Cleaning and Sanitizing of Data Centers

A Data Center as a Critical Environment, should follow some guidelines and very specific Cleaning Procedures known as Technical Cleaning based on minimizing the number of particles in suspension as indicated in the standard ISO 14644-1 and ANSI / ISA 71.04 with respect to corrosion levels. Best practices in the industry in cleaning Data Centers is summarized in the specific Contamination Control Paper in ASHRAE "2011 Gaseous and Particulate Contamination Guidelines for Data Centers":
https://www.ashrae.org/File%20Library/Technical%20Resources/Publication%20Errata%20and%20Updates/2011-Gaseous-and-Particulate-Guidelines.pdf

2020 all changes due to the pandemic COVID-19, the usual processes of Technical Cleaning should be supplemented by specific procedures of Disinfection and Sanitization to minimize pathogens and viruses in the environment.

- In this regard, the Community of Madrid in Spain published a general article about disinfection of surfaces and spaces with Coronavirus:
  https://www.comunidad.madrid/servicios/salud/desinfeccion-superficies-espacios-coronavirus
- Specifically, for Data Centers, Uptime Institute published its guide COVID-19: Minimizing critical facility:
  https://drift-lp-66680075.drift.click/0285b4ef-1d4a-4fec-9a65-b850469900bc
- ASHRAE meanwhile has also prepared a list of related resources:
  https://www.ashrae.org/technical-resources/resources

Notice that a Data Center is an environment with constant air moving, viruses can remain in the air, conditioning filters, grids and IT equipment themselves. Additionally, is a closed room whose the only access point are the entry doors, where the technicians introduce pathogens that they carry with them into their daily operations. According to 3M, 80% of dust and dirt in the critical area is introduced into the feet of technicians entering the rooms.

Also, you cannot make a proper disinfection without prior cleaning, if there is some dirt and the area proceed to sanitize, will not be easy access to the areas where dust exists and it is possible that the virus "hides" behind the motes.

New processes Technical Cleaning should include:

- **Standard Technical Cleaning** according to the standard ISO 14644 class 8, 0.3 microns HEPA vacuum and measurement of the purity of the air with particle counters.
- **Disinfecting all surfaces** with products approved by the Local Ministry of Health, i.e, in Spain: Annex 1: "Disinfectants with viricidal action in Spain" https://www.comunidad.madrid/sites/default/files/doc/sanidad/samb/anexo_1._desinfectantes_con_accion_viricida_autorizados_en_espana.pdf
- **Disinfection with UV-C** of the parts that are touched by the technicians in the room, as door handles, switches, etc.
- **General ozone disinfection**, taking special care to respect the maximum recommended levels of 0.05 ppm by WHO, Directive 92/72 / EEC "Evaluation Criteria for Ozone Air Pollution" and local laws.
- **Contamination Control Mats** on the doors of the technical rooms, which also incorporate antibacterial agents such as those used in hospitals, pharmaceutical laboratories, etc.
- Installation of **Contamination Control Cards** that monitor the levels of environmental contamination and corrosion during the following 12 months.

SANITIZATION OF THE DATA CENTER

- Disinfection of all surfaces with disinfectants approved by WHO and the Local Ministry of Health.
- UV-C disinfection of the parts that are touched by the technicians in the room, as door handles, switches, etc.
- Ozone disinfection alters the molecular structure of certain microorganisms such as viruses or bacteria, the use in Critical Environments is feasible because:
  - Works in areas with high HUMIDITY
  - It operates in a wide TEMPERATURE range
  - NOT CREATE hazardous waste to the environment neither IT Equipment.

CONTAMINATION CONTROL MATS ENTRY TO THE CPD

Located at the entrance of the technical rooms prevent more than 99% of dust and dirt from entering the room near the floor level.

