3M Transcript for the following interview: Ep 53 Peter Knott – Real Time and Video Exposure Monitoring

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Welcome to the 3M Science of Safety podcast presented by 3M Australia and New Zealand Personal Safety Division. This is a podcast that is curious about the signs and systems of all things work, health and safety, that keep workers safe and protect their health. Whether you are a safety professional, occupational hygienist, or someone with any level of WHS responsibility in the workplace, maybe you are a user of safety products or maybe you are a bit of a safety nerd who finds this stuff really interesting, then this is a podcast for you. Welcome to the 3M Science of Safety podcast everyone. I'm Mark Reggers, an occupational hygienist who likes to ask the questions why, how and please explain.

(R) And I'll be asking all those questions today to Peter Knott from GCG. Welcome, Peter.

(K) G'day Mark.

(R) Well, today, we are talking about real time and video exposure monitoring, following on from our chat from Debbie from SKC the last two weeks. But before we delve into the meaty stuff of the topic, can you please introduce yourself? Who are you, where are you from and maybe a little bit of your background, if that's okay?

(K) Yeah, not a problem. I've been an occupational hygienist since a long time ago.

(R) We're happy with that, a long time ago. We can stick with that.

(K) Worked in aluminium smelters and power stations and worked for 3M for a little bit and then in mines. Yeah, I've been with GCG for a few years now, as a consultant.

(R) What do GCG do specifically, just to give them a little bit of a highlight.

(K) So, we're an Australia-wide occupational health and safety consultancy group. We do work in mainly Queensland, WA and New South Wales, South Australia and Northern Territory.

(R) So, a lot of mining stuff, which is why those states you've just mentioned.

(K) A lot of mining stuff but there's a lot of other industrial, manufacturing facilities as well that we get involved in. We're not just a [miner]

(R) So, getting into today's topic, so we've spent the last two weeks chatting with Debbie about exposure monitoring and pumps and sampling head and passive samplers. So, what is the big difference between that traditional exposure monitoring to real time exposure monitoring?

(K) Well, real time monitoring is essentially collecting a sample over a very short period of time. It may well be down to a second or less than a second, and then presenting that result as a time history recording of the changes in exposure throughout that sample period. Traditional exposure monitoring will accumulate all of the dust or the gases or whatever onto a media and then you analyse that media. Real time monitoring separates all those little packets of exposure and presents them to you in a time history, so you can see where the peaks are, when you've had a high exposure or when you've had a period where there's been very little exposure throughout your shift or something like that. So, it gives people an idea of how their exposure changes over the course of the day.

(R) So, as you say, you're seeing the ups, you're seeing the downs rather than we've got a number, so there's an average over the eight-hour day.

(K) Yeah, exactly.

(R) So, there's plenty of contaminants that traditional exposure monitoring. Can you have the same sort of range of contaminants with real time as you can with that traditional sense?

(K) Not really, no. Because a lot of the traditional work is done by analysis of materials in a laboratory, you've got a much wider range of analytical methods available to you to sample or to collect and analyse for different compounds whereas with real time equipment, you often are taking a surrogate measurement, so the most common particulate monitoring process is where you use a light scattering photometer or something like that. And that really gives you a surrogate measurement of all the particles that are in the air. So, if you're dealing with silica or diesel or welding fume or something like that, those types of instruments aren't able to discriminate between those types of contaminants. What they do is they pick up all of the particles in the air and say, "Here's the concentration." So, their use requires a little bit of understanding of what you're trying to get out of it. But on the other hand, real time monitoring for gases and certainly for vapours, you can have instruments that will do quite a range of gases and vapours, and some of the more sophisticated pieces of equipment are able to measure very low concentrations of a wide range of organic vapours. Equipment like portable infrared spectrometers and things like that are able to sample and give you a very wide range of contaminants in a very short period of time.

