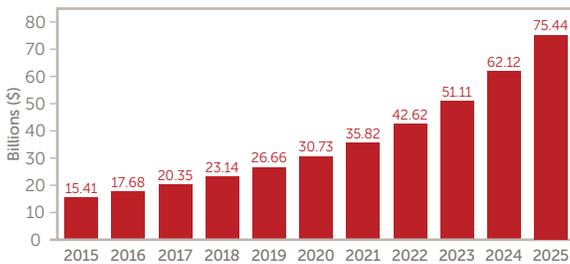


# Protect your Data!

*Equipment failure from gas-phase contamination is real*

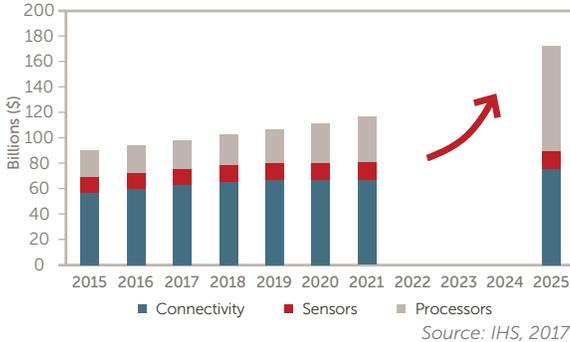
Data storage and cloud-based computing are exponentially growing markets. Data centers are the heart of that industry, but they may not be fully protected from the impact of contamination.

IoT Installed Base, Global Market



IHS Markit forecasts that by 2025, there will be more than 75 billion installed IoT devices worldwide.<sup>1</sup>

IoT Semiconductor Market



Those 75 billion devices will increase data processing challenges in the data center.

<sup>1</sup>SIA: Annual Semiconductor Sales Increase 21.6 Percent, Top \$400 Billion for First Time, (February 5, 2018)

## AIRBORNE MOLECULAR CONTAMINATION (AMC)

AMC is gas-phase chemicals that can cause equipment or component failure resulting in costly data errors and equipment downtime.

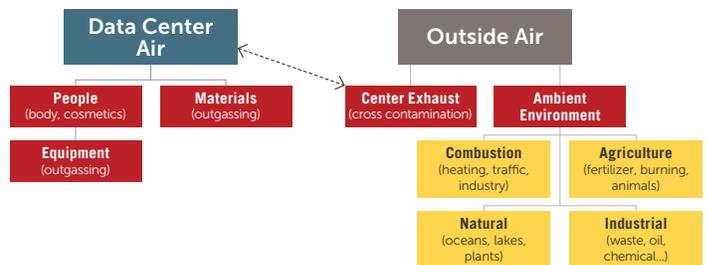
Protection from particles and dust is insufficient to meet data center environment air quality specifications. To meet these stringent specifications, AMC gas-phase filtration is required. Off-the-shelf, low-cost filters may not protect modern equipment.

## Corrosive contaminants:

- Sulfuric acid (H<sub>2</sub>SO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, from SO<sub>2</sub> and SO<sub>3</sub>)
- Nitric acid (HNO<sub>3</sub>, but not HNO<sub>2</sub>)
- Hydrogen sulfide (H<sub>2</sub>S)
- Chlorine compounds (HCl, ClO)
- Oxidative compounds like ozone (O<sub>3</sub>)
- Organic AMC such as acetic and formic acids

## AMC SOURCES

AMC can come from the outside environment or from internal materials and components. It is circulated by cooling fans, intrudes into the smallest spaces, and can pass unchanged through particle filters. Standard humidity levels (40–60% RH) promote salt formation and corrosion.



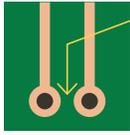
## CLEANLINESS REQUIREMENTS

Particle loads are regulated by ISO 14644-1, but the allowable Class 8 allows small particles to pass, which may be chemically reactive.

AMC levels are regulated by ISA 71.04 and IEC 60721. These standards are incomplete and only define "severity levels" not actual concentrations.

Corrosion strips are used to gauge cleanliness, but they do not determine specific contaminants or concentrations.

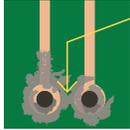
## TYPES OF AMC IMPACT



Well separated contacts

### Contact Corrosion

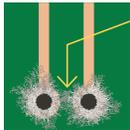
Acidic and oxidizing chemicals can directly corrode electrical contacts (wires, integrated circuits, memory, processors, etc.).



Creep corrosion causing short

### Creep Corrosion

Copper contacts can corrode, and the growth can short-circuit adjacent contacts.



Salt dendrites causing short

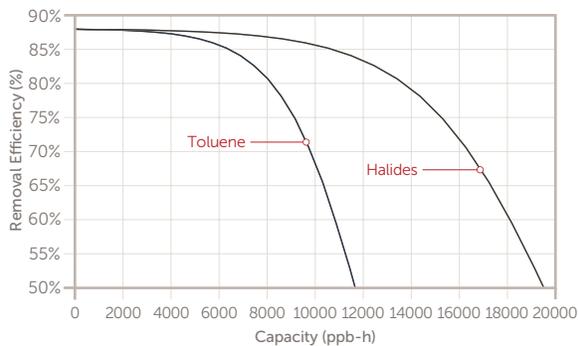
### Salt Formation

Airborne acid and base reactions can form salts, which can accumulate on electronic circuits to form dendrites. Salts are electrically conductive and can cause current creep and short-circuits.

## KNOW YOUR ENVIRONMENT

AMC identification and concentration is needed to create filter media that provide balanced lifetimes for all defect-causing contaminants.

### Chemical Performance Estimates @ 2.54 m/s (1700 CFM)



## ENTEGRIS SOLUTIONS

Entegris provides a portfolio of AMC filters to control contaminants in sensitive environments. Outlet air stream concentrations can be in the  $10^{-9}$  to  $10^{-12}$  range (ppb and ppt levels).

Our ISO 17025 accredited sampling and laboratory service defines the environment based on actual contaminant concentrations.

Our formulated media provide AMC filters that remove specific contaminants, protecting both process equipment and wafers from the damaging effects of AMC.



VaporSorb™ AMC air filters



Room air filtration system

### FOR MORE INFORMATION

Please call your Regional Customer Service Center today to learn what Entegris can do for you. Visit [entegris.com](http://entegris.com) and select the [Contact Us](#) link to find the customer service center nearest you.

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### Corporate Headquarters

129 Concord Road  
Billerica, MA 01821  
USA

### Customer Service

Tel +1 952 556 4181  
Fax +1 952 556 8022  
Toll Free 800 394 4083

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