The contamination control mats provide important benefits:

- Longer life of IT equipment
- Reduced maintenance cost of IT
- Improved reliability of the facilities
- **Bactericidal incorporate BIOMASTER**

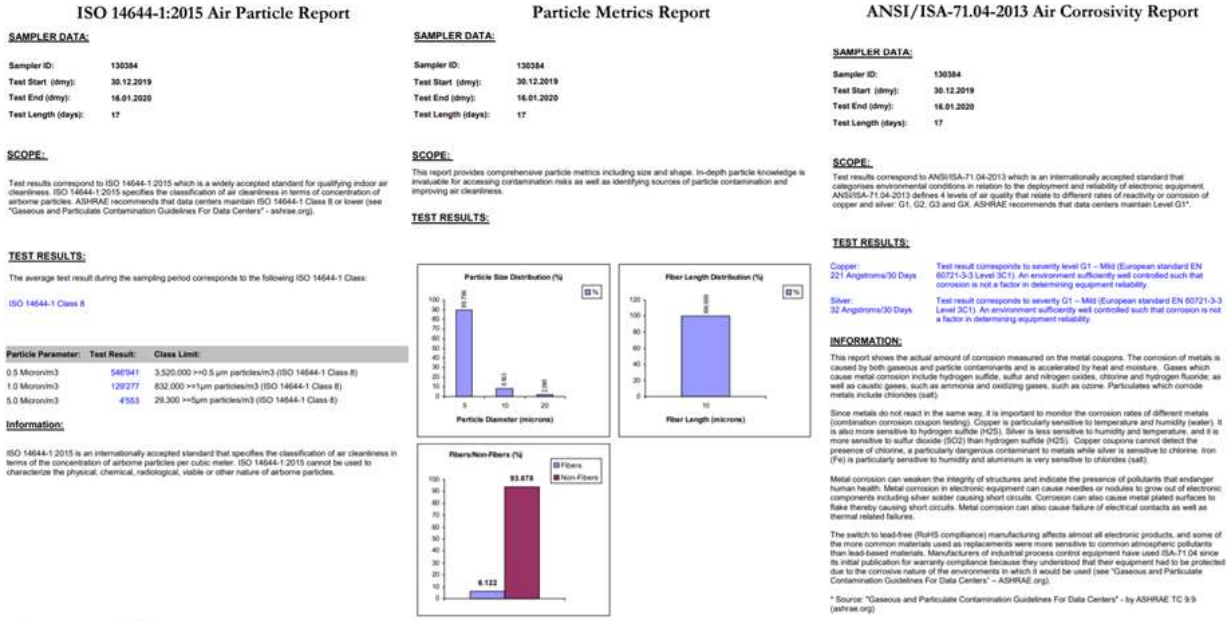
The bactericidal action of the BIOMASTER provides protection against microbes in the soles of the technicians when they enter to the critical rooms, due to being impregnated into the material, providing effective protection for 4-5 years of life of the units: https://www.addmaster.co.uk/biomaster

ANALYSIS OF CORROSION AND LEVEL OF DIRT

In addition to the analysis of suspended particles, the specific regulations of Pollution Control in Data Centers ASHRAE "2011 Gaseous and Particulate Contamination Guidelines for Data Centers" regulates the level of maximum permissible corrosion on copper and silver for 1 month term:

- Copper reactivity rate of less than 300 Å / month
- Silver reactivity rate of less than 200 Å / month

Must be installed a pair of level meters of corrosion per room every year, to measure and control the level of corrosion of the data center rooms under ANSI / ISA-71.04, which includes a pair of reports after 6 months taking environmental samples. These meters also control the level of particulate dust suspended in the air under ISO 14644-1:


ISO 14644-1:2015 Air Particle Report

SAMPLER DATA:

Sampler ID: 130384
Test Start (dmy): 30.12.2019
Test End (dmy): 16.01.2020
Test Length (days): 17

SCOPE:

Test results correspond to ISO 14644-1:2015 which is a widely accepted standard for qualifying indoor air cleanliness. ISO 14644-1:2015 specifies the classification of air cleanliness in terms of concentration of airborne particles. ASHRAE recommends that data centers maintain ISO 14644-1 Class 8 or lower (see "Gaseous and Particulate Contamination Guidelines For Data Centers" - ashrae.org).

