Data Room Contamination

A discussion on the issues of contamination within Mission Critical Environments

INTRODUCTION

Most companies own varying amounts of data equipment used for storage, processing and communications. This equipment represents a large investment to an organisation. This equipment is often referred to as Mission Critical as without it a company's will fail to be provide services or products. The need for uninterrupted use of this equipment is well understood by all organisations. Steps are taken to ensure the equipment is operated from purpose built computer rooms or data centres (critical environments). These rooms are the heart of most organisations and have systems in place to ensure the uninterrupted use of the equipment is guaranteed.

For example the provision of uninterrupted power is essential as is fire suppression and cool air. Protecting the equipment from contamination is less recognised as an issue. However, the ever improving performance of IT equipment is being achieved by in the main decreasing the size of the electrical components. This is making the control of contamination inside these critical environments just as important. The effects of contamination can be as catastrophic to the equipment and the company as sudden power loss.

The effects of contamination range from unexpected catastrophic equipment failure to the requirement for increased cooling and power. Original equipment manufacturers are starting to use evidence of insufficient data area cleanliness as a reason to void OEM warranties. This in itself can cause companies problems due to the expense of replacement parts and labour.

TYPES OF CONTAMINATION

Contamination within data rooms comes in two forms: Particulate Matter (PM) and Gaseous. These individually or combined can cause breakdowns within data rooms.

Particulate Matter (Dust)

This dust ranges in size from ultra-fine below 0.1µm (micron) to macro particles which are above 5µm. Data rooms are concerned with particles from 0.1µm to 5µm which are known as norm**. If you remember 1000µm = 1mm**. Dust of this size is ubiquitous even with the best filtration system this dust will get into the data rooms and the IT equipment. Due to its size and density most dust will enter as, or soon become airborne, then depending on its size, and forces such as gravity, Van De Waals force(electro static force), diffusion, electro static attraction, air flow and to some extent Brownian motion will find its way onto surfaces both external and internal to the equipment.

These small particles enter the data room via open doors, fresh air inlets, air con units and on people. Larger particles are transferred into the data room via human activity on shoes, wheels and boxes etc. These are then broken down by air flow to become smaller particle.

Once a particle comes into contact with a surface, either by gravitational settling, diffusional movement, or electrostatic attraction, it is generally expected to remain deposited. Re-suspension of particles in the air is expected to be minimum because of the cohesive forces between the particles and surface. Mechanical processes such as floor sweeping, movement of floor or ceiling tiles, equipment maintenance, or cabling can often cause re-suspension.

The effects dust has on IT equipment will to a degree depend on the type of dust and can be outlined under 4 headings.

- Mechanical effects: This includes obstruction of airways (overheating), interference of moving parts, abrasion, optical interference, interconnection interference and deformation of surfaces (magnetic media). During data room refurbishments equipment is often contaminated with plaster dust which is very abrasive.
- Electrical effects of dust: These include impedance changes and electronic circuit conductor bridging.
- Chemical effects: Dust settled on a printed circuit board (PCB) can lead in certain circumstance (depending on the dust) to component corrosion and/or electrical short circuiting.
- Absorption of moisture: Dust with a high deliquescent relative humidity, like cementitious dust can absorb moisture from the data room, causing the dust to become wet. Which will cause chemical problems (as above) electrical problems, it is now conductive and increase abrasion (mechanical).

Gaseous

Gaseous contaminants are produced by industrial processes or large bodies of salt water. The recent increase in hardware failure in data centres high in sulphur bearing gasses is well known and has been highlighted in a number of papers (Reid, Veale, Schueller et el 2007.) Sulphur bearing gas in the presence of moisture causes copper creep which bridges electrical components. Sulphur when mixed with silver, produces silver sulphide corrosion that will also bridge gaps. Even small amounts of airborne salt from the sea can cause corrosion and/or ion migration within equipment.