(R) So, you mentioned the type of equipment there. What comes to mind for me is like a gas detector, like in confined space that has a sensor that is analysing in the way that it analyses the particular contaminants. So, are these fancy gas detectors, when you say 'photometer'? You've got a machine. You're using it. It's giving you

a number and it's obviously tracking it and you can download on an electronic device these days?

(K) Yeah, well, there's a range of them, but some of them can be the size of a small suitcase which you're not going to strap to somebody and get them to wear all day.

(R) Unless you really don't like them, but yeah.

(K) But then you can go down to essentially a confined space gas detector that people are talking about, ones that have logging capabilities and a lot of them do nowadays, essentially that is a real time instrument. It's measuring oxygen, CO, CO2, H2S. You can get some of the ones that have VOC for volatile organic compounds with a photoionization detector in them. They're going to measure all of the organic vapours every second in some cases. So, essentially that's a real time monitor that's probably no bigger than a box of matches in some cases. Some of them are quite small.

(R) They are very small, so it really comes down to understanding what your hazard is, like a lot of things when you talk about exposure, but if you don't know what the hazard is, it's going to be hard to go down this decision path or investigation of what type of equipment maybe suitable, if suitable at all.

(K) Exactly, yeah. If you're looking at some exposures, you might want to look at solvents. If they're using a particular solvent, there may well be problems with a photoionization detector actually picking that particular solvent up. But it might have a lower response or a different response to that particular solvent. So, if you understand that what I'm going to measure is a surrogate or is an indicator of what the peak and the trough of exposure is, and not worry too much about the absolute number that the instrument gives you, then you can use those types of instruments really well.

(R) It's going to give you that insight into the task or the process to go back and say, "Let's do maybe what we can do," going through that hierarchy of controls and

then go back, as you say, to worry about that number, let's chop the heads off those peaks before we get to the real specifics.

(K) Exactly and that's one of the really good ways of using real time instruments, is not to get hung up on the number. Use it as almost an instant feedback to how effective your control is. And then if you go, "Okay, I've done this job. I got a peak that was 10, or whatever it is. Then we go in and make some changes. We go and do the job again and then my peak is five. Okay, well, that's great. That means essentially, I've halved my exposure almost."

(R) Which is the stuff you want to see when you've got these controls in place.

(K) Exactly, and that's the real benefit of real time stuff because if you go down traditional exposure monitoring routes, you get one sample for that and then you …

(R) For that worker for that day, that's one number.

(K) Exactly, so then go, "Okay, well, if I'm going to put in a control, they're not going to …" coming back and just taking one sample to say, "Yeah, my control is fine," you're a little bit on shaky ground there because you can get some variation. But you still, are exposed to that variation with real time equipment but the speed of turnaround means that you could ostensibly do, if you're looking at a single task, you could do that task multiple times through the day and then you've got your information about the amount of variability that I'm seeing in that job.

(R) That's a pretty big pro that you've mentioned there about direct exposure monitoring. Are there any cons that workplaces should be aware of, that would just be listening to you talking right now and going, "Wow, that sounds pretty good."? What's the flipside of the coin that people should be aware of?

(K) The flipside of the coin is that they're generally reasonably expensive, so even just a confined space gas detector isn't something that's cheap. They have to be maintained. That's one of the killers will all this stuff. You've got to make sure your batteries are charged; the equipment response has been calibrated. If you put it

into environments where there may be contaminants particularly for gases that will poison sensors and things like that, the ability of that instrument then to detect what you're looking for has been compromised. With a lot of your particle instruments, you can get deposition in the optics and all that stuff, and they have to be cleaned and it can be a bit of a maintenance nightmare for some of these things.

(R) It's like any bit of equipment isn't it, when you think about the upfront cost of the purchase, but it's those ongoing, not just from a cost point of view but time and effort to make sure that thing will actually do what you bought it to do over time.

(K) Yeah, well, the perfect analogy is powered air purifying respirators. They're great, but they're only great if they're maintained.

(R) And you use them as they should be used, like any bit of equipment.

