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Seeing the dangers of dust

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We asked Dr Tom Gunston to share some of what has been learnt at VJ Technology Ltd about the hazards of dust from construction site activities and to explore some of the methods to reduce risk from a potentially deadly source. While his experience is primarily in the UK and with its Health and Safety Executive (HSE), Dr Gunston offers a valuable insight into the issue in any construction environment.

A few weeks ago in a room full of construction professionals someone said: "Dust is the new Hand-Arm Vibration Syndrome (HAVS)". Broadly speaking this is right – ten years ago HAVS was top of the UK Health and Safety Executive inspector's checklist but in the last couple of years it has been dust that has led to sites being shut down for not having a plan.

There is, however, one big difference: HAVS won't kill you.

VJ Technology Ltd (VJT) has been supplying specialist fixings, power tools and other construction products for 25 years, and has always taken operator safety very seriously. The new laws on HAVS came in to force in 2005 and VJT, at the request of some major customers, took the unique step for a fixings distributor of recruiting experts in the subject from academia and setting up a testing laboratory. Almost ten years on, the 6th edition of the VJT HAV databook has just been published providing HAV exposure examples for around 80 tools – taken from a database of over 10,000 individual measurements.

In those ten years, VJT has doubled in turnover and the lab has expanded to looking at all sorts of things – including the performance of drill bits, diamond blades and other consumables; the loads achieved with fixings of all types into standard and unusual substrates; and the best ways to manage occupational hazards such as dust.

The Health & Safety Executive (HSE) had given the construction industry a few nudges about dust over the last fifty years but it does not like to weigh in too heavily unless it is sure of its facts. The number of HSE sponsored

research publications about dust and construction has been steadily increasing for many years and one in particular stood out. Brown published a paper in Occupational Medicine in 2009¹ estimating just under half a million construction workers at risk from silica dust exposure. The same paper highlighted HSE research linking 800

apart from the appearance of plastic water tanks next to petrol saws on more responsibly managed sites, nothing much changed.

Then, in the spring of 2014, the HSE launched a series of site inspections with dust control at the top of the list. A variety of notices were issued, some sites were closed or threatened with



Respirable dust created by drilling a fixing hole (left) and captured using a hollow drill bit (right)

deaths per year to lung cancer resulting from exposure to silica dust (HSE Research Report 595, Annex 6)². These findings were obviously considered big enough to justify some serious enforcement action.

Until very recently the UK construction industry had not really got to grips with dust. Risks were not widely understood; exposures were difficult to measure; control was difficult as sites are constantly changing; work is often outside and there were other hazards to worry about. The HSE 'time to clear the air' guide aimed at petrol saws, came out in 2008 and had some effect, but

closure, and it was made very clear that failing to deal with dust was no longer an option. This meant that sites and supply chains suddenly needed to understand a lot more about why dust is dangerous and what they needed to do about it. HSE Construction Information Sheet 36 (revision 2)³ on construction dust is required reading for anyone dealing with dust on construction sites.

There are, very simplistically, two sorts of dust: Respirable and inhalable. Inhalable dust consists of the bigger, visible particles, which the nose can partially filter out and in any case tend to fall to the floor fairly quickly. More

dangerous are the respirable dust particles that are too small to see, stay in the air much longer, and can get all the way into the lungs if breathed in.

Concrete, brick, stone and similar materials can contain between 20% and 70% crystalline silica. Silica dust is particularly nasty as the particles

you are working with then you can fire a laser through the dust particles and work out the amount of dust from the refraction angle of the beam. Unfortunately this works best for an even mix of dust, not the uneven cloud that comes off a power tool.

We finally tried using a carefully

tasks, then we can test different solutions back-to-back and it is usually obvious which is the better choice.

The best option for dust capture depends on the type of tool and the environment on-site. There are two basic approaches to capturing dust – ‘wet’ and ‘dry’.

Wet systems either use water to cover the substrate so that dust particles never get into the air at all, as often used with some diamond drilling rigs, or use a mist of extremely small water droplets to bind to the dust particles so that they become heavier and fall out of the air. Filtering dust out of the air needs high pressure pumps and special nozzles as the microscopically small respirable dust particles bounce off ‘ordinary’ water droplets. Ordinary hose sprayers will not work. Even the ‘mist’ setting on a standard hose attachment produces particles that are too big.

With any wet approach there needs to be a plan to deal with the muddy water, perhaps by ‘aquavac’ing and bagging up, especially on partially enclosed sites. If this slurry is allowed to dry out then the respirable dust will end up back in the air and can be very difficult to get back under control. Wet dust capture is also not a good idea with most electric tools.

Dry systems used on tools typically rely on a hood to capture the dust at source and a vac to pull in, filter and capture the dust.

