

## **Chemical Warfare at Work: your office is out to get you!!!!**

Article review by Dorothy M. Bowes

New Scientist June 21 1997 carried an article called 'Chemical Warfare at Work' by Howard Baker a London based science writer. The article warned "Don't trust anything or anyone - not your computer, your colleagues, the phone, the fax or the furniture. They're all out to get you". If you have ever been told that your chemical sensitivity is all in your mind you can now feel totally vindicated.

Some symptoms referred to from exposure to the 'sick office' give an altogether new meaning to the term Mondayitis. It seems it all happens around mid-morning - tiredness, irritability, poor concentration, dry throat and blocked nose. While it is known that the modern office with its fresh paint, carpets, synthetic furniture is a 'noxious chemical soup', people and machines are also adding their own nasty toxics into the mix. It is all out indiscriminate warfare - furniture, machines and people - all picking each other off. (Yep, I knew it was me spiking the computer)

The 'noxious chemical soup' can affect circuit boards in electronic office equipment - phones, faxes and computers - creating a 'sick office equipment syndrome'. While it was originally thought that volatile organic compounds (VOC's) were the cause of 'sick building syndrome', recent studies suggest that a more complex mechanism is at work. It seems that when individual VOC's (formaldehyde, pesticides, xylene, toluene, glycol esters.) combine with chemicals such as ozone, the resulting cocktail can be more damaging to machines than the original chemicals.

In 1996, a researcher from Bell Communications Research in New Jersey, realised there was another major source of VOC's - people themselves - and although it was known that people contributed to VOC's in indoor air, their contribution to the soup had not been measured. The research showed that humans make a major contribution to indoor air pollution, their freshly dry-cleaned clothes emit dry cleaning solvents such as trichlorethane, perchloroethane. Scent molecules and other chemicals from toiletries gas out limonene, terpinene, camphene, alpha-pinene and anything up to 100 other chemicals used in perfumes. On top of this our bodies produce acetone and isoprene naturally which also becomes part of the 'noxious chemical soup'.

If you are wondering why a telecommunications company is so concerned about VOC's and their sources, the answer is that VOC's are prime suspects in costly telecommunication failures. Circuit boards are affected by chemicals and a whole new, highly reactive dimension has been added to 'sick building syndrome' that was previously thought only to affect people.

The key culprits in 'indoor smog' are hydroxyl radicals which are desperate to find other chemicals to attach themselves to and they react very quickly with most compounds in the air. Hydroxyl radicals play a major part in forming photochemical smog in polluted cities and nobody had previously looked for them indoors. It was found that "as many as a trillion hydroxyl radicals can be present in every cubic meter of indoor air", this was much higher than was expected indoors and is higher than levels of hydroxyl radicals out of doors in the night air.

Hydroxyl radicals are formed by reactions between ozone from office equipment such as copiers and VOC's given off by people. Once hydroxyl radicals are produced, they blast apart all the other VOC's around them creating harmful chemicals such as formaldehyde, aldehydes, ketones, acetic acid and nitric acid, which are more reactive than the parent compounds. These can play a key role in damaging some electronic equipment as hygroscopic dust which settles on circuit boards can be formed. While this is dry, it is not much of a problem, but once humidity rises an ionic solution can form which creates a conducting bridge between components. Electrical errors can then occur. This type of reaction causes crosstalk or noisy phone lines.

VOC's on their own can also cause problems with electrical equipment, they can be absorbed by precious metals used to coat circuit boards. A mix of friction and electrical potential causes VOC's to react with each other forming a substance called frictional polymer that prevents current flowing around circuit boards. This is highly likely to cause failure of components and reduce their intended life. Frictional polymers and nitrate dust are estimated to have cost American telecommunications companies a minimum of \$100 million over the past ten years.

VOC related problems with electrical equipment are characterised by electrical failure with no fault to be found. Sometimes, turning the equipment off and on again, or a sharp tap will solve the problem. For most offices, it is cheaper to replace equipment than to reduce the VOC's.

This research adds to the uncertainties of how humans respond to similar airborne pollution. The mixture of airborne chemicals changes hourly and people have individual susceptibilities to them, making any studies in this area extremely difficult. Scientists are still arguing about which VOC's to measure and how to measure them.

By comparison, finding effects in machines is easy. Machines can be exposed to large volumes of VOC's but ethics committees do not allow that on people. Only limited low level testing has been done on humans who are known to suffer with 'sick building syndrome'. These have shown eye irritation, airway irritation and attention deficits after inhaling a cocktail of 22 VOC's. Similar experiments on healthy people showed the higher the concentration of VOC's the worse the symptoms.

While these experiments showed that VOC's have real effects on human health, the levels used were defined as safe for occupational health purposes, so no effects should have been found. The only explanation for this is the mixture of chemicals and practically nothing is known about mixtures.

Meanwhile back in the office.. research has been hampered because there is no standard list of VOC's to measure, only what is easiest to measure, not necessarily what is most important. However, what is important with this work is that the chemistry of photochemical smog that has been known to cause problems out of doors, is now being brought indoors, and just when you thought all this is too much.. VOC's, hydroxyl radicals, frictional polymers, nitrates.!!!, a research program underway at the Georgia Institute of Technology indicates that microorganisms can also add to small amounts of potent compounds. Samples of fungi from offices have been shown to emit VOC's, such as hexane, acetone and benzene - which is a known carcinogen.

What can you do? Reduce known sources of VOC exposure, increase ventilation rates, use charcoal filters and get some indoor plants. But if your office equipment still crashes in spite of your indoor garden - blame it on the carpet, blame it on the chipboard furniture, blame the photocopier, blame your perfume or aftershave - give the machine a thump and go for some fresh air.

Reference:

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