(K) Exactly, yep.

(R) when would you suggest considering real time monitoring

(K) If you're looking at whether you are in compliance with an exposure standard or not, then real time monitoring is not what you want to do. You really want to use a properly designed sampling strategy with the accredited methods for full shift sampling. So, that's what you use to compare things to the exposure standard unless there's an accredited method that uses a real time instrument, So, if you've got a visit from an inspector or somebody like that, or corporate people are looking at are we in compliance with the exposure standards and things like that, you really don't want to go down the track of using real time gear. If you are looking at a way of measuring impact of changes to your workplace, with a fairly short period of time in between making those changes and wanting to know if I need to do anything else, real time monitors work really well because like you said earlier, you can use them essentially as a surrogate to find out what are the peaks, what are the troughs in exposure, and then make a judgement as to what we need to do down the track. And then you can make those changes, put them in place, and then you

can come back and do your compliance monitoring down the track. If you want to see how exposures change over the course of a day, or if there are jobs or tasks within the day where there is concern about potential high exposures and things like that, you can use real time monitors for that to measure the short-term task. You can also use traditional methods for that as well. There's short term sampling guidelines and things like that to measure those samples. You need to bear in mind that as you shorten down the time periods where you take a measurement, the variation in the actual numbers will start to increase. Taking a whole heap of short-term monitors with compliance monitoring gear like tubes, filters, pumps and things like that, you're going to get a lot more variation than if you sample for a whole eight-hour day or something like that.

(R) You're going to get lots of up and down numbers potentially.

(K) You're going to get lots of numbers there, yep, that's right.

(R) Rather than one, this is the number of the overall task irrespective of when that peak or trough was.

(K) Yeah, so statistically, you can say, "Oh, everything's good." It's like, "Oh, maybe not," because you've got a lot more variation there. So, they're useful. The other area where they've worked very well is their application of continuous personal dust monitoring in underground coal mines. So, that was mandated, I think, about 2015 or something like that in the US, 2016 it could've been, where coal miners had to wear real time dust monitors and they had the ability to give them a 30 minute average throughout their day but it means that they were able to see what are the conditions or where are the locations or what are the activities that they are doing that's contributing to their higher exposures throughout the day. So, what they've done is it's led to an increase in the knowledge of these guys as to the factors that contribute to their personal exposures. So, then they're able to change what they do and their behaviour and where they stand and how they work, so that they can actually get a lower exposure.

(R) In the focus of a business of controls or ventilation may not be working in that part of the mine or be very specific to pinpoint those by contributing exposure factors.

(K) Exactly, yeah. So, that application's been transferred into diesel particulate monitoring underground as well, with some real time monitoring that's available, hopefully to achieve a similar outcome. So, there's applications where it's been able to change the way that people perceive how they're being exposed because they're getting direct feedback of, "This is what's happening whilst you're doing this particular job." And then that leads then into a bit of a feedback loop to say, "Okay, well, if I go over here, what's the number? Oh, the number's lower over here. So, if I ..."

(R) A bit of trial and error on the workers behalf to see, yeah.

(K) Exactly, yeah, so that's another really important benefit of real time monitoring, is that workers get to see immediate feedback as to what they're being exposed to and how they're being exposed.

(R) Very powerful stuff if you do go down this path, to get that real time worker involvement.

(K) Yeah, it's like a hygienist in a box.

(R) It is a hygienist in a box, but we won't mention that to any other hygienists. But video exposure monitoring; how is that overlaid over direct exposure readings?

(K) Yeah, well, video exposure monitoring takes the data that you get from a real time instrument and combines that with visual clues, visual images of what was going on at the time, what the worker was doing, what other people were doing around the worker or the person being monitored, and it gives you an extra layer of context. Not only do you see the peaks and troughs from the real time monitoring, you then get to see what the process was doing or what activities were being done

or how a person was performing their work, to give you an extra layer of interpretation as to what those peaks and troughs mean.