Tools that generate a lot of dry dust and are often used indoors, such as wallchasers, have had effective hoods for some time, but many other tools such as drills and angle grinders have often been used without hoods, so not a lot of effort had gone into developing some of the hood designs. Now that hoods are being used on-site this situation is improving and designs from most major manufacturers are much better. Compatibility is still a problem. Most hoods will work with only one make and model of tool, although VJT has identified some systems that are close to universal. Hose connectors are also a problem. The power tool industry has had no common standards for hose connectors so connecting the hood to the vac may



RCS dust from diamond cutting with (left) and without (right) backlight

are jagged and can scar the lungs. Overexposure to Respirable Crystalline Silica (RCS) dust can lead to a number of serious health problems including silicosis, Chronic Obstructive Pulmonary Disease (COPD), which includes bronchitis and emphysema, and lung cancer.

VJT had started looking seriously at the performance of dust control equipment back in 2009. There were some dust capture attachments and other products but because the general construction industry was not buying any of it, some tool manufacturers had obviously not spent too much time getting them to work properly. We needed to work out what worked and what didn't, but comparing different tools is difficult when the dangerous dust is almost weightless and essentially invisible.

We tried using off the shelf sampling pumps but you have to test for hours at a time and then wait for a couple of weeks for the samples to come back from a specialist lab with the results. If you know exactly what sort of dust

aligned beam of white light rather than a laser beam, again bending the light around the tiny dust particles to light them up. This was also not perfect as the dust particles are all sorts of different sizes so light intensity does not directly relate to dust density, but the white light did have one big benefit – it made the invisible dust very clearly visible.

One of our first tests used a very small puff of dust from a diamond blade, which touched the concrete for a fraction of a second. The difference between the small cloud of visible inhalable dust and the large cloud of usually invisible and much more hazardous respirable dust is obvious (pictured, below). This video clip has become a training aid for ourselves, some of our customers and some HSE inspectors.

At this point we stopped looking for highly technical measurement technology. We now simply run the dust capture equipment with the light beam and camera and watch the video and if we can't see any dust then effectively there isn't any. If there is some dust escaping, as is inevitable with some

require a variety of adaptors. The HSE does not approve of 'gaffer' tape as a hose connection solution. Guidance on selecting and using on tool extraction can be found in HSE Construction Information Sheet 69⁴.

class vac has better filters than an M, but should also have a higher airflow. This additional airflow can be valuable where the hood is not able to completely enclose the area where the tool contacts the substrate.

with narrow tubes, such as hole cleaning nozzles or hollow drill bits, need care as they can clog leading to ineffective hole cleaning – possibly without the operator noticing and especially if there is any moisture present. Use of hoods often requires a different technique, such as touching down a cutting blade with the hood already in contact with the substrate or lining up a drilling hole where the bit may be obscured by a hood.

VJT now has solutions for most problems and we have worked with many of our customers' sites to help manage dust, including a customer refurbishing a major maternity unit while the unit remained operational. The awareness of dust across the industry has increased greatly over the last few years. Better solutions are coming on the market and HSE inspectors are unsympathetic towards sites that do not have the problem under control. There is probably still too much focus on PPE, and the HSE has indeed tightened up on the quality and fit requirement for dust masks, but this should not be the main solution. The dust should not be in the air in the first place. ■

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Respirable dust created by drilling a fixing hole (left) and captured using a suction hood (right)



As of this article, the vac connected to the tool must be rated to a minimum of 'M' (medium) hazard class. An 'L' (low) or unrated vac will not be able to capture the very small dust particles and is effectively useless. An 'H' (high)



There are no magic bullet solutions for dust control. Something that works for small fixings in a confined space overhead will not work for intensive drilling of large diameter holes for chemical anchor studs. Solutions

References:

1. Brown, T. (2009) In-depth review: Silica exposure, smoking, silicosis and lung cancer-complex interactions. *Occupational Medicine* 2009;59:89–95.
2. HSE Research Report 595 (2007), The burden of occupational cancer in Great Britain Technical Annex 6: Lung cancer. Prepared by the Imperial College London and the Health and Safety Laboratory for the Health and Safety Executive.
3. HSE Construction Information Sheet 36, 'Construction dust', www.hse.gov.uk/pubns/cis36.htm
4. HSE Construction Information Sheet 69, 'Controlling construction dust with on-tool extraction', www.hse.gov.uk/pubns/cis69.htm
For up to date information on managing construction dust please refer to the HSE website (www.hse.gov.uk/construction/faq-dust.htm). This article was correct as far as the author was aware at the time of writing but current HSE guidance obviously takes precedence.

About VJ Technology

Part of the SIG Group of companies, VJ Technology distributes fixings, fastenings, hand tools, power tools and consumables to the UK construction and civil engineering industry from sites in Ashford and Bristol.

Technical salesmen – supported by a technical manager – offer value engineering, saving customers time and money. Quality and range of products, excellent customer service, next day deliveries and competitive pricing ensure a first-class reputation.

A dedicated laboratory, staffed by experts in Hand Arm Vibration and dust risk and control offer help and advice, including on-site testing.

VJ Techonology has a culture of 'can do, will do' and a customer centric approach. Its ambition is to be the fixings supplier of choice for the construction industry as a whole and to be regarded as the best fixings supplier in the UK.