Dr Paul Lemon & Rick Houlihan on anti-slip etching products

Anti-slip treatments: Dangers of the acid test

IN the fifth in the current series of articles in ***CFJ***, we will discuss the risks associated with the use of some floor surface anti-slip treatments:

IF you specify or install floors you'll know only too well that sooner or later something is going to go wrong! Whether the problem is due to a simple oversight, an incorrect calculation, or relying on faulty information from a third party, the consequences are the same, and are only too common. These can include mechanical failure of the floor or, more subtly, failure of the floor to perform to the desired specification.

Floor owners have a legal duty to ensure that their floor surfaces will not be dangerous in use. This specifically includes not allowing floors to be slippery, and also not allowing anti-slip floors to become slippery.

In the case of mechanical failure, the problems are usually quite obvious, including lifting tiles, warping boards, or moisture problems. The consequences are usually equally obvious: unhappy clients, potential loss of future business and the requirement to repair and make good.

The situation is far less straightforward when considering a floor's slipperiness. The problems that lead to slipperiness occur on a microscopic scale, and so are far less likely to be noticed than a warping floorboard. The point at which the problem becomes obvious is, unfortunately, normally when someone slips.

The techniques used by HSE to measure floor surface slipperiness were discussed in previous ***CFJ*** articles. If you want PDF copies, email: **paul.lemon@hsl.gov.uk**

They are also summarised in a free HSE guidance sheet: **www.hse.gov.uk/pubns/web/slips01.pdf**

HSE's preferred techniques, principally the pendulum test undertaken in line with **BS7976-2**, are used by HSL scientists in HSE and local authority enforcement action, and are likely to be relied upon to assess the slipperiness of a floor surface during slip accident investigations.

If a floor is found to be too slippery, then there are a number of potential ways forward. One solution would be to rip up the floor and start again, but this is obviously a rather extreme measure, especially for a newly installed floor. A less extreme

option is to use one of the multitude of products available on the market to modify the properties of the floor surface.

Several products aim to achieve a reduction in slipperiness by physically coating the floor surface with a rougher finish. This is often achieved by the use of resin-based products (essentially paints), which include some form of anti-slip particle (or aggregate).

These are, essentially, modern developments of the traditional old favorite 'sand-in-paint' anti-slip solution, but can, thankfully, be rather more effective.

Other products involve chemical treatment of the floor. These treatments are normally intended to etch the surface of ceramic, natural stone or conglomerate flooring, so resulting in a rougher, and therefore more slip resistant, finish.

In the right circumstances, and if applied cautiously and diligently, etching products can sometimes have a beneficial effect on the slip resistance of smooth flooring, although the durability of the improvements can be limited.

However, while the products may be effective in the right circumstances, it is less obvious what makes them effective. Some of the numerous explanations offered by suppliers are plain silly, and are a constant source of bemusement (and amusement) to us seasoned scientists at HSL.

Silly explanations we have heard range from the product causing the formation of millions of microscopic suction cups on the treated floor surface, to the development of microtexture which instantly swells (so producing a rougher texture) on contact with water.

It is far more likely that such products are effective in making surfaces less slippery because they contain modest concentrations of hydrofluoric acid (HF). This is an intriguing and, unless handled carefully, very dangerous substance.

It is used widely in the manufacture of computer microchips (as it quickly eats through the extremely hard insulators used in silicon chips). It is also widely used in making frosted glass, as it quickly attacks glass surfaces. It does this so effectively that it can't be stored in standard glass containers, as it can rapidly dissolve them!

Technicians using HF are routinely swathed in protective clothing, as the great dangers to people from exposure are well understood. Solutions containing HF are known to be both acutely and chronically toxic, as the solution will penetrate the skin and then attack the calcium present in bones.

This can lead to failure of tissues and organs which rely on calcium. As if that wasn't worrying enough, exposure to moderate concentrations of HF isn't initially painful, so you don't know you're in trouble ... until the acid begins to react. It is reasonable to assume that at this point, you know that you're in trouble. And potentially quite a lot of trouble, as HF exposure can result in severe and potentially lethal heart, liver and kidney damage.

The obvious question, therefore, when considering the use of a floor treatment product is 'Does it contain HF?' The obvious place to look for such information is on the container, but the presence of HF can be masked by other information. Read the supplier's Material Safety Data Sheet (MSDS) very carefully. If the product doesn't seem to contain hydrofluoric acid, then don't immediately assume that all is well.

HF can also be referred to as ammonium bifluoride or ammonium hydrogen difluoride: these are both technically precursors of HF, meaning that they produce HF when they're mixed with water.

So, although etching products containing HF must be used very carefully, they can reduce the slipperiness of some flooring materials, if used correctly. However, using such products on some flooring types may not result in any discernable change at all. Independent testing is recommended before using these products in order to establish the extent of any potential improvement in slip resistance, as this will depend on many factors, and can therefore be difficult to predict. ***CFJ***

The potentially harmful effects of HF should be taken seriously. HSE has produced a free publication regarding the hazards associated with HF, available to download: **www.hse.gov.uk/pubns/indg307.pdf**

Dr Paul Lemon is a senior scientist at HSL, HSE's in-house laboratory, and has specialised in floor surface slipperiness for over a decade. During this time he has led research which has resulted in the development of HSL's ramp-test methodology and the optimisation of HSL's standard pendulum test method. He is an active member of a number of BSI Committees concerning floor surface slipperiness, and was jointly responsible for the production of BS7976, the UK Slip Resistance Group Guidelines and relevant HSE guidance. He is currently leading the largest ever HSE research project into flooring slipperiness.

Rick Houlihan is a scientist in the HSL Pedestrian Safety team, and specialises in the assessment of floor surface slipperiness. He is a key member of HSL's Slips and Trips forensic investigation team and regularly undertakes investigations in a wide range of different premises. Rick has been involved in a number of major HSE research projects into the various aspects of pedestrian safety, including the causes and means of prevention of pedestrian slip accidents. He was the principal investigator throughout HSE's recent study into the effectiveness of hydrofluoric acid-based floor treatments.

Your questions on floor slipping

HSE recently commissioned HSL's largest ever research project on floor surface slipperiness and plan to update *CFJ* readers on our findings towards the end of next year.

Meanwhile, we will host a Q&A column in *CFJ* over the next few months. Write to the editor with your questions concerning floor surface slipperiness, and we'll aim to publish answers in future issues. Write to: alancfj@btconnect.com