(R) And I know having done noise monitoring with dosimeters in the past to get the graphs of the up and down, and you go, "What was that peak? What were they doing?" So, this is videoing and recording to show that is exactly what was happening. That's pretty powerful stuff.

(K) Well, your analogy with the dosimeters, we've all done it. We've all seen the peaks. I don't think anyone would actually go back to somebody and say, "So, at 11:53 and 27 seconds, there was a big peak there. Do you remember what was going on?"

(R) No, you give them the sheets and you try and get them to jot stuff down, but even then, that is still a bit grey and not that specific versus if you've got it on camera, you can really do some great analysis.

(K) Yeah, and there are situations where they're not going to be able to record. If they're operating a piece of machinery, you're not going to get them to be able to write down what I'm doing whilst I'm driving a loader or something like that. So, those sorts of traditional recording methods have serious limitations in that regard.

(R) How old is video exposure monitoring? I'd imagine it's only a couple of years old, or has it going around for a bit longer and I just haven't seen it?

(K) Video exposure monitoring was first developed back in about 1986 in Sweden, I think.

(R) Right, a lot further back than I would have thought.

(K) Yeah, back when I started being a hygienist. But the problems back then and until quite recently was that the equipment is big. If you think about video cameras back in the '80s and '90s, they were ...

(R) As big as the machinery they're probably driving.

(K) Yeah, pretty hefty things, and the ability to record that sort of data. You ended up having to record it onto a large tape system and even the real time monitors back then were large as well. So, the ability to do video exposure monitoring was quite limited to almost static jobs so people who were welding at a particular area or people who were working on one machine in a fixed ... like a press or something like that, where they'd stay in that one spot. And it pretty much stayed like that for probably 20 years, I guess. There are a number of people around the world who used video exposure monitoring. So, there was an implementation of that process in Europe in the Netherlands, the UK, the Health and Safety Executive. They developed their own system. NIOSH developed a system back in the '90s, I believe. So, it's been around and it's been somewhat on the periphery of the tools that are available.

(R) Practical application, yeah.

(K) But recently, probably 2012, 2013, NIOSH, the mining division took on a project to look at dust exposures in mining and they used body cams like GoPros, action cameras.

(R) Well, I was going to ask about the GoPro influence. Obviously, you've got these cameras that people can have strapped onto them. Is that period when it started to come back in, because of the advent of that size of technology and durability?

(K) It would seem to be the case. I'm not exactly ...

(R) Yeah, per date.

(K) Per date, but yeah, it certainly is ... the ability of small, lightweight body worn cameras, small aerosol photometers, smaller gas detection, gas photoionization detectors, that type of stuff, as the instrumentation has become smaller and it's easier for people to wear, you can put this onto somebody now and almost let them almost wear it all day if you've got the battery and the memory you need. That's really invigorated this whole area of video exposure monitoring.

(R) What's the con? Is it similar to the direct reading where it's a cost point of view? Is it more data, because I imagine now you've got video and the numbers coming at you? There's a lot more to marry up.

(K) Yeah, well, you generally start to create gigabyte sized video files, then you'll have your normal output from your direct reading instruments. They can be just pulled into some software. But I guess one of the cons that I've come across is that the use of video in workplaces has a whole heap of other …

(R) Privacy, confidentiality and stuff.

(K) Privacy, confidentiality, all that sort of stuff, and there's also a potential where it can be used not for the purposes of looking at exposure, looking at it for other purposes, "Oh, Such and Such, he didn't have his gloves when he was doing that job," like punitive things.

(R) A lot of effort to go to track someone down for not wearing their gloves, but I guess it depends on the situation, of course.

(K) Yeah, not a great example, but used for almost surveillance but when I've done it, you do it in consultation with the site and the worker and it's like, "This is for looking at their exposure," in the context of looking at this particular job or whatever. That's all we're doing it for. You don't need the audio recording stuff. You don't need to know …

(R) What you had for lunch.

