduction
3. Service life of device or media: time elapsed between installation and replacement or maintenance
4. Total cost of gas-phase air cleaning per unit delivery of VOC-free air (no standard currently available for this purpose)



2

# EN ISO standards for building applications

- EN ISO 10121-2:2013 “Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 2: Gas-phase air cleaning devices (GPACD)” (confirmed in 2018)
- EN ISO 10121-1:2014 “Test method for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 1: Gas-phase air cleaning media” (confirmed in 2019)
- EN ISO 10121-3:2022 “Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 3: Classification system for GPACDs applied to treatment of outdoor air”



# ASHRAE standards for building applications

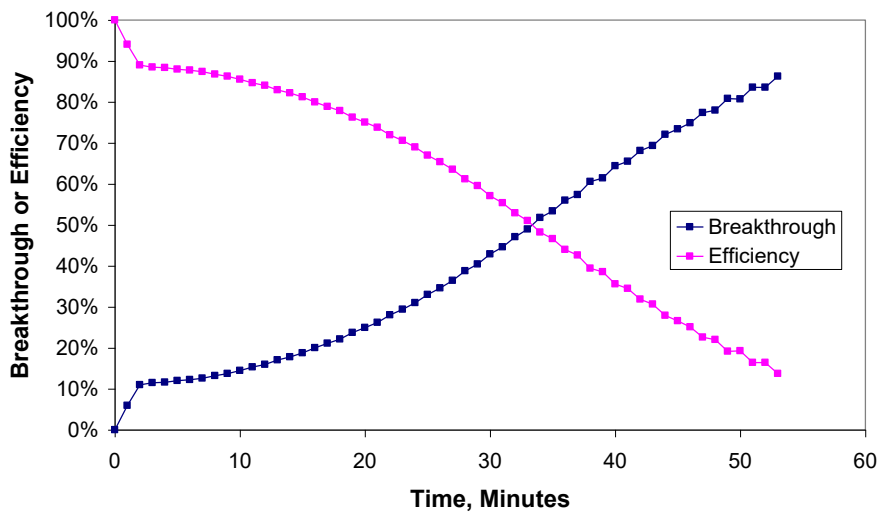
- ANSI/ASHRAE Standard 145.2-2016 "Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Air-Cleaning Devices" (first edition in 2011)
- ANSI/ASHRAE Standard 145.1-2015 "Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Loose Granular Media" (first edition in 2008)
- ASHRAE Standard 145.4P - Proposed Standard authorized June 2022 to be developed by SSPC 145 “Method of Test for Assessing the Gas-Phase Performance of Air Cleaning Devices and Systems in a Duct-Chamber Apparatus”

# Particulate vs. gas removal equipment assessment

- Particulate filter with fibrous media
  - Pressure drop gradually increases
  - Filter efficiency may increase or decrease
  - Filter is visibly working
  - Standards and test procedures to rate filters well established and being improved (new aging procedure needed for general ventilation applications)
- Gas-phase air cleaner
  - Pressure drop remains the same
  - Filter efficiency decreases
  - Usually, the filter is not visibly working
  - Standards and test procedures to rate filters are still being developed and are not commonly used



# Dynamic breakthrough/Efficiency curve



## Performance vs. features

Features

- Amount of sorbent media
- Residence time (airflow rate)

Performance

- Dynamic breakthrough or efficiency
- Capacity
- Life
  - Minimum efficiency (vs. 100% Breakthrough)
  - Maximum concentration
  - Pressure drop (ensure proper pre-filtration)



## Traditional gas-phase air-cleaning technologies

- Traditional gas-phase removal equipment based on an adsorption process, e.g., activated carbon or permanganate alumina pellets
- Adsorption technologies have long been used in a wide range of applications, so the performances and the efficiencies under various conditions are well understood
- Some current standards have limitations in their scope, which make them not suitable for emerging gas-phase electronic air-cleaning technologies

## Emerging gas-phase electronic air-cleaning technologies

- Newer technologies are used in electronic air cleaners, such as UV, UV with photocatalysts (UV-PCO), plasmas, plasma with catalysts, etc.
- These may generate oxidizing agents like radicals and ozone that remove the gases and vapors through the oxidation process; upon complete oxidation, VOCs can be converted into carbon dioxide and water
- They can generate intermediates such as carbon monoxide, formaldehyde, acetaldehyde, and acetic acid in cases of incomplete oxidation, as well as generate pollutants like ozone and nitrogen oxides inherently depending on the system



## Work in progress

- ISO/TC142/WG8 is drafting ISO/PWI 23743 “Testing of gas-phase air cleaners for improving perceived indoor air quality”
- It could be based on FDIS/ISO 16000-44 “Indoor air - Part 44: Test method for measuring perceived indoor air quality for use in testing the performance of gas phase air cleaners”
- Other experts are working on room air cleaners: IEC SC59N, JWG 2 Reduction of Chemical Gases
  - Sub Working Group 2.1 on Reduction of Ozone

**Thanks for your attention!**