

TECHNICAL BRIEFING

THE ACID TEST

While the secondary damage caused by acid corrosion is often more destructive than a fire itself, **Bernard Connolly** explains that more sophisticated analysis can cut recovery time and save money.

It is standard procedure for disaster recovery companies attending commercial premises affected by fire to test for the presence of chloride ions. And for the insured party, learning that elevated levels of chloride have been found can feel a bit like being told you have an inoperable and terminal illness.



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A Chloride
Analysis Kit

The simple conclusion drawn from high chloride levels is that significant quantities of hydrochloric acid, created by the combustion of PVC's - Poly Vinyl Chloride, are hard at work corroding and degrading every susceptible metallic surface they come into contact with. The crude inference is that everything will have to be thrown out and replaced, but a more sophisticated approach to chloride analysis can often reveal a less discouraging outlook.

All too often, chloride analysis remains a blunt instrument in the hands of DR companies. The analysis is typically little more sophisticated than concluding that, yes, chlorides are present or that (sharp intake of breath) levels are high. This simply creates alarm and does nothing to contribute to the effective management of the post-fire situation.

SECONDARY DAMAGE Some maintain that chloride testing is inevitably inexact - and, therefore, of limited use. Such critics object that different methods - or indeed the same method applied at different times, or in different locations, within the affected premises - yield significantly different results. To a certain extent this is true, but it misses the real point. The real value of chloride testing lies in the relative distribution of readings within the affected premises and what this can tell an experienced practitioner about how, where, and when secondary damage will occur.

As destructive as fire itself can be, around 75% of insured damage resulting from fires on commercial premises stems from secondary damage occurring after the blaze has been extinguished. A high proportion of this damage results from the corrosive effects of acids - primarily hydrochloric acid - created by the fire.

Virtually every office, factory or other workplace today contains significant quantities of PVC, particularly in flooring and in the insulating layers around cables and wiring. When PVC reaches temperatures above 200°C, it decomposes to release hydrogen chloride gas - known as HCl. This combines with moisture in the air to form hydrochloric acid, which condenses on surfaces as they cool. PVC typically comprises around 40% chloride by



Potentiometric
Titration

weight, and a single kilogram of PVC can produce up to a litre of hydrochloric acid.

A reliable methodology for testing chloride levels is to add silver nitrate to a solution of contaminant swabbed from a given surface area. This reacts with chlorides present in the solution to form silver chloride. In very approximate terms, levels above six to fourteen micrograms of chloride per square centimetre would normally set alarm bells ringing, although different metals react in different ways. The rate of corrosion, at its most rapid immediately following a fire, will gradually decrease thereafter, but can be strongly influenced by temperature and humidity.

In the immediate aftermath of a fire, large areas will quickly be covered in a reddish-brown flash rust. But

the distressing first impression this creates can often be deceptive. As long as corrosion remains superficial there is usually a good chance of restoring—rather than replacing—machinery and equipment. This will almost always generate significant cost savings and help get the affected company back to work quickly, without the need for modifying working practises and retraining staff on new equipment.

However, once corrosion begins to work its way into metal surfaces—resulting in pitting—the chances of restoration rapidly recede. Electronic equipment in particular will not withstand more than a few days exposure to acid corrosion because the thin metallised paths and the solder on circuit boards rapidly degrade. So it is vital that DR specialists are brought on sight as soon as possible following a fire to implement short term remedial work (wrapping, relocating, de-humidifying and applying protective oils) and to carry out a thorough chloride analysis without delay.

Rather than just testing sample areas more or less at random, as it the norm, the entire affected area should be mapped and readings taken at regular intervals. The results should be carefully plotted to create a clear impression of where chloride levels are relatively

high or low. This gives everyone involved in the DR decision making process - insurers, loss adjusters insured's, and third party service providers—a much clearer visual idea of the situation and enables remedial work to be prioritised and concentrated in those areas where it will be most beneficial.

This approach to chloride analysis can highlight some findings that might seem surprising to the inexperienced. For example, most people would expect chloride concentrations to be greatest where most PVC combusted, in reality air currents will often move HCl through a building to condense out at one or other end of the premises. Indeed, this process of migration can continue as long as there are chlorides present on the site.

SURPRISE FINDINGS

The initial corrosive reaction is not the end of the story. If the surfaces are left untreated, the reaction of ferrous chloride and ambient moisture can produce HCl and begin the process over again. In the early days of DR it was not unknown for a team to go in and clean a machine one day, only to come back the next and find it in a new layer of corrosion—hence the need to fully understand how corrosive agents act within any given environment.

Chloride analysis, however sophisticated, is of course, only one element - albeit a very important one - in a much complex picture.

There is no space here to consider the many other factors that influence the pattern and pace of secondary damage following a fire, but hopefully this brief overview may at least point the way to a more scientific, professional and demystified view of the significance of chloride contamination in post fire damage manage-



Taking Swabs
For Analysis

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