

# ENVIRONMENTAL FACTORS IN DATA CENTRES

In addition to temperature and humidity, there are many more constraints in the environment that increase failure rates, explains **Emilio Sapiña** of **Secure Technical Rooms**.

When speaking of the environment control of a data centre, we always think of having monitored the values of temperature and humidity according to the ASHRAE guidelines. The recommended temperature range is 18 °C to 27 °C. The humidity is limited to less than 60% with the lower and upper dew point temperatures of 5.5 °C and 15 °C.

However, there are many more environmental factors to consider that may increase failure rates; the most important are dust and gaseous contamination.

The effects of air pollution in data centers can be divided into three main categories:

### CHEMICAL EFFECTS

Corrosion of copper plates in the circuit boards and silver metallisation on the surface of the miniature components mount, in addition to zinc whiskers

### MECHANICAL EFFECTS

Deposits or dirt on the heat sink, interference of the optical signal and an increase in friction

### ELECTRICAL EFFECTS

Produce changes in the impedance of the circuit and the formation or the electric arc

To control the environment of a data centre, we must take periodic

ISO classification number (N)	Maximum concentration limits (particles/m <sup>3</sup> of air) for particles equal to and larger than the considered sizes shown below (concentration limits are calculated in accordance with equation (1) in 3.2)				
	0,1 µm	0,2 µm	0,3 µm	1 µm	5 µm
ISO Class 1	10	2			
ISO Class 2	100	24	10		
ISO Class 3	1 000	237	102	8	
ISO Class 4	10 000	2 370	1 020	83	
ISO Class 5	100 000	23 700	10 200	832	29
ISO Class 6	1 000 000	237 000	102 000	8 320	293
ISO Class 7				83 200	2 930
ISO Class 8				832 000	29 300
ISO Class 9				8 320 000	293 000

Note: Uncertainties related to the measurement process require that concentration data with no more than three significant figures be used in determining the classification level  
**Source: ISO 14644, Cleanrooms and Associated Controlled Environments**

measurements at soil level as indicated by the rules, and we need to plan technical cleanings performed by qualified technical staff who will use the techniques and equipment designed to clean without re-contaminating the environment or disrupting the operation of the data centre. Finally, we must train staff using the areas to perform cleaning procedures in their every-day use of the rooms.

### REGULATIONS

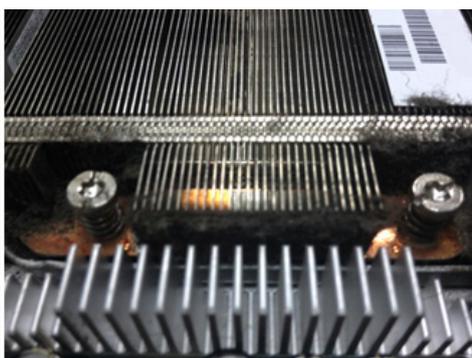
It is the responsibility of the administrators of data centers to monitor and control the level of contamination from dust and gases in their rooms, according to the following rules:

**ISO 14644** Cleanrooms and Associated Controlled Environments

**ASHRAE TC 9.9: 2011** Gaseous and Particulate Contamination Guidelines for Data Centres

**ISA Standard 71.04** Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants

Data centres should be kept clean for ISO 8 Class, according to standard 14644-1.



Source: Secure Technical Rooms

Table 2: Gaseous Corrosivity Levels per ANSI/ISA-71.04-1985

Severity level	Copper reactivity level	Description
G1 Mild	300Å/month	An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.
G2 Moderate	300-1000Å/month	An environment in which the effects of corrosion are measurable and may be a factor in determining equipment reliability.
G3 Harsh	1000-2000Å/month	An environment in which there is high probability that corrosive attack will occur.
GX Severe	>2000Å/month	An environment in which only specially designed and packaged equipment would be expected to survive.

Source: ASHRAE TC 9.9, 2011 Gaseous & Particulate Contamination Guidelines for Data Centers.

**TECHNICAL CLEANING**

Technical cleaning should be performed by specially trained people who work in critical environments, and have sufficient knowledge of the components that make up a data centre, its critical parts and the flow of air circulation, etc. The cleaning should be executed without the operating rooms impacting on the processes or causing system failures. The benefits of technical cleaning can be summarised as:

- Extending the life of the new equipment in the rooms, avoiding contamination thereof
- Minimising the risk of fire due to accumulated dust on the hardware
- Avoiding electro static discharge, causing transmission failure between computers
- Avoid the existence of ferrous material (oxides)
- Minimise mechanical wear and hardware failures
- Minimise air pollution
- Remove live contaminants
- Avoid cleaning by unqualified staff which may cause failures and system shutdowns
- Keep the environment free of contaminants
- Extend the life of air conditioning filters
- Avoid using corrosive cleaning agents which can attack the hardware and pollute the environment

The classic technical cleaning process begins at the top of the clean room, in the wiring pipes, followed by physical racks and finally, the raised floor.