SOURCES OF CONTAMINATION

Contamination can enter data rooms from many sources:

- Refurbishment and construction activity - This is possibly the biggest cause of dust within a room.
- Inadequate cleaning post construction - Dust remains in the room from the construction phase.
- Fresh air inlets - These are often filtered to 5µm allowing smaller particulate to enter, for example a common contaminant, diesel particulate material (DPM), which starts from 0.1µm in size. There are a growing number of data rooms which use air handlers designed with air-side economizers (similar to those used in commercial buildings) to take advantage of the energy- efficiency benefit of using a high volume of outside air for

cooling. It should be noted that the traditional closed-flow layout results in the same air circulating through filters repeatedly. The intake of large volumes of external air and its subsequent exhaust from the data room equipment centre results in fewer passes through the filtration system for any given volume of air.

- Open Doors - If a door is left open the positive air pressure within the room is soon lost and this allows dust to enter the room.
- People - 70% of dust arriving in a data room is brought in by people, with a high percentage of this being foot borne contamination.
- Equipment breakdown - For example fan belts on aircon units, if worn, can cause dust.
- Poor cleaning techniques and cleaning chemicals - The use of chemicals which when they dry leave a powder, or the use of none HEPA filtered vacuums will cause dust.
- Poor practices - Opening of cardboard boxes within the room. Cutting cables with saws, cabling in the room.

CONTROLLING CONTAMINATION

Controlling contamination starts with establishing suitable data equipment environments: positive pressurisation, filtered air conditioning, contamination control matting capturing foot borne dust, controlled access to the data room and good protocols. A full professional room survey should be undertaken which should include a particulate survey and visual inspection. Reports should then be drawn up as to the state of the room and the potential threats. Then an effective cleaning regime should be considered. A good quality specialist cleaning company should be employed to do the cleaning as they will have the knowledge and skills required to successfully and safely clean the data room.

At the recent Ashrae Winter Conference, in Chicago, IBM's senior systems and technology group engineer Joe Prisco, published a white paper on precisely the problem of dust (PM) in data rooms. As he described, any type of data centre contamination can cause serious problems, but he started his talk with the biggest culprit, dust (or chemically inert dust to be specific).

"*Chemically inert dust is by far the most common cause of problems; produced by the obvious sources like dead skin cells and clothing fibres but also from some slightly less obvious places, like cardboard packaging and even ink residue from printers. If left, this type of dust can have serious consequences, clogging server intakes and affecting their ability to regulate temperature; meaning more power is needed to cool the servers and keep air flowing. In time these issues only get worse and if not addressed and will eventually result in server failure. This is becoming an even bigger issue as servers become increasingly more powerful, requiring more air to be circulated for cooling. This results in fans and air conditioning systems working even harder to compensate, in the process spreading dangerous contaminates further and increasing power consumption."* (Joe Prisco IBM, 2009).

OVERVIEW

Due primarily to the reduction in the component size of IT equipment, data room contamination is fast becoming a very important issue for managers of data rooms and mission critical environments. As discussed above contamination in data rooms can cause at its worst catastrophic failure. Original equipment manufacturers are starting to use evidence of insufficient data area cleanliness as a reason to void OEM warranties, which will cause managers other problems. The increased use of fresh air into the Data Room is causing an increase in small particulate matter entering the room. This then agglomerates and causes issues as discussed like blocking air intakes, clogging heat sinks, optical interference and so on.

SOLUTION

Data room managers should look to have a full room survey carried out. This should utilise an airborne particulate reader to determine the levels and size of the PM airborne in the room. Also a visual examination of the room to determine the level of dust settled on surfaces and its ability to become re-suspended in the air. A report should then be produced to discuss the issues and the possible solutions for the Data Room manager.

IT Cleaning Ltd are able to offer a free of charge survey and report to help Data Room managers determine the threat levels from the contamination within their room. We are then able to issue a quote which will offer a bespoke solution for that room.

To arrange this service contact **IT Cleaning Limited on 0870 005 2581.**