(K) … what you had for lunch, all that sort of stuff. It's really about getting additional context as to exactly how are you being exposed.

(R) Do you have some real-world examples where you can see some of those benefits that workplaces have seen? You can't go into specifics of course, but any high-level wins that have worked really quite well that you wouldn't have been able to get without this direct and maybe video exposure monitoring?

(K) Some of the initial work that I did was looking at diesel exposures and underground trucks and there was a perception that people were winding windows down as they were driving and getting exposed to diesel exhaust in that way or parking and leaving doors open and things like that. The video exposure monitoring clearly showed that the peaks that people were getting were when they were pulling into areas that had poor ventilation, maybe a truck parking bay or something like that. It's hot underground. They're in a truck. They're got the air conditioner on, so they'll basically just leave the truck running, pull up into this little cutaway part. That area starts to fill up with diesel exhaust and it gets drawn in through the air conditioning system, in through the filtration and suddenly the people are getting exposed. So, we were able to show that there was good compliance to leaving windows closed and all that stuff, and the problem that was causing the exposure was the filtration in the air conditioning systems was inadequate to remove diesel particulate. So, that was a simple and fairly straightforward approach. We've used it more recently to look at differences in the effectiveness of ventilation with people performing different tasks. So, you can run one job with the ventilation in one configuration. Have a look, they do the job. This is where they are. This is how they're working. And this particular one, we were looking at fumes, so really fine thermally generated particles. So, you could run that scenario. We got them to do the job with the ventilation in one configuration, saw what the magnitude of the peaks were and where they were getting exposed, changed the ventilation arrangement. Done the job again, and you could see, "Look, when you do this particular part, the exposure is reduced," and you can show that back to people and they can see that, and see where they were and what they were doing and they actually provide some additional feedback as well.

(R) There's probably a lot of workplaces that never realised video exposure monitoring even existed, but for those workplaces, where would be a couple of good starting points or places they could go to actually look at this type of area and see if may be something worth investigating further?

(K) Probably in my experience, the NIOSH Mining website, where they look at the EVADE system, so it's Enhanced Video Analysis of Dust Exposures is the acronym. And it's a freely downloadable program from NIOSH. They've made I think two versions of it, so it's been developed further. And it's an easy product to use, very versatile; you can use it for noise meters, light meters, dust meters and any generic data collection device as well. So, it's quite flexible in that regard as well.

(R) GCG website; does that have information about that as much? Obviously, you've mentioned it is work that you're doing a little bit of around the place. Would that be a good spot to go to as well?

(K) I think there might've been a blog post or something like that on it, but yeah.

(R) If you've got more questions, get in contact with GCG. And summing up direct reading and video exposure monitoring, any key highlights that you would be great to leave with our listeners?

(K) It's not a compliance measure. So, if you go on the track of, "Am I exceeding the exposure standard?" or, "Am I going to compare this to the exposure standard," then for probably 99% of contaminants, direct reading instrument is not the way to go. You need to understand what you're trying to get out of the process before you leap into using direct reading instruments. But they can be very powerful to give you an indication of how good your controls are or if you want to make changes to controls, they'll give you really good instant feedback as to how things are travelling.

(R) Pete, I think you've given us a really good overview, so thanks so much for coming in today.

(K) Not a problem.

(R) Well, thanks for listening everyone. You can get in contact with the show by sending an email to scienceofsafetyanz@mmm.com. If you have any questions, topic suggestions or you'd like some assistance in your workplace around PPE or any

other topics that we've covered, 3M are certainly here to help. You can also visit our website, 3m.com.au/sospodcast for further resources on the topic we've just discussed today with Peter, as well as the transcript of our chat, including all the previous episodes we have recorded as well. Be sure to subscribe and share through Apple Podcasts, Spotify or Google Podcasts or wherever you get this podcast from. And as Ralph Marston said, "Excellence is not a skill, it's an attitude." Thanks for listening and have a safe day.