**DATA CABLING AND POWER LINES**

- Aspiration of micro-particles
- Clean the surface of the wires, racks and hardware (exterior)
- Aspiration of external racks
- Dry cleaning of critical parts
- Cleaning inside the rack, and doors
- Exterior cleaning for servers, especially in the area of fans



Source: Secure Technical Rooms

**RAISED FLOOR**

- Hand-removing of large waste
- Aspiration of waste
- Vacuum of micro-particles
- Thorough cleaning with special products of data cables, power cables, cable trays, rosettes, raised floor structure
- Aspiration of micro-particles with robotic support when the dust settles in suspension

**FLOOR PLATES**

- Removal of tiles in groups of 6 or less to avoid out the structure being out of position
- Cleanliness of its 6 faces outside of the data centre
- Positioning and leveling plates
- Cleaning of the top of the plates

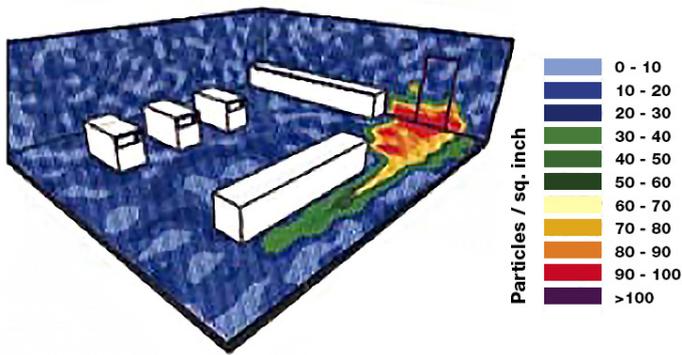
As for the equipment used in a classical technical cleaning, we can list the following:

- Vacuum with HEPA filter (filtering particles down to 0.3 microns) and accessories
- Industrial vacuum cleaner.
- Robotic vacuum cleaner with HEPA filter
- Laser particle counter
- Special products (non-corrosive, non-toxic, non-harmful to the environment and anti-tatic)
- Special brushes for all types of surfaces and corners
- Costumes of paper
- Other parts of development aid cleaning
- Laser leveller

**CONTAMINATION CONTROL TILES**

In order that a proper technical cleaning lasts over time, it is necessary to take additional measures, such as the training of technical staff in clean procedures using data centres (no packaging to enter rooms, protection with vacuum cleaners to make holes, etc.) and the installation of additional active elements such as contamination control tiles.

Although a data centre is generally a secure and watertight environment, 80% of dust and dirt is entered into the critical area by feet (Source: 3M), and penetrates through the gates when technicians enter the room. 5% slips through gaps in the sealing of wiring or piping, and the remaining 15% is carried by the team itself.



Source: Dycem

The contamination control tiles situated at the entrance of the technical rooms (pictured above), prevent up to 99% of dust and dirt from entering the room at ground level.

The above image shows the typical level of dirt that can be found in different areas of a data centre.

When installed and maintained properly, the contamination control tile provides important benefits:

- Maintains useful life of the equipment
- Reduces loss of data and read/write errors
- Reduces maintenance costs
- Improves the reliability of the facility

The polymer composition generates various advantages.

- Flexible optically smooth surface, allowing maximum contact with shoes and wheels
- High surface energy (Van der Waals forces) which allows maximum collection and retention of particles
- Ability to collect and retain contamination over a wide range of particle sizes, with the effective removal in the range of 2 to 10 microns
- Performance guaranteed to last over several years, with a regimen of regular, simple cleaning and effective pollution control
- Collects pollution through complete floor coverage
- The removed particles are contained within the controlled environment, thereby preventing their release into the environment



■ **Emilio Sapiña** is Managing Director of **Secure Technical Rooms**, specialising in advanced services and high security solutions for data center business. The firm offers innovative solutions to help minimise the effects that the ambient environment has on clean environments.

info@securetechnicalrooms.com

Tel: +34-65766344

www.securetechnicalrooms.com