TEST RESULTS:

The average test result during the sampling period corresponds to the following ISO 14644-1 Class:

ISO 14644-1 Class 8

Particle Parameter:	Test Result:	Class Limit:
0.5 Micron/m3	546'941	3,520,000 >=0.5 µm particles/m3 (ISO 14644-1 Class 8)
1.0 Micron/m3	129'277	832,000 >=1µm particles/m3 (ISO 14644-1 Class 8)
5.0 Micron/m3	4'553	29,300 >=5µm particles/m3 (ISO 14644-1 Class 8)

Information:

ISO 14644-1:2015 is an internationally accepted standard that specifies the classification of air cleanliness in terms of the concentration of airborne particles per cubic meter. ISO 14644-1:2015 cannot be used to characterize the physical, chemical, radiological, viable or other nature of airborne particles.

Particle Metrics Report

SAMPLER DATA:

Sampler ID: 130384
Test Start (dmy): 30.12.2019
Test End (dmy): 16.01.2020
Test Length (days): 17

SCOPE:

This report provides comprehensive particle metrics including size and shape. In-depth particle knowledge is invaluable for accessing contamination risks as well as identifying sources of particle contamination and improving air cleanliness.

TEST RESULTS:

ANSI/ISA-71.04-2013 Air Corrosivity Report

SAMPLER DATA:

Sampler ID: 130384
Test Start (dmy): 30.12.2019
Test End (dmy): 16.01.2020
Test Length (days): 17

SCOPE:

Test results correspond to ANSI/ISA-71.04-2013 which is an internationally accepted standard that categorises environmental conditions in relation to the deployment and reliability of electronic equipment. ANSI/ISA-71.04-2013 defines 4 levels of air quality that relate to different rates of reactivity or corrosion of copper and silver: G1, G2, G3 and GX. ASHRAE recommends that data centers maintain Level G1*.

TEST RESULTS:

Copper: 221 Angstroms/30 Days — Test result corresponds to severity level G1 – Mild (European standard EN 60721-3-3 Level 3C1). An environment sufficiently well controlled such that corrosion is not a factor in determining equipment reliability.

Silver: 32 Angstroms/30 Days — Test result corresponds to severity G1 – Mild (European standard EN 60721-3-3 Level 3C1). An environment sufficiently well controlled such that corrosion is not a factor in determining equipment reliability.

INFORMATION:

This report shows the actual amount of corrosion measured on the metal coupons. The corrosion of metals is caused by both gaseous and particle contaminants and is accelerated by heat and moisture. Gases which cause metal corrosion include hydrogen sulfide, sulfur and nitrogen oxides, chlorine and hydrogen fluoride; as well as caustic gases, such as ammonia and oxidizing gases, such as ozone. Particulates which corrode metals include chlorides (salt).

Since metals do not react in the same way, it is important to monitor the corrosion rates of different metals (combination corrosion coupon testing). Copper is particularly sensitive to temperature and humidity (water). It is also more sensitive to hydrogen sulfide (H2S). Silver is less sensitive to humidity and temperature, and it is more sensitive to sulfur dioxide (SO2) than hydrogen sulfide (H2S). Copper coupons cannot detect the presence of chlorine, a particularly dangerous contaminant to metals while silver is sensitive to chlorine. Iron (Fe) is particularly sensitive to humidity and aluminium is very sensitive to chlorides (salt).

Metal corrosion can weaken the integrity of structures and indicate the presence of pollutants that endanger human health. Metal corrosion in electronic equipment can cause needles or nodules to grow out of electronic components including silver solder causing short circuits. Corrosion can also cause metal plated surfaces to flake thereby causing short circuits. Metal corrosion can also cause failure of electrical contacts as well as thermal related failures.

The switch to lead-free (RoHS compliance) manufacturing affects almost all electronic products, and some of the more common materials used as replacements were more sensitive to common atmospheric pollutants than lead-based materials. Manufacturers of industrial process control equipment have used ISA-71.04 since its initial publication for warranty compliance because they understood that their equipment had to be protected due to the corrosive nature of the environments in which it would be used (see "Gaseous and Particulate Contamination Guidelines For Data Centers" – ASHRAE.org).

* Source: "Gaseous and Particulate Contamination Guidelines For Data Centers" - by ASHRAE TC 9.9 (ashrae.org)

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