



## **The Effects of Air Quality in the Data Center**

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### **Data Center Indoor Air Quality**

If you asked most people to classify a Data Center's Air Quality, they would probably associate it with a Clean Room. They are mostly contained, have fine particulate filtration, have excellent temperature control and have a reasonable degree of humidity control. If you asked those same people to quantify their response, they would be unaware of related standards and also be unaware of the impact of air on the equipment being operated in the room. This is a case where the unknowns can be a real problem.

Gas phase contaminants, too small to be caught by traditional HEPA filters, are present in every environment. In high enough concentrations, those contaminants have an impact on electronic equipment and human response.

### **What is the impact of Indoor Air Quality in my Data Center?**

Electronic equipment (both active and passive) is susceptible to corrosion from Sulfur Oxides (often referred to as SO<sub>x</sub>), Nitrogen Oxides (often referred to as NO<sub>x</sub>) and other gases found in urban environments. Most of these gases are byproducts of the combustion of fossil fuels. Board level corrosion shows itself in various forms including contaminated solder joints, corrosive shorting across conductive pathways and whiskering, which can lead to both particulate matter and shorts across contact points. All of these examples represent life shortening events for equipment.

In addition to the corrosive gases, Volatile Organic Compounds (VOCs) are also present in almost all indoor environments. ( <http://www.epa.gov/iaq/voc2.html> ) These compounds cause a human response in the respiratory system and eyes. Long-term exposure to these compounds is a subject of ongoing research and standards development in both private and government research.

Other destructive gases include fluorine, which is a primary component found in power and communications cables present in the Data Center.

([http://msds.dupont.com/msds/pdfs/EN/PEN\\_09004a2f801b4efc.pdf](http://msds.dupont.com/msds/pdfs/EN/PEN_09004a2f801b4efc.pdf))

Standards and recommendations exist for acceptable levels of these gas phase contaminants. Both are constantly under review as new techniques are developed to make the building process more efficient, improvements in operation efficiencies are identified, new manufacturing processes are implemented and biological research is conducted. More information is available through the Environmental Protection Agency ([www.epa.gov/iaq](http://www.epa.gov/iaq)) or through your regional Air Quality department.

Equipment manufacturers, who are very knowledgeable about the impact of IAQ on their products' performance, often specify IAQ as part of their Site Preparation documents for product commissioning along with Temperature, Humidity and Power requirements. It is safe to say that they are establishing a communication, thereby providing warranty notification, of the issues and placing IAQ responsibility on the equipment operator.

Additional consideration should be paid to the resultant damages covered neither by warranty nor by insurance. Not only does the owner stand to lose their equipment, but also the information lost as a result. These damages are traditionally not covered without incurring additional premium costs.

***So, how do you quantify your assumption that your Data Center has an acceptable Air Quality level?***

ANSI/ISA S71.04 establishes specifications for Indoor Air Quality (IAQ) as it specifically relates to its impact on the life expectancy of electronic equipment. Four levels are defined as G1, G2, G3 and GX, with G1 being the best or least contaminated. A short description of each follows.

- **G1**
  - Severity Level **Mild**
  - An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability
- **G2**
  - Severity Level **Moderate**
  - An environment in which the effects of corrosion are measurable and corrosion may be a factor in determining equipment reliability
- **G3**
  - Severity Level **Harsh**
  - An environment in which there is a high probability that corrosive attack will occur. These harsh levels should prompt further evaluation resulting in environmental controls or specially designed and packaged equipment
- **GX**
  - Severity Level **Severe**
  - An environment in which only specially designed and package equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier.

The IAQ level is determined by a "Corrosivity Coupon Analysis", provided by manufactures such as Pure Air Filtration ([www.pureairfiltration.com](http://www.pureairfiltration.com)). A coupon analysis evaluates the effect of the air on exposed copper and silver over a 30 day period. After the 30 day period, the coupon is sent to a laboratory to

measure the depth of contamination that has occurred. The depth of contamination determines the IAQ level.

### **How do you condition your Data Center Air Quality?**

Once the IAQ level is determined, a chemical analysis is performed to identify the gas contaminants present. With the contaminants identified, a filtration strategy can be established to extend the life expectancy of electronics and make a safer work environment for Data Center staff.

Kevin Jameson , President of Pure Air Filtration, states “Removal of contaminant gases from the air requires introducing a ‘gas absorbent media’ into the environment. The gases bond to the absorbent media, which is replaced periodically, rather than bonding to your most valuable resources...your equipment and staff.”

Filtration systems currently on the market consist of rack mounted and portable units that offer deployment options based on space availability in the Data Center. Both systems provide an air intake with particulate filtration, followed by absorbent media cassettes (customized to target identified contaminants) and an exhaust system that reintroduces the filtered air back into the Data Center.

### **How do you maintain the desired IAQ level?**

Air quality monitoring devices are also commercially available. These products provide a perpetual electronic evaluation of air quality as it changes. Users often notice patterns in air quality readings due to maintenance, parcel delivery schedules and other site activities. Overall air quality readings will shift over time as scheduled chemical media replacement nears.

Buildup of contaminant gases on the chemical media is a good thing as it didn't build up on your equipment. In order to assure ongoing compliance with ISA standards and not allow your IAQ to degrade, the chemical media must be replaced about every six months as part of scheduled maintenance. Should a chemical media replacement not return the Data Center to the required level, a coupon analysis is recommended to determine if the initial chemical analysis has remained constant.

### **What if I am using outdoor air to cool my Data Center?**

HVAC system design varies within the Data Center industry. Many Data Centers justifiably introduce very little outside air since the occupant rate is low is very low compared to commercial buildings. Other Data Centers follow commercial standards to introduce “fresh” air from outside. Recent trends in data center cooling bring large amounts of outside air into the data center. But, what if the outside air is the source of air quality problems? The air in urban environments is often filled with automobile and industrial pollutants. Even “fresh” ocean air contains contaminants that can quickly corrode electronics. IAQ analysis may define that contaminants from the outside must be removed prior to introducing the air into the data center. Air filtration systems scaled up to meet the building's indoor air requirement are placed at the outside air intake.

In summary, there are numerous contaminant gases present both indoors and outdoors that can affect your electronic equipment and Data Center staff. There are standards to identify acceptable levels and those levels are specified in ways that affect your warranties and liabilities. Technology and products proven in other markets have been customized for implementation into the Data Center. These products protect your most valuable resources and provide compliance with the standards and supplier warranties.

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